METHODS OF AND MEANS FOR THE STACKING OF ARTICLES INTO LAYERS

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This invention relates to methods of and apparatus for stacking articles into layers and in particular to a method and apparatus in which layers of articles are tilted as described in co-pending application No. 723,883.

The present invention provides a method of stacking articles which comprises the steps of transferring a horizontal layer of articles consisting of at least two rows of articles on to a horizontal tilting platform, at least one of said rows being situated on the slotted zone of a supply platform and at least said one row being trans-ferred by moving the tilting platform upwards through that slotted zone, tilting the tilting platform to a substantially vertical position, depositing the now vertical layer of articles on a stacking platform, tilting the tilting platform to a substantially horizontal position and moving it below another row of articles which has in the meantime been assembled on that slotted zone.

Preferably the vertical layer of articles is moved forwards by the tilting platform through a distance equal to the width of the vertical layer during and/or subsequent to its deposition on the stacking platform.

The present invention also provides a means by which apparatus comprising a slotted supply platform, an L-shaped tilting platform having a slotted back part and a slotted foot part, a slotted stacking platform, and means for moving the tilting platform round an endless path such that when the back part of the tilting platform is horizontal, the back part is moved upwards through the supply platform, the tilting platform is then tilted so that the back part is substantially vertical and is moved forwardly and downwardly so that the slotted foot part passes through the stacking platform and is thereafter returned to its starting point without passing downwardly through the slotted supply platform.

Preferably the moving means comprise a first member one end of which is pivotally connected to the tilting platform and the other end of which is pivotally connected to the frame, a second member one end of which is pivotally connected to the tilting platform at a point spaced from the first mentioned pivot, a third member one end of which is pivotally connected to the other end of the second member, the other end of the third member being pivotally connected to the frame, means for tilting the first member and means for tilting the third member.

Preferably the fixed pivots of the first and third member lie on a common axis and that axis and the axes of the other three pivots constitute the corners of a parallelogram.

The present invention will now be described with reference to the accompanying drawings in which:

FIG. 1 is a schematic side elevation partly in section of one embodiment;
FIG. 2 is a plan view of the apparatus shown in FIG. 1;
FIG. 3 shows schematically the movements of the members which constitute the parallelogram during operation of the machine;
FIG. 4 is a plan view of a second embodiment, and
FIG. 5 shows a detail of the embodiment of FIG. 4 in side elevation.

In the embodiment shown in FIGS. 1 and 2, the articles are supplied in the direction of arrow A by a conveyor belt on to a fixed platform 1 which constitutes the supply platform. When the article at the front of the row contacts a micro-switch (not shown) located at 2, pneumatic cylinder 3 is actuated so that its piston moves in a right-hand direction (FIG. 1). This piston is coupled to a slide 13 carrying the pusher-member 4, which in turn pushes a row of five articles on to the parallel fingers 5 (which constitute the slotted zone) of the fixed platform 1. A stop 6 carried by a lever 7 pivoted at 8 and loaded by a spring 9 to extend over the surface of platform 1 arrests the row of articles which have been pushed forward by member 4.

A lever 10 pivoted at 11 and acting on a micro-valve 12 is arranged in the path of slide 13. When slide 13 contacts lever 10, the movement of the piston of cylinder 3 is reversed. When therefore this piston has completed its stroke in a left-hand direction, it stops until micro-switch 2 receives a new impulse from the next row of articles supplied.

Tilting platform 14 is provided with two C-shaped plates 15 rigidly secured to it. Two parallel members 17 are pivoted at 16 to plates 15. A third member 18 is pivoted at 19 to platform 14. Members 17 are pivoted at 20 in bearings 21 fixed to the frame of the machine.

Member 22 has one of its ends pivoted at 20 and its other end rotatably connected at 23 with the end of member 22. The dimensions are such that the axes 16, 20, 23 and 19 lie at the four corners of a parallelogram. The movements of the links constituting the parallelogram are shown in FIG. 3. In that figure, A, B, C and D represent the initial position (i.e. the position occupied in FIG. 1) of axes 19, 20, 23 and 19.

A pneumatic cylinder 24 is pivoted at 25 to the frame of the machine. Its piston rod 26 carries a fork 27 pivoted at 28 to a lug 29 rigidly connected with member 22. A micro-valve 30 carried by a bracket 31 fixed to the frame of the machine, is arranged to be actuated by a projection 32 carried by member 22.

A pneumatic cylinder 33 pivoted at 34 to the frame of the machine carries a fork 35 at the end of its piston rod. Fork 35 is pivoted at 36 to the members 17. A micro-valve 37 fixed to the frame of the machine is arranged to be actuated by one of the members 17. A third micro-valve 38 carried by a bracket 39 is arranged to be actuated by member 22. A lever 40 pivoted at 41 to plates 15 and urged by a spring (not shown) to rotate in an anti-clockwise direction extends through a slot at the back part of the L-shaped tilting platform. Lever 40 is arranged to actuate a micro-switch 42 fixed to the frame of the machine.

The tilting platform operates as follows: when the last row 43 on platform 14 is completed, the front row 44 contacts lever 45 which is thereby rotated in a clockwise direction and actuates micro-switch 42. This has as a result that compressed air is supplied to the right-hand end of cylinder 24, the piston of which then rotates member 22 in a clockwise direction through an angle of about 90°. The links of the parallelogram now occupy the position A'B'C'D'. During this rotation members 17 stay put until projection 32 contacts micro-switch 30, whereupon the piston of cylinder 22 is moved in a right-hand direction, so that members 17 are rotated in a clockwise direction around pivot 20. On rotation of members 17, members 22 stay put. The links of the parallelogram now occupy the position A'B'C'D'.

During the above-mentioned movements, platform 14 is initially rotated round pivot 16 to adopt a vertical position and subsequently moved in this position in a right-hand and slightly downward direction.

During the period that the platform 14 is in a vertical position, the layer of articles on platform 14 rests on the
fingers 46 constituting the foot part of the L-shaped tilting platform. The moment these fingers 46 pass through the slots 47 of the stacking platform 48, the vertical layer of articles is deposited on the stacking platform 48. In consequence of the continuation of the rotation of the members 17 around pivot 20 after the vertical layer has been deposited on the stacking platform, this layer—and therefore also the layers previously deposited on the stacking platform—is displaced in a righthand direction over a distance at least equal to the width of one layer.

When the members 17 have rotated over such an angle that valve 37 is actuated by one of these members, the piston of cylinder 34 is retracted. During this retraction, members 17 stay put again so that the now empty tilting platform 14 is rotated in an anti-clockwise direction around pivot 16 until it dips slightly below the horizontal. The links of the parallelogram now occupy the position ABCD. When the tilting platform has reached this latter position, member 22 actuates valve 38, whereby cylinder 33 is actuated to rotate members 17 in an anti-clockwise direction. Because during this latter rotation member 22 stays put, platform 14 is moved into a horizontal position along a slightly rising path in a lefthand direction. When the piston of cylinder 33 completes its stroke in a lefthand direction, the fingers 49 of the back part of the tilting platform move through the slots between the fingers 5 of the fixed supply platform 1. To assist the tilting platform 14 in reaching exactly its initial position (shown in FIG. 1), a guide roller 59 rotatably mounted fixed to the frame of the machine co-operates with a bevelled part at the underside of the platform. The links of the parallelogram have now returned to the starting position ABCD.

It will be noted that the tilting platform returns to its starting position where the upper surface of its back part is below or in line with the upper surface of the supply platform without having passed downwards through the supply platform. This is due to the fact that the back part is situated below the transfer platform before moving sideways (i.e. to the left in FIG. 1) under it. As the tilting platform does not have to pass downwards through the transfer platform during its return to the starting position, articles can be assembled on the transfer platform immediately the previous layer has been removed. This enables the layer to be assembled slowly thereby allowing the articles to be handled gently. Although the movement of the parallelogram has been divided into four sequential steps, it will be evident that some of these steps may overlap each other, i.e. the subsequent step may be taken before the previous step has been completed.

Because the bevelled part depresses lever 7, the stop 6 is moved out of the path of the rows of articles to be loaded on to the tilting platform.

A new cycle of the tilting platform 14 will start when a new row 44 contacts lever 40.

A box 51, placed on platform 48, is intermittently pushed backwards by the incoming stack of articles. The box is supported by a plate 52 pivoted at 53 to arm 54 pivoted at 55 in a bearing rigidly fixed to the frame of the machine. Rigidly fixed to arm 54 is a second arm 56, to which the piston-rod of a shock-absorber 57 is pivoted. The other end of shock-absorber 57 is pivoted at 58 to a bracket secured to the frame of the machine.

The arm 54 is kept in the position shown by a roller 59 mounted on one end of a lever 60 pivoted at 61 to the frame of the machine. A compression-spring 62 urges roller 59 in a recess of a cam 63 rigidly fixed to arm 54, when a filled box is pushed from the stacking platform 48, it descends by gravity on to roller conveyor 64. This movement is damped by the damper 57. After a filled box is discharged and a new box is placed on the stacking platform, the support is brought back manually into the position shown.

The embodiment shown in FIGS. 4 and 5 of the drawing differs from the embodiment of FIGS. 1 and 2 only in that the articles are continuously supplied by a conveyor belt in the direction of the arrow B, i.e. in the same plane as the movement of the tilting platform.

Although in both embodiments the vertical layer or layers of articles on the stacking platform are pushed into a carton in the same direction as the tilting movement, it will be appreciated that the vertical layer or layers which have been assembled on the stacking platform can be pushed into a carton by a movement which is at right angles to the tilting movement. However, in such an embodiment, that pushing movement cannot readily be provided by the tilting platform; an additional member is then required.

What is claimed is:

1. An apparatus for stacking articles comprising a frame, a slotted supply platform, an L-shaped tilting platform having a slotted back part and a slotted foot part, a slotted stacking platform, and means for moving the tilting platform round an endless path such that when the back part of the tilting platform is horizontal, the back part is moved upwards through the supply platform, the tilting platform is then tilted forwardly so that the back part is substantially vertical and is moved forwardly and downwardly so that the slotted foot part passes through the stacking platform and the tilting platform is thereafter tilted backwardly and returned to its starting position without passing downwardly through the slotted supply platform, in which the moving means comprise a first member one end of which is pivotally connected to the tilting platform and the other end of which is pivotally connected to the frame, a second member one end of which is pivotally connected to the tilting platform at a point spaced from the first mentioned pivot, a third member one end of which is pivotally connected to the other end of the second member, the other end of the third member being pivotally connected to the frame, means for tilting the first member and means for tilting the third member.

2. An apparatus as claimed in claim 1 in which the fixed pivots of the first and third member lie on a common axis and in which the four pivots constitute the corners of a parallelogram.

3. An apparatus as claimed in claim 2 in which the means for tilting the first member and the means for tilting the third member are arranged to lock their respective members in predetermined positions when the other means is in operation.

4. An apparatus as claimed in claim 2 in which the means for tilting the first and third members each comprise a pneumatic or hydraulic cylinder.

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