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ARTICLE PICKING EQUIPMENT

Field of the Invention

The present invention relates to equipment which picks articles individually from a group of articles loaded in a stock area which stores articles, and which transfers a suitable number of the picked articles to a transport conveyor after storing them.

Background of the Invention

On article picking equipment, a plurality of types of articles are stacked in each group in a stock area, the type of article corresponding to the request is picked from the stock area and a plurality of picked articles are paid out onto the transport conveyor as a group. A conventional article picking equipment is provided with a stock area that stores articles in a stacked state, an article picking device that individually picks articles from an article group stacked in the stock area, a stock device that receives and stores articles from the article picking device, a travelling carriage arranged so as to freely elevate with the article picking device and stock device and which runs in the left and right directions, and a transport conveyor that extends to the left-right directions such that the articles are received from the stock device.

One example of the aforementioned article picking device is provided with a slanting device and a picking device that picks articles by being inserted into

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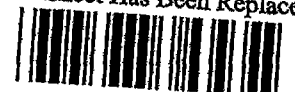


the space below the article slanted by the slanting device. This slanting device is provided with a frame arranged such that it freely elevates with respect to the travelling carriage, an arm arranged such that it freely moves backwards and forwards with respect to the frame and a slanting tool arranged on the tip of the arm.

Furthermore, the picking device is provided with a frame arranged such that it freely elevates with respect to the travelling carriage, an arm arranged such that it freely moves backwards and forwards with respect to the frame and a slanting tool arranged on the tip of the arm.

The travelling carriage runs while straddling the transport conveyor. Due to this, in order to avoid a collision with the article paid out onto the transport conveyor from the stock device, it is necessary for the travelling carriage to wait for the paid out article to be transported by the transport conveyor. However, making the travelling carriage standby decreases the processing efficiency of the equipment.

When articles positioned to the left and right are to be continuously picked, it is necessary to move the article picking device a predetermined amount to the left and right to the picking positions by running the travelling carriage. However, as the travelling carriage is a heavy object mounted with the article picking device and stock device, sudden movements to the left and right as well as stoppages are difficult and it is necessary to perform the movements and stoppages at low speed. Due to this, it is difficult to improve the picking



processing abilities of conventional equipment.

Summary of the Invention

In order to achieve an increase in the processing efficiency of the equipment and to achieve an increase in the picking processing efficiency, it is an object of the present invention to propose article picking equipment not requiring the travelling carriage to standby and which picks articles positioned to the left and right without moving the travelling carriage.

A first aspect of the present invention is article picking equipment provided with a stock area that stores articles in a stacked state, an article picking device that individually picks articles from an article group stacked in the stock area, a stock device that receives and stores articles from the article picking device, a travelling carriage arranged with the article picking device and stock device which are freely elevating and which runs in the left and right directions, and a transport conveyor that extends to the left-right directions such that the articles are received from the stock device, where the travelling carriage is positioned such that it runs between the stock area and the transport conveyor.

As the travelling carriage runs between the stock area and the transport conveyor, the travelling carriage may be run regardless of the existence of articles on the transport conveyor.

Furthermore, the stock device is positioned to one side of the left or



right side of the article picking device such that it receives articles moved along the left/right direction from the article picking device and also transfers the received stored articles onto the transport conveyor by transporting them in the forward/backward direction.

Accordingly, as the stock device is positioned to one side of the left and right of the article picking device, the dimensions of the forward/backward direction can be shortened and the dimension between the stock area and transport conveyor may be shortened.

A second aspect of the present invention is article picking equipment provided with a travelling carriage that runs to the right and left, a slanting device and a picking device that picks the articles by being inserted into the space below the article which has been slanted by the slanting device, the slanting device is provided with a frame arranged so as to freely elevate with respect to the travelling carriage, an arm arranged so as to move freely backwards and forwards with respect to the frame and a slanting tool arranged on the tip of the arm, the picking device is provided with a frame freely elevating with respect to the travelling carriage, an arm which is able to move freely backwards and forwards with respect to the frame and a picking tool arranged on the tip of the arm, where the slanting device is arranged with an arm which is able to freely move to the left and right with respect to the frame and the picking device is arranged with an arm which is able to freely move to the left and right with respect to the frame.

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Accordingly, when the travelling carriage is stationary, the slanting device may change the position to the next picking position of the slanting tool by moving the arm to the left and right and the picking device may change the position to the next picking position of the picking tool by moving the arm to the left and right.

Brief Description of the Drawing

Figure 1 shows a first embodiment of the equipment of the present invention and is a perspective view showing the entire equipment from above the stock area at an angle.

Figure 2 is a perspective view of the entire equipment shown from above the transport conveyor at an angle on the same embodiment.

Figure 3 is a right side view showing the main part in a stationary state of the same embodiment.

Figure 4 is a right side view showing the main part in a state immediately before the slanting of the article starts on the same embodiment.

Figure 5 is a right side view showing the main part in a state where the article is slanted on the same embodiment.

Figure 6 is a right side view showing the main part in a state where the slanted article is to be picked on the same embodiment.

Figure 7 is an enlarged right side view showing the state where the tip of the arm has been advanced and the picking arm has been advanced on the same



embodiment.

Figure 8 is an enlarged right side view showing the state where the picking arm, pressing tool and back plate are retracted.

Figure 9 is an enlarged view being a section along line IX-IX of Figure 7.

Figure 10 is a right side view with a partial section showing the relationship between the upper frame and arm.

Figure 11 is a plan view showing the pulling conveyor and picking tool.

Figure 12 is a plan view showing the arm and picking tool partially omitted and with the pulling conveyor omitted.

Figure 13 is an enlarged view being a section along line XIII-XIII of Figure 11.

Figure 14 is an enlarged view being a section along line XIII-XIII of Figure 11.

Figure 15 is a right side view showing the picking tool.

Figure 16 is a plan view showing a partial section of the picking tool.

Figure 17 is a plan view showing a stock device.

Figure 18 is a rear view showing a stock device.

Figure 19 is an enlarged side view showing the relationship between the receiving conveyor of the stock device and the send-out conveyor.

Detailed Description of the Preferred Embodiments

Hereafter, the article picking equipment of the present invention

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(hereafter, called "equipment") will be described based on the embodiments shown in the drawings.

Figures 1 through 6 show a first embodiment of the equipment. In the following description, "front" refers to the stock area S side, "rear" refers to the transport conveyor C side, "right" refers to the right when the front is viewed from the rear and "left" refers to the left when the front is viewed from the rear.

As shown in Figures 1, 2, and 5, the equipment is provided with a stock area S that stores articles B in a stacked state, an article picking device 1 that individually picks an article B from an article group stacked in the stock area S, a stock device 2 that receives and stores an article B from the article picking device 1, a travelling carriage 3 arranged with the article picking device 1 and stock device 2 which are freely elevating and which runs in the left and right directions, and a transport conveyor C that extends to the left-right directions such that an article B is received from the stock device 2. One aspect of the equipment is that the travelling carriage 3 is positioned so that it runs between the stock area S and transport conveyor C and the stock device 2 is positioned at one side (shown on the left side in Figures 1 and 2) of the left/right sides of the article picking device 1. the stock device 2 receives an article B sent along the left/right direction from the article picking device 1 and transfers the received and stored article B to the transport conveyor C by paying it out in the front/rear direction.



As shown in Figure 5, the article picking device 1 is provided with a slanting device 4 that lifts the lower front of the stacked article B causing it to slant, and a picking device 5 that picks the article B by being inserted into the space below the article B slanted by the slanting device 4. As shown in Figures 1 and 5, the slanting device 4 is provided with a freely elevating frame 6 guided by masts 3a,3a to the left and right of the travelling carriage 3, an arm 7 that freely moves in the left/right direction by being guided on a guide tool 19,19 (refer to Figure 10) arranged on the frame 6 and moreover having a tip 7a that freely extends in the front/rear direction, and a slanting tool 8 arranged on the tip 7a of the arm 7.

As shown in Figures 7 through 9, that slanting tool 8 is provided with a pressing tool 11 and a lifting arm 16. The pressing tool 11 is positioned so as to be freely elevating on the tip 7a of the freely extending arm 7 via a slider 9 and a rack 10. The pressing tool 11 is driven by a drive device 17 comprising a drive motor 17a and drive belt 17b and the like and elevates from a raised standby position (see Figure 8) to a pressing position (see Figure 7) where it presses the upper surface of the article B. The pressing tool 11 is axially supported so as to be able to rotate freely on the lower end of the slider 10 and is able to press the upper surface of the article B slanted and picked by the picking device 5 (refer to Figure 6). The lifting arm 16 is pivoted 14 on the left and right sliders 12,12 positioned so as to be able to move freely in the front/rear direction on the tip 7a of the arm 7 and is pivoted 15 on a nut 83



screwed on to a delivery screw 13 mounted on the sliders 12,12.

The lifting arm 16 comprises a set of three links 16a,16b,16c connected so as to freely rotate and has an arrangement whereby the entire link structure moves forwards and backwards due to the driving by the motor 18 of the slider 12 which freely moves in the front/rear direction guided by the tip 7a of the arm 7, and also moves a pressing tip 16d vertically by separating the pivot 14 and pivot 15 by the driving of the delivery screw 13 by the motor 84. The lifting arm 16 raises the pressing tip 16d when the nut 83 moves in the direction such that the space between the pivots 14 and 15 increases and lowers the pressing tip 16d when the nut 83 moves in the direction such that the space between the pivots 14 and 15 decreases. The lifting arm 16 positions the pressing tip 16d lowered from the raised standby position (the position shown by the double dotted line in Figure 7) at the front of the article B (refer to Figure 4) and while pressing the front of the article B, slants the article B by slightly raising the pressing tip 16d (refer to Figure 5).

As shown in Figures 7 and 8, the slanting tool 8 is provided on the tip 7a of the freely extending arm 7 with a back plate 20 that supports the rear of the lifted article B. The back plate 20 is provided with freely extending plates 20a,20b,20c and lifts and stores the tip plate 20c which drops under its own weight by a hoist operation tool 21 comprising an air cylinder, smooth wheel and rope or the like (refer to Figure 8). When no article B exists in front of the slanted article B, the back plate 20 supports the rear of the slanted



article B by the tip plate 20c lowered from the raised stored position to the lowered supporting position.

As shown in Figures 1 and 5, the picking device 5 is provided with freely elevating frames 22,23 guided on the left/right masts 3a,3a of the travelling carriage 3, a pulling conveyor 26 positioned between the frames 22,23, an arm 25 (refer to Figure 5) that moves in the left/right and front/rear directions and is guided by the frames 22,23, and a picking tool 24 connected to the tip of the arm 25. As shown in Figures 11 through 13, left and right middle frames 28,29 that move to the front and rear guided by the frames 22,23 are positioned between the frames 22,23. The middle frames 28,29 are connected by connector frames 35,35 as shown in Figure 12 and guide rails 36,36 extending to the left and right are arranged on the connector frames 35,35. The guide rails 36,36 guide the slider 90 so that it freely moves to the left and right and the slider 90 guides the arm 25 so that it freely moves to the front and rear.

Driving of the middle frames 28,29 to the front and rear with respect to the frames 22,23 is performed by a drive motor 30. The drive motor 30 is provided with front and rear pulley shafts 31,31 supported at both ends of the frames 22,23, a pulley 32 fixed to the left and right of each of the pulley shafts 31, left and right continuous belts 33,33 suspended on the front and rear pulleys 32,32, and a motor 34 that drives the pulley 31. The continuous belts 33,33 are connected by a connector 41 (refer to Figure 14) to the middle frames 28,29 in a suitable place.

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The driving of the arm 25 in the left and right directions with respect to the middle frames 28,29 is performed by a drive device 91 and the driving in the front and rear directions with respect to the middle frames 28,29 is performed by a drive device 37. The drive device 91 is provided with a belt 92 that spans the left/right direction between the middle frames 28,29 and is connected to the slider 90 at both ends 92a,92a, and a motor 93 that drives the belt 92, and performs the moving and stoppage in the left/right directions of the slider 90 that guides the arm 25 by control of the motor 93.

The drive device 37 is provided with a spline shaft 38 supported at both ends on the middle frames 28,29 so as to freely rotate, a motor 39 that rotates the spline shaft 38, a toothed pulley 40 that freely rotates and supports the slider 90 and is fitted to the spline shaft 38 such that it freely slides, and a toothed belt 94 mounted on the arm 25 such that it engages with the toothed pulley 40. The movement and stoppage in the front and rear directions of the toothed belt 94 and arm 25 is performed by rotationally controlling the toothed pulley 40 by the motor 39.

The drive device 30 moves the picking tool 24 forwards and backwards together with the pulling conveyor 26 and the drive devices 37,91 is able to stop in the desired picking position by moving the picking tool 24 to the left/right and forwards/rear directions irrespective of the pulling conveyor 26 (refer to the chain double-dashed line of Figures 11 and 12).

As shown in Figures 11, 13 and 14, the pulling conveyor 26 supports a

plurality of rollers 42 on the middle frames 28,29 and connects so as to be able to flex freely the plurality of rollers 42 upto the final roller 42-1 supported on the middle frames 28,29. The arrangement of this freely flexing connection sequentially connects pairs of adjacent rollers 42 by links such that free rotation is possible. The roller group of the flexing part is guided on guide rails 44,45 arranged on the inside of the frame 22,23 and moves forwards and backwards in association with the advancement/retraction of the middle frames 28,29.

The rotating drive device 46 used for the roller group is arranged with a chain sprocket 47 on the shaft part of each roller 42, a chain 48 sequentially spans the pairs of adjacent sprockets 47,47 and the chain 48 spans the optional sprocket 47 and the output sprocket 50 of the roller drive motor 47. The roller drive motor 49 is mounted on the middle frame 29 and moves to the forward and rear together with the middle frame 29. The roller drive motor 49 moves each of the rollers 42 simultaneously by that driving.

As shown in Figure 5, due to the arrangement of a stopper 65 spanning the entire effective width of the conveyor closest to the rear side, the pulling conveyor 26 stops the article B transported to the rear by the stopper 65 and does not release it. Furthermore, as shown in Figure 2, due to the positioning of a pusher 66 such that it advances (in the direction of arrow H) from the standby position on the right to the left, the pulling conveyor 26 delivers the article B received by the stopper 65 (refer to Figure 5) to the stock device 2.



As the pulling conveyor 26 stores the retracting side which is flexibly linked when retracting between the frames 22,23, the equipment may have a compact arrangement without that retracting side projecting towards the rear from a predetermined position.

As shown in Figures 15 and 16, the picking tool 24 is provided with frames 52,52 connected by a pin 51 to the tip of the arm 25, a drive motor 53 arranged towards the rear and between the frames 52,52 and having output shafts 53a,53a that project to the left and right from the frame 52,52, free shafts 54,54 supported at both the front and rear of the frames 52,52, pulleys 55 mounted on both the left and right ends of the output shafts 53a,53a and free shafts 54,54, left and right tension pulleys 63,63 mounted on the frames 52,52, left and right continuous belts 56,56 suspended on the tension pulleys 63 and each set of pulleys 55,55,55, extension frame 57,57 mounted on the tip of the frames 52,52, a free shaft 58 supported towards the tip of the extension frames 57,57, pulleys 59,59 mounted on both free shafts 54,58, a guiding continuous belt 60 suspended on the pulleys 59,59, and guide rollers 61,61 supported on both ends of the free shaft 58 of the tip so as to freely rotate.

The picking tool 24 drives the guiding continuous belt 60 and pulleys 55,55 in the picking direction (the direction of the arrow F) due to the activation of the drive motor 53. The picking tool 24 is arranged with freely advancing/retracting detecting rods 62,62 and is able to detect the relative positional relationship with the article to be picked.

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The drive device shown in Figure 1 which elevates the upper frame 6 comprising the slanting device and the lower frames 22,23 comprising the picking device 5 has been omitted from the diagram but is provided with a main winch arranged above the travelling carriage 3 and a sub-winch arranged on the upper frame 6, connects the lower end of the rope wound on the main winch to the upper frame 6 and connects the lower end of the rope wound on the sub-winch to the lower frames 22,23.

As shown in Figures 18 and 19, the stock device 2 is provided with a plurality of sets of receiving conveyors 68 for receiving the article B pushed out from the pulling conveyor 26, and a plurality of sets of send-out conveyors 69 for sending out at the rear at right angles to the transport direction (the direction of the arrow H in Figure 18) of the receiving conveyor 68 and the transport surface 68a of the receiving conveyor 68 is able to freely project with respect to the transport surface 69a of the send-out conveyors 69 (refer to Figure 19).

The receiving conveyor 68 and send-out conveyors 69 achieve a reduction in the production costs by each send-out conveyors 69 arranged between adjacent receiving conveyors 68,68, the spacing between adjacent receiving conveyors 68,68 being wider the further upstream (front side) in the send-out direction and being smaller the further downstream (rear side). The stock 2 receives large articles B in the wide interval P area and receives small articles B in the small interval P area.

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Each receiving conveyor 68 is mounted with a plurality of freely rotating rollers 72 between the long frames 71,71 connected to the elevator devices 70,70 for projecting and the transport surface 68a comprising the outer surface of the rollers 72 is slanted downwards from the right hand receptor upstream side towards the left downstream side. The stock device 2 is arranged with a stopper 72 on the left side and receives articles B moved by being guided by the receiving conveyor 68.

Each of the aforementioned send-out conveyors 69 comprises freely rotating rollers 75 with both ends connected to the left and right main body frames 73,74. The drive device 76 which forcibly drives the rollers 75 is provided with a continuous belt 77 in contact with the outer surface of each roller 75, pulleys 78,78 on which is suspended the continuous belt 77 and a motor (omitted from the drawing) that drives the continuous belt 77.

The stock device 2 is guided so as to freely elevate on the mast 3a of the travelling carriage 3 and the lower end of the hoist rope 79 of the elevator winch (omitted from drawing) arranged above the travelling carriage 3 is connected to the main body frame 80. The stock device 2 elevates from a height where an article B pushed out from the pulling conveyor 26 shown in Figure 2 is received, to a height where the received article is paid out onto the transport conveyor C. The transport conveyor C comprises a belt conveyor or a roller conveyor or the like extending in the left/right direction as shown in Figures 1 and 2. The travelling carriage 3 contains the drive device (omitted from



drawing) such that it moved in the left/right directions guided by the rails 81,82.

Next, the operations of the equipment will be described.

Firstly, as shown in Figure 3, the article picking device 1 is in a standby state with the tip 7a of the arm 7 retracted and the picking tool 24 retracted. Next, when an article taking signal is generated, the travelling carriage 3 runs as far as the predetermined article taking position and then stops. Thereafter, the upper frame 6 and the lower frames 22,23 elevate as far as the respective predetermined taking heights.

In continuance, as shown in Figure 4, the article picking device 1 presses the rear of the taken article B by the lowered pressing tool 11 after moving the tip 7a of the arm 7 to a predetermined position. Then, the lifting arm 16 presses the front of the article B taken by the pressing part 16d. Then the lifting arm 16 slants the article B by raising the pressing part 16d as shown in Figure 5 and the picking tool 24 advances into the lower space D formed below the slanted article B while lifting up the article B by the guide rollers 61,61. Simultaneous with this, the slanting tool 8 raises the pressing tool 11 and retracts the lifting arm 16. Furthermore, the slanting tool 8 presses using the pressing tool 11 the upper surface of the article B moved onto the picking tool 24 as shown in Figure 6 by lowering the pressing tool 11 and slightly retracting the arm 7 thus the article B can be moved without falling and the like even if the picked article is rapidly moved.

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In this state, the continuous belt 56 of the picking tool 24 and pressing tool 11 retract simultaneously and deliver the article B to the pulling conveyor 26. The pulling conveyor 26 transports the received article B and stops it by the stopper 65. In continuance, the pulling conveyor 26 pushes the article into the stock device 2 by the pushing device 66. The stock device 2 receives the article B on the raised receiving conveyor 68 and stops it with the stopper 72 as shown in Figure 18.

Lastly, once the stock device 2 has received a predetermined number of articles B, it lowers to the height of the transport conveyor C, and thereafter drives and raises the send-out conveyors 69 and completes one article picking cycle by paying out the article B onto the transport conveyor C.

An article picking equipment of the present invention as described above demonstrates the following advantages.

As the next article picking operations may be performed while running the travelling carriage irrespective of the existence of an article paid out onto the transport conveyor, the processing ability of the equipment may be improved.

As the dimensions between the stock area and transport conveyor may be shortened, a more efficient use of space by the equipment may be achieved.

As the position of the comparatively light slanting tool and picking tool may be changed to the next picking position by moving in the left/right direction while the travelling carriage is in the stationary state, changing the picking position at high speed is possible and the processing ability of the equipment may be improved.





Claims;

1. An article picking equipment provided with a stock area that stores articles in a stacked state, an article picking device that individually picks articles from an article group stacked in the stock area, a stock device that receives and stores articles from the article picking device, a travelling carriage arranged with the article picking device and stock device which are freely elevating and which runs in the left and right directions, and a transport conveyor that extends to the left-right directions such that the articles are received from the stock device, where

the travelling carriage is positioned such that it runs between the stock area and the transport conveyor.

2. An article picking equipment as in claim 1, wherein the stock device is positioned to one side of the left or right side of the article picking device such that it receives articles moved along the left/right direction from the article picking device and also transfers the received stored articles onto the transport conveyor by transporting them in the forward/backward direction.

3. An article picking equipment provided with a travelling carriage that runs to the right and left, a slanting device and a picking device that picks the articles by being inserted into the space below the article which has been

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slanted by the slanting device, the slanting device is provided with a frame arranged so as to freely elevate with respect to the travelling carriage, an arm arranged so as to move freely backwards and forwards with respect to the frame and a slanting tool arranged on the tip of the arm, the picking device is provided with a frame freely elevating with respect to the travelling carriage, an arm which is able to move freely backwards and forwards with respect to the frame and a picking tool arranged on the tip of the arm, where the slanting device is arranged with an arm which is able to freely move to the left and right with respect to the frame, and the picking device is arranged with an arm which is able to freely move to the left and right with respect to the frame.

4. An article picking equipment as in claim 3, wherein the slanting device has a pressing tool that pushes an article to the rear of the article to be picked and a lifting arm that pushes the front surface of the article to be picked.

5. An article picking equipment as in claim 4, wherein the lifting arm causes the tip to press the front surface of the article and slants the article by raising the tip.

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