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(54) **FORMER AND PROCEDURE TO FORM CARDBOARD BOX CORNERS IN ASSEMBLING MACHINES**

(57) A former of cardboard box corners in assembling machines from a die-cut cardboard sheet (1) provided with tabs (2) folded by means of a folding mechanism in cooperation with a fastening mechanism (3) to define a reinforcement on each corner of the box. The bending mechanism comprises a frame (15) capable of displacing vertically, which is provided with a horizontal beam (15a), both ends of which comprise a bending head (6), which includes a gusset plate (7), for bending the tab (2) of two corners of a same side of the box. The gusset plate (7) is attached to a gear to provide it with an angular bending movement of the tab. This configuration allows for forming the two corners in a single operation of vertical displacement, in an upward/downward direction, of the frame (15) and angular displacement, in a forward/backward direction, of the gusset plate (7).

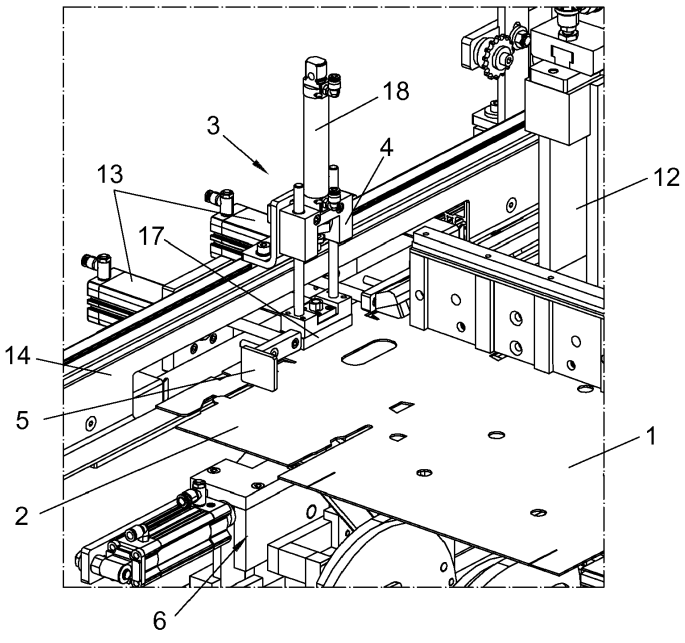

FIG. 2

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Description

OBJECT OF THE INVENTION

[0001] The present invention refers to a former of cardboard box corners from a die-cut sheet in an assembling machine. In the die-cut sheet, tabs are defined which, after being folded, define a reinforcement positioned on each corner of the box.

[0002] The former is composed of a bending mechanism in charge of lifting the tab and folding it around the fastening plate in cooperation with a fastening mechanism for establishing the folding areas of the tabs. Afterwards, both mechanisms are removed and box assembly is started.

[0003] The former operates outside the mould, prior to the box assembly operation, therefore, it is applicable to any box assembly system, regardless of the type of cardboard used.

[0004] The invention also describes the corner forming procedure.

[0005] It is of particular use in the industry of mechanisms for the manufacture of cardboard boxes by folding.

TECHNICAL PROBLEM TO ADDRESS AND BACKGROUND OF THE INVENTION

[0006] Several devices related to the forming of cardboard boxes are known in the current state of the art. These devices normally work with cardboard sheets that are previously die cut and marked where they will be subsequently bent, in order to facilitate the process in the box assembling machine.

[0007] Many assembling machines that form boxes with all types of configurations may be found in the state of the art, including, for example, lids, openings, grips or bent areas to facilitate storage in height.

[0008] One of the most critical parts of the box is, however, the corner, since an open corner entails the complete collapse of the box with a chance of losing its contents.

[0009] To avoid this problem, there are assembling machines that configure boxes with reinforced corners.

[0010] Document ES-2536581_A2 shows a sample of this technology, describing a cardboard box assembling machine which includes four movable corner devices to make it adaptable to different box sizes.

[0011] The reinforcement generally used is simple, created by means of tabs protruding from two parallel lateral sides of the box and incorporating glue in order to, after being bent 90 degrees, be pressed against the adjoining sides in the mould and form the box. Another type of reinforcement known comprises a larger tab incorporating two foldings to form a "V" with a flap, such that a triangular structure is configured and the flap is used to attach to the adjoining sides by means of glue included thereon.

[0012] These reinforcements are created by means of mechanisms that, through different operations, configure the way the tabs are to be subsequently attached to the adjoining side, forming the reinforced corner.

[0013] However, the configuration of the reinforced corners entails that the assembling machines are increasingly more complex, having an impact not only on the initial cost of the machine, but also on more complex maintenance tasks.

[0014] The present invention solves this problem, which is not addressed in the current state of the art, by describing a mechanism capable of creating reinforced corners in a cardboard box in a single operation, with the resulting savings as to the cost of manufacturing the assembling machine and its maintenance.

DESCRIPTION OF THE INVENTION

[0015] To achieve the goals and solve the previously mentioned inconveniences, the invention provides a new former of cardboard box corners in assembling machines, starting from a die-cut cardboard sheet wherein some tabs are defined to form the corners and located in two parallel side areas of the box once it is assembled. The tabs are intended to be folded by a bending mechanism in cooperation with a fastening mechanism, by means of which the folding areas of the tabs are established, such that said tabs are finally attached to the adjoining sides of the box once it is assembled.

[0016] The main novelty of the former of the invention is the fact that it is characterised in that it comprises a bending mechanism that in turn comprises a vertically displaceable frame, which is provided with a horizontal beam, both ends of which comprise a bending head that includes a gusset plate, for bending the tab of two corners of a same side of the box. The gusset plate is attached to a gear to provide it with an angular bending movement of the tab.

[0017] These characteristics provide the bending mechanism with a configuration that allows for forming the two corners in a single operation of displacement, in an upward/downward direction, of the frame and angular displacement, in a forward/backward direction, of the gusset plate.

[0018] In the preferred embodiment of the invention, the gusset plate is composed of a pushing flange intended for bending the tab, and a pressure flange intended for configuring the folding of the tab by pressing it through one side. In addition, the gear is configured to provide the gusset plate, through an arm, with a 90-degree rotation movement. This configuration allows for the bending of the tabs, based on an L-shaped configuration, in cooperation with the fastening mechanism, as described in the exemplary embodiment of the invention.

[0019] In the invention, the gusset place may be replaced in order to mount a gusset plate with a configuration adapted to the different bendings desired for the tabs, such as, for example, a triangular folding, etc.

[0020] In addition, in the preferred embodiment, the

bending heads are located in both oblong holes of the beam and positioned symmetrically with respect to the fastening mechanism, such that the position of each bending head is variable to adjust it to the dimensions of the box to be formed.

[0021] To facilitate the adjustment of the position of the bending heads, they are mechanically attached such that they move symmetrically with respect to the fastening mechanism, thus facilitating and simplifying its adjustment to adapt to the different box sizes.

[0022] As to the fastening mechanism, it is worth noting that it comprises a presser, by means of which the cardboard sheet is immobilised in the assembling machine and, in addition, it comprises two fasteners by means of which the bending area of the tabs of the two corners of a same side of the box are defined. Thus, the bending of the tabs is carried out through the bending mechanism in the areas established by the fasteners.

[0023] In the invention, the two fasteners of the fastening mechanism are arranged in a gib through which they may slide and be positioned symmetrically with respect to the presser, in order to allow for the adjustment of their position, thus adapting to the different dimensions the boxes may have.

[0024] To facilitate the adjustment of the fasteners, they are mechanically attached such that they move symmetrically with respect to the presser, thus simplifying this operation significantly.

[0025] In the preferred embodiment, the fastener has a rectangular configuration with a height defining the folding area of the tab.

[0026] Given that most of the boxes are composed by four corners, the invention is intended to comprise two bending mechanisms to actuate them simultaneously and form the four corners of a box in a single operation.

[0027] The invention describes as well the procedure to form corners in a cardboard box.

BRIEF DESCRIPTION OF THE FIGURES

[0028] To complete the invention being described, and in order to help understand the characteristics of the invention, according to a preferred embodiment thereof, it is accompanied by a set of drawings in which the figures described below have been represented, for purely illustrative purposes and should not be construed as limiting:

- Figure 1 shows a perspective view of a box assembling machine with an enlargement showing the main components of the corner former.
- Figure 2 shows a perspective view of a box assembling machine with a cardboard sheet, wherein the extended fastening mechanism is visible.
- Figure 3 shows a perspective view of the bending mechanism comprising two bending heads mounted on a beam with an enlargement of one of the bending heads showing its components in greater detail.
- Figure 4 shows a perspective view of a bending head after lifting a tab.
- Figure 5 shows a perspective view of the bending head after folding the lifted tab.
- Figure 6 shows a perspective view of the assembling machine with the folded tab and the fastening and bending mechanisms retracted.
- Figure 7 shows a perspective view of the assembling machine with the pushing piston guiding the cardboard sheet with the tabs folded towards the mould to form the box.

[0029] Provided below is a list of the references used in the figures:

1. Cardboard sheet.
2. Tab.
3. Fastening mechanism.
4. Presser.
5. Fastener.
6. Bending head.
7. Gusset plate.
8. Pushing flange.
9. Pressure flange.
10. Arm.
11. Guiding element.
12. Pushing piston. Also known as "male former" or "pushing mandrel".
13. Activation mechanism.
14. Gib.
15. Frame.

15a. Beam.

16. Oblong hole.
17. Presser (4) platform.
18. Vertical cylinder of the presser (4).

DESCRIPTION OF A PREFERRED EMBODIMENT OF THE INVENTION

[0030] As it has been mentioned, the present invention refers to a former of cardboard box corners from a die-cut sheet (1) located in an assembling machine.

[0031] The former of corners consists in creating reinforcements by bending tabs (2) included in the die-cut sheet (1). Although the configuration of this reinforcement may be carried out by printing in the tab several shapes or geometries, such as a triangular turret, in the preferred embodiment an L-shaped configuration has been chosen. To conduct this configuration, the tab (2) is divided into three parts, leaving the lower and intermediate parts, both parts closest to the cardboard sheet (1), folded one on top of the other, perpendicularly to the sheet (1), and the upper part supported on the cardboard sheet (1). Afterwards, in the assembly of the box and, once in the mould, the upper part of the tab (2) will be attached to the cardboard sheet (1) through the area of the adjoining lateral side. For an stable assembly, the cardboard sheet (1) includes glue in previously defined areas where the different parts will be attached. Logically,

when speaking of the glue attachment, it is carried out as flexible as possible, allowing for any type of adhesive, silicone, glue, etc.

[0032] Taking this configuration into account, the areas where the glue is incorporated may be found either in the body of the cardboard sheet or in the tabs (2), indifferently.

[0033] The assembling machine contains a space where the cardboard sheets (1) are stored and transported individually and horizontally to the forming area before being introduced in the mould by being vertically pushed by a pushing piston (12).

[0034] The former of the invention incorporates two bending heads (6), since an assembled box will have at least two corners. A fastening mechanism (3) cooperates with the bending heads (6), as described below.

[0035] Figure 1 shows the forming area of a cardboard box assembling machine. This figure displays a cardboard box assembling machine, where the following may be observed: a pushing piston (12), one of the guiding elements (11) to guide the cardboard sheet (1) to be assembled towards the mould, one of the bending heads (6) and the fastening mechanism (3) for bending the tabs (2) that will form the corners.

[0036] Figure 2 shows the assembling machine of Figure 1 in an operating situation, wherein a die-cut cardboard sheet has been introduced in order to work thereupon. In this figure, the fastening mechanism (3) may be appreciated in an operating position.

[0037] The fastening mechanism (3) comprises, as main elements, a presser (4), in charge of fastening and releasing the cardboard sheet (1) in the assembling machine and two fasteners (5), located symmetrically with respect to the presser (4) and located restricting the folding line of the tabs (2).

[0038] The figure represents how, on the one hand, the presser (4) has been deployed to fasten the position of the cardboard sheet (1). On the other, the fasteners (5) have also been deployed to restrict and define the folding position of the tabs (2).

[0039] The fastening mechanism (3) acquires this position when it is detected that a sheet (1) is in position to be mounted. Material control and defining elements for the different box forming stages have not been represented nor described in the figures since they are usual elements in the state of the art.

[0040] In this Figure 2, it may be observed that the presser (4) is composed, basically, of a platform (17) attached to a vertical cylinder (18) that receives energy to transfer movement. The vertical cylinder (18) is pneumatic, but it could be electric or hydraulic. The presser (4) has a vertical linear movement, towards the sheet (1), to immobilise it, and in the opposite direction to release it, only allowing for the extended and retracted positions.

[0041] In addition, each of the fasteners (5) is basically composed of a protrusion that ends in a plate, of a specific size, moved by a pneumatic activation mechanism (13) which, like in the case of the presser (4), may also be electric or hydraulic. The fastener (5) acts as a stop to facilitate the folding movement of the tab (2) once the bending head (6) is actuated. The movement of the fastener (5) is linear and horizontal allowing only the extended or retracted positions to position on the sheet (1) or outside it, respectively. The movement of the fasteners (5) is synchronised with that of the presser (4).

[0042] The position of the two fasteners (5), located on each of the sides of the presser (4), may be adjusted based on the size of the cardboard sheet (1) to be handled. The adjustment may be carried out independently on each of the fasteners (5) or, preferably, simultaneously on both, for which they need to be mechanically connected.

[0043] For such purpose, in Figure 2 and, in greater detail, in Figure 1, it may be appreciated how the activation mechanisms (13) of the fasteners (5) may be positioned throughout a longitudinal gib (14), such that this adjustment may be carried out.

[0044] Although the need for assembling boxes opened on one of the sides may arise, for which a single former is needed, the assembling machine is typically arranged with two formers, operating on both of the parallel sides of the sheet (1), and thus assembling a closed box through its four lateral sides.

[0045] A bending head (6) is shown in detail in Figure 3. Two bending heads (6) are fastened to a horizontal beam (15a) which, as indicated, are always in pairs and, due to the symmetry of the boxes, are positioned symmetrically with respect to a fastening mechanism (3). As it is represented, the bending heads (6) are fastened to the beam (15a) in both oblong holes (16), such that its position may vary. This is so because the bending heads (6) may be used for boxes of different sizes. The position of each bending head (6) may be obtained manually and independently for each of them, although, preferably, the positioning is carried out by electric means and simultaneously, for the purposes of which both bending heads (6) are mechanically attached, to prevent any errors in the positioning.

[0046] Figure 4 shows one of the bending heads (6) actuating on the related tab (2). This figure shows a stage following that shown in Figure 2. This means that the bending heads (6) will only actuate once the fastening mechanism (3) is extended.

[0047] It may be observed that the bending head (6) has emerged from underneath the sheet (1), pushing it to position the tab (2) vertically.

[0048] Figure 3 shows an enlarged bending head (6) to view its components in detail. It comprises a gusset plate (7) connected to a body by means of an arm (10) which, attached to some gears, allows for a rotating movement. The gusset plate (7) is configured with two flanges (8, 9), a pushing flange (8) actuating on the tab (2) and in contact with the tab (2) at all times during the folding process, and a pressure flange (9) in charge of maintaining the appropriate shape in the reinforcement configuration created.

[0049] As it is shown in the enlarged area of Figure 1, the pressure flange (9), in resting position, is in horizontal position, with the attachment to the arm (10) being located in the upper side. The pushing flange (8) protrudes upwards.

[0050] Bending heads (6) have a linear vertical movement from a resting position in a lower position towards an actuated position in an upper position, where it is in the operating position. In this position, the gusset plate (7) is actuated to proceed to the folding of the tabs (2) by means of the rotation movement. The vertical movement of the bending heads (6) is carried out by vertically displacing the frame (15).

[0051] The bending heads (6) conduct the movement from the resting position towards the operating position, once the fasteners (5) have been extended. With this movement, each bending head (6) pushes a tab (2), through the pushing flange (8) of the gusset plate (7), to leave it in vertical position. The bending of the tab (2) is carried out with the help of the related fastener (5). Up to this movement, the arm (10) has not been actuated yet to move the gusset plate (7). Once the tab (2) has been lifted in vertical position, the gusset plate (7) is actuated, which rotates pushing the tab (2) with the pushing flange (8) to proceed to fold it around the fastener (5). The gusset plate (7) movement continues while the upper part of the tab (2) comes into contact with the cardboard sheet (1) and begins to fold. At the same time, the intermediate part begins to fold around the fastener (5) and is progressively pushed by the pressure flange (9) of the gusset plate (7) until the gusset plate (7) reaches its final position, wherein the intermediate part of the tab (2) is positioned throughout the fastener (5) and the upper part of the tab (2) is positioned on the cardboard sheet, in an L-shaped configuration.

[0052] Once the corner reinforcement is formed, the gusset plate (7) returns to its retracted position, and the bending heads (6) return to their lower resting position, withdrawing from the sheet (1). In addition, the activation mechanism (13) withdraws the fasteners (5) synchronously with the turning of the pushing flange (8), that is, when the pushing flange (8) begins to turn, the fasteners (5) are withdrawn, and the presser (4) is actuated to release the sheet. This is shown in Figure 6, wherein the cardboard sheet (1) remains with the tabs (2) folded.

[0053] As from this moment, the pushing piston (12) begins to act pushing the sheet (1) towards the mould, helped by the guiding elements (11) for the box assembly.

[0054] Figure 7 shows the box entering into the mould to be assembled with the tabs (2) already formed, and the rest of the forming of the box is carried out in the traditional way, therefore, it is not described since it is not the object of the invention.

[0055] The invention describes as well the procedure to form cardboard box corners from a die-cut sheet in an assembling machine performed by the former before described.

[0056] The procedure comprises the following steps:

a) Introducing a cardboard sheet (1) in the forming area of the assembling machine;
b) Deploying the presser (4) to fix the position of the cardboard sheet (1);
c) Deploying the fasteners (5) to restrict and define the folding position of the tabs (2);
d) Actuating the bending heads (6) to push the tabs (2) into vertical position;
e) Actuating the gusset plates (7) rotating the pushing flanges (8) to fold the tabs (2) around the corresponding fasteners (5);
f) Withdrawing the fasteners (5);
g) Withdrawing the gusset plates (7);
h) Withdrawing the bending heads (6)
i) Withdrawing the presser (4) to release the cardboard sheet (1);
j) Actuate the pushing piston (12) to vertically move the cardboard sheet (1) into the mould and forming the box by sliding along the guiding elements (11).
Additionally, step f) may be followed by the following step:
k) Pressing the pressure flange (9) against the tab (2) to maintain the shape of the reinforcement configuration created.

[0057] Steps b) and c) may be performed in a synchronised manner.

[0058] Steps f) and g) may also be performed in a synchronised manner.

[0059] It needs to be considered that the present invention is not limited by the embodiment disclosed herein. Other embodiments can be made by persons skilled in the art in light of this description. In consequence, the scope of the invention is defined by the following claims.

Claims

1. A former of cardboard box corners in assembling machines from a die-cut cardboard sheet (1), wherein tabs (2) are defined to form the corners and located in areas of two parallel sides of the box once said box is assembled and intended to be folded, in cooperation with a fastening mechanism (3) for establishing the folding areas of the tabs, such that said tabs are attached to the adjoining sides of the box once it is assembled, being the former **characterised in that** it comprises a bending mechanism that in turn comprises:

    - a frame (15) capable of displacing vertically, which is provided with a horizontal beam (15a), both ends of which comprise:

        ◦ a bending head (6), which includes a gusset plate (7) for bending the tab (2) of two corners of a same side of the box; the gusset plate (7) being attached to a gear in order

to be provided with an angular movement for bending the tab,

such that, the bending mechanism is configured to form the two corners in a single operation of vertical displacement, in upward/downward direction, of the frame (15) and of angular displacement, in forward/backward direction, of the gusset plate (7).

2. A former of cardboard box corners in assembling machines, according to claim 1, **characterised in that** the gusset plate (7) is configured by means of a pushing flange (8), intended for bending the tab (2), and a pressure flange (9), intended to configure the folding of the tab (2) by applying pressure to a side, and the gear is configured to provide the gusset plate (7), through an arm (10), with a 90-degree rotation movement.

3. A former of cardboard box corners in assembling machines, according to claim 1, **characterised in that** the gusset plate (7) is replaceable and comprises a configuration adapted to the bending to be carried out in the tabs (2).

4. A former of cardboard box corners in assembling machines according to claim 1, **characterised in that** the bending heads (6) are located in both oblong holes (16) of the beam (15a) and located symmetrically with respect to the fastening mechanism (3), such that the position of each bending head (6) is variable.

5. A former of cardboard box corners in assembling machines according to claim 1, **characterised in that** the bending heads (6) are mechanically attached such that said bending heads move symmetrically with respect to the fastening mechanism (3).

6. A former of cardboard box corners in assembling machines, according to claim 1, **characterised in that** the fastening mechanism (3) comprises a presser (4) for immobilising the cardboard sheet (1) in the assembling machine and two fasteners (5) to define the bending area of the tabs (2) of two corners of a same side of the box.

7. A former of cardboard box corners in assembling machines according to claim 6, **characterised in that** the two fasteners (5) of the fastening mechanism (3) are arranged in a gib (14) through which said two fasteners are able to displace and position symmetrically with respect to the presser (4).

8. A former of cardboard box corners in assembling machines according to claim 7, **characterised in that** the fasteners (5) are mechanically attached such that the fasteners move symmetrically with respect to the presser (4).

9. A former of cardboard box corners in assembling machines, according to any of the claims 6 to 8, **characterised in that** the fastener (5) has a rectangular configuration with a height defining the folding area of the tab (2).

10. A former of cardboard box corners in assembling machines, according to any of the preceding claims, **characterised in that** it comprises two bending mechanisms to actuate them simultaneously and form four corners of a box in a single operation.

11. Procedure to form cardboard box corners from a die-cut sheet in an assembling machine, according to the former defined in claims 1 to 10, **characterised in that** it comprises the following steps:

a) Introducing a cardboard sheet (1) in the forming area of the assembling machine;
b) Deploying the presser (4) to fix the position of the cardboard sheet (1);
c) Deploying the fasteners (5) to restrict and define the folding position of the tabs (2);
d) Actuating the bending heads (6) to push the tabs (2) into vertical position;
e) Actuating the gusset plates (7) rotating the pushing flanges (8) to fold the tabs (2) around the corresponding fasteners (5);
f) Withdrawing the fasteners (5);
g) Withdrawing the gusset plates (7);
h) Withdrawing the bending heads (6)
i) Withdrawing the presser (4) to release the cardboard sheet (1);
j) Actuate the pushing piston (12) to vertically move the cardboard sheet (1) into the mould and forming the box by sliding along the guiding elements (11).

12. Procedure to form cardboard box corners from a die-cut sheet in an assembling machine, according claim 11, **characterised in that** step f) is followed by the additional step:

k) Pressing the pressure flange (9) against the tab (2) to maintain the shape of the reinforcement configuration created.

13. Procedure to form cardboard box corners from a die-cut sheet in an assembling machine, according claims 11 or 12, **characterised in that** steps b) and c) are performed in a synchronised manner.

14. Procedure to form cardboard box corners from a die-cut sheet in an assembling machine, according to any of the previous claims, **characterised in that** steps f) and g) are performed in a synchronised manner.

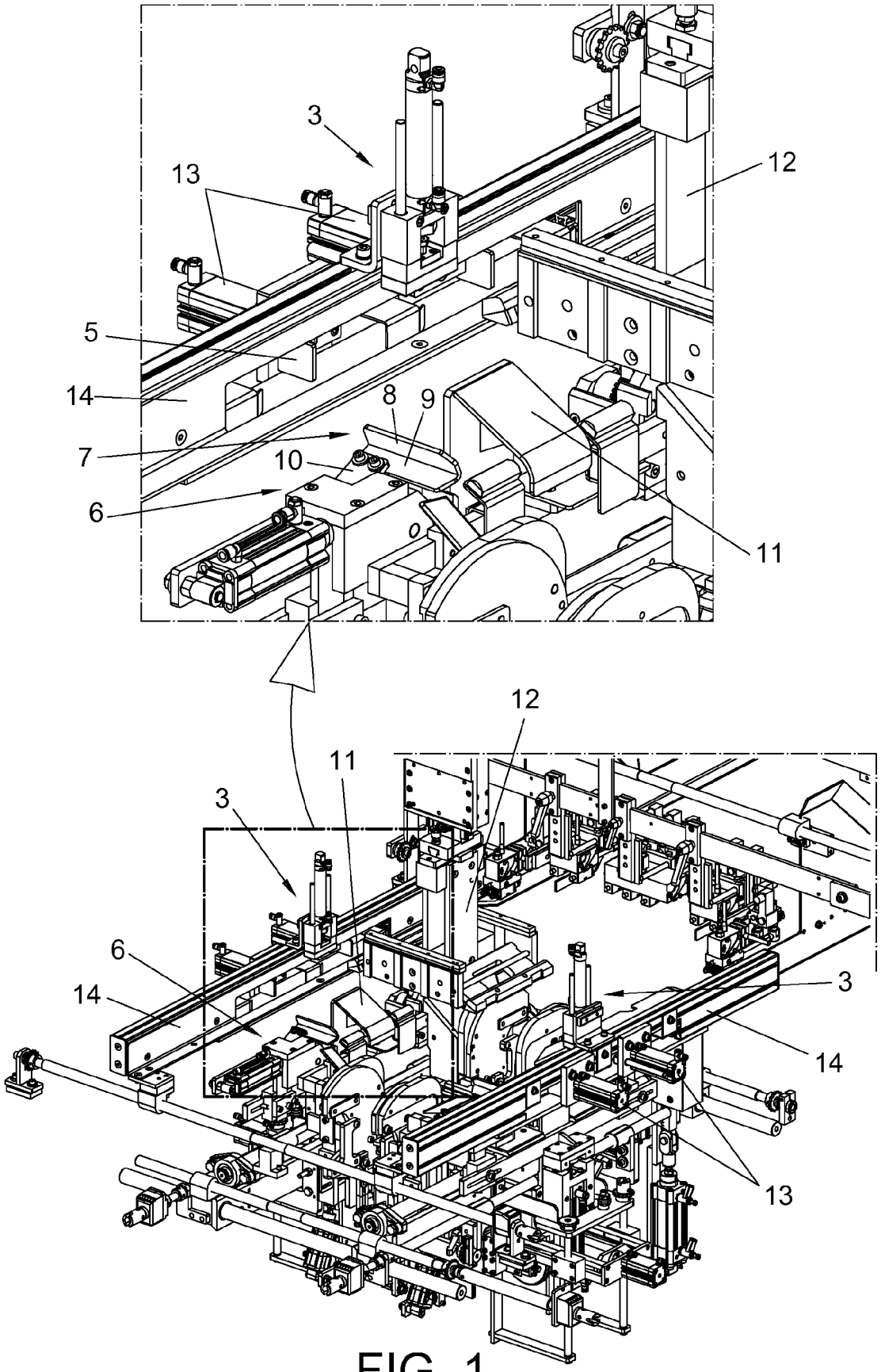

FIG. 1

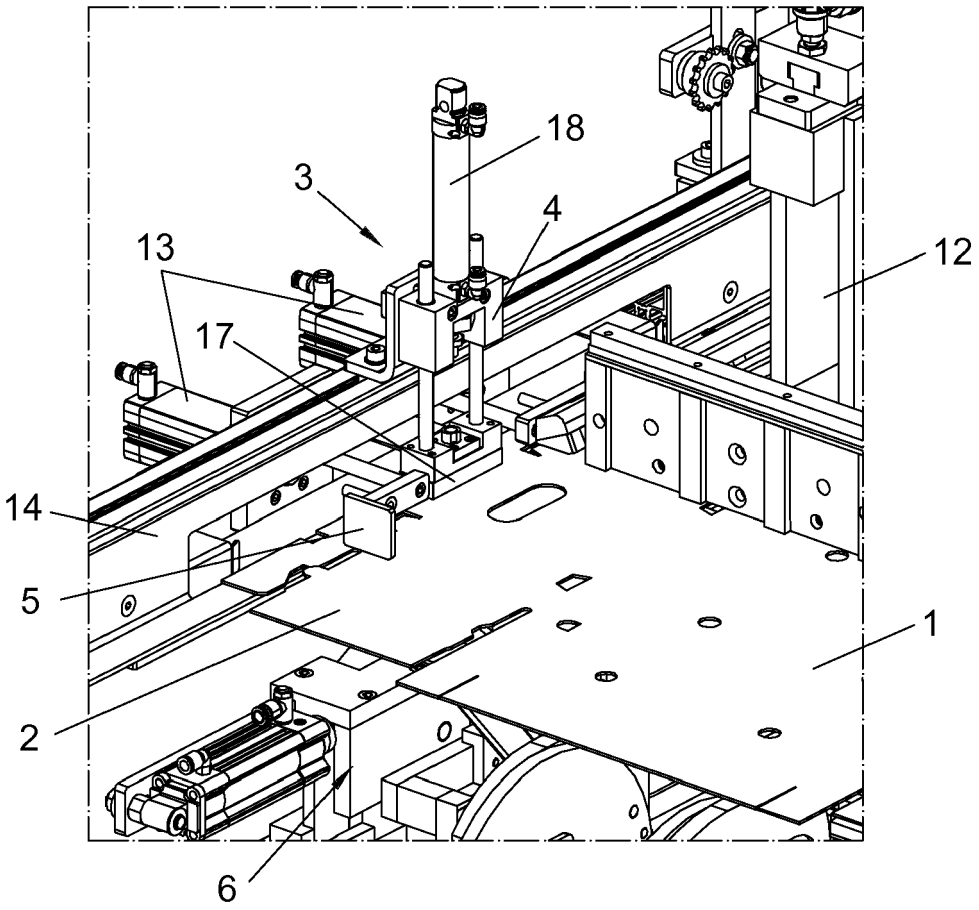

FIG. 2

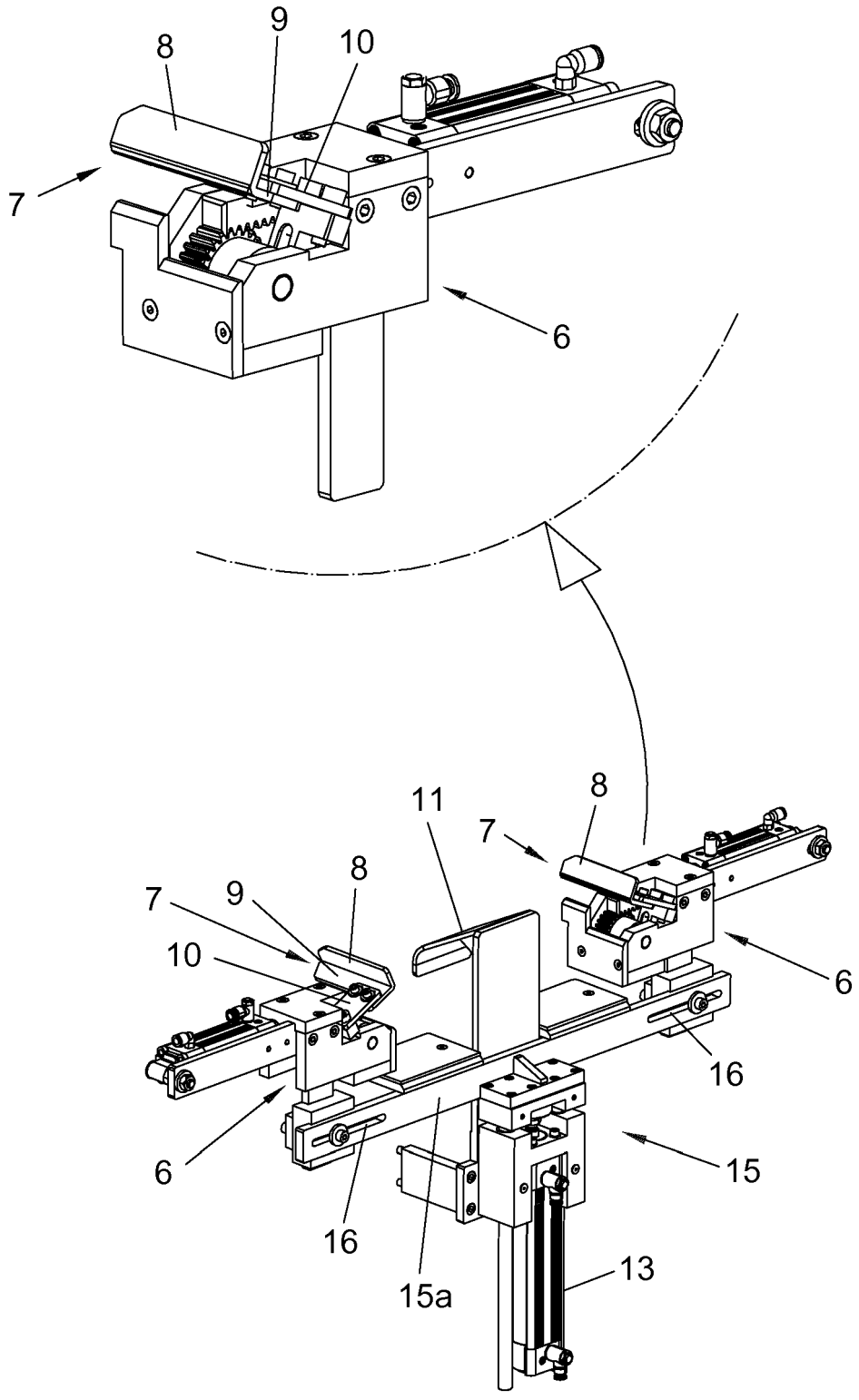

FIG. 3

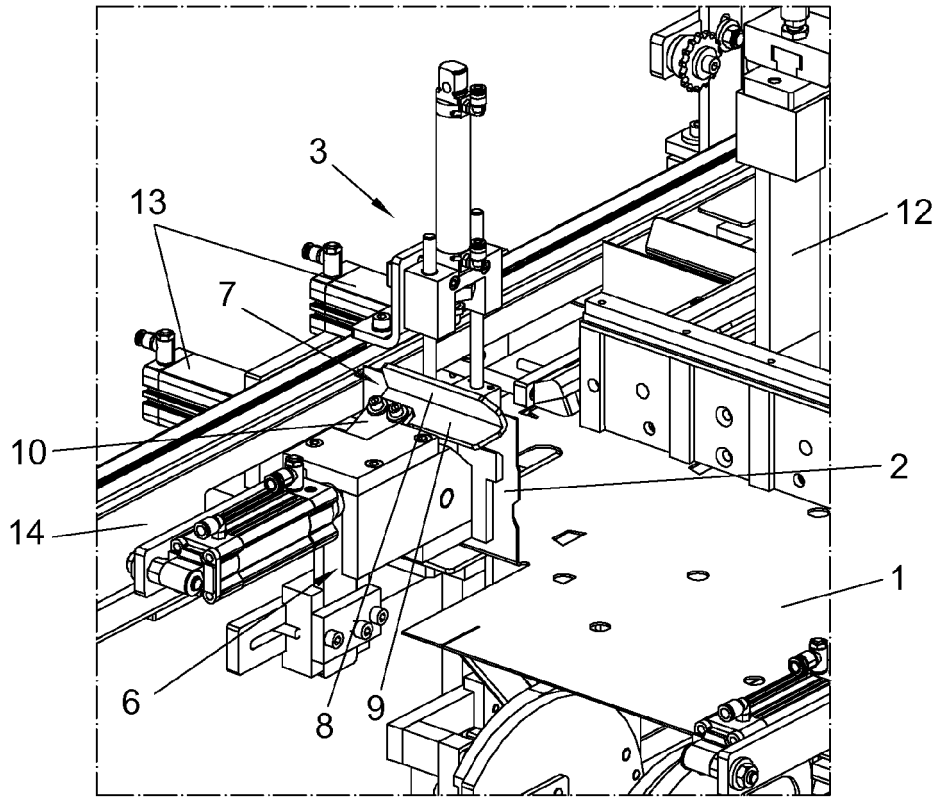

FIG. 4

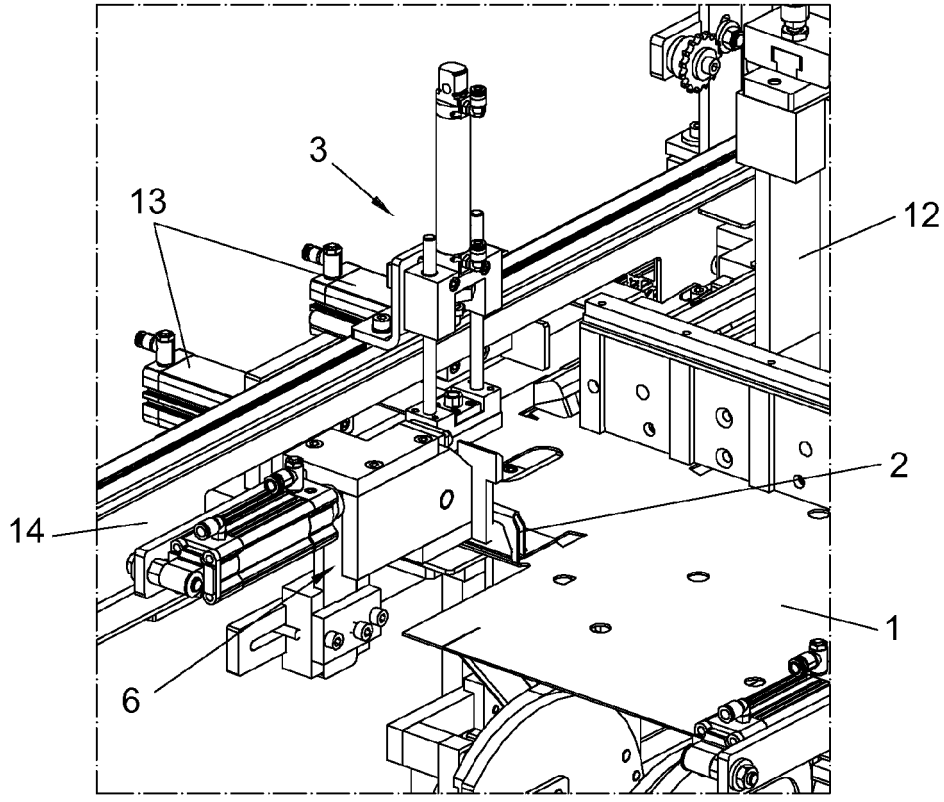

FIG. 5

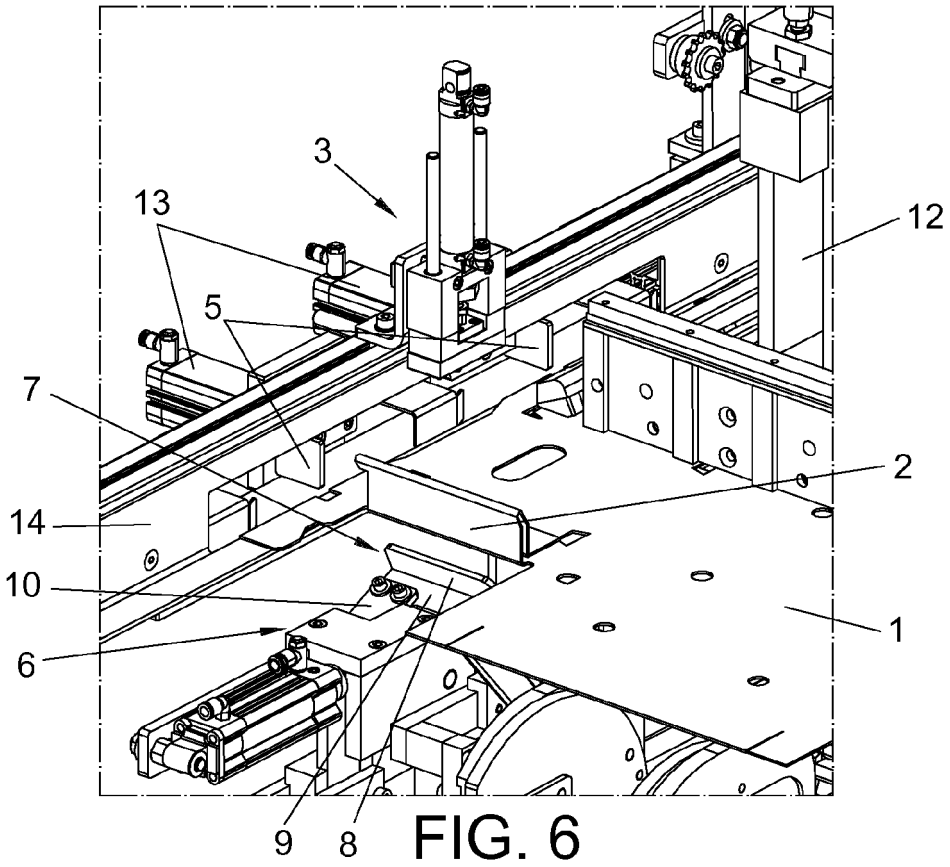

FIG. 6

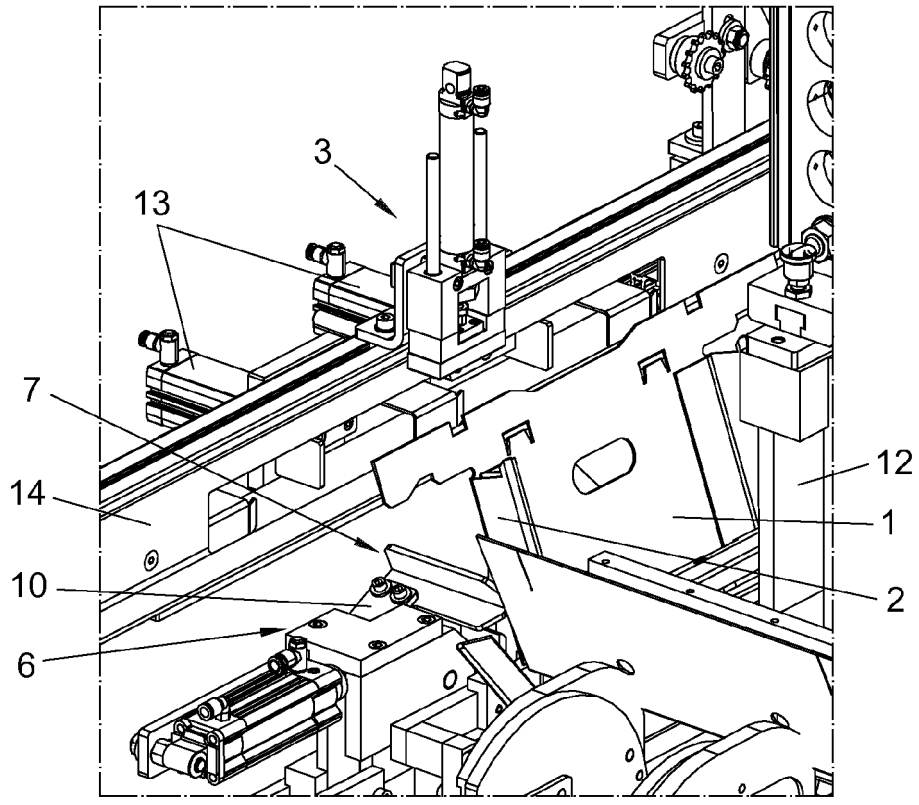

FIG. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 17 15 9774

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	ES 2 536 581 A2 (BOIX MAQUINARIA SL [ES]) 26 May 2015 (2015-05-26) * page 10, line 10 - page 10, line 23; figures 5a,5b *	1,11	INV. B31B50/46 B31B110/30
A	BE 1 007 271 A4 (BOIX MAQUINARIA SA [ES]) 9 May 1995 (1995-05-09) * page 2, line 29 - page 3, line 14; figure 1 *	1,11	

TECHNICAL FIELDS SEARCHED (IPC)

B31B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	18 September 2017	Farizon, Pascal

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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D : document cited in the application
L : document cited for other reasons

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