(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 524 072 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
19.03.2025 Bulletin 2025/12

(21) Application number: **25155533.0**

(22) Date of filing: **18.12.2012**

(51) International Patent Classification (IPC):
B65H 11/00 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
B31B 50/624; B31B 50/022; B31B 50/042; B31B 50/044; B65H 9/101; B65H 2701/1764

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **25.01.2012 IT BO20120029**

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
19159315.1 / 3 513 960
17171930.5 / 3 246 154
12820929.3 / 2 807 020

(71) Applicant: **EMMECI S.p.A.**
50050 Pieve a Ripoli-Cerreto Guidi (FI) (IT)

(72) Inventors:
- **BARONI, Pablo**
  50050 Cerreto Guidi (FIRENZE) (IT)
- **MAZZINGHI, Mauro**
  50050 Cerreto Guidi (FIRENZE) (IT)

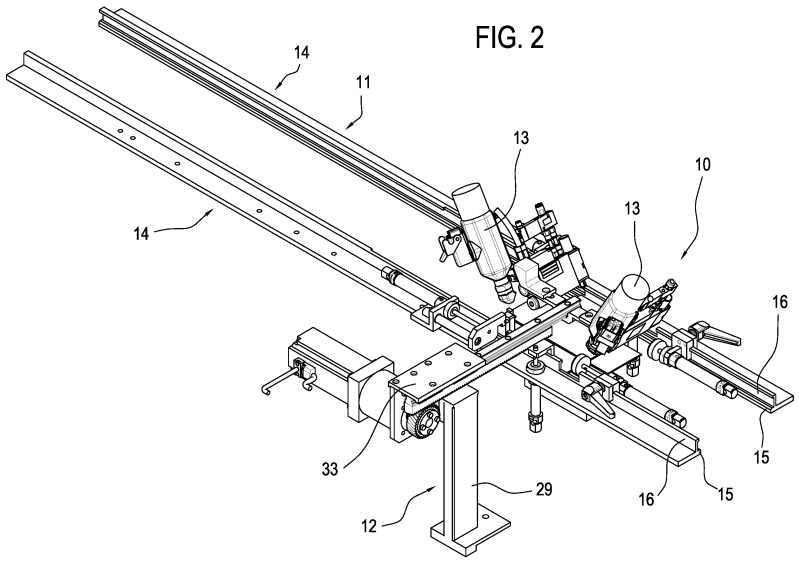
(74) Representative: **Conti, Marco**
Bugnion S.p.A.
Via di Corticella, 87
40128 Bologna (IT)

Remarks:
This application was filed on 03-02-2025 as a divisional application to the application mentioned under INID code 62.

(54) GLUING DEVICE FOR A BOX FORMING MACHINE AND RELATED GLUING METHOD

(57) A gluing device (10) for a box forming machine (1), configured to apply liquid glue to a flat blank (2) of paper or cardboard having V-shaped grooves between a base (3) and a plurality of segments (4) connected to the base (3) and defining oblique faces (5) contained in the thickness of the segments (4), comprises: a supporting structure (11) for feeding the blank (2) to a gluing station by moving it in a feed plane along a longitudinal direction; liquid glue dispensing nozzles (13) which are movable along a predetermined direction parallel to the feed plane in order to spread glue on one or more of the oblique faces (5), where the supporting structure (11) comprises:
- two guides (14) shaped in such a way as to prevent transversal movements of the blank (2) and to slidably support portions of the segments (4) of the blank (2); positioning means (17) operating on the blank (2) to move it to a predetermined longitudinal position in the gluing station; locking means (26) for holding the blank (2) in place so it is in the same plane as the feed plane while it is at the predetermined longitudinal position.

FIG. 2



EP 4 524 072 A2

Description

Technical field

[0001] This invention relates to a gluing device for a box forming machine and to a related gluing method.

Background art

[0002] The invention relates to the technical field of industrial processing of sheets of paper or cardboard for forming finely finished, quality boxes. These boxes are made from specially shaped sheets, called blanks, consisting of a base and a plurality of segments (or panels) connected to the base and foldable relative to it to make up a sidewall of the box.

[0003] As regards the shape of the blank, generally speaking the number of segments of the blank is equal to the number of sides of the base and each segment is connected to a respective side of the base. This type of blank may be generally referred to as "petalled", like a flower.

[0004] Blanks of other shapes are also used, however.

[0005] For example, the number of segments may be equal to (or greater than) the number of sides of the base, but the number of segments connected directly to the base may be less than the number of sides of the base since some of the segments may be connected to other segments.

[0006] In such a case, the blank is referred to as "H-shaped" or "T-shaped" or "cross-shaped", depending on the configuration adopted by the blank when it is laid out flat.

[0007] If the segments are greater in number than the sides of the base, some of the segments are associated with other segments and are foldable sideways to cover the same face of the sidewall of the box, each enclosing a respective vertical edge of that face.

[0008] It should be noted that the invention disclosed herein is applicable independently of the type of blank used.

[0009] The industrial process starting with the blank and ending with the finished box comprises two distinct steps: a step of forming the box, followed by a step of covering the box by applying a covering sheet to it.

[0010] This invention relates specifically to the step of forming the box.

[0011] The forming step in turn comprises two successive steps: a first step of folding, followed by a step of sealing or closing.

[0012] In the step of folding, the segments of the blank (which is laid out flat to start with) are folded about the perimeter of the base to form the sidewall of the box. The sidewall of the box defines as many lateral edges as there are corners of the base.

[0013] Of these vertical edges (of the vertical wall of the box), at least two are defined by a pair of adjacent lateral borders belonging to consecutive folded segments. This applies generally speaking to any type of blank. More specifically, if the blank is of the "petalled" type, all the lateral edges are defined by corresponding pairs of adjacent lateral borders belonging to consecutive folded segments (on the other hand, if the blank is T-shaped or H-shaped, only a subset of the lateral edges is defined by corresponding pairs of adjacent lateral borders of consecutive folded segments).

[0014] It should be noted that this invention is not limited to a specific type of blank but applies to all type of blanks.

[0015] In particular, box forming machines usually comprise a vertically movable die which is operatively coupled to an inner surface of the base (or of the sidewall of the box) to fold the segments of the blank by causing them to interact with fixed contact members.

[0016] When the step of folding the segments about the base is over, the above mentioned lateral edges are open and a step of connecting adjacent panels is necessary to close the lateral edges.

[0017] For this purpose, according to automatic forming machines known in the prior art, a step of sealing follows by which the open lateral edges of the box sidewall are joined (that is, closed).

[0018] As regards the step of sealing, two alternative technical solutions are essentially known.

[0019] According to a first solution (described for example in patent document WO2007/129201 A2 in the name of the same Applicant as this invention), sealing occurs by applying sealing strips (called "stay tapes") to the open lateral edges in order to close them.

[0020] More specifically, box forming machines usually comprise sealing heads having respective sealing tape dispensers and applicator elements ("pressers") designed to apply strips of sealing tape to corresponding open lateral edges of the box. The sealing heads can move towards and away from the box between a non-interference position where they are clear of the box and a sealing position where they operate on the corresponding open lateral edges to press the tapes against respective lateral edges of the box, thereby sealing them.

[0021] In the step of sealing, the function of the die is that of defining a constraining element operatively inserted snugly into the space inside the box during the action of the pressers, thereby preventing the pressers from deforming the sidewall of the box.

[0022] In a second solution (described for example in patent document WO2009/090481 A2 in the name of the same Applicant as this invention) hot-melt glue is distributed along the vertical edges of the sidewall of the box, in the interstices formed by the borders of the pairs of segments placed side by side. In practice, this forms a bead of glue which joins the end borders of the joined segments to form the corresponding edges of the sidewall.

[0023] The pressers are then moved forward to abut against the edges, with the further important function of cooling the glue.

[0024] The solution which involves applying the stay tapes is simple and reliable but has the disadvantage of worsening the appearance of the box because the tapes are not negligible in thickness (compared to the blank) and are therefore visible.

[0025] The solution which involves spreading hot-melt glue along the gap formed by the borders of the folded segments to form the edges of the sidewall of the box avoids the use of the stay tapes, thereby improving the aesthetic appearance of the box, but is inconvenient because it is particularly complicated (and hence relatively unreliable). The complication is due, for example, to the need to cool the glue and the difficulty of spreading the glue precisely in the interstices.

[0026] Thus, neither of the techniques described above is free of disadvantages. Moreover, it should be noted that another requirement in the sector of fine quality boxes regards the box edges, which must be sharp and well-defined, without visible signs of misshapen or rounded parts.

[0027] For this purpose, the use of special blanks is known in the prior art (for example, from patent document US6029884). These blanks are obtained by a process which comprises trimming the sheet of paper to form V-shaped grooves.

[0028] Thus, in a blank of this type (modified), the free sides of some lateral segments (the sides that are joined to form the sidewall of the box), as well as the sides for joining the base to the segments, are bevelled to define oblique faces contained in the thickness of the blank.

[0029] In this solution, the glue is spread on all the oblique faces defined by the bevels (and thus along all the sides of the base and along the sides of the segments) when the blank is laid out flat horizontally (and thus, before the segments are folded to form the vertical edges of the box).

[0030] In this solution, there is a supporting structure configured to enable the blank to move in a feed plane along a longitudinal feed direction to convey it to a gluing station.

[0031] The glue is applied by glue heads which are movable along predetermined directions parallel to the feed plane in such a way as to spread the glue on the oblique faces.

[0032] This method has a twofold advantage: on the one hand it allows production of boxes whose sharp edges have none of the aesthetic flaws due to the stay tapes, and on the other, it avoids the complications associated with spreading hot melt glue along interstices of vertical edges. The gluing system of the special V-grooved blank described in patent document US6029884 has some limitations which make it unsuitable for use in an automatic box forming machine.

[0033] In this regard, it should be noted that a blank gluing system, in order for it to be used in an automatic forming machine, must meet not only the need for glue spreading precision but also that for high speed (so as to guarantee a high output per hour).

[0034] US2007/199648A discloses a method for producing blanks from cardboards.

Disclosure of the invention

[0035] This invention has for an aim to provide a blank gluing device for an automatic box forming machine which overcomes the above mentioned disadvantages of the prior art.

[0036] More specifically, it is aim of this invention to provide a blank gluing device for an automatic box forming machine which is particularly precise and suitable for use in an automatic box forming machine.

[0037] Another aim of this invention is to provide a blank gluing device for an automatic box forming machine which is particularly rapid.

[0038] A further aim of this invention is to provide a method for gluing flat blanks which is particularly precise and suitable for use in a box forming process implemented by automatic machinery.

[0039] The above mentioned aims are fully achieved by the apparatus and method according to the invention as characterized in the appended claims.

[0040] More specifically, the gluing device according to the invention is a gluing device for a box forming machine and is configured to apply liquid glue to a flat blank of paper or cardboard having a base and a plurality of segments connected to the base and foldable to form a box sidewall, where the free sides of the segments, designed to be joined to form the edges of the box sidewall, are bevelled to define oblique faces contained in the thickness of the segments.

[0041] The gluing device comprises:

- a supporting structure configured to enable the blank to move in a feed plane along a longitudinal feed direction to convey it to a gluing station;
- at least one liquid glue dispensing nozzle movable along a predetermined direction parallel to the feed plane in such a way as to spread the glue on one or more of the oblique faces.

[0042] According to the invention, the supporting structure comprises:

- a first and a second guide positioned longitudinally in the feed plane and shaped in such a way as to prevent transversal movements of the blank and to slidably support lateral end portions of the segments of the blank;
- positioning means operating on the blank to move it to a predetermined longitudinal position in the gluing station;
- locking means operating on the blank in order to hold the blank in place so it is in the same plane as the feed plane while it is at the predetermined longitudinal position.

[0043] This guide system, combined with the positioning means and with the locking means, allows the blank to be positioned extremely precisely and held in place while the glue dispensing nozzles are working. This ensures the glue is applied correctly and makes the device particularly precise.

[0044] It should be noted that the guides are configured to support the end portions of blank segments and, in particular, the guides are spaced from each other to define an empty space between them.

[0045] This solution makes it possible to leave the base of the blank free to be moved downwards without constraints or interference. That makes the device especially suited to be used in an automatic forming machine, allowing a particularly high processing speed to be reached. In effect, after the glue has been spread, the blank is lowered directly to fold the segments without having to move the blank sideways away from the gluing station.

[0046] Preferably, the predetermined direction of moving the at least one nozzle is perpendicular to the longitudinal blank feed direction defined by the supporting structure.

[0047] This allows the glue to be spread only along the oblique surfaces positioned transversely relative to the longitudinal blank feed direction. This has the advantage of making the device particularly precise, since the longitudinal positioning of the blank, because it is performed by specific positioning means, is particularly precise relative to transversal positioning, since the guides must leave a minimum possibility of transversal movement (play) to allow it to move forward along the guides themselves. Furthermore, spreading the glue only on the transversal oblique faces (and not on the longitudinal ones) saves time.

[0048] In light of this, it should be noted that the device preferably comprises a pair of nozzles which are spaced along the longitudinal direction.

[0049] This allows the speed of the device to be further increased because the entire step of spreading the glue is completed in the interval of time taken by the nozzles to move transversely across the blank.

[0050] Preferably, the pair of nozzles is positioned at a variable distance along the axis parallel to the longitudinal blank feed direction defined by the supporting structure. This makes changeover particularly easy.

[0051] In light of this, it should be noted that the positioning means, too, are provided with adjusters which make changeover of the device particularly quick and easy, as described in more detail below.

[0052] It should be noted that, for their part, the locking means are important for the precision and reliability of the device.

[0053] In effect, the locking means guarantee that while the glue is being spread the blank does not undergo deformation or bending (moving under the force of gravity outside the feed plane) which would prevent the glue from being correctly spread on the oblique faces of the edges (it should be noted that the V-shaped grooves formed on the blank weaken it and make it particularly susceptible to such deformation).

[0054] The invention also provides a forming machine for making boxes of paper or cardboard from flat blanks and comprising the gluing device.

[0055] The forming machine is particularly precise and fast and allows boxes to be made automatically from the special blanks (with V-shaped grooves). Preferably, the forming machine also comprises a system for applying stay tapes to the edges of the sidewall of the box (this system being of a *per se* known type).

[0056] Advantageously, that makes the forming machine particularly flexible since it can make boxes from blanks of any kind.

[0057] In effect, if the blank is a special blank (with V-shaped grooves), the gluing device is enabled and the system for applying stay tapes is disabled. Vice versa, if the blank is of a traditional type (without V-shaped grooves), the gluing device is disabled and the system for applying stay tapes is enabled.

[0058] The invention also provides a gluing method for applying liquid glue to a flat blank of paper or cardboard having a base and a plurality of segments connected to the base and foldable to form a box sidewall, where the free sides of the segments, designed to be joined to form the edges of the box sidewall, are bevelled to define oblique faces contained in the thickness of the segments.

[0059] According to the invention, the method comprises the following steps:

- feeding a blank to a gluing station, by making the blank slide along a longitudinal direction, with lateral end portions of blank segments slidably supported on a first and a second guide positioned longitudinally in the feed plane and spaced from each other to define an empty space between them;
- positioning the blank at a predetermined longitudinal position (in line with a predetermined reference axis perpendicular to the feed plane), in the gluing station by a controlled movement of the blank along the longitudinal direction;
- locking the blank at the predetermined longitudinal position while keeping it in the same plane as the feed plane;
- moving at least one liquid glue dispensing nozzle along a predetermined direction parallel to the feed plane in such a way as to spread the glue on one or more of the oblique faces defined by the bevelled edges.

Brief description of drawings

[0060] These and other features of the invention will become more apparent from the following detailed description of a preferred, non-limiting embodiment of it, with reference to the accompanying drawings, in which:

- Figure 1 is a perspective view illustrating a box forming machine equipped with a gluing device according to this invention;
- Figure 2 illustrates a detail A from Figure 1, namely the gluing device;
- Figure 3 illustrates the device of Figure 2 according to a different perspective;
- Figure 4 illustrates a first detail of the device of Figure 3, namely a blank conveyor;
- Figure 5 illustrates a second detail of the device of Figure 3;
- Figure 6 illustrates a blank in a perspective view;
- Figure 7 illustrates the blank of Figure 6, in a view along the section line A-A shown in Figure 6;
- Figure 8 illustrates the detail of Figure 4, with a blank coupled thereto, in a first operating configuration;
- Figure 9 illustrates the detail of Figure 4, with a blank coupled thereto, in a second operating configuration.

Detailed description of preferred embodiments of the invention

[0061] The numeral 1 in the drawings denotes a box forming machine according to this invention.

[0062] The forming machine 1 is a machine for forming boxes of paper or cardboard from flat blanks 2 (of paper or cardboard), having a base 3 and a plurality of segments 4 connected to the base 3 and foldable to form a box sidewall.

[0063] The forming machine 1 is set up to use special blanks 2 having the features described below (illustrated in Figures 6 and 7).

[0064] The free sides of the segments 4, which are intended to be joined to form the sidewall of the box, are bevelled to define oblique faces 5 contained in the thickness of the segments 4.

[0065] Generally speaking, this special blank (hereinafter referred to simply as "blank", for short) is made from a sheet on whose top face V-shaped grooves are formed (for example by cutting) along straight trajectories comprising (defined by) the sides of the base 3.

[0066] Preferably, therefore, the sides of the base 3 and the sides of the segments 4 connected to corresponding sides of the base 3 are also bevelled to define oblique faces contained in the thickness of the base 3 and of the segments 4, respectively.

[0067] The numeral 6 in Figures 6 and 7 denotes the oblique faces on the sides of the base 3.

[0068] Preferably, these oblique faces 5, 6 are inclined at an angle of approximately 45 degrees to the plane defined by the blank 2. That way, when the segments 4 are folded relative to the base to form a right angle, the lateral oblique faces 5 of the segments 4 and the oblique faces 6 of the base 3 come into contact with each other.

[0069] The forming machine 1 (illustrated schematically in Figure 1) comprises:

- folding elements (not illustrated, of substantially known type) operating on the segments 4 of the blank 2 in such a way as to fold them relative to the base 3;
- presser elements 7 (partly illustrated, of substantially known type) movable towards and away from the box in order to press against the vertical edges of the box sidewall (the edges being formed when the free sides of the folded segments 4 are joined to each other);
- manipulating means, configured to interact with the blank 2 and with the box to impart vertical movements perpendicular to the direction of movement of the presser elements 7.

[0070] The manipulating means comprise a die 8 shaped to snugly occupy the inside of the box and connected to a motor-driven shaft 9 which moves it along a predetermined vertical axis (according to a substantially known method).

[0071] Also, preferably, the forming machine 1 comprises stay tapes (not illustrated, but of a *per se* known type) coupled to the presser elements 7 to allow strips of the stay tapes to be applied to the vertical edges of the box sidewall in order to seal them (according to a method known in the trade, applicable to any type of blank and not only to the above described special blanks, that is, blanks with V-shaped grooves).

[0072] According to the invention, the forming machine 1 comprises a gluing device 10 for applying glue (liquid glue, preferably of the hot-melt type) on the (special) blanks 2.

[0073] Indeed, the invention has for an object the gluing device 10 as well as the forming machine 1 which incorporates the device 10.

[0074] In effect, the device is designed to be connected to a traditional forming machine 1 in order to modify it to make it particularly suitable for forming boxes from the (special) blanks 2.

[0075] The description below will therefore focus on the gluing device 10.

[0076] The gluing device 10 comprises:

- a supporting structure 11 configured to enable the blank 2 to move in a feed plane along a longitudinal feed direction to convey the selfsame blank 2 to a gluing station;
- a supporting and movement system 12 for at least one liquid glue dispensing nozzle 13, configured in such a way that the at least one nozzle 13 is movable along a predetermined direction parallel to the feed plane in such a way as to spread the glue on one or more of the oblique faces 5 of the segments 4.

[0077] The supporting structure 11 is illustrated in detail in Figures 4, 8 and 9. The supporting structure 11 comprises a first and a second guide 14 positioned longitudinally in the feed plane of the blank 2 to define the longitudinal direction of movement of the blanks 2.

[0078] Each guide 14 is shaped in such a way as to prevent transversal movements of the blank 2 (that is, movements perpendicular to the longitudinal direction of movement and contained in the feed plane).

[0079] Also, each guide 14 is shaped to slidably support a portion of the blank 2. More specifically, the guide 14 is shaped in such a way as to slidably support a lateral end portion of one of the segments 4 of the blank 2.

[0080] In the example illustrated, each guide 14 has an L-shaped or C-shaped profile, the guides 14 being opposed to one another.

[0081] More specifically, in the example illustrated, each guide 14 comprises a ledge 15, which lies in the feed plane, for slidably supporting the lateral portions of the blank 2.

[0082] More precisely, it should be noted that the feed plane (that is, the plane in which the blank 2 lies) is defined by the large surfaces of the ledges 15 on which the blank 2 itself rests.

[0083] Further, each guide 14 comprises a wall 16 perpendicular to the ledge 15 (and to the feed plane).

[0084] Thus, the walls 16 of the guides 14 laterally delimit a slideway for the blank 2, preventing transversal movements of the latter.

[0085] The first and second guides 14 are spaced from each other to define an empty space between them.

[0086] The supporting structure 11 also comprises brackets (not illustrated) for connecting the guides 14 to a frame of the machine 1. Alternatively, the guides 14 (and, more generally speaking, the supporting structure 11) may be fastened to any base in a fixed position relative to the frame of the forming machine 1.

[0087] The forming machine 1 (that is, the gluing device 10) also comprises a pushing element (not illustrated, of *per se* known type, consisting for example of a finger connected to an actuator) movable longitudinally between the guides 14 to move the blank forward along the guides 14 towards the gluing station.

[0088] Thus, the supporting structure 11, together with the pushing element, constitutes a conveyor adapted to feed the blanks 2 to the gluing station. Further, according to the invention, the supporting structure 11 comprises positioning means 17 operating on the blank 2 to move it to a predetermined longitudinal position in the gluing station.

[0089] It should be noted that the predetermined longitudinal position is, more specifically, a position of alignment with a predetermined reference axis perpendicular to the feed plane and consisting preferably of the axis (vertical) along which the die 8 moves.

[0090] In the preferred embodiment illustrated, the positioning means 17 comprise at least a first pusher 18 configured to interact with a corresponding border of one of the segments 4 of the blank resting on the (ledges 15 of the) guides 14, the blank being positioned transversely, in order to impart a controlled movement to the blank 2 along the longitudinal direction.

[0091] Preferably, the positioning means 17 comprise at least one second pusher 19 positioned at a predetermined distance from the first pusher 18 along the longitudinal direction, the first pusher 18 and the second pusher 19 operating on corresponding borders of segments 4 of the blank 2 (resting on the ledges 15 of the guides 14) from longitudinally opposite sides, that is, in such a way that the first pusher 18 and the second pusher 19 are positioned downstream and upstream of the blank 2 positioned in the gluing station, relative to the advancing direction of the blank along the longitudinal direction.

[0092] In practice, the blank 2 positioned in the gluing station is longitudinally interposed between the first pusher 18 and the second pusher 19. Preferably, the positioning means 17 of the supporting structure 11 comprise a pair of first pushers 18 and a pair of second pushers 19.

[0093] In practice, in the preferred embodiment illustrated, the positioning means 17 comprise a total of four pushers operating on both the segments 4 (transversely opposed and resting on the ledges 15 of the guides 14), on the opposite transversal sides of the selfsame segments 4.

[0094] The first pushers 18 are preferably associated with the guides 14.

[0095] The second pushers 19, too, are preferably associated with the guides 14. Thus, the pushers 18 and 19 are configured to interact with corresponding transversely positioned borders of the blank segments 4 resting on (the ledges 15 of the) guide 14.

[0096] The pushers 18 and 19 (consisting, for example, of the pistons of corresponding cylinder/piston assemblies) are movable longitudinally between an extended position where they abut against the borders of the blank 2 when the blank 2 is at the predetermined longitudinal position and a withdrawn position where they are away from the blank 2.

[0097] The pushers 18 and 19 are shown in the extended position in Figure 8 and in the withdrawn position in Figure 9.

[0098] Preferably, the ends of the first pushers 18, that is the pushers 18 positioned downstream, define flat portions 20 positioned perpendicularly to the feed plane (to provide a better grip on the borders of the segments 4).

[0099] Preferably, the second pushers 19, that is, the pushers 19 located upstream (of the blank 2 positioned in the gluing station), have teeth 21 (pivotally connected to the end of a stem, that is, of a piston, of a corresponding second pusher 19) which are movable between a first operating position where they are spaced from the feed plane of the blank 2 so as not to interfere with blank feed, and a second operating position where they intersect the feed plane so as to define an abutment for the transversal border of the blank 2.

[0100] Preferably, the teeth 21 of the second pushers 19 oscillate about respective transversal axes.

[0101] Preferably, the teeth 21 of the second pushers 19 oscillate freely. That way, the blank 2 itself, as it advances along the longitudinal direction towards the

gluing station, moves the teeth 21 to the first operating position. Then, once the blank 2 has passed them, the teeth 21 return to the second operating position by gravity (the second operating position being a position of equilibrium into which the teeth 21 tend to move when no external forces are applied to them).

[0102] The second pushers 19 are also equipped with stops 22. The teeth 21 abut against the stops 22 when they are at the second operating position. The stops 22 are configured to prevent the teeth 21 from rotating in response to a pushing action (for example from the blank 2) backwards away from the gluing station along the longitudinal direction.

[0103] Alternatively, instead of the stops 22, any other suitable system may be used to allow the teeth 21 to move from the second operating position to the first only when the blank 2 passes as it advances towards the gluing station, preventing this movement in response to a force tending to move the blank backwards in the opposite direction.

[0104] Preferably, the pushers 18 and 19 are connected to the guides 14. Preferably, the pushers 18 and 19 are slidably coupled to the guides 14 (for example, they are mounted on sliders 23 that run on rails 24 defined by the guides 14).

[0105] The positioning means 17 preferably also comprise locking/unlocking means (for example brakes which can be operated by levers 25).

[0106] This makes it possible to adjust the position of the pushers (of the first pushers 18 and, by means of a similar system, also of the second pushers 19) longitudinally and to decide the exact point they must be fixed to on the guides 14.

[0107] This adjustment system has two functions.

[0108] A first function is that of aligning the positioning means 17 relative to a vertical axis (that is, perpendicular to the feed plane which the guides 14 lie in) of the forming machine 1, for example, relative to the vertical axis of movement of the die 8.

[0109] A second function is that of adjusting the distance (along the longitudinal direction) between the first pushers 18 and the second pushers 19, in order to adapt the positioning means 17 to different box sizes.

[0110] Preferably, the pushers 18 and 19 are pneumatic.

[0111] Preferably, the pushers 18 and 19 have a predetermined stroke (length of movement of the stem, or piston, relative to the cylinder).

[0112] The predetermined stroke (fixed) is determined during a preliminary step of calibrating the gluing device 10 (described in detail below).

[0113] Further, according to the invention, the supporting structure 11 comprises locking means 26 operating on the blank 2 for holding the blank in place so it is in the same plane as the feed plane while it is in the predetermined longitudinal position (determined by the positioning means 17).

[0114] The locking means 26 are preferably associated with the guides 14.

[0115] Preferably, the locking means 26 define jaws 27 which are movable between an open position of non-interference with the blank 2, and a closed position, where they operate on the blank segments 4 resting on the guides 14 in order to keep them in the feed plane.

[0116] More specifically, in the example illustrated, the jaws of the locking means 26 are configured to interact with the ledges 15 so as to press the lateral end portions (of the segments 4) of the blank 2 (these end portions being operatively interposed between the jaws 27 and the ledges).

[0117] The jaws 27 are connected to corresponding actuators 28. The actuators 28 (for example, pneumatic) are preferably associated with the guides 14. As regards the gluing nozzles 13 and the supporting and movement system 12 for the nozzles 13, attention is drawn to the following (with reference in particular to Figures 2, 3 and 5).

[0118] In one variant embodiment not illustrated, the locking means 26 are defined by a plate positioned in a zone under the blank 2 and movable vertically, acting in conjunction with the die 8 or other contact member (smaller than the die 8) positioned in the zone above the blank 2 and movable vertically.

[0119] In this solution, the plate and the contact member can be moved towards each other in such a way as to hold in between them a central portion of the base 3 of the blank 2.

[0120] The supporting system 12 for the nozzles 13 preferably comprises a bracket 29 having a first end which can be anchored to the frame of the forming machine 1 or to the supporting structure 11.

[0121] The bracket 29 is positioned relative to the guides 14 in such a way that it rises up (substantially perpendicularly) from the feed plane.

[0122] A rod 32 is movably connected in cantilever fashion to a second end 31 of the bracket 29. The rod 32 is connected to the bracket 29 movably so it can be translated in a predetermined direction parallel to the feed plane (that is, to the plane in which blank 2 lies).

[0123] In the preferred embodiment (illustrated), the supporting and movement system 12 for the nozzles 13 is positioned in such a way that the rod 32 is movable along a transversal direction, that is, a direction perpendicular to the longitudinal direction of movement of the blank 2 along the guides 14. Preferably, the supporting and movement system 12 for the nozzles 13 is positioned laterally of one of the two guides 14.

[0124] The rod 32 is movable in both directions.

[0125] More specifically, the rod 32 is slidably coupled to a guide block 33 fixed to the bracket 29.

[0126] Preferably, the rod 32 is driven by an electric motor 34. Preferably, the rod 32 defines a rack coupled to the electric motor 34 through the agency of a pinion.

[0127] The nozzles 13 (the at least one nozzle 13) are connected to the free end of the rod 32.

[0128] The nozzles (the at least one nozzle) 13 are

inclined with respect to the feed plane (at angles of approximately 45 degrees); preferably, the nozzles are directed in such a way as to converge (in the glue emitting direction). Hence, the nozzle 13 is inclined with respect to the feed plane in such a way as to spread the glue perpendicularly (substantially) perpendicularly to the corresponding oblique face 5 (of the bevelled edge). The nozzles 13 dispense liquid, hot-melt glue of a *per se* known type. Preferably, the nozzles 13 are adjustably mounted on the rod 32 so that their angle of inclination can be varied.

[0129] Preferably, the nozzles 13 are adjustably mounted on the rod 32 so that the distance between the nozzles 13 themselves can be varied.

[0130] In the example illustrated, there is a bar 35 fixed to the free end of the rod 32 and transversely thereto (so that the bar 35 is positioned along the longitudinal direction). The nozzles 13 can be anchored along slots 36 defined by the bar 35 and extending longitudinally.

[0131] The fact that the nozzles 13 are mounted with a variable spacing along an axis parallel to the longitudinal direction of blank 2 feed allows the gluing device 10 to be adapted to blanks 2 of different sizes.

[0132] Operatively, the gluing device 10 according to the invention works as follows.

[0133] A blank 2 (of the type shown in Figures 6 and 7) is coupled to the guides 14 in such a way that lateral end portions of two segments 4 of it (on laterally opposite sides) rest on the (ledges 15 of the) guides 14.

[0134] The blank 2 is fed forward towards a gluing station until it is interposed between the first pushers 18 and the second pushers 19. As it moves, the blank (or more specifically, the segments 4 resting on the guides 14) interacts with the teeth 21 of the second pushers 19, pushing them to a position of non-interference solely under the action of its own passing.

[0135] At this point, the four pushers (the first pushers 18 and the second pushers 19) are moved towards the segments 4 of the blank 2 (the lateral segments 4 resting on the guides) until abutting (when the pushers themselves reach the end of their stroke) against the transversely positioned borders of these segments (this configuration is shown in Figure 8).

[0136] The first pushers 18 and the second pushers 19 advance towards the blank 2 from opposite sides (longitudinally) of the blank 2 itself in order to close it in the middle.

[0137] At this point, the locking means 26 (which up to this moment have been inactive in the position of non-interference with the blank 2) are activated in order to lock the blank at the predetermined longitudinal position reached when the pushers 8, 9 are in abutment against the blank 2.

[0138] As a result of activation of the locking means 26 (the lateral segments 4 of the blank 2 are gripped, so that) the blank 2 is forced to remain in place and in the same plane as the feed plane.

[0139] At this point, the first pushers 18 and the second pushers 19 withdraw longitudinally away from the blank 2 and return to a position of non-interference therewith (this situation is illustrated in Figure 8).

[0140] At this point, the nozzles 13 are moved along the trajectories defined by the oblique faces 5 of the segments 4 and are activated to apply glue at least on a number of oblique faces 5 equal to half the total number of oblique faces 5 of the segments 4, so that for each pair of oblique faces 5 (belonging to different segments 4 and) combining to form an edge of the box sidewall, at least one has glue applied to it.

[0141] Preferably, the nozzles 13 are moved transversely to apply glue to all of the oblique faces 5 which are transversely positioned, while no glue is applied to the oblique faces 5 which are positioned longitudinally. Preferably, the nozzles 13 remain active so as to spread glue also on the oblique faces 6 of the base 3 which are positioned transversely (and which are interposed between the oblique faces 5 of the segments to which glue is also applied) while, preferably, no glue is applied to the oblique faces 6 of the base 3 which are positioned longitudinally.

[0142] This makes the device 10 particularly fast.

[0143] It should be noted that the supporting structure 11 is configured in such a way that the spacing of the guides 14 can be adjusted during initial setting up of the device 10.

[0144] In light of this, the device 10 is preferably configured in such a way that a blank whose base 3 is rectangular in shape is coupled to the guides 14 with the long sides of the base positioned longitudinally.

[0145] This makes the device 10 particularly fast.

[0146] Described below is the procedure (briefly mentioned above) for calibrating, that is, setting up, the positioning means 17.

[0147] First of all, the blank 2 (of the required size for the boxes to be made) is positioned in the gluing station between the first pushers 18 and the second pushers 19.

[0148] Next, the pushers 18 and 19 are extended (to the end of their stroke) and are moved along the guides 14 until the blank 2 is at the required longitudinal position, with the pushers 18 and 19 extended and in abutment against the lateral segments 4 of the blank 2 itself.

[0149] At this point, the pushers 18 and 19 are fixed stably to the guides 14 in such a way that the fixed parts of the pushers (for example, in the case of cylinder and piston assemblies, the cylinders) remain in place during the operation of the device 10.

[0150] This invention therefore also provides a gluing method for applying liquid glue to the blank 2.

[0151] According to the invention, the method comprises the following steps:

- feeding the blank 2 to the gluing station, by making the blank slide along a longitudinal direction, with lateral end portions of the segments 4 of the blank 2 slidably supported on the guides 14 (positioned longitudinally in the feed plane and spaced from each

other to define an empty space between them);

- positioning the blank 2 at a predetermined longitudinal position in the gluing station by a controlled movement of the blank 2 along the longitudinal direction (through the agency of the positioning means 17); this controlled movement of the blank 2 occurs (normally) in the opposite direction to the feed direction;
- locking the blank 2 at the predetermined longitudinal position while keeping it in the same plane as the feed plane (through the agency of the locking means 26);
- moving at least one liquid glue dispensing nozzle 13 along a predetermined direction parallel to the feed plane in such a way as to spread the glue on one or more of the oblique faces 5.

[0152] Preferably, the at least one nozzle 13 (preferably, the pair of nozzles 13) is moved only transversely to the longitudinal direction of blank 2 feed, so that glue is applied only to a subset of the oblique faces 5 defined by the bevelled edges.

[0153] Preferably, the positioning of the blank 2 at the predetermined longitudinal position is accomplished by moving a first pusher 18 and a second pusher 19 longitudinally in opposite directions until the selfsame pushers 18 and 19 reach an extended position where they are in abutment against corresponding borders of the blank 2 segments 4 resting on the guides (the borders being) positioned transversely to the longitudinal direction of blank 2 feed.

[0154] Also, preferably, before the step of moving the at least one liquid glue dispensing nozzle 13 and after the step of locking, the pushers 18 and 19 are moved away from each other to a withdrawn position of non-interference with the blank 2.

[0155] It should be noted that the invention also provides a method for modifying a forming machine 1 to make it suitable for making boxes from special blanks (of the type described above and illustrated in Figures 6 and 7). This method comprises providing a gluing device 10 (as described above) and installing it in a forming machine 1 (for example of the traditional type, equipped with stay tape applicators).

[0156] The gluing device 10 is installed in the forming machine 1 in place of the existing blank feed guides. Alternatively, the existing guides may be modified to obtain the supporting structure 11 described above.

[0157] Whatever the case, the gluing device 10 is installed in the forming machine 1 at a position above a box outfeed station 37 and also above the folding elements (by which the segments 4 of the blank 2 are folded relative to the base 3). Indeed, it is essential for the glue to be applied to the blank 2 when the latter is still laid out flat, that is to say, before the segments 4 are folded.

Claims

1. A gluing device (10) for a box forming machine (1) and configured to apply liquid glue to a flat blank (2) of paper or cardboard having a base (3) and a plurality of segments (4) connected to the base (3) and foldable to form a box sidewall, where the free sides of the segments (4), designed to be joined to form the edges of the box sidewall, are bevelled to define oblique faces (5) contained in the thickness of the segments (4), comprising:

- a supporting structure (11) configured to enable the blank (2) to move in a feed plane along a longitudinal feed direction to convey it to a gluing station;
- at least one liquid glue dispensing nozzle (13) movable along a predetermined direction parallel to the feed plane in such a way as to spread the glue on one or more of the oblique faces (5),

wherein the supporting structure (11) comprises:

- positioning means (17) operating on the blank (2) to move it to a predetermined longitudinal position in the gluing station;
- locking means (26) operating on the blank (2) in order to hold the blank in place in the same plane as the feed plane, while it is in the predetermined longitudinal position,

characterized in that the supporting structure (11) further comprises a first and a second guide (14) positioned longitudinally in the feed plane, wherein the locking means (26) include jaws (27) which are movable between an open position, of non-interference with the blank (2), and a closed position, where the jaws (27) operate on the blank segments (4) resting on the guides (14) in order to keep them in the feed plane, wherein the jaws (27) are connected to corresponding actuator (28),

so that the blank (2) is locked at the predetermined longitudinal position while kept in the same plane as the feed plane, through the jaws (27) which are configured to move between the open position and the closed position, wherein the jaws (27) are configured to operate on the blank segments (4) resting on the first and the second guides (14) in order to keep the blank segments in the feed plane.

2. The device according to claim 1, wherein the guides are configured to prevent transversal movements of the blank, transversal movements being defined as movements perpendicular to the longitudinal direction of movement and contained in the feed plane.

3. The device according to claim 1 or 2, wherein the

locking means (26) are associated with the guides (14).

4. The device according to any of the previous claims from 1 to 3, wherein each guide (14) is shaped for slidably supporting a portion of the blank (2).

5. The device according to any of the previous claims, wherein the actuators (28) connected to the jaws (27) are pneumatic actuators.

6. The device according to any of the previous claims, wherein the positioning means (17) comprise at least a first and a second pusher (18, 19) associated with the guides (14) to interact with corresponding transversely positioned borders of the blank (2) segments (4) resting on the guides (14), the pushers (18, 19) being movable longitudinally between an extended position where they abut against the borders of the blank (2) when the blank (2) is at the predetermined longitudinal position and a withdrawn position where they are away from the blank (2).

7. The device according to claim 6, wherein the first pushers (18) are positioned downstream of the blank (2) positioned in the gluing station, wherein the end of the first pushers (18) define flat portions (20) positioned perpendicularly to the feed plane.

8. The device according to claim 6 or 7, wherein the second pushers (19) are located upstream of the blank (2) positioned in the gluing station and include teeth (21) which are movable between a first operating position, where they are spaced from the feed plane of the blank (2) so as not to interfere with blank feed, and a second operating position, where they intersect the feed plane so as to define an abutment for the transversal border of the blank (2).

9. The device according to claim 8, wherein the teeth (21) of the second pushers (19) oscillate about respective transversal axes.

10. The device according to any of the previous claims, comprising a supporting system (12) for the nozzles (13), the supporting system (12) includes:

- a bracket (29) having a first end anchored to the supporting structure (11);
- a guide block (33) fixed to the bracket (29);
- a rod (32), slidably coupled to the guide block (33), the nozzles (13) being connected to a free end of the rod (32), wherein the rod (32) is movable with respect to the bracket (29) so it can be translated in a predetermined direction parallel to the feed plane.

11. A machine (1) for forming boxes of paper or cardboard from flat blanks (2) having a base (3) and a plurality of segments (4) connected to the base (3) and foldable to form a box sidewall, comprising:

- folding elements operating on the segments (4) of the blank (2) in such a way as to fold them relative to the base (3);
- presser elements (7) movable towards and away from the box in order to press against the vertical edges of the box sidewall, the edges being formed when corresponding free sides of the folded lateral segments (4) are joined to each other;
- manipulating means (8, 9) configured to interact with the blank (2) and with the box to impart vertical movements perpendicular to the direction of movement of the presser elements,

characterized in that it comprises a gluing device (10) according to any of the preceding claims.

12. A gluing method for applying liquid glue to a flat blank (2) of paper or cardboard having a base (3) and a plurality of segments (4) connected to the base (3) and foldable to form a box sidewall, where the free sides of the segments (4), designed to be joined to form the edges of the box sidewall, are bevelled to define oblique faces (5) contained in the thickness of the segments (4),

wherein the method comprises the following steps:

- feeding a blank (2) to a gluing station, by making the blank slide along a longitudinal direction, with portions of the blank (2) slidably supported on a first and a second guide (14) which are positioned longitudinally in the feed plane;
- positioning the blank (2) at a predetermined longitudinal position in the gluing station by a controlled movement of the blank (2) along the longitudinal direction;
- locking the blank (2) at the predetermined longitudinal position while keeping it in the same plane as the feed plane, through jaws (27) which are moved between an open position, of non-interference with the blank (2), and a closed position, where the jaws (27) operate on the blank segments (4) resting on the guides (14) in order to keep them in the feed plane;
- moving at least one liquid glue dispensing nozzle (13) along a predetermined direction parallel to the feed plane in such a way as to spread the glue on one or more of the oblique faces (5),

wherein the jaws (27) are connected to corresponding actuator (28), so that the blank (2) is locked at the predetermined longitudinal position while kept in the same plane as the feed plane, through the jaws (27) which move between the open position and the closed position, wherein the jaws (27) are operate on the blank segments (4) resting on the first and the second guides (14) to keep the blank segments in the feed plane.

13. The method according to claim 12, wherein, as a result of the activation of the jaws (27), the blank (2) is forced to remain in place and in the same plane as the feed plane, and wherein, at this point, first and second pushers withdraw longitudinally away from the blank (2) and return to a position of non-interference therewith.

FIG. 1

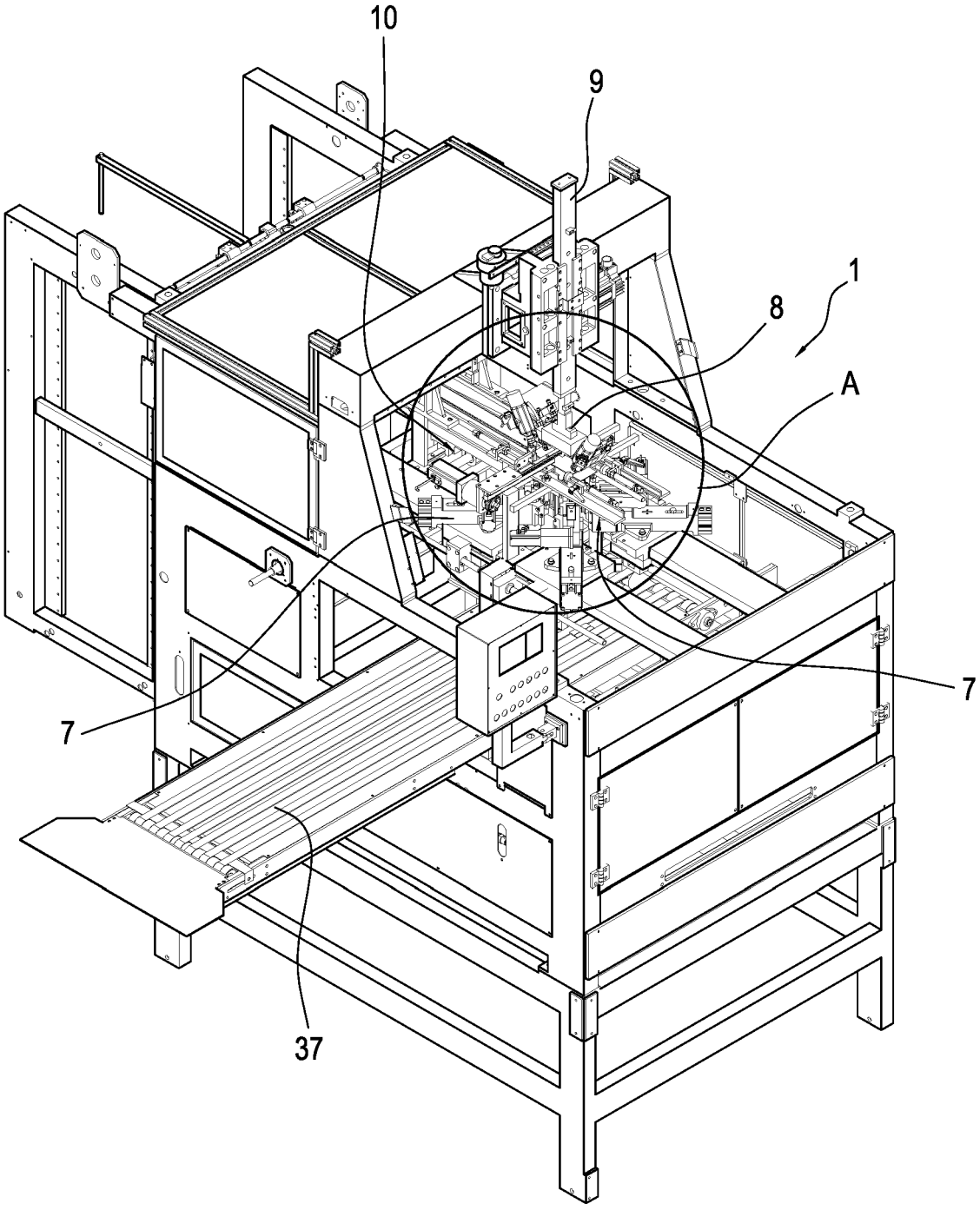


FIG. 2

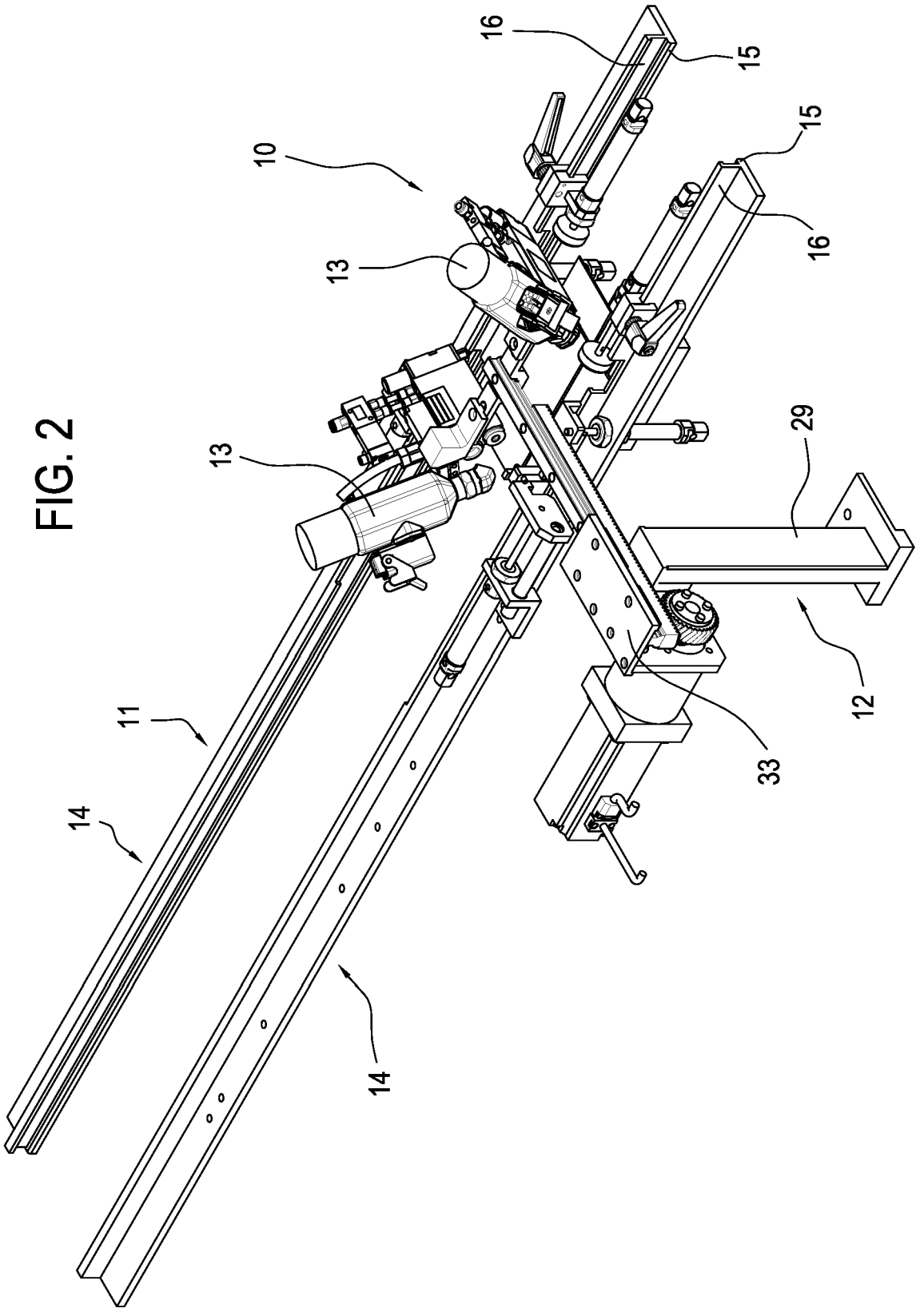


FIG. 3

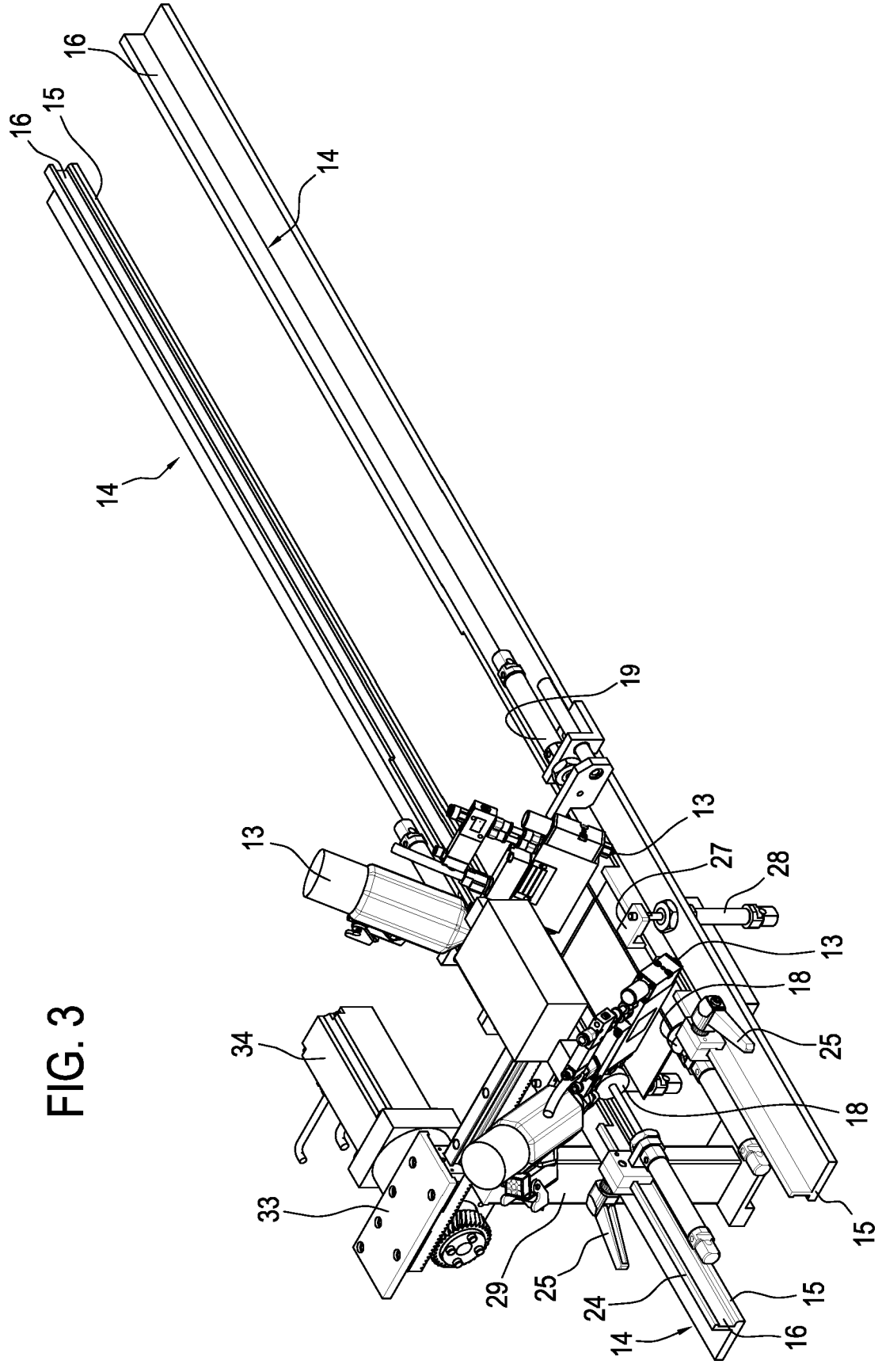
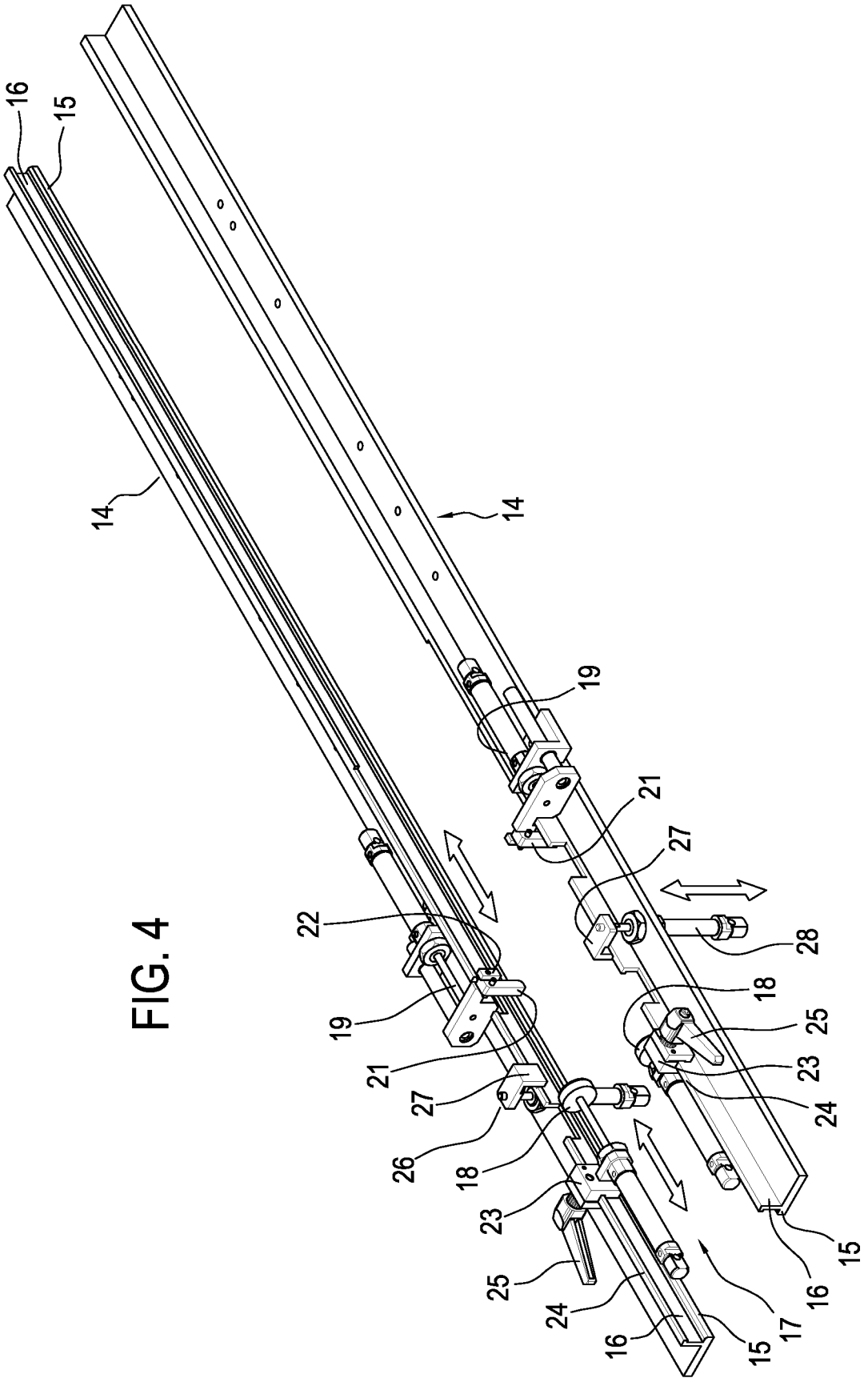


FIG. 4


16
15
14
14
19
21
27
22
28
18
19
25
21
23
27
24
26
18
23
25
24
16
15
17
16
15

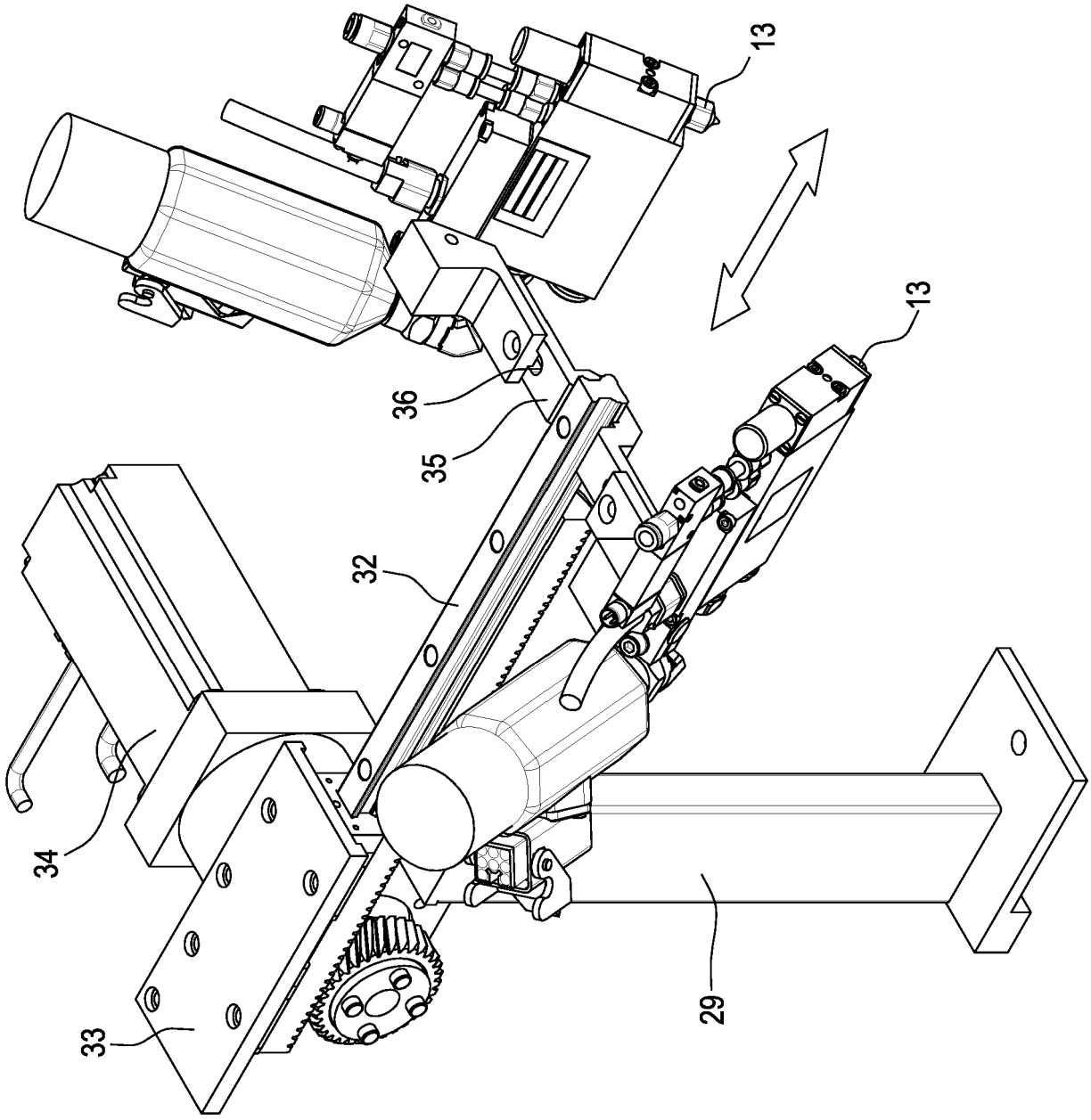


FIG. 5

FIG. 6

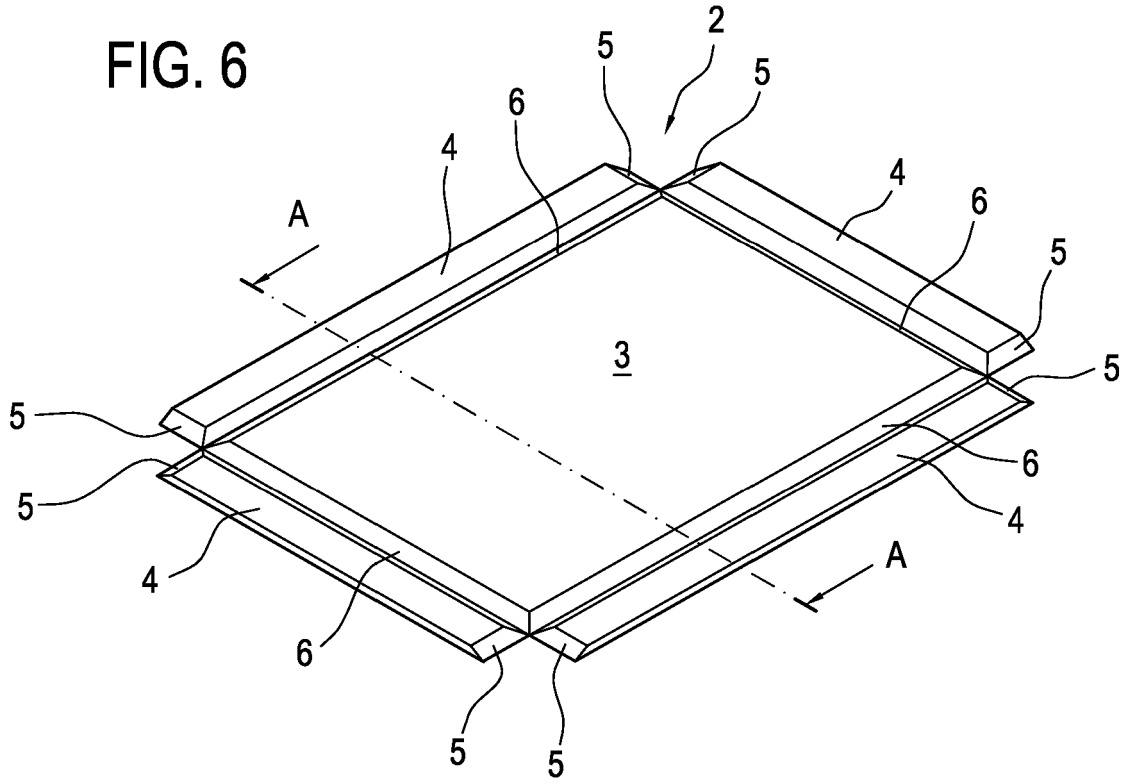
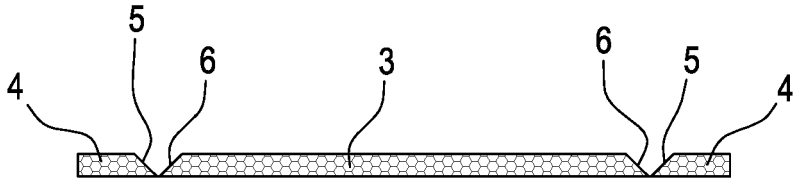


FIG. 7



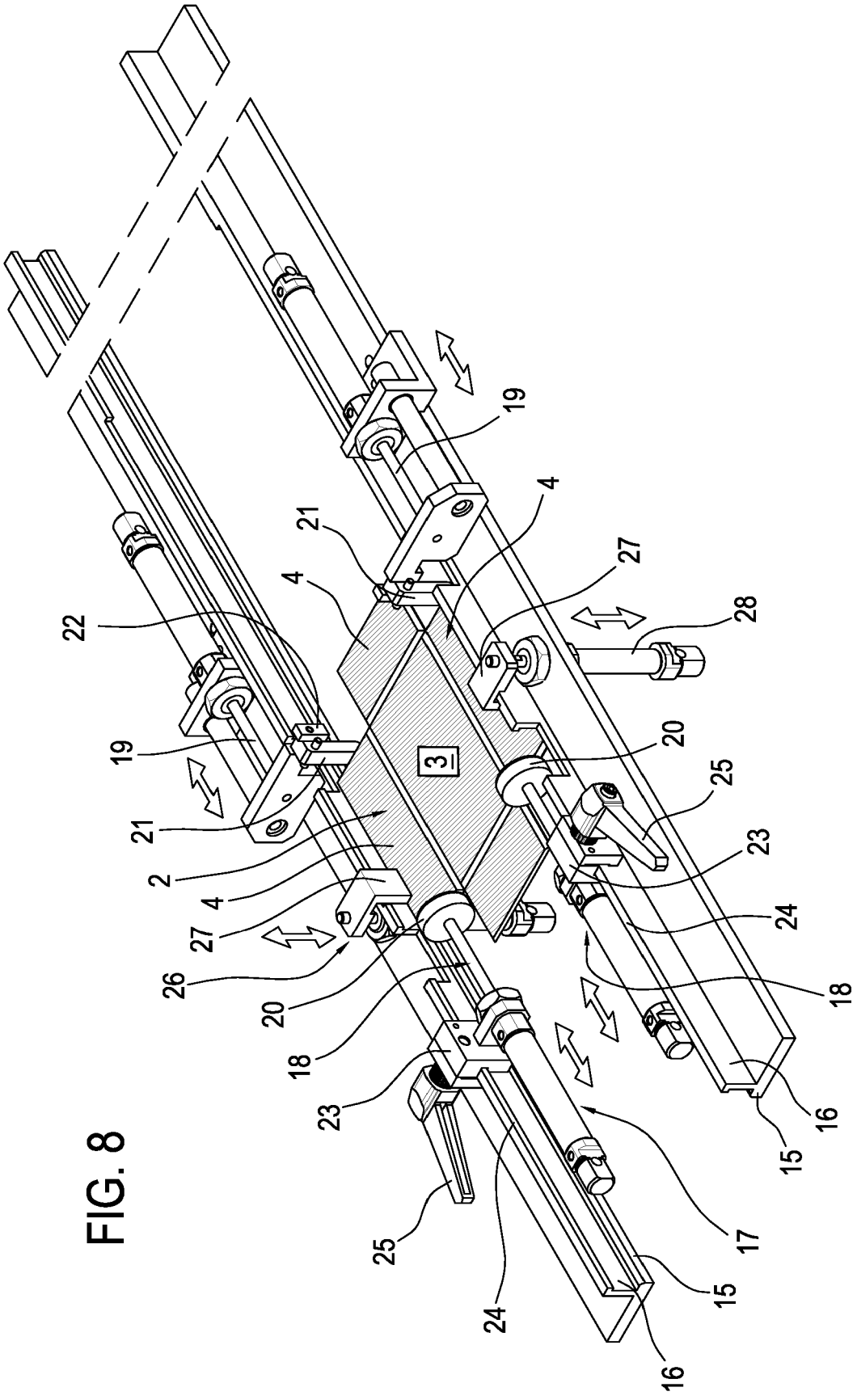


FIG. 8

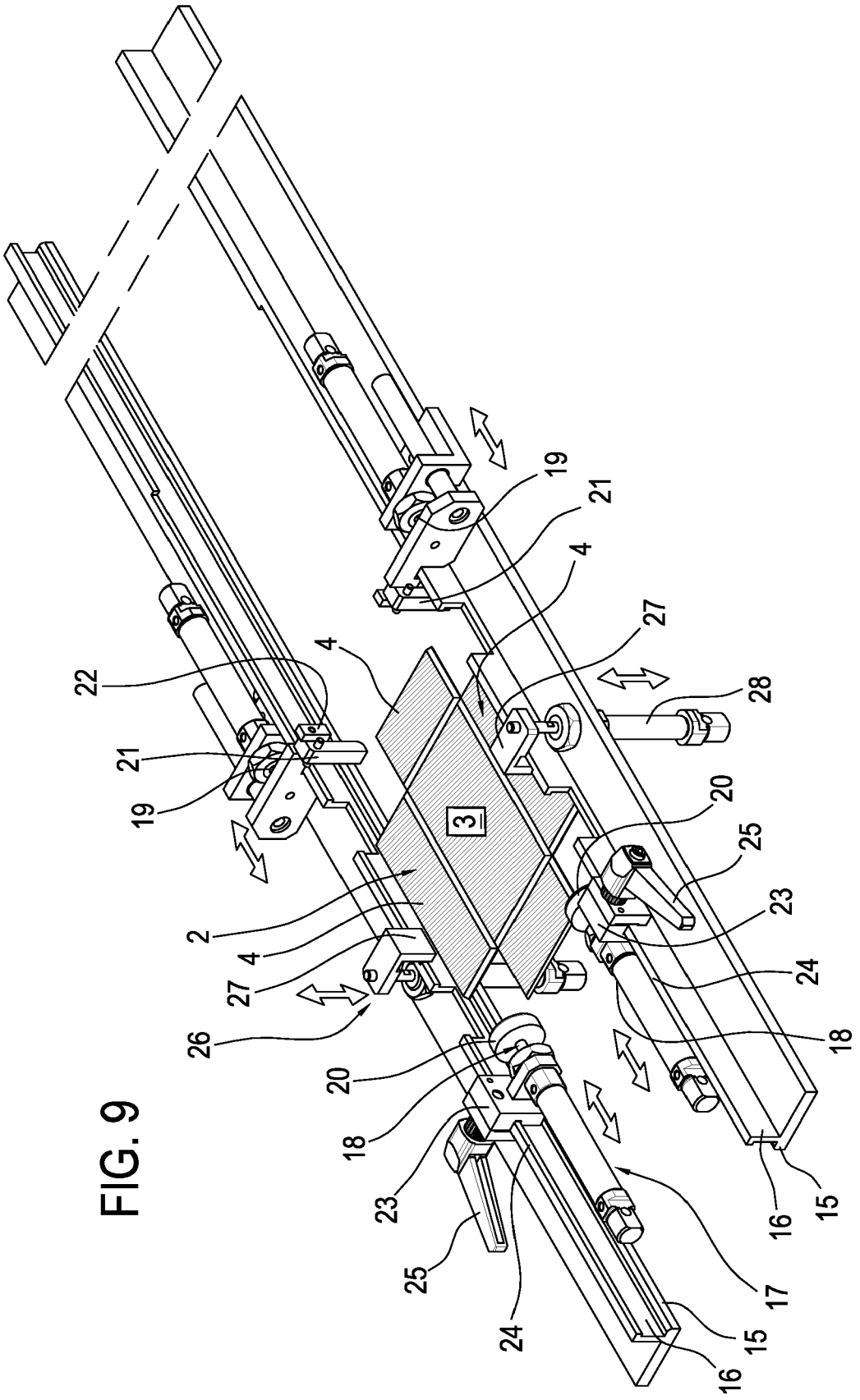

22
21
19
4
2
4
27
26
20
18
23
25
24
3
19
21
4
27
28
20
25
23
24
18
16
15
17
15
16

FIG. 9

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2007129201 A2 **[0019]**
- WO 2009090481 A2 **[0022]**
- US 6029884 A **[0027] [0032]**
- US 2007199648 A **[0034]**