

APPARATUS FOR STACKING OBJECTS AND TRANSFERRING THE OBJECT
STACK TO A PACKAGE CONVEYOR

The invention relates to an apparatus for stacking objects and transferring the object stack to a package conveyor with a feeder moving the objects to the package conveyor.

Pharmaceutical products are usually packed in blister packages that are made in a thermoforming machine from foils and that creates individual blister packs. As a rule a plurality of the blister packs are contained in a single cardboard box so that an apparatus of the above-described type is needed between the thermoforming machine and the boxing machine. The problem here is insuring good process safety with a high production rate, since stacking the blister packs is difficult and there are problems when the stack is formed by dropping the objects since the objects must fall through different distances as the stack grows. As the objects drop they can become canted and even slight misalignments can disrupt the production line.

It is an object of the present invention to improve on an apparatus of the above-described type such that during the entire process extremely close control is maintained of the objects as they are moved.

This object is attained according to the invention in an apparatus of the above-described type in that a feeder

extends laterally adjacent and parallel to the package conveyor above a cassette having at least one stack well, that the cassette has a lifter that sets the height of a floor of the stack well dependent on the number of objects stacked in the stack well, and that the cassette is advanced synchronously in the transport direction with the package conveyor during transfer perpendicular to the transport direction by a pusher of the finished object stack from the stack well into the package conveyor.

Such an apparatus has the advantage that as usual the object stack is formed from the bottom up, but always with the same drop distance, since as a result of the lifter the floor of the stack well is suitably positioned. The dropping of the objects from the feeder into the stack shaft is the sole time during the entire process that the displacement of the object is not controlled by the machine, but due to the short drop distance the object cannot move from the desired orientation. It is further advantageous that as a result of the synchronized movement of the cassette with the package conveyor the transfer is well controlled and the object stack is safely held either by the side walls of the stack well or by the elements of the package conveyor.

It is preferred that the package conveyor be a recirculating conveyor belt with uniformly distributed object cells and that there are a plurality of stack wells spaced like the package cells. This construction improves the throughput of the apparatus according to the invention the number of stack wells being set to accommodate the required

production capacity. It is important to note that even during transfer of the objet stacks they are always being laterally guided either by the side walls of the stack wells or by the package cells.

In order to simplify the mechanism of the apparatus according to the invention, it is preferred that the feeder be a suction belt for suspending and transporting the objects so that no means must be provided to support the objects from underneath. Such means would have to be moved out of the path of the dropping objects in the stack shafts, whereas the use of the suction belt makes it possible to operate merely by controlling its depressurization.

So that the system is of limited size, the cassette has a servo drive for synchronous movement with the package conveyor during transfer and for returning it to a stack-forming position after transfer, since in this manner the cassette does not move continuously in the transport direction of the package conveyor, but is only synchronized during transfer and is then shifted back upstream in order to start a new cycle.

In order to facilitate a control dropping of the objects in the stack shafts a sensor is provided above each stack well for determining correct positioning of the objects in the stack wells in the stack-forming position of the cassette. In addition the feeder has for each stack well a vertically movable abutment that is moved into the path of the object in accordance with the output of the respective sensor o that the object is in the right position for

dropping into the stack well. This dropping is most simply effected in that the feeder for each stack well has a vertically adjustable pusher that knocks the object off the suction belt so that it no longer held by suction thereon and the object can drop down into the stack well.

In order to simplify the mechanism of the apparatus, the lifter has two spaced guide pins on which a lifter bar carrying the floors of the stack wells can move vertically, therefore a single lifter can work with a plurality of stack wells in order to form a plurality of object piles.

In order to ensure during transfer of the object stack a uniform force over its entire height, the pusher has respective pusher bars engageable with the object stacks.

in order to make the apparatus adjustable, the stack wells are each formed by two side walls whose spacing is adjustable to accommodate different formats.

It is particularly preferred according to the invention when the sensors are connected with a process controller so that all kinds of different packages can be formed and object stacks can be made the same in adjacent stack wells.

In the following the invention is more closely described with reference to an embodiment shown in the drawing; therein:

FIG. 1 is a perspective schematic representation of the apparatus according to the invention;

FIG. 2 is a perspective view showing only the cassette;

FIG. 3 is a perspective view showing only the feeder;

FIG. 4 is a perspective view showing only the package conveyor;

FIG. 5 is a perspective view showing the cassette with the feeder and the package conveyor;

FIG. 6 is a view like FIG. 1 before the start of the formation of the object stack in the first stack well;

FIG. 7 is a view like FIG. 6 showing the deposition of the first object in the first stack well;

FIG. 8 is a view like FIG. 6 showing the deposition of the first object in the second stack well;

FIG. 9 is a view like FIG. 6 showing the deposition of the first object in the third stack well;

FIG. 10 is a view like FIG. 6 showing the deposition of the first object in the fourth stack well;

FIG. 11 is a view like FIG. 6 showing the deposition of the first object in the fifth stack well;

FIG. 12 is a view like FIG. 6 showing the action of the lifter to make a uniform drop distance for the second layer of objects in the object stacks;

FIG. 13 is a view like FIG. 6 showing the action of the lifter in preparation for transfer of the formed object stacks into the package conveyor;

FIG. 14 is a view like FIG. 6 showing shifting of the cassette to synchronize with the package conveyor;

FIG. 15 is a view like FIG. 6 showing pushing of the object stacks into the package conveyor; and

FIG. 16 is a view like FIG. 6 showing package conveyor carrying off the object stacks during return of the cassette to the stack-forming position.

The drawing shows an apparatus 1 for stacking objects 2 and transferring the formed object stacks 3 into a package conveyor 4 that has an endless conveyor belt 5 forming an endless row of object cells 6. The apparatus 1 furthermore has a feeder 7 that moves the objects 2 to the conveyor 4, that is formed as a suction-belt assembly 8 for suspending and transporting the objects 2, and that in the embodiment illustrated in the drawing has two suction belts 9 for the objects 2 which are blister packs. The feeder 7 extends laterally along and parallel to the package conveyor 4 above a cassette 10. The cassette 10 has at least one stack well 11, but in the embodiment illustrated in the drawing has five stack wells 11, and the cassette 10 has a lifter 12 for setting the level of floors of its stack wells 11 according to the number of the objects 2 stacked in the stack wells 11. The lifter 12 has two spaced guide pins 17 on which is vertically shiftable a lifter bar 18 carrying the floors of the stack wells 11. During transfer of finished object stacks from the stack wells 11 into the conveyor 4 by means of a slide 13 effective perpendicular to the transport direction 22, the cassette 10 is displaced in the direction 20 synchronously with the conveyor 4 to which end a

controlled servo drive is used that also returns the cassette 10 into a stack-forming position after sliding out of the object stacks 3. When the cassette 10 is in the stack-forming position, a sensor 14 above each stack well 11 can detect the correct positioning of one of the objects 2 relative to the respective stack shaft 11, the sensors 14 being built into the feeder 7. The sensors 14 are connected to a processor/controller. The feeder 7 further has for each stack well 11 a vertically displaceable abutment 15 and a vertically displaceable pusher 16. The slide 13 has a respective pusher bar 19 engageable with each object stack. The stack wells 1 are each formed by two side walls 20 whose spacing can be adjusted for different formats.

In the following the operation of the apparatus 1 according to the invention is described for one cycle that makes five object stacks 3 and transfers them into the package conveyor 4. The starting point is shown in FIG. 1 where an object 2 is fed by the suction belt 8 of the feeder 7 above the cassette 10 that is in the stack-forming position. FIG. 6 shows the position in which the sensor 14 in the first stack well 11 is detecting the proper positioning of one of the objects 2 above the stack well 11, whereupon the abutment 15 is dropped and the object 2 engages against this abutment 15 and is aligned by it. Then the pusher 16 in the feeder 7 is moved downward and pushes the object 2 off the suction belt 8 so that the object 2 drops in the stack well 11 until it lands on the floor positioned by the lifter 12, which is about the thickness of one object 2

underneath the upper edge of the side walls 20 of the stack well 11 so that the object 2 is wholly received in the stack well 11. Subsequently these steps are repeated for the second, third, fourth, and fifth stack wells 11 so that there is one object 2 in each of the stack wells 11. Then the lifter 12 (FIG. 12) moves downward so as to create in each well 11 room for another object. Once each stack well 11 holds an object stack 3 with the required number of objects 2, the lifter 12 moves all the way down (FIG. 13) and simultaneously the cassette 10 is accelerated in the transport direction of the conveyor system until they are moving synchronously. Then the pusher 13 slides the object stacks from the stack wells 11 into the object cells 6, and when the transfer is complete the pusher 13 returns to its starting position, the cassette 10 is moved back into the stack-forming position, and the lifter 12 moves upward until the floors of the stack wells 11 are repositioned for the start of a new cycle.

CLAIMS

1. An apparatus for stacking objects (2) and transferring the object stack (3) to a package conveyor (4) with a feeder (7) that conveys the objects (2) to the package conveyor (4), characterized in that a feeder (7) extends laterally adjacent and parallel to the package conveyor (4) above a cassette (10) having at least one stack well (11), that the cassette (10) has a lifter (12) that sets the height of a floor of the stack well (11) dependent on the number of objects (2) stacked in the stack well (11), and that the cassette (10) is advanced synchronously in the transport direction (22) with the package conveyor (4) during transfer perpendicular to the transport direction (22) by a slide (13) of the finished object stack (3) from the stack well (11) into the package conveyor (4).

2. The apparatus according to claim 1, characterized in that the package conveyor (4) is a recirculating conveyor belt (5) with uniformly distributed object cells (6) and that there are a plurality of stack wells (11) spaced like the package cells (6).

3. The apparatus according to claim 1 or 2, characterized in that the feeder (7) has a suction belt (8) for suspending and transporting the objects (2).

4. The apparatus according to one of claims 1 to 3, characterized in that the cassette (10) has a servo drive for synchronous movement with the package conveyor (4) during transfer and for returning it to a stack-forming position after transfer.

5. The apparatus according to claim 4, characterized in that a sensor (14) is provided above each stack well (4) for determining correct positioning of the objects (2) in the stack wells (11) in the stack-forming position of the cassette (10).

6. The apparatus according to claim 5, characterized in that the feeder (7) has for each stack well (11) a vertically movable abutment (15).

7. The apparatus according to claim 5 or 6, characterized in that the feeder (7) has for each stack well (11) a vertically movable pusher (16).

8. The apparatus according to one of claims 2 to 7, characterized in that the lifter (2) has two spaced guide pins (17) on which a lifter bar (18) carrying the floors of the stack wells (11) can move vertically.

9. The apparatus according to one of claims 1 to 8, characterized in that the slide (13) has respective pusher bars (14) engageable with the object stacks (11).

10. The apparatus according to one of claims 1 to 9, characterized in that the stack wells (11) are each formed by two side walls (20) whose spacing is adjustable to accommodate different formats.

11. The apparatus according to one of claims 5 to 10, characterized in that the sensors (14) are connected with a process controller.