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(54) **A SYSTEM FOR STACKING FOLDED BOXES**

(57) The invention relates to a system (100) for stacking folded boxes. The system comprises a stacker unit (150) for forming a stack of folded boxes. Further, the system comprises a conveyor unit (200) for conveying folded boxes into the stacker unit. Seen in a vertical direction, the conveyor unit and a receiving part of the stacker unit are arranged in such a manner that in use the folded boxes are falling from the conveyor unit into the stacker unit under influence of gravity.

Fig. 1

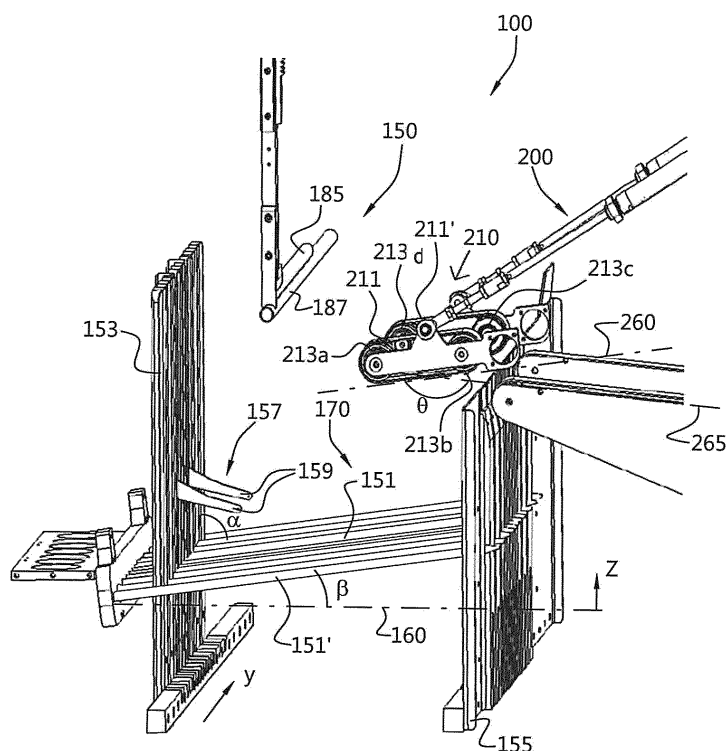


Fig. 2

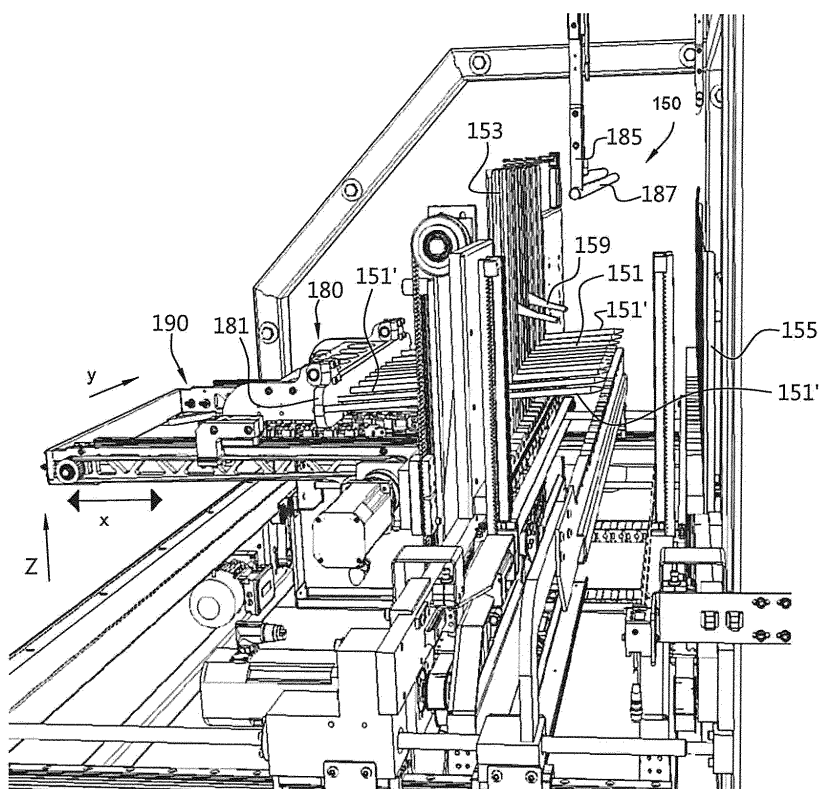
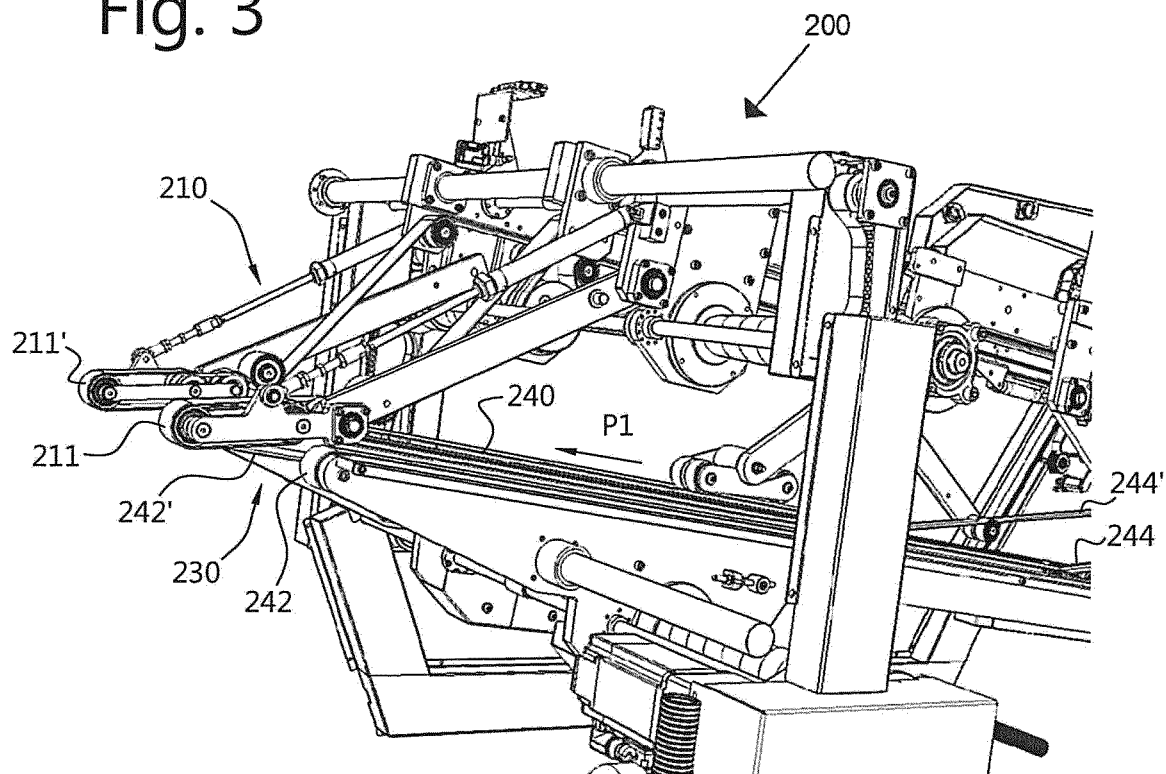


Fig. 3



Description

[0001] The invention relates to a system for stacking folded boxes. The system comprises a stacker unit for forming a stack of folded boxes and a conveyor unit for conveying folded boxes into the stacker unit.

[0002] US2003/0100422 discloses a system for stacking folded boxes. The system comprises an input device for feeding folded boxes to a stacker unit. The stacker unit uses a pusher mechanism for engaging with a side of one of the folded boxes and for driving a plurality of folded boxes into a vertical stack at a first location. Further, the system comprises a transferring device for lifting the stack and transferring it to a second location. The transferring device is adapted to rotate the stack through a predetermined angle between lifting the stack at the first location and transferring it to the second location. In certain types of boxes a compensation by this transferring device is needed to achieve an easily processable bundle or packet. A drawback of the system known from US2003/0100422 is the pushing mechanism for stacking folded boxes. The pushing mechanism provides a relatively low throughput limit of boxes, in particular in combination with boxes having an irregular shape. First, the required back and forth movement of the pusher mechanism is relatively time consuming. Second, a relatively high accurate control of the movement of the pusher mechanism is required for stacking the boxes in the desired manner, and even with such an accurate control the system remains relatively susceptible for machine failure for example if the side of one of the boxes to be engaged by the pusher mechanism is not oriented in a correct manner, which for certain folded box shapes such as for example folded boxes having an irregular shape is not uncommon.

[0003] DE 295 07 281 U1 discloses a system according to the preamble of claim 1.

[0004] JP 2012 006713 A discloses a stacker device capable of accumulating booklet forms in aligned state even if a processed section is swollen by the folding process or bookbinding process.

[0005] It is an object of the present invention to provide an improved system for stacking folded boxes. For example, the system for stacking folded boxes has a relatively high throughput which is relatively independent of the type or format of the folded boxes to be stacked and/or is less susceptible for machine failure as a result of the condition/orientation how the conveyor unit conveys the folded boxes.

[0006] The object is achieved by the system as defined in claim 1. The system for stacking folded boxes comprises a stacker unit for forming a stack of folded boxes and a conveyor unit for conveying folded boxes into the stacker unit. Seen in a vertical direction, the conveyor unit and a receiving part of the stacker unit are arranged in such a manner that in use the folded boxes are falling from the conveyor unit into the stacker unit under influence of gravity, wherein the receiving part of the stacker

unit is configured to change the inclination angle of the folded boxes with respect to a horizontal plane during stack-formation in the stacker unit.

[0007] In the system, the orientation, format and/or condition of the boxes in the conveyor unit is not relevant or less relevant, because the boxes are more or less released from the conveyor in a falling manner into the stacker unit due to the height difference between an exit of the conveyor unit and the receiving part of the stacker unit. The inventors have discovered that the productivity of the system and the flexibility in formats and types of boxes to be stacked can be greatly increased by "catching" the boxes in the stacker unit by means of the receiving part of the stacker unit, wherein the receiving part is configured to change the inclination angle of the folded boxes with respect to a horizontal plane during stack-formation in the stacker unit. Hence, during landing of the folded boxes on the receiving part, the angle may decrease from a starting value between 10-45 degrees to a lower end value, for example approximately zero degrees. The starting value can be varied by a control mechanism depending on the type and format of the folded boxes to be stacked. For certain formats and types of boxes, it is also possible to have a starting value of the inclination angle of approximately zero degrees.

[0008] In one aspect, the stacker unit comprises a receiving space defined at least by the receiving part and a stop plate of the stacker unit, wherein the angle α between the receiving part and the stop plate is variable between 30-120 degrees, preferably between 45-100 degrees. This variable angle α can be used by the receiving part to change the inclination angle of the folded boxes with respect to a horizontal plane during stack-formation in the stacker unit. The receiving space may further be defined by a back plate, wherein between the stop plate and the back plate the receiving part is arranged. By varying the dimensions of the receiving space, for example by varying the distance between the stop plate and the back plate, the system can be used in a flexible manner for stacking various series of boxes, wherein each series may have a different format and type of boxes to be stacked.

[0009] In a further aspect, the receiving part of the stacker unit is configured to lower the folded boxes received thereon during stack-formation in the stacker unit. In this way, the falling distance between the various boxes to be stacked on the receiving part can be controlled such that the risk of uncontrolled movements of a folded box falling on another folded box during stack-formation can be minimized.

[0010] The system may further comprise at least one robot unit comprising a moveable arm with a gripper unit arranged to clamp a stack of folded boxes formed in the stacker unit through recesses in the stop plate. By using such a robot unit, it is possible for the gripper unit to grasp a stack of folded boxes in the receiving space after formation in a relatively fast manner.

[0011] The stacker unit may further comprise a pres-

sure element, wherein the pressure element is configured to hold the stack of folded boxes between the pressure element and the receiving part. Keeping pressure on a stack of folded boxes reduces the risk of machine failure and provides a stack of folded boxes that can be moved in a relatively controlled manner. The pressure element of the stacker unit may be moveably connected to the stop plate and movable from a first rest position to a second pressure position for holding the stack of folded boxes between the pressure element and the receiving part of the stacker unit and vice versa, wherein in the first rest position the pressure element provides no obstacle for the boxes falling into the stacker unit. Such a pressure element provides an efficient system for stacking boxes and moving the stack of folded boxes in a relatively controlled and fast manner. The movement of the pressure element from the first rest position to the second pressure position is particularly advantageous when the stack of folded boxes formed in the stacker unit is to be moved by the robot unit comprising the moveable arm with the gripper unit, because such a pressure element forms no obstacles for the robot unit or for the stack to be displaced by means of the robot unit. The system may further comprise a pusher mechanism for pushing a stack formed in the stacker unit, preferably in a direction transverse to the conveying direction of the folded boxes in the conveyor unit. The robot unit and/or the pusher mechanism is/are configured to move a stack formed in the stacker unit between the stacker unit and a processing station, for example a processing station for forming a package of stacks formed by the stacker unit and/or a processing station for strapping the package or the stacks formed by the stacker unit. The processing station may have a pressure element having a corresponding design as the pressure element provided in the stop plate of the stacker unit, wherein the pressure element is also provided in a corresponding plate of the processing station, wherein the plate is also provided with recesses like the stop plate of the stacker unit. The pressure element in the processing station may be configured to hold the stack of folded boxes between the pressure element and a support of the processing station. This design of the pressure element is particularly advantageous after positioning the stack of folded boxes in the processing station by means of the robot unit, because the pressure element does not form an obstacle for the movements of the robot unit when the pressure element is in the first rest position during positioning of the stack of folded boxes in the processing station and after releasing the stack by the robot unit, the robot unit can be moved away from the stack when the pressure element has been moved to the second pressure position without hindrance.

[0012] In addition, the system may comprise a pressure mechanism configured to hold the stack of folded boxes formed in the stacker unit together. The pressure mechanism is configured to hold the stack of folded boxes together in the stacker unit after stack formation, during pushing the stack formed in the stacker unit towards the

processing station, and/or in the processing station.

[0013] In one different aspect, the conveyor unit may be provided with a guiding mechanism for guiding folded boxes towards the stacker unit, wherein the guiding mechanism is provided at an exit of a conveyor of the conveyor unit and the guiding mechanism is moveable between a first position extending above the receiving part for guiding folded boxes towards the stacker unit and a second non-guiding position, preferably the second non-guiding position is a position in which the guiding mechanism provides no obstruction for other components of the system, such as for example a robot unit. The guiding mechanism provides a more controlled transfer between the conveyor unit and the stacker unit. The adjustable angle between the conveying direction of the conveyor and the guiding mechanism in the first guiding position is larger than 90 degrees and smaller than 180 degrees, preferably larger than 130 degrees and smaller than 170 degrees.

[0014] In a preferred embodiment of the system according to the invention, the guiding mechanism comprises at least one endless belt.

[0015] In a particular embodiment of the system according to the invention, in the conveyor unit the folded boxes are held between at least two conveyor elements for conveying the folded boxes to the stacker unit.

[0016] In a more preferred embodiment of the system according to the invention the conveyor unit comprises a counter for counting and controlling the number of folded boxes to be conveyed into the stacker unit.

[0017] The present invention will be explained in more detail below with reference to the appended figures showing an exemplary embodiment of a system for stacking folded boxes.

Fig. 1 shows a perspective view of a system for stacking folded boxes, wherein for visibility reasons only the main aspects of the system are shown;

Fig. 2 shows a perspective view of a portion of the system for stacking folded boxes, in particular the stacker unit;

Fig. 3 shows a perspective view of a portion of the system for stacking folded boxes, in particular the conveyor unit;

Figure 4 shows a perspective view of a portion of the system for stacking folded boxes, in particular the robot unit;

[0018] Like parts are indicated by the same reference signs in the various figures.

[0019] Each feature disclosed with reference to the figure can also be combined with another feature disclosed in this disclosure including the claims, unless it is evident for a person skilled in the art that these features are incompatible.

[0020] The figures 1-4 show a system 100 for stacking folded boxes (not shown). The system 100 comprises a stacker unit 150 for forming a stack of folded boxes (not shown) and a conveyor unit 200 for conveying folded boxes into the stacker unit. Seen in a vertical direction (direction indicated by arrow Z in figure 1) the conveyor unit 200 and a receiving part 151 of the stacker unit 150 are arranged in such a manner that in use the folded boxes are falling from the conveyor unit 200 into the stacker unit 150 under influence of gravity. The receiving part 151 of the stacker unit 150 is configured to change the inclination angle β of the folded boxes with respect to a horizontal plane indicated by dashed line 160 (figure 1) during stack-formation in the stacker unit 150. The stacker unit 150 comprises a receiving space 170 defined at least by the receiving part 151 and a stop plate 153 of the stacker unit 150, wherein the angle α between the receiving part 151 and the stop plate 153 is variable between 30-120 degrees, preferably between 45-100 degrees. In the embodiment shown in figure 1 the angle α and the angle β relate to each other, in that if the angle α increases, the angle β will decrease and vice versa. The stop plate 153 extends substantially in the vertical direction indicated by arrow Z, such that if the angle α is 90 degrees, the receiving part 151 extends in a horizontal plane, for example the horizontal plane indicated with dashed line 160. The stop plate 153 comprises a number of vertically extending plate parts which are spaced apart to define recesses between the plate parts. The receiving part 151 comprises a number of fork shaped elements 151', which are located at an even distance from each other, wherein the distance is defined by the width dimensions of the plate parts of the stop plate 153, such that the fork shaped elements 151' may extend through the recesses of the stop plate 153 as shown in figures 1 and 2. The receiving space 170 is further defined by a back plate 155, wherein between the stop plate 153 and the back plate 155 the receiving part 151 is arranged. On a side of the stop plate 153 facing away from the receiving space 170 a control mechanism 180 (figure 2) for displacing the receiving part 151 is mounted on the frame 190 of the system 100. The control mechanism 180 is able to change the above indicated angle α (and angle β) by pivoting control plate 181 around a pivot axis such that the receiving part 151 of the stacker unit 150 is configured to change the inclination angle of the folded boxes with respect to the horizontal plane 160 during stack-formation in the stacker unit 150. By pivoting control plate 181 around the pivot axis it is further possible to lower the receiving part 151 of the stacker unit 150 such that the receiving part 151 is configured to lower the folded boxes received thereon during stack-formation in the stacker unit 150. However, it is also possible that the system 100 comprises a drive mechanism controlled by the control mechanism 180 for vertically displacing the frame 190 together with the receiving part 151, i.e. it is also possible to lower the receiving part 151 of the stacker unit 150 by this drive mechanism such that the receiving

part 151 is configured to lower the folded boxes received thereon during stack-formation in the stacker unit 150 in a direction as indicated with arrow Z. Further, control mechanism 180 is able to displace the receiving part 151 in the direction indicated by arrow x (figure 2) over the frame 190. The dimensions of the receiving space 170 can be adapted, for example by changing the vertical height of the receiving part 151 in or opposite to the direction as indicated with arrow Z and/or by moving at least one of the stop plate 153 and the back plate 155 with respect to each other in or opposite to the direction indicated by arrow x. Hence, by adapting the dimensions of the receiving space 170 a relatively large number of formats and types of folded boxes to be stacked in the stacker unit 150 can be handled.

[0021] The system 100 further comprises a pusher mechanism (not shown) for pushing a stack formed in the stacker unit 150 in a direction indicated by arrow y (figure 1). The pusher mechanism may comprises at least two contact sections for contacting two separate sections of the stack formed in the stacker unit, wherein the at least two contact sections can be displaced with respect to each other. Hence, when pushing folded boxes having an irregular shape, it is possible by using the two separate sections to contact the boxes at optimal positions for pushing the stack such that during pushing the risk that at least one of boxes is pushed out of the desired travel path is reduced. A drive unit connected to a controller can be provided to displace the contact sections with respect to each other, wherein the controller receives information about the format and type of folded box to be processed in the system 100. The contact sections of the pusher mechanism are particularly advantageous when handling boxes with a crash-lock bottom in the system 100, because the dimensions and shapes of these boxes are relatively irregular which makes it difficult to move these boxes in a stack without deviating from the desired travel path of the stack in the system 100. Further, the system 100 comprises a pressure mechanism 185 configured to hold the stack of folded boxes formed in the stacker unit 150 together. The pressure mechanism 185 comprises a rod 187. The pressure mechanism 185 can be moved from a rest position to a pressure position contacting the top box of a stack of boxes by means of the rod 187, wherein in the pressure position the pressure mechanism 185 exerts a predetermined amount of pressure on the stack of boxes, such that the stack of boxes is positioned between the receiving part 151 and the rod 187. The pusher mechanism is configured to move a stack formed in the stacker unit 150 between the stacker unit 150 and a processing station (not shown), for example a processing station for forming a package of stacks formed by the stacker unit 150 and/or a processing station for strapping the package or the stacks formed by the stacker unit 150. The pressure mechanism 185 is configured to hold the stack of folded boxes together in the stacker unit, in particular during pushing the stack formed in the stacker unit 150 towards the processing

station, and/or in the processing station.

[0022] The conveyor unit 200 is shown in more detail in figure 3. The conveyor unit 200 is provided with a guiding mechanism 210 for guiding folded boxes in a controlled manner towards the stacker unit 150, wherein the guiding mechanism 210 is provided at an exit 230 of a conveyor 240 of the conveyor unit 200. The guiding mechanism 210 is moveable between a first position (shown in figures 2 and 3) extending above the receiving part 151 for guiding folded boxes towards the stacker unit 150 and a second non-guiding position. The guiding mechanism 210 comprises two endless belts 211, 211' supported by rollers 213a-d. The first position of the guiding mechanism 210 is also illustrated in figure 1 by dashed line 260 which coincided with the side of the endless belt 211 able to contact the boxes to be conveyed into the stacker unit 150. The second non-guiding position is a position in which the guiding mechanism 210 provides no obstruction for other components of the system 100, such as for example a robot unit to be discussed later. A line coinciding with the same side of the endless belt 211 as shown in figure 1 may in the second non-guiding position of the guiding mechanism 210 for example extend in a vertical direction indicated with arrow Z. Further, the angle θ (figure 1) between the conveying direction of the conveyor 240 indicated by arrow P1 (figure 3) or the dashed line 265 (figure 1) and the guiding mechanism 210 in the first guiding position (shown in figures 1 and 3) is adjustable depending on the number and/or, type and format of the folded boxes to be transferred to the stacker unit 150. The adjustable angle θ between the conveying direction P1 of the conveyor 240 and the guiding mechanism 210 in the first guiding position as shown in figures 2 and 3 is approximately 160 degrees. The angle θ can be varied between larger than 90 degrees and smaller than 180 degrees, preferably larger than 130 degrees and smaller than 170 degrees to optimize the transfer of boxes into the stacker unit 150.

[0023] In the conveyor unit 200 the folded boxes are held between at least two conveyor elements 242, 242', 244, 244' for conveying the folded boxes to the stacker unit 150 in an efficient and controlled manner. The conveyor elements 242, 242', 244, 244' may be formed by endless belts as shown in figure 3.

[0024] The conveyor unit 200 comprises a counter (not shown) for counting and controlling the number of folded boxes to be conveyed into the stacker unit, i.e. by counting the folded boxes and conveying the predetermined (counted) number of boxes to the stacker unit 150 each stack to be formed in the stacker unit 150 comprises the desired number of folded boxes. The counted boxes are conveyed by the conveyor unit 200 in batches to the stacker unit 150.

[0025] The system 100 further comprises at least one robot unit 300 (figure 4) comprising a moveable arm 301 with a gripper unit 303 arranged to clamp a stack of folded boxes formed in the stacker unit 150. The gripper unit 303 comprises fingers 305 which are dimensioned and

spaced such that the fingers 305 can be moved through the recesses in the stop plate 153. The upper and lower fingers 305 of the gripper unit 303 can be moved with respect to each other by an actuator mechanism to clamp a stack of folded boxes there between. The robot unit 300 is configured to move a stack formed in the stacker unit 150 between the stacker unit 150 and a processing station, for example a processing station for forming a package of stacks formed by the stacker unit and/or a processing station for strapping the package or the stacks formed by the stacker unit. It is possible to rotate the gripper unit 303 with the stack of folded boxes during the transfer to the processing station. The rotated stack may for example be positioned on a stack provided in the processing station by the pusher mechanism to provide a (more) stable packet of at least two stacks of folded boxes in the processing station, wherein the packet can be strapped in the processing station or in a subsequent strapping machine (not shown). The stacker unit 150 comprises a pressure element 157 (figure 1) provided in the stop plate 153, wherein the pressure element 157 is configured to hold the stack of folded boxes between the pressure element 157 and the receiving part 151 of the stacker unit 150. The pressure element 157 comprises at least two pressure fingers 159. The pressure element 157 is moveably connected to the stop plate 153 and movable from a first rest position (not shown) to a second pressure position (shown in figures 1 and 2) for holding the stack of folded boxes between the pressure fingers 159 of the pressure element 157 and the receiving part 151 and vice versa, wherein in the first rest position the pressure element 157 provides no obstacle for the boxes falling into the stacker unit. Preferably, the pressure fingers 159 of the pressure element 157 extend in the first rest position in the recesses of the stop plate 153 in a vertical direction indicated by arrow Z, i.e. the pressure fingers 159 extend parallel to the wall parts of the stop plate 153 in the first rest position and preferably the pressure fingers 159 do not protrude from the stop plate 153 in the first rest position. The pressure element 157 moves from the first rest position to the second pressure position when the stack of folded boxes formed in the stacker unit 150 is to be moved by the robot unit 300. For example, it is possible that the pressure mechanism 185 exerts a pressure on the stack of folded boxes directly after formation of the stack, wherein if the stack is to be moved by the robot unit 300, the pressure element 157 is activated by moving the pressure fingers 159 from the first rest position to the second pressure position, after which the pressure mechanism 185 is moved away from the stack of folded boxes in the receiving space 170 such that it is possible to grasp the stack by the robot unit 300 and lift the stack of folded boxes out of the receiving space 170. In an alternative operating mode, it is also possible to move the pressure fingers 159 from the first rest position to the second pressure position directly after formation of the stack in the stacker unit 150 without using the pressure mechanism 185. By using the pressure

mechanism 185 or the pressure element 157 it is possible to push the stack by means of the pusher mechanism in a more controlled manner in a direction indicated by arrow y (figure 1) or to lift the stack out of the receiving space 170 by the robot unit in a direction indicated by arrow Z.

[0026] Further, it is possible that the stacker unit 150 is able to align the boxes in a stack formed on the receiving part 151, for example by moving the stop plate 153 and the back plate 155 together and/or by vibration of the receiving part 151. Such plate movements and/or vibration may also be provided in the plates and/or support of the processing station.

[0027] In addition, the processing station has a pressure element (not shown), wherein the pressure element is configured to hold the stack of folded boxes between the pressure element and a support of the processing station. The stacker unit 150 and the processing station each comprise a corresponding pressure element such that the pressure element is moveably connected to a plate of the processing station and movable from a first rest position to a second pressure position for holding the stack of folded boxes between the pressure element and a lower support of the processing station and vice versa. The pressure element of the processing station does also not form an obstacle for the movements of the robot unit when the pressure element is in the first rest position during positioning of the stack of folded boxes in the processing station and after releasing the stack by the robot unit, the robot unit can be moved away from the stack when the pressure element has been moved to the second pressure position without hindrance.

Claims

1. A system (100) for stacking folded boxes, the system comprises a stacker unit (150) for forming a stack of folded boxes and a conveyor unit (200) for conveying folded boxes into the stacker unit (150), wherein seen in a vertical direction the conveyor unit (200) and a receiving part (151) of the stacker unit (150) are arranged in such a manner that in use the folded boxes are falling from the conveyor unit (200) into the stacker unit (150) under influence of gravity, **characterized in that** the receiving part (151) of the stacker unit (150) is configured to change the inclination angle of the folded boxes with respect to a horizontal plane during stack-formation in the stacker unit (150).
2. The system (100) according to claim 1, wherein the stacker unit (150) comprises a receiving space (170) defined at least by the receiving part (151) and a stop plate (153) of the stacker unit (150), wherein the angle α between the receiving part (151) and the stop plate (153) is variable between 30-120 degrees, preferably between 45-100 degrees.
3. The system (100) according to claim 2, wherein the receiving space (170) is further defined by a back plate (155), wherein between the stop plate (153) and the back plate (155) the receiving part (151) is arranged.
4. The system according to claim 2 or 3, wherein the dimensions of the receiving space can be adapted.
5. The system (100) according to any preceding claims, wherein the system comprises at least one robot unit (300) comprising a moveable arm (301) with a gripper unit (303) arranged to clamp a stack of folded boxes formed in the stacker unit (150) through recesses in the stop plate.
6. The system (100) according to any preceding claims, wherein the stacker unit (150) comprises a pressure element (157), wherein the pressure element (157) is configured to hold the stack of folded boxes between the pressure element (157) and the receiving part (151).
7. The system (100) according to claim 6, wherein the pressure element (157) is moveably connected to the stop plate (153) and movable from a first rest position to a second pressure position for holding the stack of folded boxes between the pressure element and the receiving part (151) and vice versa, wherein in the first rest position the pressure element provides no obstacle for the boxes falling into the stacker unit.
8. The system (100) according to claim 5 and 7, wherein the pressure element (157) moves from the first rest position to the second pressure position when the stack of folded boxes formed in the stacker unit (150) is to be moved by the robot unit (300) comprising the moveable arm (301) with the gripper unit (303).
9. The system (100) according to any preceding claims, wherein the system comprises a pusher mechanism for pushing a stack formed in the stacker unit (150), preferably in a direction transverse to the conveying direction of the folded boxes in the conveyor unit.
10. The system (100) according to claim 9, wherein the pusher mechanism comprises at least two contact sections for contacting two separate sections of the stack formed in the stacker unit, wherein the at least two contact sections can be displaced with respect to each other.
11. The system (100) according to claim 5 and 9, wherein the robot unit (300) and/or the pusher mechanism is configured to move a stack formed in the stacker unit between the stacker unit (150) and a processing station, for example a processing station for forming a

package of stacks formed by the stacker unit and/or a processing station for strapping the package or the stacks formed by the stacker unit.

12. The system (100) according to any preceding claims, wherein the system comprises a pressure mechanism configured to hold the stack of folded boxes formed in the stacker unit (150) together. 5
13. The system (100) according to claim 9 and 12, wherein the pressure mechanism is configured to hold the stack of folded boxes together in the stacker unit (150), during pushing the stack formed in the stacker unit towards the processing station, and/or in the processing station. 10 15
14. The system (100) according to any preceding claims, wherein the conveyor unit (200) is provided with a guiding mechanism (210) for guiding folded boxes towards the stacker unit (150), wherein the guiding mechanism (210) is provided at an exit (230) of a conveyor (240) of the conveyor unit (200) and the guiding mechanism (210) is moveable between a first position extending above the receiving part for guiding folded boxes towards the stacker unit (150) and a second non-guiding position, preferably the second non-guiding position is a position in which the guiding mechanism (210) provides no obstruction for other components of the system, such as for example a robot unit. 20 25 30
15. The system (100) according to claim 14, wherein an adjustable angle between the conveying direction of the conveyor (240) and the guiding mechanism (210) in the first guiding position is larger than 90 degrees and smaller than 180 degrees, preferably larger than 130 degrees and smaller than 170 degrees. 35

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Fig. 1

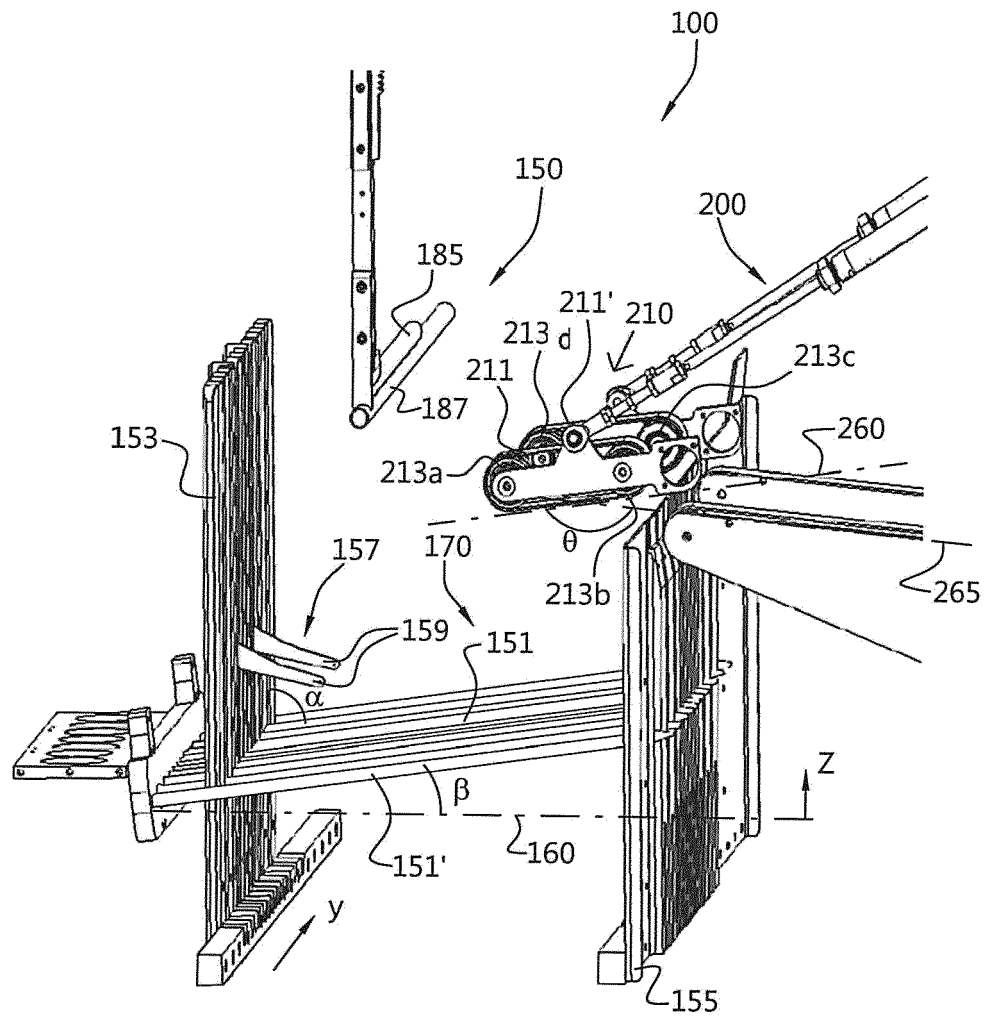


Fig. 2

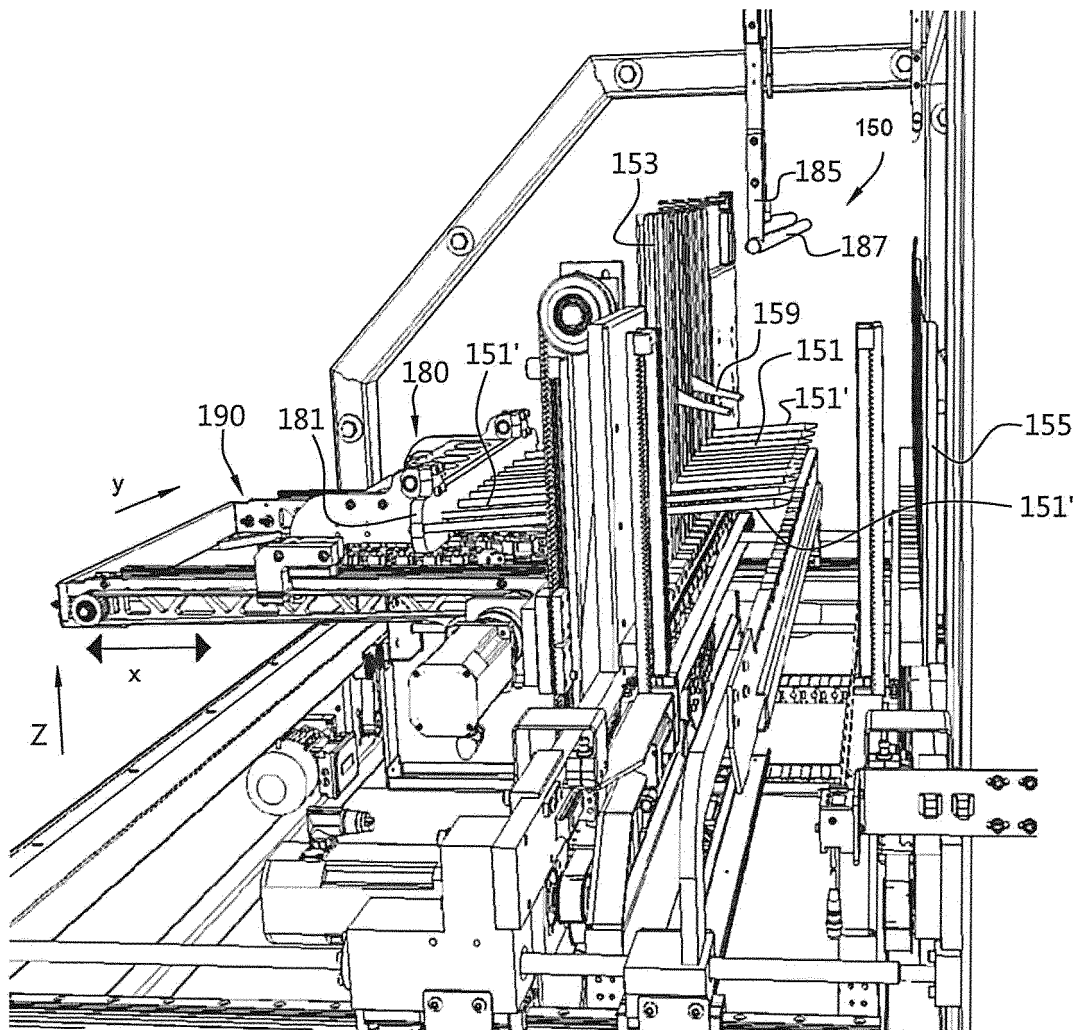


Fig. 3

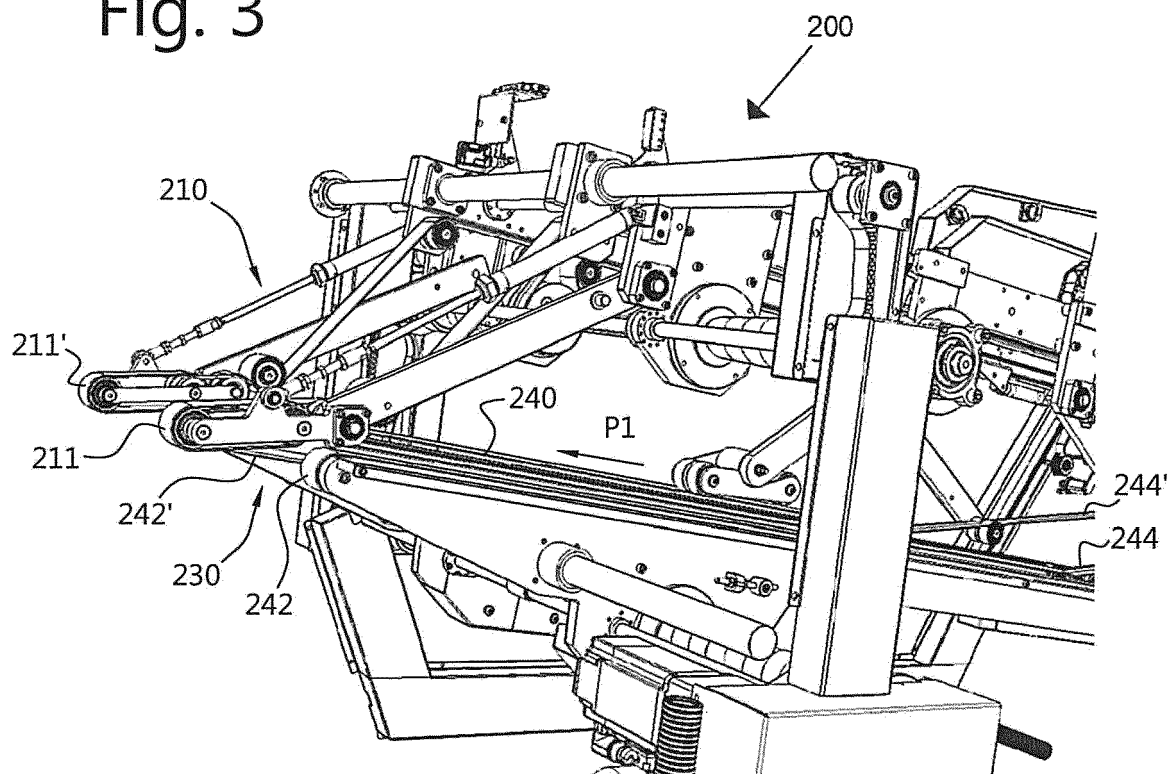
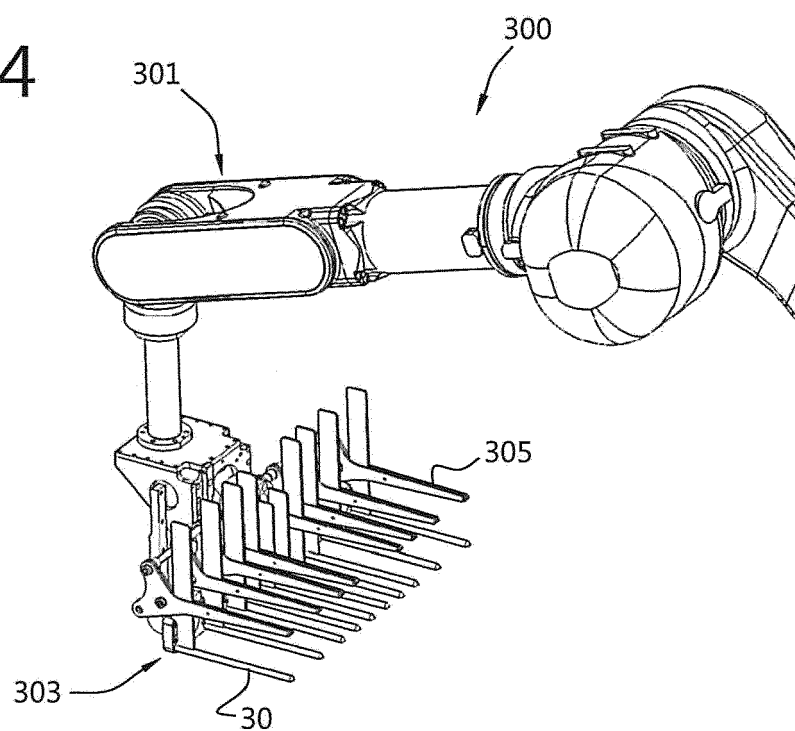


Fig. 4





EUROPEAN SEARCH REPORT

 Application Number
EP 21 15 7314

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 9 July 2021	Examiner Ureta, Rolando
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			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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