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(54) **BOX CLOSING SYSTEM AND PROCESS**

(57) The invention proposes a box closing system which comprises in the following order an entry guide system (6) to fold a closure panel (2) of a not yet closed box (4) towards the body of the box; a folding disc (9) to fold the closure flap (8) of the closure panel (2) and put it onto the body of the box; a guiding element (10) to space the closure flap (8) from the body of the box and to force it to form with respect to the remaining part of the closure panel (2) an angle smaller than 90°; an inserting roll (12) to push the closure flap (8) into the body of the box; a closing roll (16) to snap-in-close the box (4); and a transport system (20) to transport at least a box at least from the entry guide system (6) to the closing roll (16). The invention further relates to a relative box closing

process which includes, in the given order, the following steps: raising or lowering of the closure panel (2) of an open box (4), such that the panel covers the opening of the box (4); folding of the closure flap (8) of said closure panel (2) of the box (4) such that the flap is put on the body of the box; spacing of said closure flap (8) from the body of the box and folding of the closure flap (8) with respect to the remaining part of the closure panel (2) in the direction of the body of the box such that the closure flap (8) and the remaining part of the closure panel of the box form an angle smaller than 90°; inserting said closure flap (8) insaid body of the box; and, finally, snap-in-closing of said box (4).

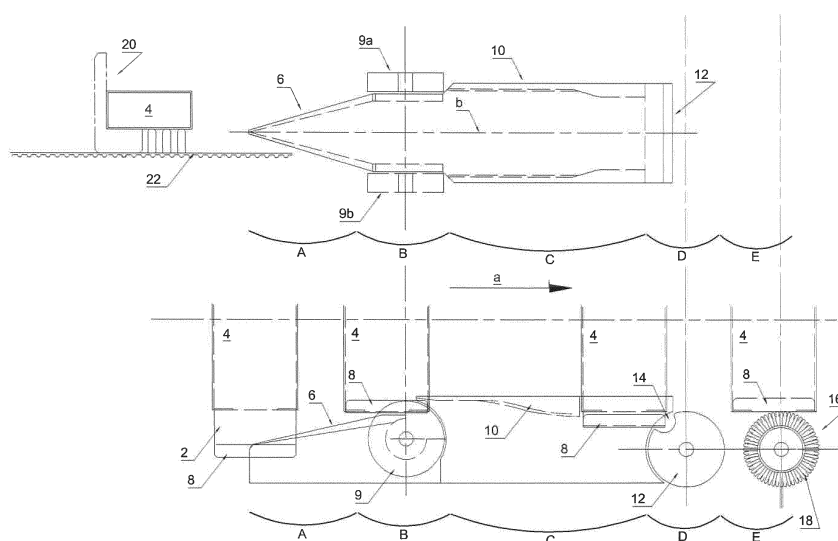


Fig. 1

Description

TECHNICAL FIELD

[0001] The invention relates to a box closing system, in particular for boxes for the pharmaceutical sector which, in technical jargon, are referred to as cartons, and are closed with a snap-in closure panel. The invention further relates to a respective box closing plant which allows the simultaneous closing of the boxes on both sides. The box closing system and plant allow the closing of boxes with closure panels located on opposite sides of the box, in which both closure panels are a continuation of the same side of the body of the box and also the closing of boxes with closure panels which are located on opposite sides of the box but of which a closure panel is the continuation of one side of the body of the box, while the other closure panel is the continuation of another side of the body of the box. A respective box closing process is also proposed.

STATE OF THE ART

[0002] For box closing, in particular of paper or cardboard folding boxes, comprising the folding of lateral dust-proof closure flaps and the insertion of the closure flap of a closure panel in the body of the box and the subsequent snap-in-closing, different methods and corresponding devices are known, which require, with the change of the type (e.g. change of the position of the closure panels) and of the format/size of the box, a change and/or an adjustment of the folding and insertion tools, which results in a considerable loss of time and in the need to provide complex systems for the adaptation of the closure device to the box format.

DISCLOSURE OF THE INVENTION

[0003] The object of the invention is to overcome the above-described disadvantages and to propose a box closing system and process requiring, with the change of the box type, less changes and/or adjustments of the box type and less corresponding adjustment means compared to the state of the art. Further objects of the invention become apparent from the description of preferred embodiments of the invention.

[0004] In a first aspect of the invention, the object is achieved by a box closing system as defined in the first claim, namely by a box closing system comprising:

- (a) an entry guide system suitable to fold a closure flap of a not yet closed box towards the body of the box;
- (b) downstream the entry guide system a folding disc suitable to fold the closure flap of the closure panel along a folding line and to put the closure flap onto the body of the box;
- (c) downstream the folding disc a guiding element

suitable to space the closure flap from the body of the box and to force the closure flap spaced from the body of the box to form with respect to the remaining part of the closure panel an angle smaller than 90°; (d) downstream the guiding element an inserting roll to push the closure flap into the body of the box such that the remaining part of the closure panel closes the box and forms a side of it; (e) downstream the inserting roll a closing roll to snap-in-close the box; and (f) a transport system to transport at least a box at least from the entry guide system, to the folding disc, to the guiding element, to the inserting roll, to the closing roll, wherein

- (i) said entry guide system comprises a plane obliquely inclined with respect to the transport direction of the box wherein the closure panel can be passed in front of the obliquely inclined plane and will be, at contact with it, raised or lowered such to cover the opening of the box during the passage;
- (ii) the surface of the folding disc destined to come into contact with the closure flap of the closure panel of the box is parallel to the side of the box onto which the closure flap will be put;
- (iii) the guiding element comprises

- (I) a first shaping defining a curved path which pushes the closure flap with the passage of the box along said first shaping away from the body of the box; and
- (II) a second shaping defining a height limitation which folds the closure flap such that it forms with respect to the remaining part of the closure panel an angle smaller than 90°; and wherein

- (iv) the inserting roll and the closing roll are arranged such that their rotation axis extends perpendicularly to the side of the box onto which the closure flap can be put by the folding disc and such that the part of the closure panel, which forms a side of the box, passing in front of the respective inserting and closing rolls is partially in contact with the lateral surface of the rolls.

[0005] The proposed box closing system allows to close boxes with closure panels in different positions and of boxes having different sizes. Advantageously, in particular, the entry guide system and the inserting roll and the closing roll are, thanks to their extension in the form of a plane and of cylinders in the case of rolls, capable of performing their action regardless of the extension of the closure panel. For this purpose, advantageously, the inserting roll and the closing roll are arranged such that there is a tangential contact with the front side of the box,

i.e. with the closure panel which closes the box forming the front side. The front side is a plane tangential to the lateral surface of the rolls.

[0006] Preferably, the obliquely inclined plane approaches the front side position and then advantageously terminates in a plane sector parallel to the front side in order to be able to hold the closure panel against the body of the box.

[0007] Also, the extensions of the first shapings of the guiding element are preferably chosen with such dimensions that the closure flap - regardless of its extension - is spaced from the body of the box so that its front edge is essentially flush with the front edge of the side of the box on which the closure flap was supported. Having the front edge of the closure flap essentially flush with the front edge of the side of the box on which the closure flap was supported, the second shaping that limits the height does not have to be adapted to different sizes of the closure flap if it is made in such a way as to press at least against the front part of the closure flap.

[0008] Advantageously, the plane sector of the entry guide system, the end portion of the first shaping (which defines the position of the front edge of the closure flap after being spaced from the body of the box), the second shaping and the perimeter of the inserting roll and of the closing roll are arranged along a line which forms the fixed (imaginary) edge for the side of the box to be closed. This allows to transport the box with a simple translational motion, without having to make any other position changes compared to the individual closing components within the box closing system.

[0009] Advantageously, the position of the front part of the box along its longitudinal extension transversely to the advance direction therefore does not change. This facilitates the fixed positioning of the elements shown under points (a) to (e) with reference to the position (distance) with respect to the front side of the box.

[0010] These considerations mean that different sizes of the body of the box have no relevance from the functional point of view of the system, except for the height adjustment of the folding disc and the guiding element to take into account different heights of the boxes and/or of different positions of the closure panel that must be approached by raising or lowering to the body of the box. Height refers to the position or extension along the direction of the rotation axes of the folding disc and/or the inserting and closing rolls.

[0011] The first shaping advantageously provides a curved pattern in the transport direction (as can be seen in exemplary form in Figure 1) which pushes the flap by shifting with its front edge along the curvature away from the body of the box. Advantageously, the second shaping includes, for example, introduced by a second entry guide system (as can be seen in exemplary form in Figure 3), a protrusion with respect to the plane of the side on which the closure flap is supported thereby pressing onto the closure flap to create between the closure flap and the remaining part of the the closure panel an angle small-

er than 90° (as seen in exemplary form in Figure 4). In the described variant, the guiding element is supported by the second shaping, respectively, on the side on which the closure flap is folded and on the closure flap itself.

[0012] Preferably, the entry guide system involves a division of the obliquely inclined plane, which realizes specular inclinations along the dividing line, in order to allow a closure panel to be folded either from the bottom or from the top towards the body of the box. This is particularly advantageous to take into account the fact that the boxes on the market are of two types with regard to the closure panel position. To better illustrate this difference in the boxes, reference is made to Figures 7a and 7b, representing state-of-the-art boxes of both types. In Figure 7a, the body of the box, which is composed of a top side and a bottom side and two lateral sides, is referred to as **5a**. The box **4a** has two closure panels **2a** with one closure flap **8a** each. The closure panels are in one case the continuation of the top side and in the other case the continuation of the bottom side. The reference number **6a** indicates dust-proof closure flaps, while the reference number **7a** indicates small cuts between the closure flap **8a** and the remaining part of the closure panel **2a** which serve, when closing the box **4a**, to wedge the panel with the corresponding shaped edges of the dust-proof closure flaps **6a**. In Figure 7b, instead, the body of the box, which is composed of a top side and a bottom side and two lateral sides, is referred to as **5b**. The box **4b** has two closure panels **2b** with one closure flap **8b** each. The closure panels are in both cases continuations of the bottom side of the box. The reference number **6b** indicates dust-proof closure flaps, while the reference number **7b** indicates small cuts between the closure flap **8b** and the remaining part of the closure panel **2b** which serve, when closing the box **4b**, to wedge the panel with the corresponding shaped edges of the dust-proof closure flaps **6b**.

[0013] In a preferred embodiment of the invention, the folding disc is adjustable in height, the height being defined by the position of the folding disc along its rotation axis. This height variability allows to fold a closure flap on the upper side of the box if the closure flap closes by raising it upwards from the bottom, or allows to fold the closure flap on the bottom side of the box when the closure panel closes by lowering it downwards from the top, considering the two types of boxes on the market. Alternatively, adjustments that take account of the above differences can also occur by moving the box with respect to the folding disc.

[0014] Always in terms of different closure panel positions and height adjustments, a further advantageous variant of the closing system provides that said guiding element comprises a second set of a first and a second shaping of mirror-imaged extension with respect to the first set of a first and a second shaping which is adjustable in height to approach a set of shapings or the other at the top or bottom of the box, respectively. Optionally, the guiding element includes, for each set of shapings, a

stopper protrusion which limits the re-opening of the box to a determined grade or the distance of the closure flap from the body of the box to a certain distance. Such stopper protrusions can be, for example, rods that show one end towards the closure panel.

[0015] Advantageously, the guiding element is a U-shaped profile where the shapings are respectively located on the inner lateral sides of the profile and where the lateral sides of the profile are positioned respectively outside the box on the top and bottom sides of the boxes and where the front side of the box to be closed points towards the bottom of the profile.

[0016] In a preferred embodiment of the invention, the closing roll is provided on the lateral surface of a plurality of protuberances preferably having elastic features. It has been shown that the "hammer" action of the individual protuberances results in a good snap-in-closing. Snap-in-closing refers in particular to boxes with a cut between the closure flap and the remaining part of the closure panel to wedge the cuts with relative bevels of the dust-proof closure flaps.

[0017] In another advantageous variant of the invention, the inserting roll and the closing roll are wound by a belt, wherein at least one additional roll is optionally present within the belt. The additional roll or a series of additional rolls allows to manage, according to principles known by the skilled person, the movement of the belt and of the rolls wound into it.

[0018] The box closing system and the relative plant and process described hereinafter are particularly suitable for closing boxes with snap-in closure panels which comprise a cut between the closure flap and the remaining part of the closure panel and thus, advantageously, also dust-proof closure flaps.

[0019] The box closing system can advantageously be combined with a dust-proof closure flap closing system, placed upstream.

[0020] In a variant of the invention, the inserting roll includes a groove on the lateral surface. This groove simplifies grasping of the closure panel to then push it against the body of the box by simultaneously inserting the closure flap into the body of the box. It is to be taken into account that the groove position with respect to the incoming closure panel requires consideration of the phase.

[0021] In an advantageous variant of the invention, the transport system of the box closing system according to the invention comprises (a) a first support plane; and (b) a second support plane which is orthogonal to the first support plane; wherein the first support plane comprises a first sector suitable to fix reversibly a box by adhesion; and wherein said box is supportable or supported with a first side which preferably does not correspond to a closing side of the box onto said first support plane and fixable or fixed reversibly by adhesion with said first side on said first sector and wherein said box is supportable or supported with a second side, which is contiguous to said first side and which preferably does not correspond to a

closing side of the box, on said second support plane. Such a transport system is described in Italian Application No. 102016000082727, on behalf of the same applicant. Such a system is particularly suitable for use in the box closing system according to the invention, since it releases the front part, the top part and a lateral part of the box so that the box can be introduced with no particular obstacles or displacements of fixed edges of traditional transport systems in the entry guide system with subsequent application of the folding disc, of the guiding element and of the subsequent rolls which require to be free to act on the front-top and front-lateral part of the box.

[0022] The first and second support planes serve as so-called fixed edges of the system. Their orthogonal position allows to place a box with orthogonal sides in a defined position. Even such a transport system does not require adaptations to any dimensional changes (in particular changes in width and height) of the box, thereby supporting the purpose of the invention to reduce adjustments by changing the box type. Preferably, the boxes are of the kind that in technical jargon is known as cartons. Preferably, the first support plane is essentially parallel to the direction of advancement of the transport device.

[0023] In a highly preferred embodiment of the invention, the second support plane comprises a second sector suitable to fix reversibly by adhesion said second contiguous side. The presence of two "adhesive sectors" helps to create an "orthogonal configuration" of the box because one side of the box that is not only supported on a support plane but also exerts an adhesive force on it, forces the two contiguous sides of the box in an orthogonal position that is necessary for its closing and/or filling. In the case of the presence of two sectors suitable for fixing by adhesion a side of the box in reversible form, the box is fixable or fixed reversibly with the second side, which is contiguous to the first side and which preferably does not correspond to a closing side of the box on said second sector of said second support plane. Advantageously, said sectors which are suitable to reversibly fix one side of the box essentially lie in the support surface of the support plane and do not protrude from it. In a further variant of the invention, the first sector and/or the second sector are provided with an adhesive medium, which is selected between a suction means, a surface suitable to fix materials by friction and a surface suitable to fix materials by glueing. In other words, the suction means can be defined as a sub-pressure or a vacuum. In the case of the suction means, which is preferred, the sector suitable to fix a side of the box by adhesion is, for instance, represented by a recess or opening in the support plane, which comprises a connection to a suction device which, in case of closing of the recess or opening with a box resting on it, allows to create a vacuum inside the recess/opening, thus exerting an adhesion force on the box. Advantageously, sealing systems can be provided to perfect the vacuum. By filling the recess/opening with a gas, which in the simplest case is air, preferably always through the same suction device, the adhesion

is suspended and the box can be removed from the transport device, such as by tilting the transport device or by pushing with a pushing element. The suction means has the advantage of not wearing the adhesive force rapidly, as is the case, for example, with bonding materials which, with repeated use, lose their adhesive strength for material detachment and/or dust deposit. Fixing by friction can, for example, occur with silicone materials.

[0024] Preferably, the box comprises two closing sides. The transport device according to the invention is particularly suitable for boxes with two closing sides, in particular with two open closing sides, since the combination of two fixed edges orthogonal with one or, more preferably, two sectors suitable for reversibly fixing by adhesion two contiguous sides of the box allows an "orthogonal configuration" also of boxes having two open sides, which can be easily subjected to deformation by creating a box configuration which, in section, looks like a parallelogram rather than a rectangle.

[0025] Advantageously, the transport device according to the invention is provided with or associated to at least one further support representing the continuation of one of the support planes to allow to increase the support surface. Such support may be, for example, made of a plurality of plastic nodules, which may be attached to a conveyor belt or a toothed belt conveyor platform on which the transport device is secured as well.

[0026] In an advantageous alternative of the box transport device according to the invention, one or each of the support planes may comprise more than one sector capable of reversibly fixing one side of the box by adhesion. A plurality of sectors increases fixing security and could be especially useful in case of transport of large boxes. The best layout of the "adhesion sectors" on the support planes can easily be identified by the person skilled in the art. In the case of single sectors, a more central position will be preferable, while in the case of a plurality of sectors it will be more advantageous to have an arrangement which guarantees fixing points which are uniformly distributed on the support plane and do not concentrate in an area. Another aspect of the invention relates to a box closing plant which comprises two box closing systems according to the invention, wherein one box closing system is situated in front of the other one with the respective single components corresponding one with the other to permit the contemporary closing of two opposed sides of the box. Alternatively, the second closing system may also be disposed downstream or offset with respect to the first closing system. In another further alternative, the closing of the second side is performed by passing the box with only one side closed a second time through the box closing system, for example, having introduced a product into the box between one passage and the other.

[0027] A final aspect of the invention relates to a box closing process which comprises the following steps in the given order:

- (i) preferably provision of a box closing system according to anyone of the claims from 1 to 8 or of a box closing plant according to claim 9;
- (ii) raising or lowering of the closure panel of an open box, preferably with said entry guide system, such that the panel covers the opening of the box;
- (iii) folding of the closure flap of said closure panel of the box, preferably with said folding disc, such that the flap is put on the body of the box;
- (iv) spacing, preferably by said guiding element, of said closure flap from the body of the box and folding of the closure flap with respect to the remaining part of the closure panel in the direction of the body of the box such that the closure flap and the remaining part of the closure panel of the box form an angle smaller than 90°;
- (v) inserting said closure flap, preferably by the action of said inserting roll against the closure panel, into said body of the box; and
- (vi) snap-in-closing of said box, preferably by the further action of said closing roll on said closure panel.

[0028] The succession of the above phases represents, compared to the state of the art, in particular with the use of the closing system/plant according to the invention, few adjustments of the system by changing the format (position of the closure panels, size) of the boxes to be closed. Advantageously, during the box closing process according to the invention, the box is transported from one phase to the next and during the listed phases by means of a transport system as defined in claim 6 or one of its embodiments described above.

[0029] The transport can take place in alternate form, as well as in continuous form. In variants of the invention, the transport system can be a horizontal or vertical transport system.

[0030] The transport is advantageously realized with the support and reversible fixing of the box with said first side, which preferably does not correspond to a closing side of the box on said first sector on said first support plane and support with said second side, which is contiguous to said first side and which preferably does not correspond to a closing side of the box, on said second support plane of said transport device; with the transport of said box for a determined stretch and precisely from the entry guide system to the closing roll or during the phases from raising or lowering of the closure panel in the body of the box. The removal of said box from the transport device after snapping in the closure panel can be added.

[0031] The process allows the transport of boxes of different sizes without having to adjust the transport device after changing the type or size of the box to adapt it to the new size, as is necessary in state-of-the-art transport systems. In addition, it does not hinder a positioning of boxes also of different type, so that the closing side for each type of box is always in the same position on the transport device.

[0032] Advantageously, the box closing process according to the invention comprises, after phase (vi), the change of the type or of the size of the box (that is, the replacement of boxes used so far with boxes of other sizes) and then the repetition of the phases from (i) to (vi), possibly adjusting, if necessary, the height of the folding disc and the position of the guiding element to take into account the type and the size of the closure panel.

[0033] Preferably, the box packaging plant according to the invention also includes a box filling unit and/or a unit for closing the dust-proof closure flaps.

[0034] A final aspect of the invention relates to the use of the box closing system, plant and process according to the invention in the pharmaceutical sector for the transport of boxes for pharmaceutical products or the like or in the cosmetic sector for the transport of boxes for cosmetic products. An alternative relates to the use in the food sector for the transport of foodstuff boxes.

[0035] The features described for one aspect of the invention may be transferred *mutatis mutandis* to the other aspect of the invention.

[0036] Said objects and advantages will be better highlighted during the description of preferred embodiment examples of the invention, given by way of example and not of limitation. Variants of the invention are the object of the dependent claims. The description of the preferred embodiment examples of the transport device according to the invention is given, by way of example and not of limitation, with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037]

- Fig. 1 illustrates in a top view a box closing system according to the invention;
- Fig. 2 illustrates the box closing system of Fig. 1 in a side view;
- Fig. 3 illustrates a detail of Fig. 1, the folding disc, in another side view;
- Fig. 4 illustrates in a cross-sectional side view the guiding element of the box closing system of Fig. 1;
- Fig. 5 illustrates another exemplary embodiment of the folding disc of Fig. 3;
- Fig. 6 illustrates in further detail the exemplary embodiment of the transport device represented within the box closing system in Fig. 1; and
- Figs. 7a/b represent two different types of state-of-the-art boxes that are distinguished by the position of their closure panels.

DESCRIPTION OF PREFERRED EXEMPLARY EMBODIMENTS

[0038] Fig. 1 is an exemplary embodiment of the box

closing system according to the invention. The closing system is divided into five areas. The area **A** corresponds to the area where the closure panel **2** of the box **4** is raised by means of an entry guide system **6**. The box **4** moves with the closure panel **2** extended and opened in the direction of the arrow **a** and enters the area **A** of the closing system. In the area **A**, the closure panel **2** encounters the entry guide system **6** which is represented by a plane inclined obliquely with respect to the advance direction **a** which, in contact with the closure panel **2**, causes the closure panel to be raised in the direction of the body of the box **4** so that the closure panel **2** is supported on the opening of the box **4**. The box **4** proceeds in its path and reaches the area **B** wherein the closure flap **8** of the closure panel **2** of the box **4** is folded by the action of the folding disc **9** on the body of the box **4**. The box **4** then reaches the area **C** dedicated to the re-opening of the box **4**. A guiding element **10** is provided with a shaping suitable to disengage the closure panel **2** from the body of the box **4** in a first stretch and to bend the closure flap **8** at a angle less than 90° with respect to the rest of the closure panel **2**. The curved path of a first shaping of the guiding element **10** shown in Fig. 1 forces the closure flap that passes with its front edge along the curved line to detach from the box. In a second stretch, a second shaping which is introduced by a second entry guide (inclination visible in Fig. 2 in the guiding element **10**) presses with a protrusion **11** that acts as a reducer in height on the closure flap **8**. When the closure flap **8** arrives in the area **D**, the box **4** encounters, in its forward movement, an inserting roll **12** pushing the closure panel **2** with the closure flap **8** inside the body of the box **4**. In the shown exemplary embodiment, the inserting roll **12** has a groove or recess **14** which is, however, not necessary and may also be omitted. The recess **14** can be useful to have a better "grasp" of the closure panel. By passing over the inserting roll **12**, the box **4** is closed. At the end of the closing path, in the area **E**, the (temporarily) closed box passes over a closing roll **16** provided with gummy protuberances **18** which give small strokes to the closure panel **4** so as to completely snap-in-close the box **4**.

[0039] Fig. 2 shows the closing system of Fig. 1 in a side view; compared to the view of Fig. 1, the system is shown flipped by 90°. On the left is the box **4** arranged on a transport device **20** located on a conveyor platform **22**, illustrated better later with reference to Fig. 6. Inside area **A** the entry guide system for raising the closure panel towards the body of the box **4** can be noted. The representation is specular with respect to line **b** to take into account that the disc **9** can be adjusted in height to assume different positions between position **9a** and **9b** in order to take into account the closing of boxes with "bottom-up" closure shown in Fig. 7b or "top to bottom" closure, as shown in Fig. 7a and different sizes of the box height (area **B**). For the same reason, the representation is specular also for the entry guide system **6** and the guiding element **10**.

[0040] The concept of changing the height of the disc **9** in positions from **9a** to **9b** in the direction of the double arrow **c** is repeated in Fig. 3, showing how the disc **9a** leans over the closure flap and above the body of the box **4**. In a variant with a closure panel located at the bottom side of the box, the disc would push the closure flap from below (**9b**) against the body of the box.

[0041] In Fig. 4, it is to be noted that the guiding element **10** is provided with the beveled geometry of a step-shaped shaping **11** which allows to press the closure flap **8** at an angle less than 90° with respect to the rest of the box, while the stopper protuberances **13** keep the closure panel **2** in a position which is not too detached from the body of the box **4**. In a variant with a closure panel that is located on the bottom side of the box, the guiding element would be raised so as to be supported with the lower shaping on the bottom side of the box **4**.

[0042] Fig. 5 shows another exemplary embodiment of the folding disc **9a** and **9b** of Fig. 3, designated respectively with **109a** and **109b**, wherein the disc has bevels **24** on the edges to facilitate the gripping and bending of the closure flap under the folding disc.

[0043] Figure 6 shows in a sectional view a box transport system **20** mounted on a toothed belt conveyor platform **22**. Each transport device **20** is provided with two orthogonal support planes **26a** and **26b** each serving as a fixed edge of the system. Each support plane **26a** and **26b** comprises a sector **28a** and **28b**, respectively, capable of reversibly fixing a box by adhesion which, in the present case, comprises a suction system **30**. Such systems may be openings, for example, in the form of a suction cup, inside which a small channel **32** emerges. The small channels **32** of both sectors suitable for fixing a box by adhesion are in communication via a connecting channel **34**. Through an opening **36**, which is in communication with the system of channels **34** and **32**, a vacuum can be applied by means of a connection to a suction device (not shown).

[0044] On each represented transport device **20** a box **4** is provided, supported on two contiguous sides **42a** and **42b** by two support planes **26a** and **26b** and where it is held in position and in "orthogonal configuration" (the corners of the box sections are rectangular) by orthogonal fixed edges (support planes **26a** and **26b**). The box is then secured by applying a vacuum through the suction system **30** in the recesses **38** in the support planes **26a** and **26b** which comprise the suction system **30** and which are closed by the box positioned above said support planes **26a** and above the recesses **38** with a suction system **30**, in which the recesses **38** correspond to the sectors which are suitable to reversibly fix the supported side of the box by adhesion. The boxes **4** also support further supports **40** which are arranged on the toothed belt conveyor platform **22** so as to form the continuation of the support plane **26b**.

[0045] In the implementation phase, further non-described modifications or embodiments of the invention may be made to the box closing system, to the box closing

plant, to the box closing process and to their use, object of the invention. If such modifications or such variants should fall within the scope of the following claims, they should all be considered protected by the present patent.

Claims

1. Box closing system comprising:

- (a) an entry guide system (6) suitable to fold a closure panel (2) of a not yet closed box (4) towards the body of the box;
 - (b) downstream the entry guide system (6) a folding disc (9) suitable to fold the closure flap (8) of the closure panel (2) along a folding line and to put the closure flap (8) onto the body of the box;
 - (c) downstream the folding disc (9) a guiding element (10) suitable to space the closure flap (8) from the body of the box and to force the closure flap (8) spaced from the body of the box to form with respect to the remaining part of the closure panel (2) an angle smaller than 90°;
 - (d) downstream the guiding element (10) an inserting roll (12) to push the closure flap (8) into the body of the box such that the remaining part of the closure panel closes the box (4) and forms a side of it;
 - (e) downstream the inserting roll (12) a closing roll (16) to snap-in-close the box (4); and
 - (f) a transport system (20) to transport at least a box (4) at least from the entry guide system (6), to the folding disc (9), to the guiding element (10), to the inserting roll (12), to the closing roll (16),
- wherein

- (i) said entry guide system (6) comprises a plane obliquely inclined with respect to the transport direction of the box (4) wherein the closure panel (2) can be passed in front of the obliquely inclined plane and will, at contact with it, be raised or lowered such to cover the opening of the box during the passage;
- (ii) the surface of the folding disc (9) destined to come into contact with the closure flap (8) of the closure panel (2) of the box (4) is parallel to the side of the box onto which the closure flap (8) will be put;
- (iii) the guiding element (10) comprises

- (I) a first shaping defining a curved path which pushes the closure flap (8) with the passage of the box (4) along said first shaping away from the body of the box; and

(II) a second shaping (11) defining a height limitation which folds the closure flap (8) such that it forms with respect to the remaining part of the closure panel an angle smaller than 90°;

and wherein

(iv) the inserting roll (12) and the closing roll (16) are arranged such that their rotation axis extends perpendicularly to the side of the box onto which the closure flap (8) can be put by the folding disc (9) and such that the part of the closure panel, which forms a side of the box, passing in front of the respective inserting (12) and closing rolls (16) is partially in contact with the lateral surface of the rolls.

2. Box closing system according to claim 1 **characterized in that** said folding disc (9) is adjustable in height, the height being defined by the position of the folding disc (9) along its rotation axis.
3. Box closing system according to claim 1 or 2 **characterized in that** said guiding element (10) comprises a second set of a first and a second shaping of mirror-imaged extension with respect to the first set of a first and a second shaping and is adjustable in height to approach one set or the other one, respectively, to the top or bottom part of the box (4) and which comprises optionally for every shaping set a stopper protrusion (13) which limits the re-opening of the box (4) to a determined grade or the distance of the closure flap (8) from the body of the box to a certain distance.
4. Box closing system according to anyone of the preceding claims **characterized in that** said closing roll (16) on the lateral surface is provided with a plurality of protuberances (18) preferably with elastic properties.
5. Box closing system according to anyone of the preceding claims **characterized in that** said inserting roll (12) comprises a groove (14) on the lateral surface.
6. Box closing system according to anyone of the preceding claims from 1 to 3 **characterized in that** said inserting roll and said closing roll are wound by a belt, wherein at least one additional roll is optionally present within the belt.
7. Box closing system according to anyone of the preceding claims **characterized in that** said entry guide system involves a subdivision of the obliquely inclined plane, which realizes specular inclinations along the dividing line, in order to allow a closure

panel to be folded either from the bottom or from the top towards the body of the box.

8. Box closing system according to anyone of the preceding claims **characterized in that** said transport system comprises a box transport device (20) comprising

- (a) a first support plane (26b); and
- (b) a second support plane (26a) which is orthogonal to said first support plane (26b);

wherein said first support plane (26b) comprises a first sector (28b) suitable to fix reversibly the box (4) by adhesion; and wherein said box (4) is supportable or supported with a first side (42b) which preferably does not correspond to a closing side of the box onto said first support plane (26b) and fixable or fixed reversibly by adhesion with said first side (42b) on said first sector (28b) and wherein said box (4) is supportable or supported with a second side (42a), which is contiguous to said first side (42b) and which preferably does not correspond to a closing side of the box, on said second support plane (26a).

9. Box closing plant which comprises two box closing systems according to anyone of the preceding claims wherein one of the box closing systems is situated in front of the other one with the single respective components corresponding one with the other to permit the contemporary closing of two opposed sides of the box.

10. Box closing process comprising the following steps in the given order:

- (i) preferably provision of a box closing system according to anyone of the claims from 1 to 8 or of a box closing plant according to claim 9;
- (ii) raising or lowering of the closure panel (2) of an open box (4), preferably with said entry guide system (6), such that the panel covers the opening of the box (4);
- (iii) folding of the closure flap (8) of said closure panel (2) of the box (4), preferably with said folding disc (9), such that the flap is put on the body of the box;
- (iv) spacing, preferably by said guiding element (10), of said closure flap (8) from the body of the box and folding of the closure flap (8) with respect to the remaining part of the closure panel (2) in the direction of the body of the box such that the closure flap (8) and the remaining part of the closure panel of the box form an angle smaller than 90°;
- (v) inserting said closure flap (8), preferably by the action of said inserting roll (12) against the

closure panel (2), into said body of the box; and
(vi) snap-in-closing of said box (4), preferably
by the action of said closing roll (16) on said
closure panel (2).

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11. Box closing process according to claim 10, **characterized in that** said box (4) is transported from one step to the other and during the listed steps by a transport system (20) as defined in claim 8.

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12. Box closing process according to claim 10 or 11, **characterized in that** the transport of the box (4) from one step to the other and during the listed steps takes place in continuous or alternate form.

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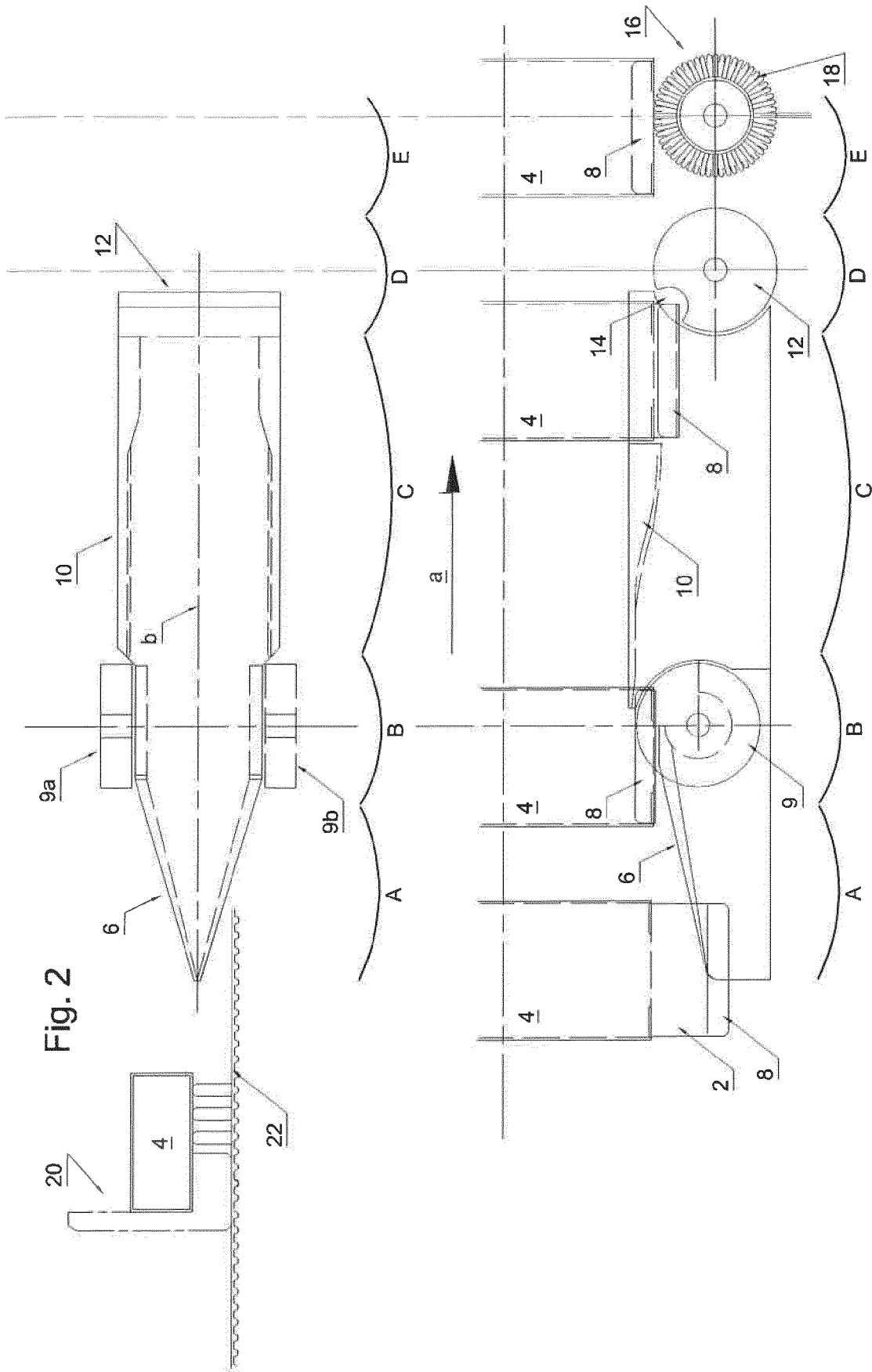
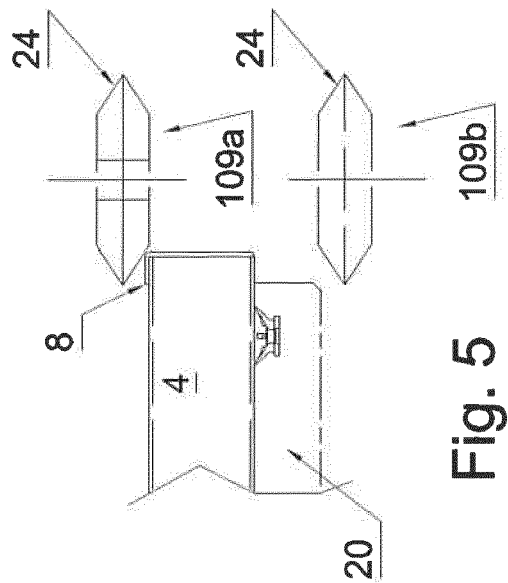
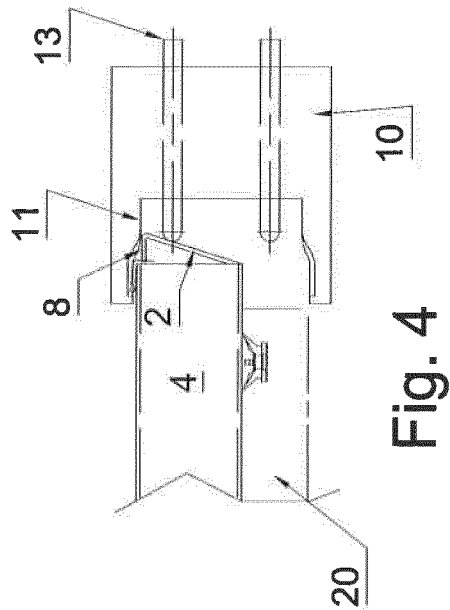
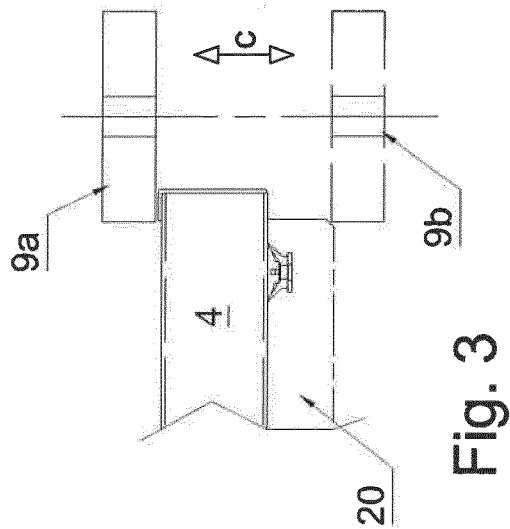
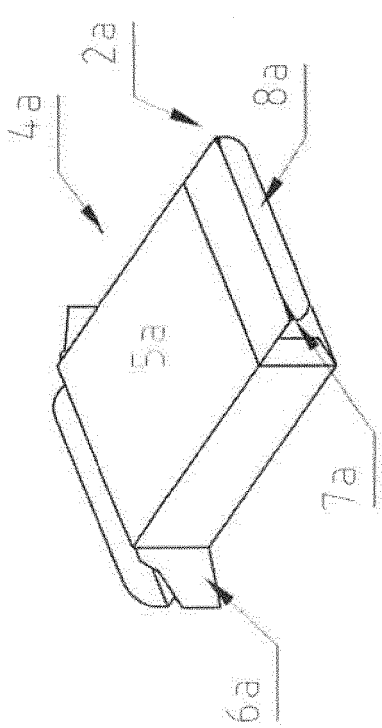


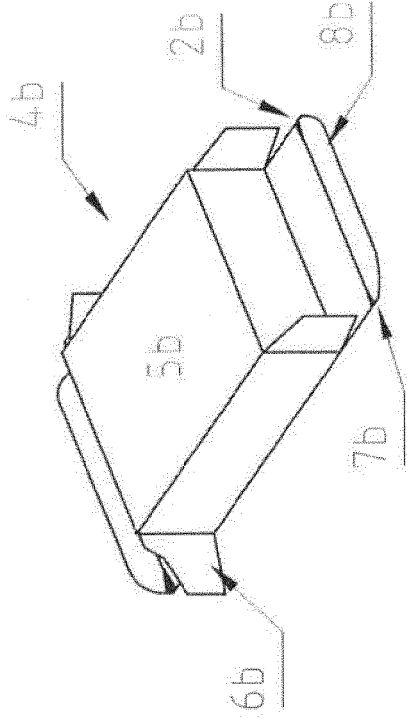
Fig. 1

Fig. 2





STATE OF THE ART
Fig. 7a



STATE OF THE ART
Fig. 7b

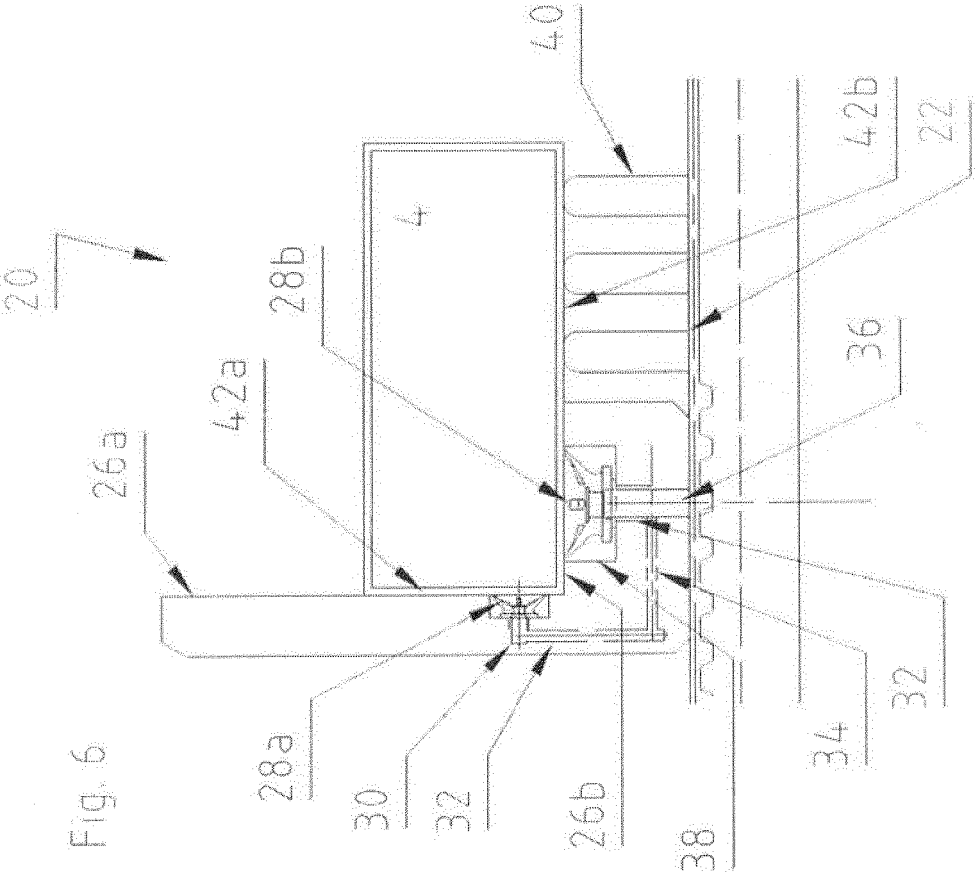


Fig. 6



EUROPEAN SEARCH REPORT

Application Number
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Place of search Munich		Date of completion of the search 19 December 2017	Examiner Grondin, David
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