



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
25.08.2010 Bulletin 2010/34

(51) Int Cl.:
B31B 15/00 ^(2006.01) **B31B 1/48** ^(2006.01)
B65D 5/00 ^(2006.01)

(21) Application number: **10151991.6**

(22) Date of filing: **28.01.2010**

(84) Designated Contracting States:
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 SE SI SK SM TR
Designated Extension States:
AL BA RS

(71) Applicant: **EMMECI S.p.A.**
20121 Milano (IT)

(72) Inventor: **Bassi, Gino**
40017 San Giovanni in Persiceto (Bologna) (IT)

(74) Representative: **Conti, Marco**
Bugnion S.p.A.
Via Goito, 18
40126 Bologna (IT)

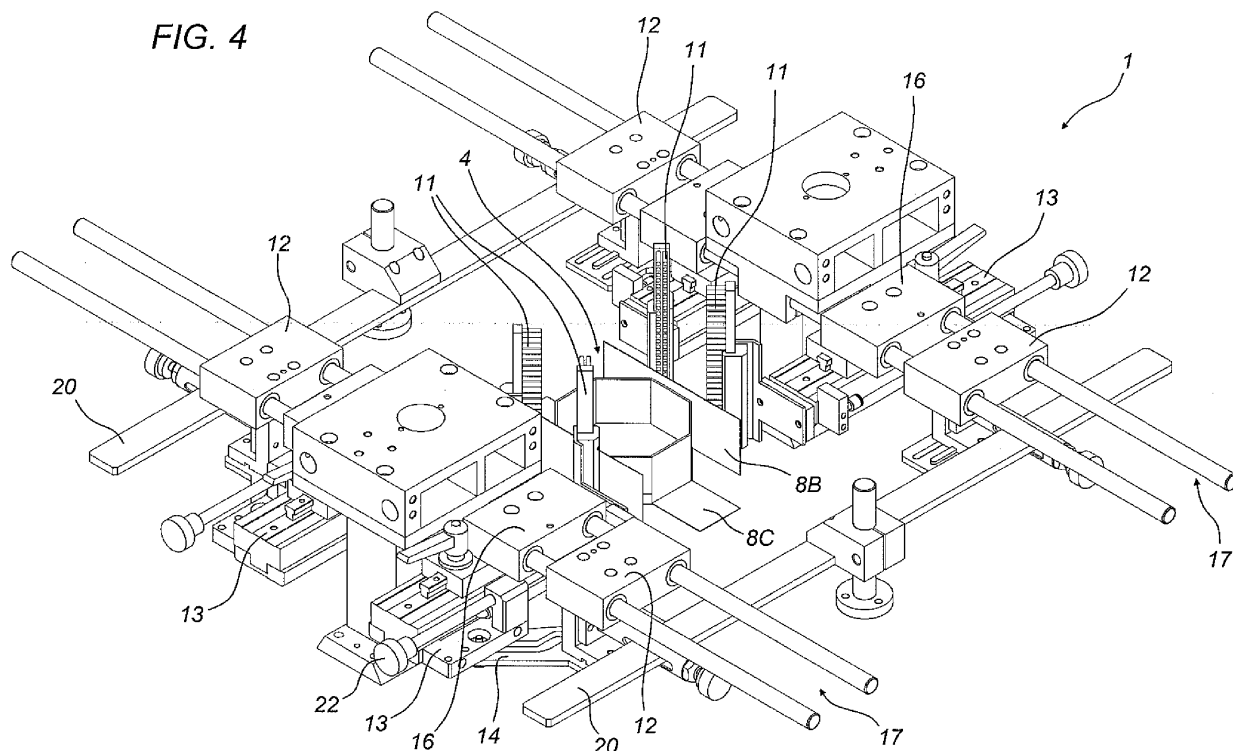
(30) Priority: **19.02.2009 IT BO20090092**

(54) **Apparatus and process for covering a box having a bottom wall with more than four sides**

(57) An apparatus (1) and a process for covering a box (2) with more than four sides, using a covering blank (6) having at least segment (8A) made in such a way that it completely covers at least two faces (5) of the lateral wall (4) of the box (2) and partly covers at least another face (5), comprise at least two folder elements (11) mov-

able relative to the box (2) positioned in a fold over station to laterally fold the at least one segment (8A) and bring it completely into contact with the lateral wall (4) of the box (2); the apparatus and the process contemplate moving at least one of the folder elements (11) along a pre-determined path comprising at least one change of direction.

FIG. 4



Description

[0001] The subject-matter of this invention is an apparatus and a process for covering a box having a bottom wall with more than four sides.

[0002] The invention relates to the technical field of industrial processing for covering finely finished, quality boxes.

[0003] The boxes in question are made from specially shaped sheets of paperboard or cardboard, known as blanks.

[0004] More specifically, the boxes are formed from flat blanks consisting of a base and a plurality of faces connected to the base and designed to be folded relative to the base to form a lateral wall of the box.

[0005] The industrial process leading to the finished box comprises two distinct stages: a stage of erecting the box, followed by a stage of covering the box by applying a covering sheet (or lining) to it.

[0006] This invention relates specifically to the stage of covering the box.

[0007] More specifically, in the context of this invention, the box to be covered is a box with a bottom wall having more than four sides and a lateral wall with as many faces.

[0008] The covering sheets are in turn specially shaped sheets that constitute covering blanks.

[0009] The covering blank is a flat blank having a base shaped like the bottom wall of the box and segments (that is, lateral portions) connected to the base and designed to be folded in such a way as to cover the lateral wall of the box.

[0010] As regards the shape of the covering blank, generally speaking the number of segments of the covering 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. It should be noted that in petalled covering blanks, all the segments are substantially the same in size, except for fold over lips, where present.

[0011] More specifically, each segment of the covering blank defines two lateral edges. Thus, in a petalled covering blank, the number of lateral edges (of the petals) is twice the number of sides of the base of the covering blank (which is equal to the number of sides of the bottom wall of the box and the number of lateral edges of the lateral wall of the box).

[0012] At their lateral edges, some of the segments of the covering blank are provided with lips (for folding over laterally), that is to say, laterally protruding flaps of the covering blank.

[0013] The lip of one segment applied to the lateral wall of the box to cover one face completely also covers a limited portion of another face (of the lateral wall of the box) adjacent to the fully covered face (the portion covered by the lip runs along the edge at the intersection between the two faces); that way, all the edges of the

lateral wall of the box are covered completely without leaving any part uncovered.

[0014] The operation of folding the lips is termed folding over.

5 **[0015]** After folding over, there is at least one face of the lateral wall of the box that is only partially covered (by only one or two lips).

[0016] In a subsequent step, therefore, at least one further segment is folded in order to cover that face completely; the further segment thus overlaps the previously folded lip.

[0017] The box covering process can thus be divided into the following steps.

10 **[0018]** First, a layer of glue is applied to the covering blank.

[0019] Next, the box to be covered is placed on the covering blank previously glued (that is, pre-glued) in such a way that the bottom of the box adheres to the base of the covering blank.

20 **[0020]** The covering blank segments provided with lips are then folded (from a horizontal position, where they lie in the same plane as the base, to a vertical position) to cover respective portions of the lateral wall of the box.

[0021] The lips are then folded laterally for folding over.

25 **[0022]** Next, the remaining segments of the covering blank are folded (from the horizontal position to the vertical position) to overlap the folded lips.

30 **[0023]** Lastly, a flap of the covering blank protruding vertically upwards (that is on the opposite side to the bottom wall) is folded onto the inside of the box so as to cover the free upper edge.

35 **[0024]** The box covering system currently used, based on the use of petalled covering blanks has the disadvantage of being very complex.

[0025] In particular, the prior art technical solutions are particularly disadvantageous during fold over, especially in the case of boxes having more than four sides.

40 **[0026]** In effect, the higher the number of sides is, the higher the number of lips to be folded over, considerably increasing the complexity of the process.

[0027] Moreover, if the box has an odd number of sides, two additional steps are necessary to fold over all the vertical edges; thus, for geometric reasons, the segments of the covering blank must be folded in three different steps, alternated with two different fold over steps.

[0028] As an alternative to the petalled covering blank, the Applicant has developed a modified covering blank where at least one of the segments is oversize, that is, wider than the side of the base of the covering blank it is connected to; more specifically, the oversize segment is adapted to completely cover at least two of the faces of the lateral wall of the box.

55 **[0029]** Use of the modified covering blank therefore makes it possible to reduce the number of lips necessary for folding over, compared to the number of sides of the box. Indeed, if an oversize segment covers two contiguous

ous faces of the lateral wall of the box, the edge at the intersection between these faces does not need a fold over lip since it is covered completely by the oversize segment itself.

[0030] Thus, the fold over lips are less in number; the fold over lips are not totally absent, however.

[0031] In effect, the oversize segments of the modified covering blank are provided (at least at one of their lateral edges) with additional (excess) portions constituting fold over lips.

[0032] In light of this, the prior art covering systems cannot be used to cover boxes with these modified covering blanks.

[0033] Also known in the prior art (from US2574127) are machines for covering boxes having more than four sides using petalled blanks where the folding elements are guided in their movement along a curved path determined by geometrical constraints on the machine.

[0034] The shortcomings of this type of machine are those associated with the use of petalled covering blanks. An added disadvantage is that the number of folders it uses must necessarily be same as the number of sides of the box to be covered; that inevitably translates as greater machine complexity and higher costs.

[0035] Also known (from US1829063) are machines for covering boxes having more than four sides using petalled blanks where each folding element is fixed to one end of a rod whose other end is pivoted to a slider which is movable along an axis towards the box; the rod is also connected to a return spring designed to push the rod into alignment with the axis along which the slider moves towards the box.

[0036] The shortcomings of this type of machine are those associated with the use of petalled covering blanks.

[0037] If one attempted to use the machine with modified blanks (with appropriate adaptations), there would still be the disadvantage of applying excessive pressure on the wall of the box (that is, on the covering blank) under the action of the return spring and the movement imparted to the folder (which is a passive element whose path is determined by the profile of the box), with the risk of damaging the covering sheet, or even the box itself.

[0038] This invention therefore has for an aim to provide an apparatus and a process that overcome the above mentioned disadvantages of the prior art.

[0039] More specifically, this invention has for an aim to provide an apparatus and a process for covering a box having a bottom wall with more than four sides using a modified covering blank.

[0040] Another aim of this invention is to provide an apparatus and a process for covering a box having a bottom wall with more than four sides using a modified covering blank that allows rapid and effective changeover to boxes of different shapes.

[0041] The apparatus according to the invention is an apparatus for covering a box which has a bottom wall with a predetermined number of sides (in particular, more than four sides) and a lateral wall having as many faces,

using a flat covering blank which has a base shaped like the bottom wall of the box and segments connected to the base and which can be folded to cover the lateral wall of the box, at least one of the segments being made in such a way that it completely covers at least two of the faces of the lateral wall of the box and partly covers at least another face of the lateral wall.

[0042] The apparatus comprises:

- 10 - means for placing the box in a folding station, on the pre-glued covering blank positioned on a horizontal surface, with the bottom wall in contact with the base of the blank;
- a mould which can move vertically and is operatively connected to an inner surface of the box to move it vertically from the folding station to a fold over station which is lower than the folding station;
- at least one contact element positioned in the folding station for interacting with a segment of the covering blank during its motion as one with the box, causing the segment to be folded from the horizontal position to a vertical position in which it is in contact with a corresponding face of the lateral wall of the box;
- at least two folder elements movable relative to the box positioned in the fold over station;
- movement means connected to the brushes for laterally folding said segment and bringing it completely into contact with the lateral wall of the box.

[0043] The process according to the invention is in turn a process for covering a box which has a bottom wall with a predetermined number of sides (preferably, more than four sides) and a lateral wall having as many faces, using a flat covering blank which has a base shaped like the bottom wall of the box and segments connected to the base and which can be folded to cover the lateral wall of the box, at least one of the segments being made in such a way that it completely covers at least two of the faces of the lateral wall of the box and partly covers at least another face of the lateral wall.

[0044] The process comprises the following steps:

- placing the box in a folding station, on the pre-glued covering blank positioned on a horizontal surface, with the bottom wall in contact with the base of the blank;
- preparing at least one contact element in the folding station;
- moving the box vertically, from the folding station to a fold over station which is lower than the folding station, causing the interaction of the contact element with a corresponding segment of the covering blank during its motion as one with the box, and thus causing the segment to be folded from the horizontal position to a vertical position in which it is in contact with a corresponding face of the lateral wall of the box;
- moving at least two brushes relative to the box po-

sitioned in the fold over station, to laterally fold said segment and bring it completely into contact with the lateral wall of the box.

[0045] The above mentioned aims are fully achieved by the apparatus and process according to the invention as characterized in the appended claims.

[0046] More specifically, the apparatus according to the invention is **characterized in that** the means for moving at least one of the brushes are adapted to move the brush along a predetermined path comprising at least one change of direction.

[0047] The process according to the invention is **characterized in that** at least one of the brushes is moved along a predetermined path comprising at least one change of direction.

[0048] 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 of an apparatus according to the invention with reference to the folding station;
- Figure 2 shows the apparatus of Figure 1 with an eight-sided box coupled to it;
- Figure 3 shows the apparatus of Figure 2 with the box in a different working position;
- Figure 4 shows the apparatus of Figure 2 with reference to the fold over station;
- Figure 5 is a perspective view from above showing a detail of the apparatus of Figure 4 where the brush is in a first working position;
- Figure 6 shows the detail of Figure 5 with the brush in a second working position;
- Figure 7 shows the detail of Figure 5 with the brush in a third working position;
- Figure 8 is a perspective view from below of the detail of Figure 5;
- Figure 9 shows the detail of Figure 8, with the brush in a second working position;
- Figure 10 shows the detail of Figure 8, with the brush in a third working position;
- Figure 11 shows the apparatus of Figure 2 with reference to a second folding station;
- Figure 12 shows the apparatus of Figure 11 with the box in a different working position;
- Figure 13 shows the apparatus of Figure 2 with reference to a station for finishing the upper edge;
- Figure 14 shows the eight-sided box of Figure 2 during a first covering step;
- Figure 15 shows the box of Figure 14 during a second covering step;
- Figure 16 shows the box of Figure 14 during a third covering step;
- Figure 17 shows the box of Figure 14 during a fourth covering step;
- Figure 18 shows the box of Figure 14 during a fifth covering step;
- Figure 19 shows the box of Figure 14 during a sixth covering step;
- Figure 20 shows the eight-sided box of Figure 2 in the fold over station, with the brush in the first working position;
- Figure 21 shows the box of Figure 20, with the brush in the second working position;
- Figure 22 shows the box of Figure 20, with the brush in the third working position;
- Figure 23 is a perspective view showing the apparatus according to the invention in another embodiment for a six-sided box, with reference to the folding station with the six-sided box coupled to it;
- Figure 24 is a perspective view from above showing a detail of the apparatus of Figure 23, with the brush in a first working position;
- Figure 25 shows the detail of Figure 24, with the brush in a second working position;
- Figure 26 shows the detail of Figure 24, with the brush in a third working position;
- Figure 27 shows the six-sided box of Figure 23 during a first covering step;
- Figure 28 shows the box of Figure 27 during a second covering step;
- Figure 29 shows the box of Figure 27 during a third covering step;
- Figure 30 shows the box of Figure 27 during a fourth covering step;
- Figure 31 shows the box of Figure 27 during a fifth covering step;
- Figure 32 shows the box of Figure 27 during a sixth covering step;
- Figure 33 shows the six-sided box of Figure 23 in the fold over station, with the brush in the first working position;
- Figure 34 shows the box of Figure 33, with the brush in the second working position;
- Figure 35 shows the box of Figure 33, with the brush in the third working position.

[0049] The numeral 1 in the drawings denotes an apparatus according to this invention for covering boxes 2 of paperboard or cardboard.

[0050] The box 2 has a bottom wall 3 with a predetermined number of sides and a lateral wall 4 having as many faces 5.

[0051] More generally, it should be noted that the box might have any shape; in the examples illustrated, the bottom wall of the box has a polygonal shape but the box might also have curved lateral walls.

[0052] In particular, the apparatus 1 is designed to cover (preferably but not exclusively) boxes 2 having more than four sides.

[0053] The apparatus 1 is designed to cover the box 2 with a covering blank 6 having a base 7 shaped like the bottom wall 3 of the box 2 and segments 8 connected to the base 7 and designed to be folded in such a way

as to cover the lateral wall 4 of the box 2.

[0054] It should be noted that at least one of the segments 8 is an oversize segment 8A, that is to say, a segment adapted to cover completely at least two of the faces 5 of the lateral wall 4 of the box and to partly cover at least one other face 5 of the lateral wall 4.

[0055] It should be noted that the covering blank 6 preferably also comprises at least one undersize segment 8B (that is to say, designed to cover only a limited portion of one of the faces 5), connected to one of the sides of the base 7 adjacent to the side of the base 7 the oversize segment 8A is connected to.

[0056] According to the invention, the covering blank 6 also comprises segments 8C of standard size, that is, of a size such that the segment (when folded vertically) completely covers only one face 5 of the lateral wall 4 of the box 2.

[0057] The standard size segments 8C might not be present. That is because the number of standard size segments is equal to the difference between the number of sides of the box 2 and the total number of oversize segments 8A and undersize segments 8B. Thus, if the sum of oversize segments 8A plus undersize segments 8B is equal to the number of sides of the box 2 (or to the number of sides of the base 7 of the covering blank 6), the number of standard size segments 8C is zero.

[0058] The apparatus 1 comprises a mould 9 which moves vertically and is operatively connected to an inner surface of the box to move it vertically.

[0059] The mould 9 also constitutes means for positioning the box 2 in a folding station of the apparatus 1.

[0060] It should be noted that the box 2, when it is in the folding station, is positioned on the pre-glued covering blank 6 and is in a horizontal plane; more specifically, the box 2 is positioned on the covering blank 6 with the bottom wall 3 in contact with (that is, glued to) the base 7 of the blank 6. As is known, the mould 9 constitutes a constraining element operatively fitted to size in an internal volume of the box 2 and constitutes abutment surfaces operatively in contact with the inside surfaces of the faces 5.

[0061] The mould 9 is movable vertically (as one with the box 2 and with the covering blank 6 applied to it) in order to move the box from the folding station to a fold over station; the fold over station is lower than the folding station.

[0062] It should be noted that the apparatus 1 also comprises a mould (not illustrated in the drawings but well known in the trade) positioned outside the box 2, shaped like, and in contact with, the bottom wall 3 of the box 2. The outside mould is movable vertically in synchrony with the mould 9 and acts in conjunction with the latter in order to move the box 2 and hold it in the required positions (for example in the fold over station).

[0063] In the folding station, the apparatus 1 comprises at least one contact element 10. The contact element 10 is in the form of an elongated element associated with a frame of the apparatus 1 (illustrated only partly in the

drawings but of per se known type) and located at a fixed position relative to the box 2, that is, relative to the mould 9.

[0064] Preferably, the contact element 10 comprises a brush.

[0065] The contact element 10 is positioned in the folding station to interact with a segment 8 of the covering blank during its motion as one with the box 2, causing the segment to be folded from the horizontal position to a vertical position in which it is in contact with a corresponding face 5 of the lateral wall 4 of the box 2.

[0066] Each contact element 10 extends in a predetermined direction, according to the profile of the box 2.

[0067] In the embodiment illustrated, two types of contact elements 10 are provided.

[0068] The contact elements 10 of the first type comprise contact elements 10A whose extension is generally larger than the width of the segments 8, that is, of the oversize segments 8A (to enable boxes 2 of different sizes to be covered without having to change the contact elements 10A).

[0069] The contact elements 10 of the second type comprise contact elements 10B whose extension is equal to (and in any case not greater than) the width of the undersize segments 8B; that is to say, the length of the sides of the base 7 of the blank 6 the segments 8B are connected to.

[0070] It should be noted that the number of contact elements 10 located in the folding station depends on the number of sides of the box 2 to be covered and on the shape of the covering blank 6.

[0071] In light of this, it should be noted that the drawings show by way of an example two different embodiments of the apparatus 1 (that is, two different applications of this invention): a first embodiment relating to boxes with eight sides (Figures 1-22), and a second embodiment relating to boxes with six sides (Figures 23-35).

[0072] In the first embodiment (eight-sided box), the apparatus 1 comprises, in the folding station, six contact elements 10 (two contact elements 10A of the first type and four contact elements 10B of the second type).

[0073] In the second embodiment (six-sided box), the apparatus 1 again comprises, in the folding station, six contact elements 10 (two contact elements 10A of the first type and four contact elements 10B of the second type), but orientated differently relative to each other.

[0074] It should be noted that in the first embodiment (eight-sided box) the covering blank 6 comprises two standard size segments 8C.

[0075] In the second embodiment (six-sided box) the covering blank 6 does not have any standard size segments 8C.

[0076] Unless otherwise specified, the description which follows refers to both embodiments without distinction.

[0077] Generally speaking, as regards the contact elements 10 in the folding station, the number of contact elements 10A of the first type is equal to the number of

oversize segments 8A, while the number of contact elements 10B of the second type is equal to the number of undersize segments 8B.

[0078] In the fold-over station, the apparatus 1 comprises at least two folding elements 11, which are movable relative to the box 2 positioned in the fold over station.

[0079] In the example illustrated, the folding elements 11 are brushes. Alternatively, the folding elements might comprise paddles, blades or idle rollers.

[0080] Reference to brushes 11 instead of folding elements 11 in this description shall not therefore be understood as limiting the scope of the invention since the fact that the folding elements are brushes is not an essential feature of the invention.

[0081] More specifically, according to the invention, the apparatus 1 comprises twice as many brushes 11 as there are oversize segments 8A on the covering blank 6.

[0082] Indeed, in the fold over station the oversize segment 8A (or at least one of the oversize segments 8A), that is already in the vertical position in contact with one face 5 of the lateral wall 4 of the box 2 (as a result of the vertical movement of the box 2 through the folding station) is folded laterally so as to cover at least one other face 5 (adjacent to the previous one) completely and a further face 5 partly; this partial covering constitutes folding over.

[0083] At the sides of it, the oversize segment 8A has two opposite ends that must both be folded and/or folded over. It follows therefore that there are twice as many movable brushes 11 as there are oversize segments 8A.

[0084] According to the invention, the oversize segment 8A is folded laterally by the continuous movement of the brushes 11, although at least one of the brushes folds the oversize segment 8A on two different faces 5 of the lateral wall 4 of the box (together forming an edge, and hence an angle, between them).

[0085] The apparatus 1 comprises brush 11 movement means for laterally folding the oversize segment 8A (or other segments 8) and move it fully into contact with the lateral wall 4 of the box.

[0086] In light of this, according to the invention, the movement means of at least one of the brushes 11 are adapted to move the brush 11 along a predetermined path comprising at least one change of direction.

[0087] Preferably, the predetermined path comprises a first stretch of predetermined length and a second stretch that makes a predetermined angle with the first stretch.

[0088] Hereinafter, for convenience of description and in accordance with the examples illustrated, it is assumed that the movement means of all the brushes 11 are of the same type (that is, adapted to move the brush 11 along a predetermined path comprising at least one change of direction and, preferably, comprising a first stretch of predetermined length and a second stretch that makes a predetermined angle with the first stretch and, more specifically, as described below).

[0089] Preferably, the movement means comprise a head 12 and a slide 13 interconnected in such a way that the slide 13 is constrained to slide along a predetermined path relative to the head 12.

5 **[0090]** Preferably (as in the examples illustrated), the slide 13 is constrained to slide relative to the head 12 by means of a system comprising a cam 14 and a roller 15.

[0091] According to the invention, the profile of the cam 14 corresponds to the predetermined path so as to constrain the slide 13 to move along said path.

10 **[0092]** The brush 11 is associated with the slide 13.

[0093] More specifically, the slide 13 is movable relative to the head 12 in a horizontal plane (perpendicular to the direction of movement of the mould 9 and hence of the box 2) in a first direction and a second direction (not parallel to each other).

15 **[0094]** The movement means of each brush 11 also comprise an actuator connected to the slide 13 and designed to move it relative to the head 12 from a process start position to a process end position and vice versa.

20 **[0095]** For example, the actuator comprises a pneumatic piston associated with the slide 13.

[0096] The brush 11 movement means also comprise a block 16 slidably connected to a guide 17 oriented in the first direction; in the example illustrated, the guide 17 consists of a pair of rods (tubular in shape in the example illustrated) along which the block 16 is constrained to run.

25 **[0097]** The slide 13 is coupled to the block 16 so that it can slide relative to it in the second direction.

30 **[0098]** For example, the block 16 forms a track oriented in the second direction and the slide 13 is slidably coupled to the track.

[0099] In the preferred embodiment illustrated, the first and second directions are perpendicular to each other.

35 **[0100]** In other terms, the track formed by the block 16 (along which the slide 13 runs) is perpendicular to the guide 17 along which the block 16 runs.

[0101] According to another aspect of the invention, the head 12 is movable relative to the frame of the apparatus 1, so that the relative position between the head 12 and the block 16 (that is, the slide 13) can be adjusted by operating on the head 12 while holding the block 16 in place.

40 **[0102]** In light of this, the head 12 is slidably coupled to the guide 17.

[0103] The head 12 further comprises locking elements 18 (partly illustrated in the drawings) to hold the head 12 relative to the guide 17.

45 **[0104]** These locking elements 18 (comprising screws for example) constitute locking means to fasten the head 12 to the frame in different positions relative to the fold over station.

[0105] In light of this, it should be noted that the head 12 is integral with a perforated protrusion 19; the perforated protrusion 19 is inserted in a bar 20 that is integral with the frame of the apparatus 1 and perpendicular to the guide 17.

55 **[0106]** The perforated protrusion 19 is also provided

with an adjustment screw 21 for adjusting the position of the head 12 along the direction defined by the guide 17, in order to move the brushes 11 towards and away from the wall of the box 2; the purpose of this is to compensate for mechanical tolerances, if any, (for example due to irregular thickness of the paper the covering sheet is made of) and to control the pressure of the brushes 11 on the paper (that is, on the lateral wall of the box).

[0107] That way, each of the movement means in its entirety (that is, the head 12 and the related cam 14, the block 16 and the related slide 13 and roller 15, and the brush 11 connected to the slide 13) can be moved along the bar 20 (the guide 17 also moves along the bar 20 as one with the movement means).

[0108] It should also be noted that the movement means comprise a limiter 22, operating on the actuator in such a way as to limit the latter's stroke; the limiter 22 thus operates on the slide 13 in order to limit the latter's stroke relative to the head 12 to a predetermined value (depending on the size of the box to be covered).

[0109] The fact that the position of the head 12 can be adjusted (prior to processing, that is, covering, of the box) relative to the position of the brush 11 makes it possible to adapt the covering apparatus to boxes 2 of different sizes.

[0110] More specifically, this adjustment possibility allows changeover from one box size to another where the length of the box sides changes but the angles made by the faces 5 of the lateral wall 4 of the box 2 with the adjacent faces 5 do not change.

[0111] In effect, the adjustment allows the position of the roller 15 relative to the cam 14 when the process starts to be changed.

[0112] In light of this, the limiter 22 allows slide 13 feed to be interrupted when the roller 15 is at the end of its stroke in the cam 14.

[0113] According to the invention, therefore, the cam profile determines the path of the brush 11.

[0114] In light of this, these adjustments vary the length of the path of the brushes 11 (obviously, the path of each brush 11 is adjusted independently of the other brushes 11).

[0115] This applies to all the brushes 11 and the respective movement means.

[0116] In the examples illustrated, the apparatus 1 comprises four brushes 11 and four respective movement means.

[0117] It should be noted, however, that according to the invention there may be any number of brushes 11 and respective movement means, depending on the shape of the box 2.

[0118] To adapt the covering apparatus 1 to boxes 2 having different angles made by the lateral wall 4 faces 5, the cam 14 can be replaced with a cam having a different profile.

[0119] To facilitate replacement, the cam 14 is positioned, according to the invention, in an easy to access position and is fastened to the block 16 in such a way

that it can be easily removed and fitted.

[0120] In the examples illustrated, the cam 14 defines a first stretch and a second stretch at an angle to each other (in the horizontal plane).

5 [0121] More specifically, in the examples illustrated, the cam 14 defines a first and a second stretch which are straight and make a predetermined angle with one another.

10 [0122] In the first example illustrated, the angle is 135 degrees (box 2 whose bottom wall 3 has the shape of a regular octagon); in the second example illustrated, the angle is 120 degrees (box 2 whose bottom wall 3 has the shape of a regular hexagon).

15 [0123] It should be noted that according to another aspect of the invention, the profile of the cam 14 might be at least partly curved.

[0124] More specifically, one or both of the stretches defined by the cam 14 might be curved.

20 [0125] This advantageously makes it possible to cover boxes having faces that are rounded (and hence not necessarily flat).

[0126] It should be noted that the angle made by the first and second stretches defined by the cam 14 is preferably greater than 90 degrees.

25 [0127] According to another aspect of the invention, the cam 14 might define more than two stretches not in line with each other, that is to say, making predetermined angles with each other.

30 [0128] This advantageously makes it possible to use covering blanks 6 having oversize segments 8A made in such a way as to completely cover any number of faces 5 of the lateral wall 4 of the box 2.

35 [0129] In effect, each of the angles made by consecutive stretches of the cam 14 corresponds to a deviation in the movement of the brush 11, with the result that the brush 11 follows the profile of the lateral wall 4 of the box forming any number of angles.

40 [0130] The apparatus according to the invention is adapted to cover boxes 2 having any number of sides and of any shape with covering blanks 6 having any shape.

[0131] This guarantees the maximum flexibility and minimizes overlapping of covering blank 6 portions on the lateral wall 4 of the box 2; in other terms, the invention makes it possible to reduce to a minimum the surface area of the lateral wall 4 of the box 2 where (for folding over requirements at the corners of the box 2) there is overlapping of two portions (that is, two layers) of the covering blank 6.

50 [0132] According to another aspect of the invention, the apparatus 1 comprises a second folding station located under the fold over station; that way, the fold over station is vertically interposed between the (first) folding station described above and this second folding station.

55 [0133] The second folding station is necessary when covering blanks 6 having certain particular shapes are used.

[0134] For example, the second folding station is nec-

essary in the first example illustrated (eight-sided box), whereas it is not necessary in the second example illustrated (six-sided box); in effect, in the second example, the lateral wall 4 of the box 2 is already completely covered in the fold over station.

[0135] Preferably, therefore, the apparatus 1 comprises the second folding station.

[0136] In light of this, the mould 9 is operatively connected to an inner surface of the box 2 to move it vertically from the fold over station to a second folding station which is lower than the fold over station.

[0137] The apparatus 1 further comprises at least one other contact element 10C positioned in the second folding station to interact with a respective segment 8 (in particular a standard size segment 8C, where present) during its motion as one with the box 2, causing the segment to be folded from the horizontal position to a vertical position in which it is in contact with a corresponding face 5 of the lateral wall of the box.

[0138] This face 5 (onto which the segment 8C is folded in the second folding station) is partly covered because, in the fold over station above, parts of other segments 8 of the covering blank 6 (more specifically, of the over-size segments 8A) were previously applied to this face 5 during the fold over step.

[0139] In this regard it should be noted that Figures 11 and 12 illustrate the second folding station in the example relating to the eight-sided box.

[0140] It should be noted that the covering blank 6 is made in such a way that when the lateral wall 4 of the box 2 is completely covered, an upper edge 23 formed by the folded covering blank 6 extends beyond the upper edge of the box 2.

[0141] This upper edge formed by the covering blank 6 is folded onto the inside of the box 2 by folding means 24, illustrated in Figure 13.

[0142] A further aspect of the invention is described below.

[0143] It should be noted that the apparatus 1 is adapted to cover boxes 2 having any number of sides, especially boxes with more than four sides.

[0144] The invention therefore can also be used to cover boxes having an odd number of sides (that is to say, having a bottom wall 3 with an odd number of sides).

[0145] This is made particularly easy by the use, according to the invention, of the covering blank 6 in combination with brush 11 movement means according to the invention which enable at least one of the brushes 11 in the fold over station to be moved along a path that is not straight, that is to say, a path forming one or more angles.

[0146] This invention also provides a process for covering the box 2, in particular where the box 2 has more than four sides (that is, where the bottom wall 3 has more than four sides).

[0147] The process according to the invention uses a covering blank 6 of the type described above, that is, a covering blank 6 comprising at least one oversize seg-

ment 8A.

[0148] The process comprises the following steps:

- placing the box 2 in the folding station, on the pre-glued covering blank 6 positioned on a horizontal surface, with the bottom wall 3 in contact with the base 7 of the blank 6;
- preparing at least one contact element 10 in the folding station;
- moving the box 2 vertically, from the folding station to the fold over station which is lower than the folding station, causing the interaction of the contact elements 10 with corresponding segments 8 of the covering blank 6 during its motion as one with the box 2, and thus causing the segment 8 to be folded from the horizontal position to a vertical position in which it is in contact with a corresponding face 5 of the lateral wall 4 of the box 2;
- moving the brushes 11 relative to the box 2 positioned in the fold over station, to laterally fold the vertical segments 8 and bring them completely into contact with the lateral wall 4 of the box 2.

[0149] According to the invention, at least one of the brushes 11 is moved along a predetermined path comprising at least one change of direction; more specifically, the predetermined path comprises a first stretch of predetermined length and a second stretch that makes a predetermined angle with the first stretch.

[0150] It should be noted that the length of the first stretch is equal to the width of the face 5 to be covered (in the fold over station) adjacent to the face 5 which the segment 8A has been applied to in the folding station.

[0151] The length of the first stretch is determined by the shape of the cam 14 and by the position of the roller 15 relative to the cam 14 when the process starts.

[0152] This position can be adjusted during setting up of the apparatus by keeping the brush 11 in a fixed position (and consequently holding the roller 15 in place as one with the slide 13 which is in turn integral with the brush 11) and moving the cam 14 (or rather, moving the block 16 as one with the cam 14).

[0153] In light of this, the process also comprises the following steps:

- preparing the head 12 and the slide 13 (the brush 11 being associated with the slide 13) connected to each other by the cam 14/roller 15 system (or any other equivalent coupling mechanism or system), the cam 14 having a profile corresponding to the predetermined path, for constraining the slide 13 to move along said path;
- moving the slide 13 relative to the head 12, causing the brush 11 to move along the predetermined path.

[0154] To adapt the covering process to boxes 2 having sides of different lengths, the invention contemplates a preliminary step of moving the head 12 relative to the

frame of the apparatus 1 and locking the head itself in a predetermined position (relative to the cam 14).

[0155] Operatively, therefore, covering according to the invention occurs as described below.

[0156] In a first covering step, the box 2 is positioned in the folding station, with the covering blank 6 lying in a horizontal plane and the box 2 placed on top of it with the bottom wall 3 in contact with the base 7 of the blank 6 (Figures 14 and 27, with reference to the first and second examples, respectively).

[0157] In a second covering step, the box is moved vertically from the top downwards through the folding station (in the first example illustrated, from the position of Figure 1 to the position of Figure 3).

[0158] That way, the oversize segments 8A and the undersize segments 8B are folded into contact with the box 2 (Figures 15 and 28, with reference to the first and second examples, respectively).

[0159] Next, the box is held in place in the fold over station and, at the same time, the brushes 11 are moved to apply to the lateral wall 4 of the box the parts of the oversize segments 8A that are still spaced from it.

[0160] More specifically, in a third covering step, the faces 5 of the lateral wall 4 of the box 2 adjacent to the faces 5 the oversize segments 8A were applied to during the second step are covered completely. During this step, the brushes 11 are moved along respective stretches whose length is equal to the width of the faces 5 to be covered (that is, equal to the length of the sides of the bottom wall 3 of the box 2 said faces 5 are connected to).

[0161] The lengths of these stretches are adjusted during a preliminary step of setting up the apparatus, where the position of each cam 14 is adjusted relative to the position of the respective roller 15 and the limiters 22 are adjusted, as described above.

[0162] At the end of the third step, there are still parts (or lips) of the oversize segments 8A that do not adhere to the lateral 4 of the box 2 (Figures 16 and 29, with reference to the first and second examples, respectively).

[0163] In a fourth step, the movements of the brushes 11 are diverted relative to their previous directions of movement to follow the profile of the box 2 and fold also the lips onto the lateral wall 4, thereby completing fold over of respective corners of the lateral wall 4 of the box 2 (Figures 17 and 30, with reference to the first and second examples, respectively).

[0164] It should be noted that the third and fourth steps according to the invention are performed with a single uninterrupted movement of the brushes 11.

[0165] At the end of the fourth step, there remain to be covered the faces 5 that were partly covered during the fourth step.

[0166] A fifth covering step completes the covering of the lateral wall 4 by folding predetermined segments 8 onto the faces that are still not completely covered.

[0167] This step may take place in the fold over station (as in the case of example 2, Figures 30 and 31), where end portions of the oversize segments 8A are folded over

other end portions of other oversize segments 8A folded previously.

[0168] Alternatively, this step may take place in the second folding station (as in the case of example 1, Figures 17 and 18); in this case, the segments 8C that have not yet been folded are folded from a horizontal position to a vertical position as the box 2 passes (moving further downwards vertically) through the second folding station causing the segments 8C to interact with the contact elements 10 of the second folding station (Figures 11 and 12, illustrating the first example).

[0169] At the end of the fifth step, all the segments 8 have been fully applied to the lateral wall 4 of the box 2, which is thus completely covered; only the upper edge 23 remains to be covered (Figures 18 and 31, with reference to the first and second examples, respectively).

[0170] In a sixth covering step, the upper edge is folded onto the inside of the box 2, into contact with an inside surface of the lateral wall 4 of the box 2, in a finishing station (Figures 19 and 32, with reference to the first and second examples, respectively).

[0171] This invention therefore offers the following advantages.

[0172] First of all, this invention provides an apparatus and a method for covering fully automatically boxes with any number of sides and of any shape, especially boxes with more than four sides.

[0173] Also, the invention allows the use of modified covering blanks 6, that is to say, blanks with oversize segments 8A, thus minimizing the number of lateral edges of the box 2 that require folding over.

[0174] Moreover, covering according to the invention is particularly efficient and fast because the brushes 11 move in all the different directions in a single uninterrupted motion.

[0175] Another advantage is the versatility of the invention which enables boxes of any shape to be covered and allows the covering apparatus and process to be easily adapted for easy changeover.

[0176] This is achieved by the adjustment system which makes it possible (during setup) to adjust the position of the cams 14 relative to the rollers 15 and to adjust the limiters 22.

Claims

1. An apparatus (1) for covering a box (2) which has a bottom wall (3) with more than four sides and a lateral wall (4) having as many faces (5), using a flat covering blank (6) which has a base (7) shaped like the bottom wall (3) of the box (2) and segments (8) connected to the base (7) which can be folded to cover the lateral wall (4) of the box (2), at least one of the segments (8A) being made in such a way that it completely covers at least two of the faces (5) of the lateral wall (4) of the box (2) and partly covers at least another face (5) of the lateral wall (4), the ap-

paratus comprising:

- means for placing the box (2) in a folding station, on the pre-glued covering blank (6) positioned on a horizontal surface, with the bottom wall (3) in contact with the base (7) of the blank;
- a mould (9) which moves vertically and is operatively connected to an inner surface of the box (2) to move it vertically from the folding station to a fold over station which is lower than the folding station;
- at least one contact element (10) positioned in the folding station for interacting with a segment (8) of the covering blank (6) during its motion as one with the box (2), causing the segment to be folded from the horizontal position to a vertical position in which it is in contact with a corresponding face (5) of the lateral wall (4) of the box (2);
- at least two folder elements (11) movable relative to the box (2) positioned in the fold over station;
- movement means connected to the folder elements (11) for laterally folding said at least one segment (8) and bringing it completely into contact with the lateral wall (4) of the box (2),

the apparatus being **characterized in that** the movement means of at least one of the folder elements (11) are adapted to move it along a predetermined path comprising a first stretch of predetermined length and a second stretch which is at a predetermined angle to the first stretch, said predetermined path comprising at least one change of direction.

2. The apparatus according to claim 1, wherein the movement means comprise:

- a head (12) and a slide (13) connected to each other by a cam (14) / roller (15) system, the cam (14) having a profile corresponding to said predetermined path, for constraining the slide (13) to move along said path;
- an actuator connected to the slide (13) for moving it relative to the head (12), the folder element (11) being connected to the slide (13).

3. The apparatus according to claim 2, wherein the movement means comprise a block (16) slidably connected to a guide (17) oriented in a first direction, the slide (13) being connected to the block (16) so that it can slide relative to it in a second direction which is not parallel with the first direction.

4. The apparatus according to claim 3, wherein the first and second directions are perpendicular to each other.

5. The apparatus according to any of the claims from 2 to 4, wherein the head (12) can move relative to an apparatus (1) frame, the apparatus (1) comprising lock / release means (18) for constraining the head (12) to the frame in different positions, relative to the fold over station.

6. The apparatus according to claim 5, comprising a limiter (22), for limiting to a predetermined value the stroke of the slide (13) relative to the head (12).

7. The apparatus according to any of the foregoing claims, wherein the second stretch is straight.

8. The apparatus according to any of the foregoing claims, wherein the mould (9) is operatively connected to the box (2) to move it vertically from the fold over station to a second folding station which is lower than the fold over station, the apparatus (1) also comprising at least one other contact element (10C) positioned in the second folding station, for interacting with a corresponding segment (8C) during its motion as one with the box (2), causing the segment to be folded from the horizontal position to a vertical position in which it is in contact with a corresponding only partly covered face (5) of the lateral wall (4) of the box (2).

9. A process for covering a box (2) which has a bottom wall (3) with more than four sides and a lateral wall (4) having as many faces (5), using a flat covering blank (6) which has a base (7) shaped like the bottom wall (3) of the box (2) and segments (8) connected to the base (7) which can be folded to cover the lateral wall (4) of the box (2), at least one of the segments (8A) being made in such a way that it completely covers at least two of the faces (5) of the lateral wall (4) of the box (2) and partly covers at least another face (5) of the lateral wall (4), comprising the following steps:

- placing the box (2) in a folding station, on the pre-glued covering blank (6) positioned on a horizontal surface, with the bottom wall (3) in contact with the base (7) of the blank;
- preparing at least one contact element (10) in the folding station;
- moving the box (2) vertically, from the folding station to a fold over station which is lower than the folding station, causing the interaction of at least one contact element (10) with a corresponding segment (8) of the covering blank (6) during its motion as one with the box (2), and thus causing the segment (8) to be folded from the horizontal position to a vertical position in which it is in contact with a corresponding face (5) of the lateral wall (4) of the box (2);
- moving at least two folder elements (11) rela-

tive to the box (2) positioned in the fold over station, to laterally fold said at least one segment (8A) and bring it completely into contact with the lateral wall (4) of the box (2),
the process being **characterized in that** at least one of the folder elements (11) moves along a predetermined path comprising a first stretch of predetermined length and a second stretch which is at a predetermined angle to the first stretch, said predetermined path comprising at least one change of direction.

10. The process according to claim 9, comprising the following steps:

- preparing a head (12) and a slide (13) connected to each other by a cam (14) / roller (15) system, the cam (14) having a profile corresponding to said predetermined path, for constraining the slide (13) to move along said path, and the folder element (11) being connected to the slide (13);
- moving the slide (13) relative to the head (12), causing the folder element (11) to move along the predetermined path.

11. The process according to claim 10, comprising a preliminary step of moving the head (12) relative to a frame and locking the head (12) in a predetermined position relative to the fold over station.

FIG. 1

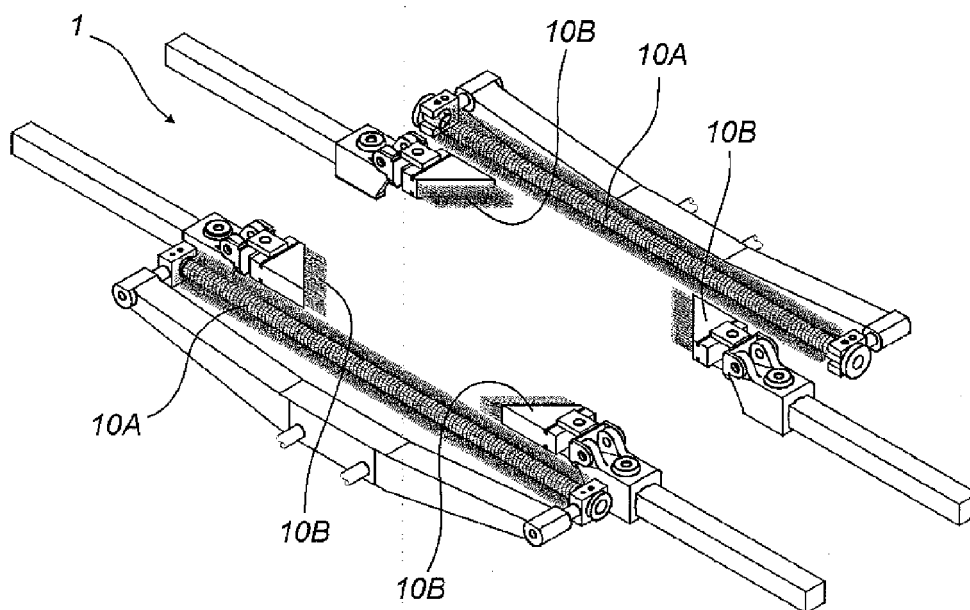


FIG. 2

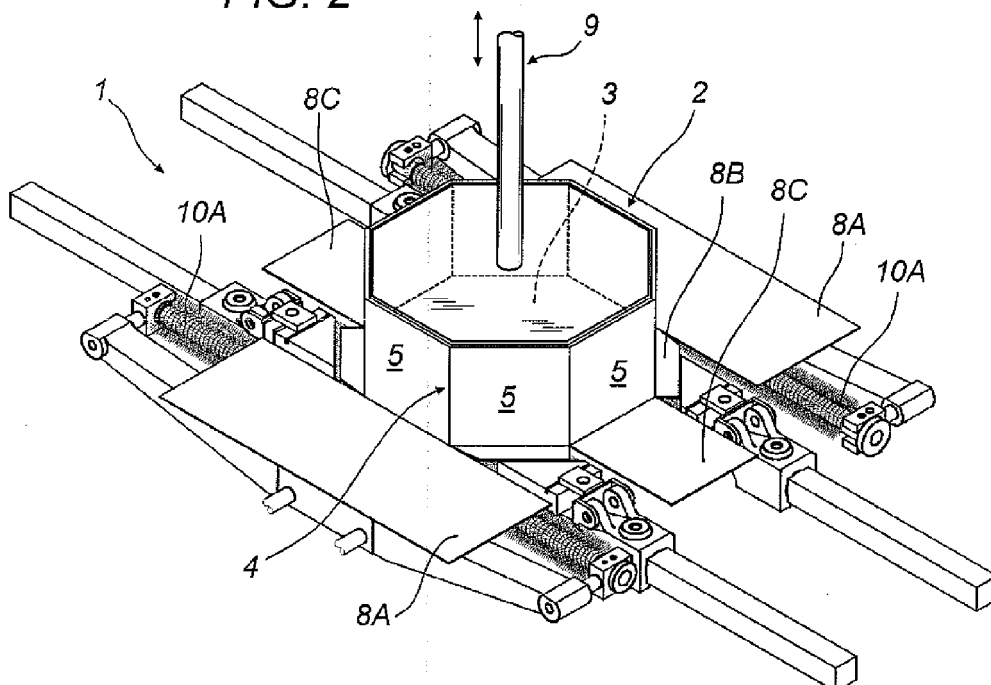
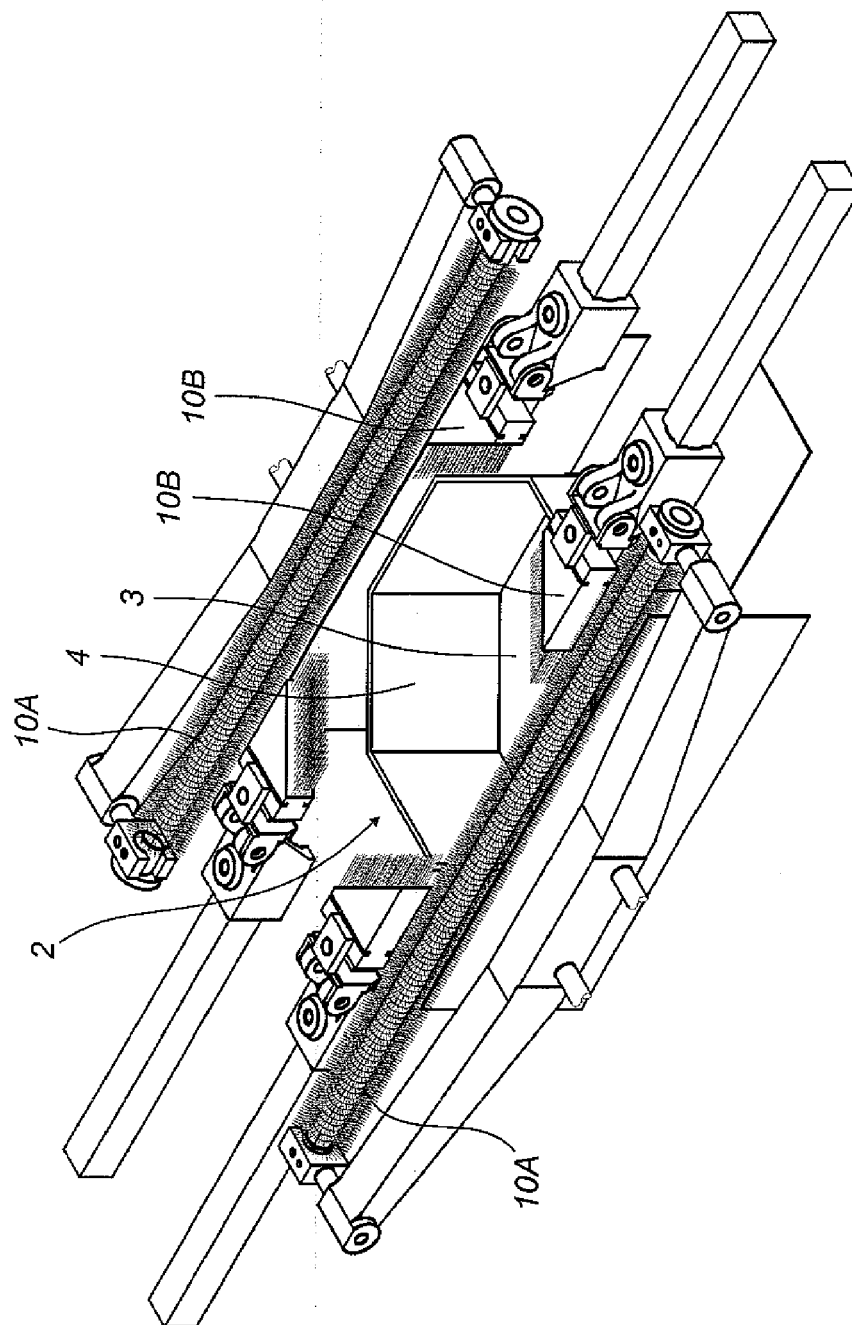


FIG. 3



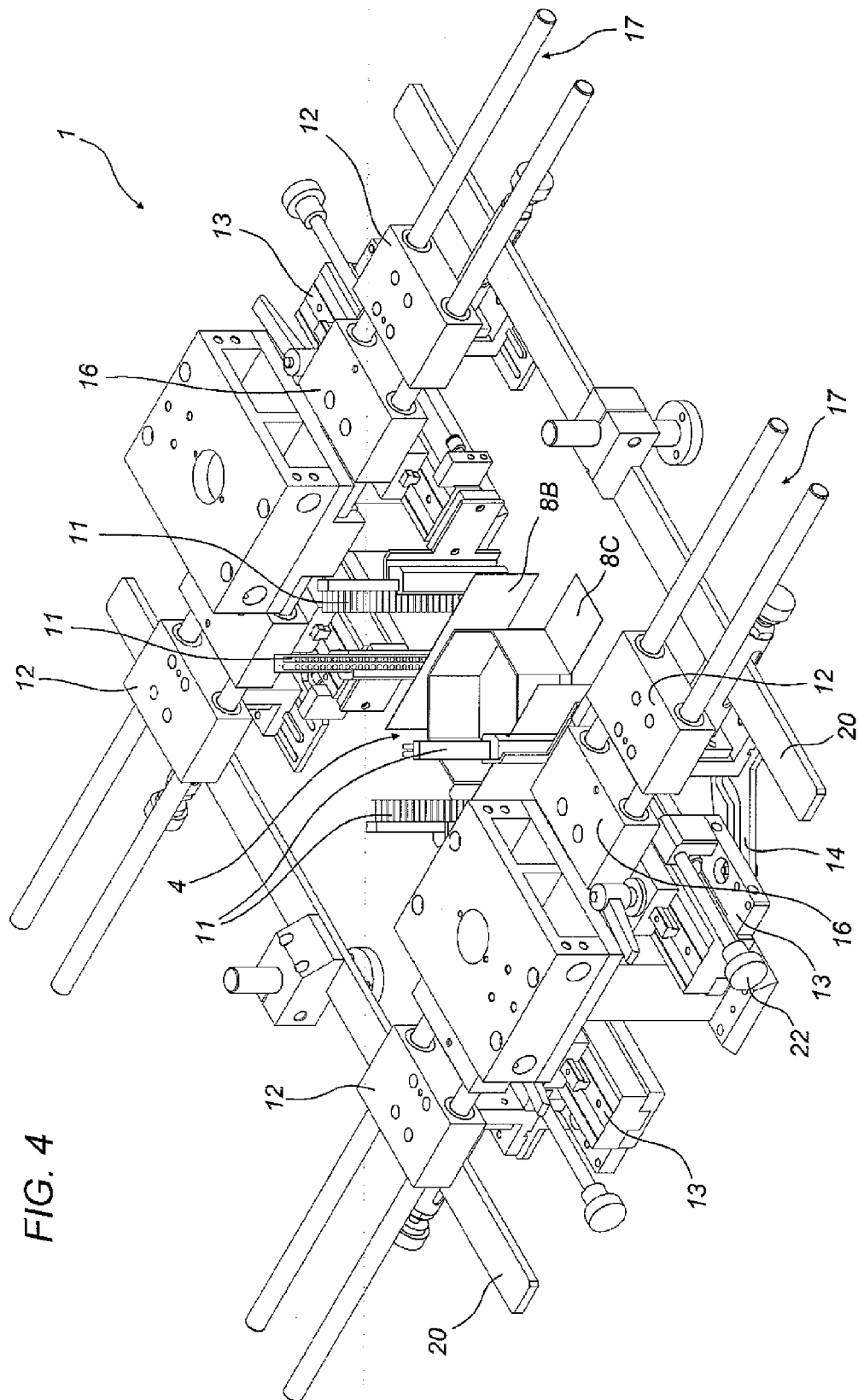


FIG. 4

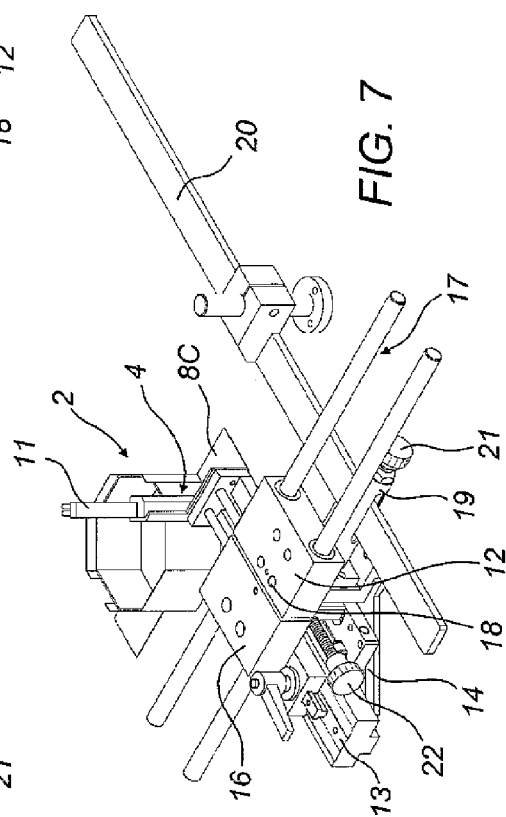
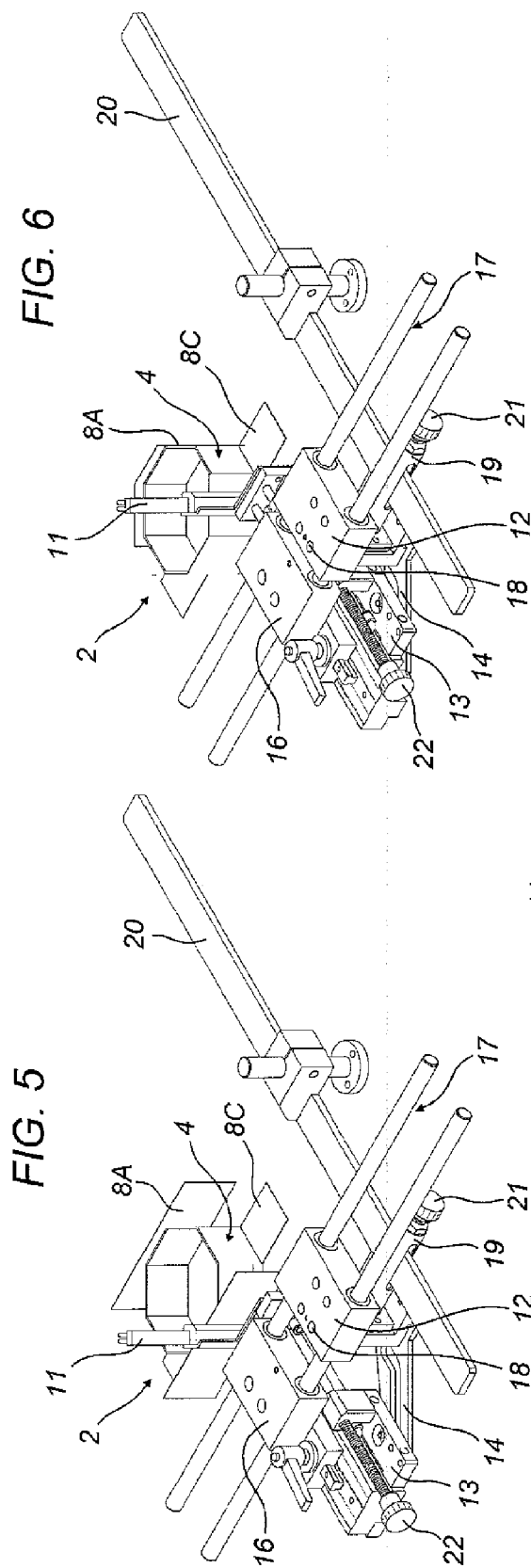


FIG. 8

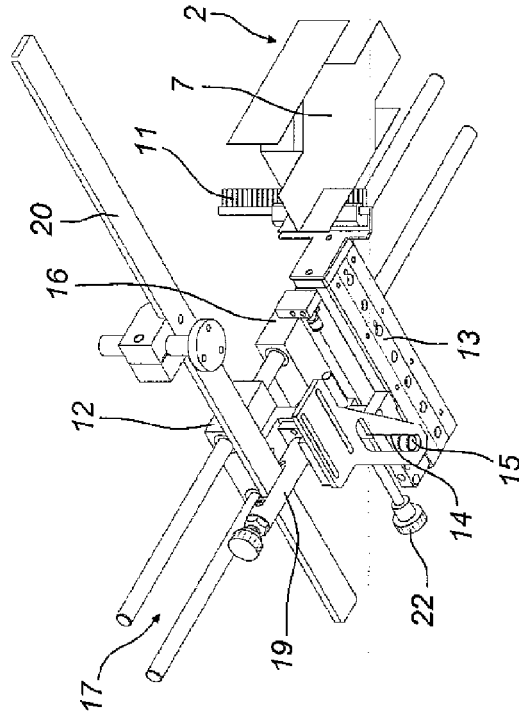


FIG. 9

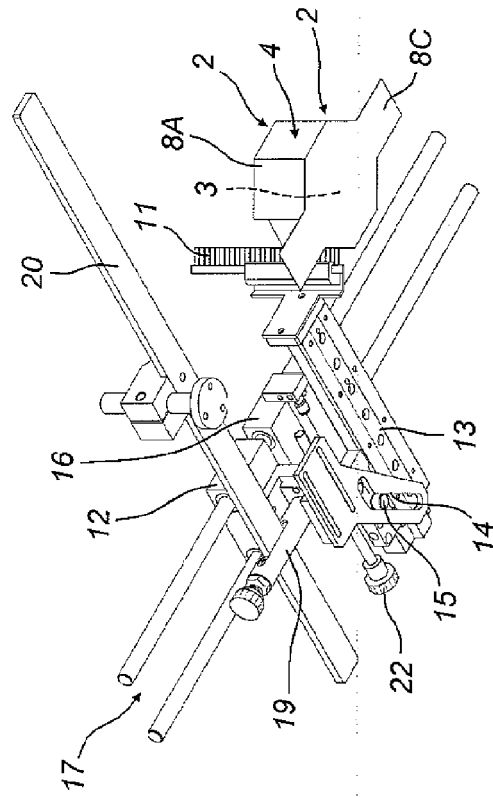


FIG. 10

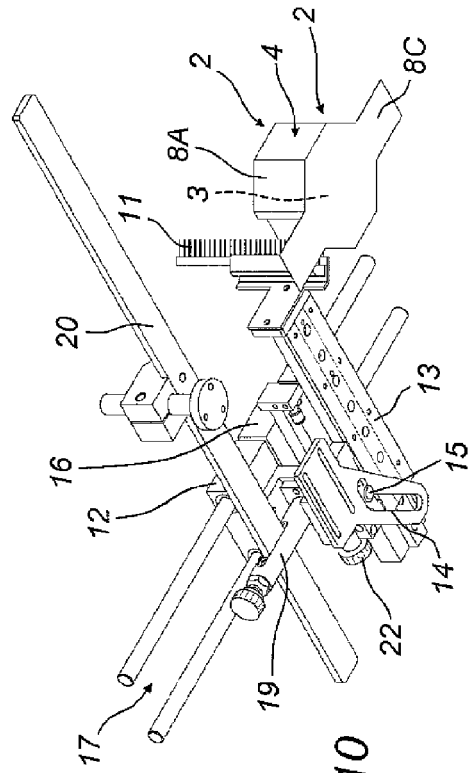


FIG. 11

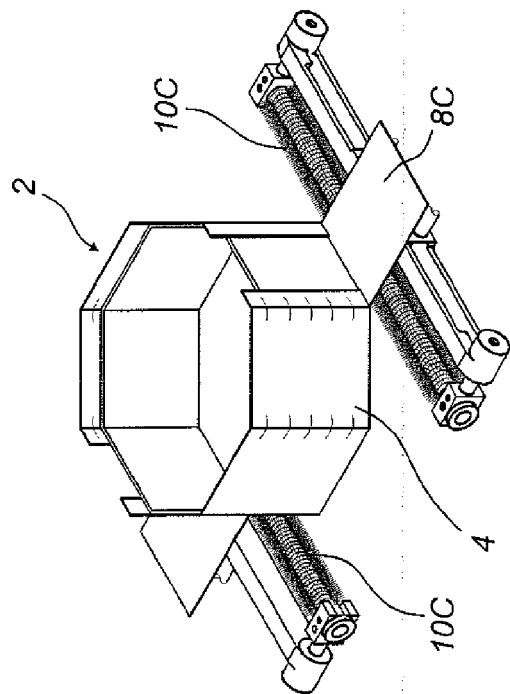


FIG. 12

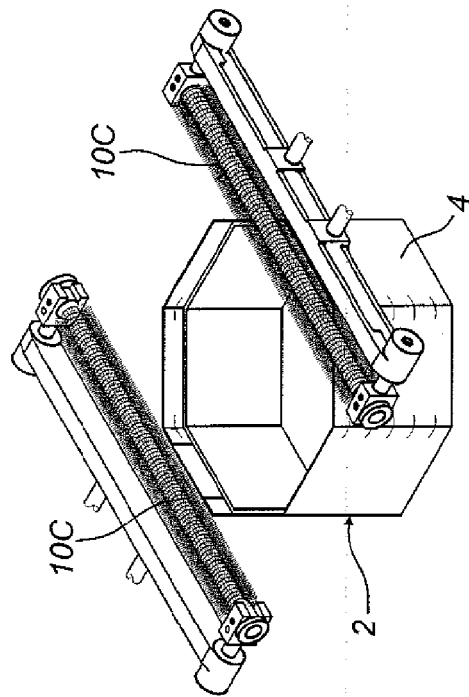


FIG. 13

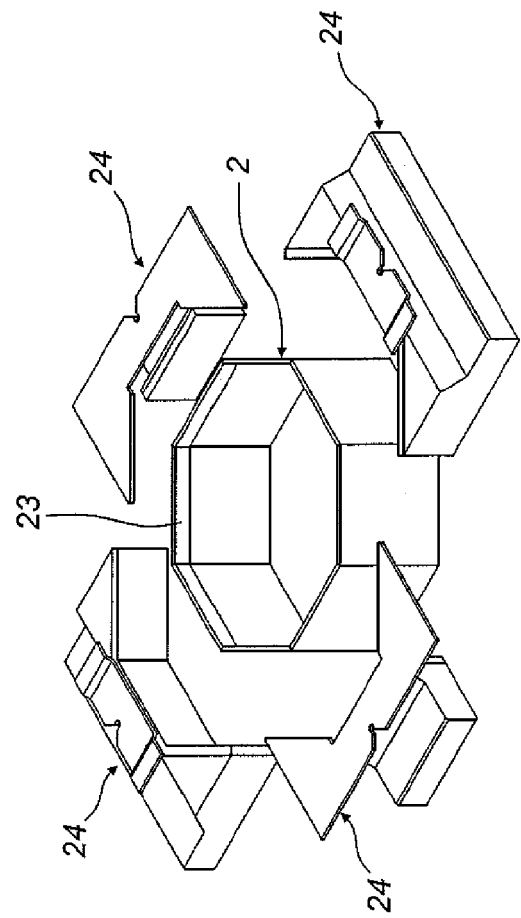


FIG. 14

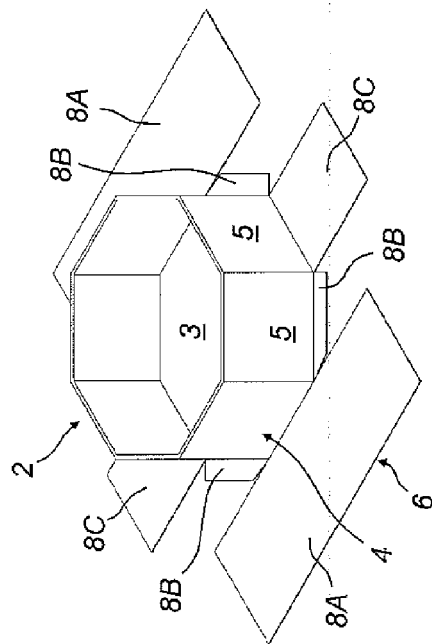


FIG. 15

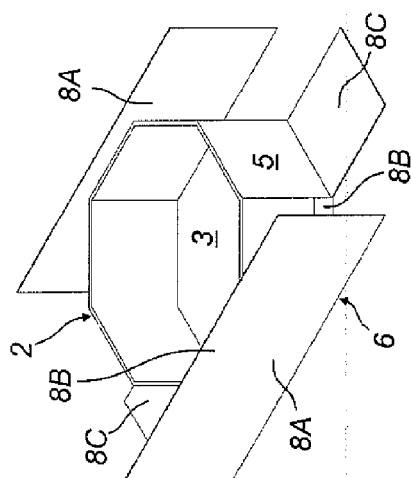


FIG. 16

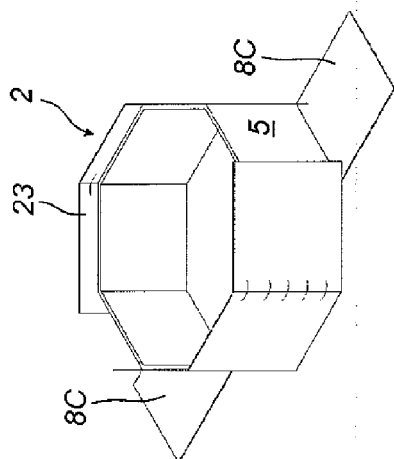


FIG. 17

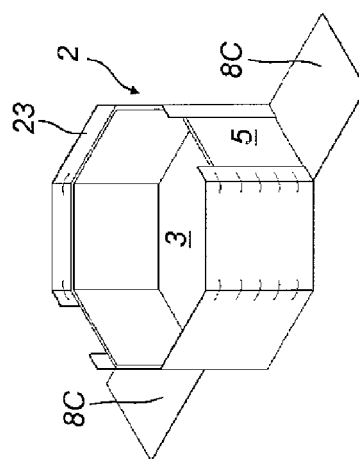


FIG. 18

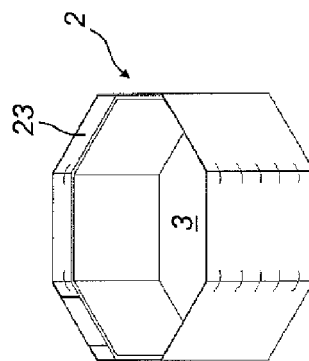
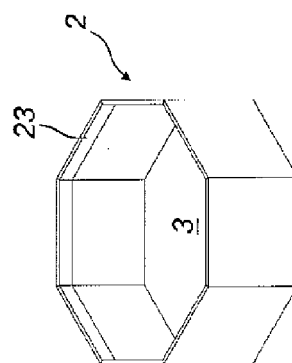
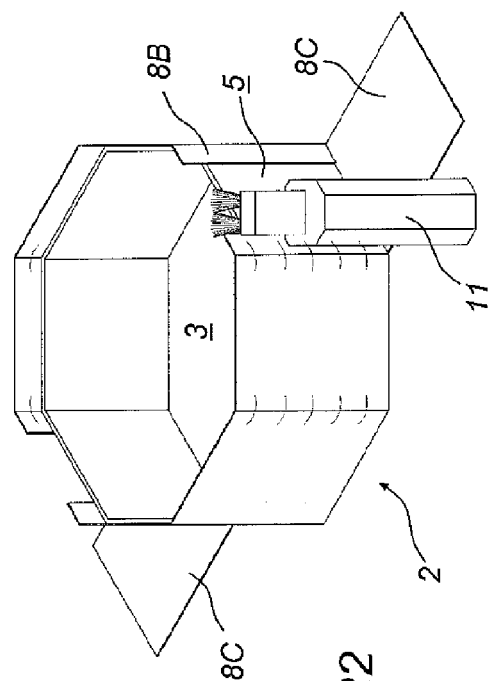
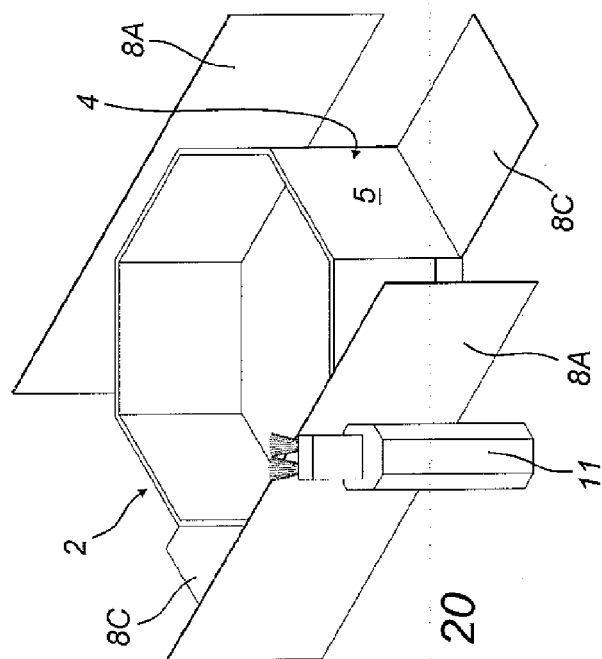
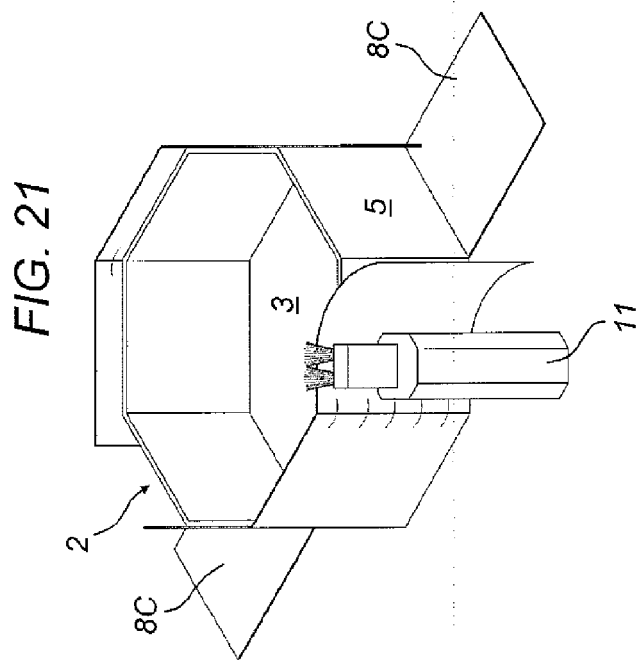


FIG. 19





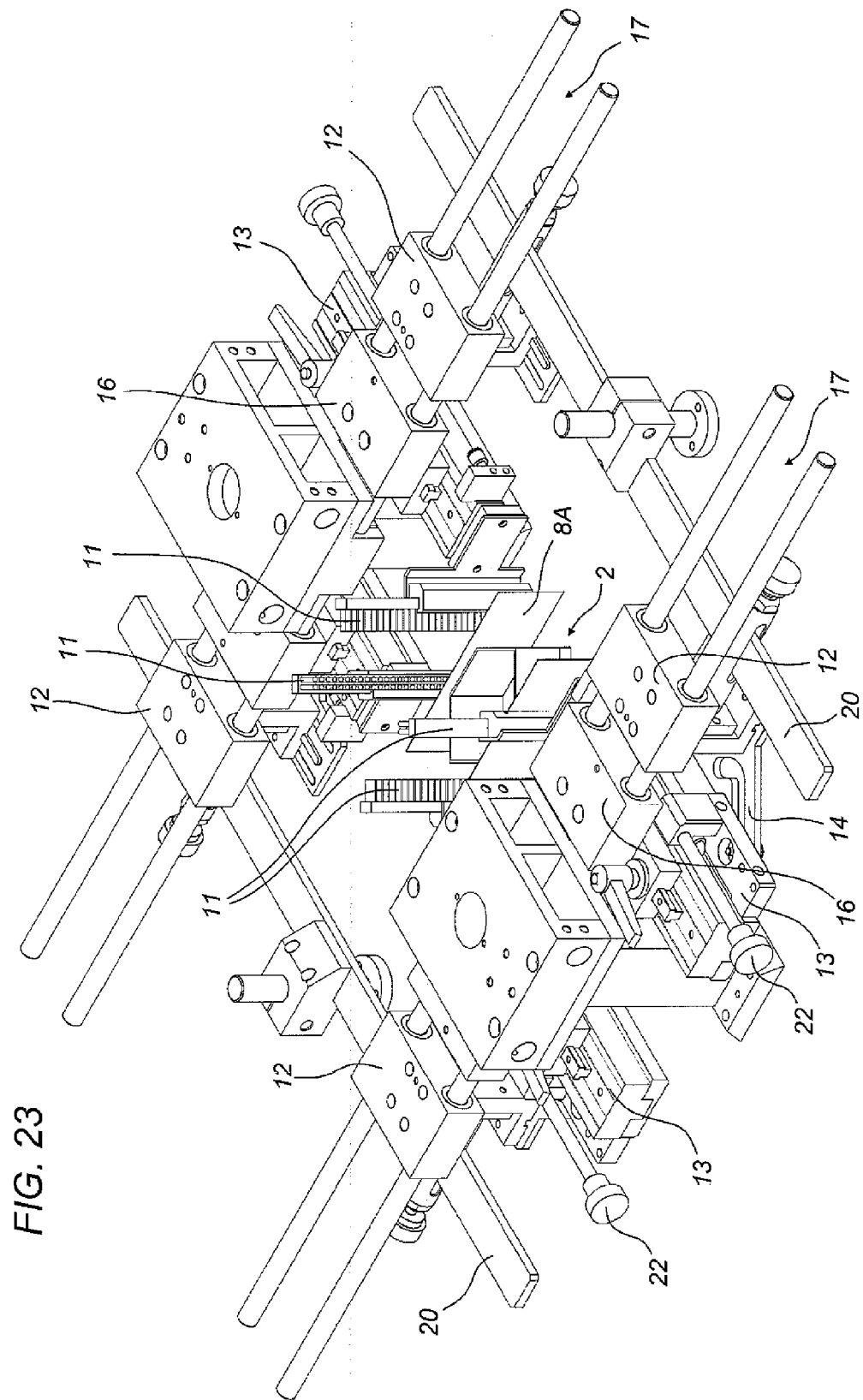


FIG. 23

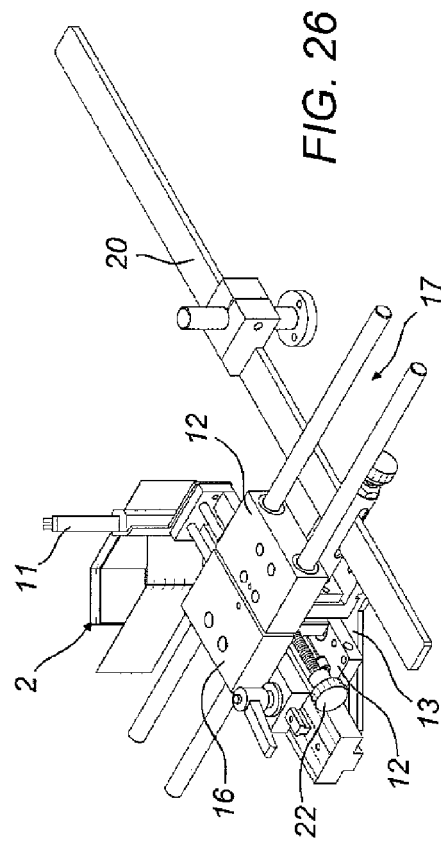
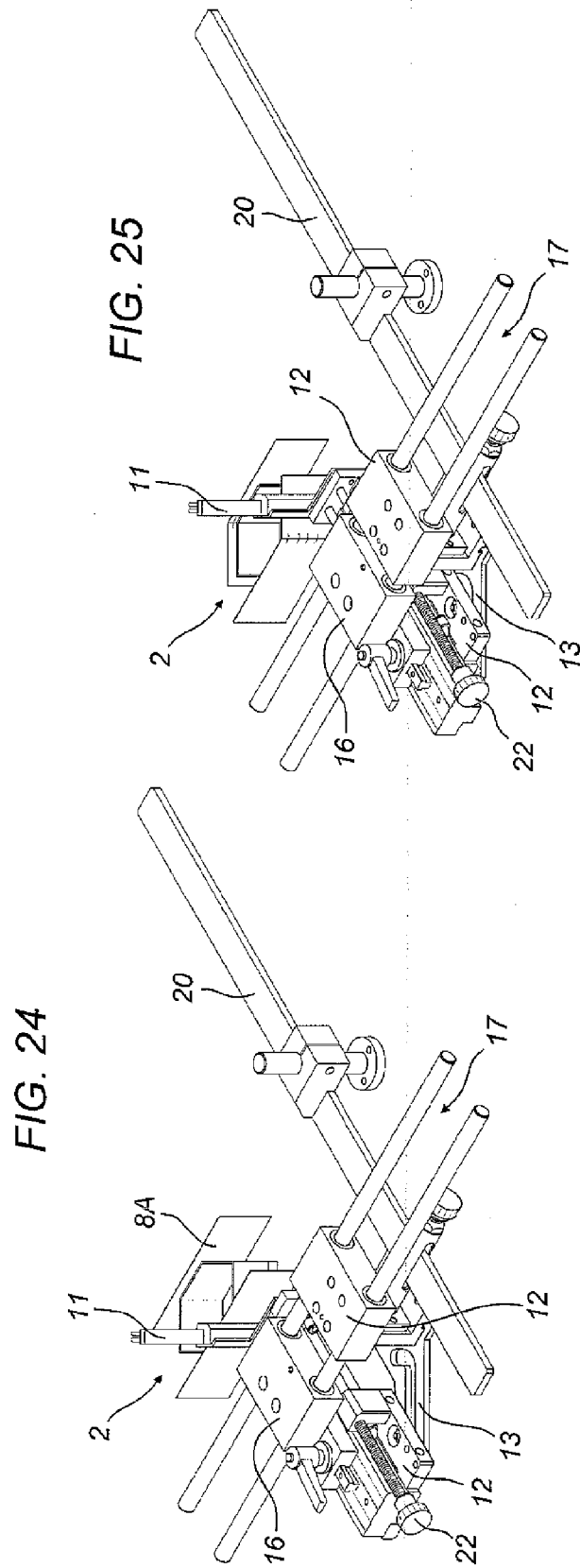


FIG. 27

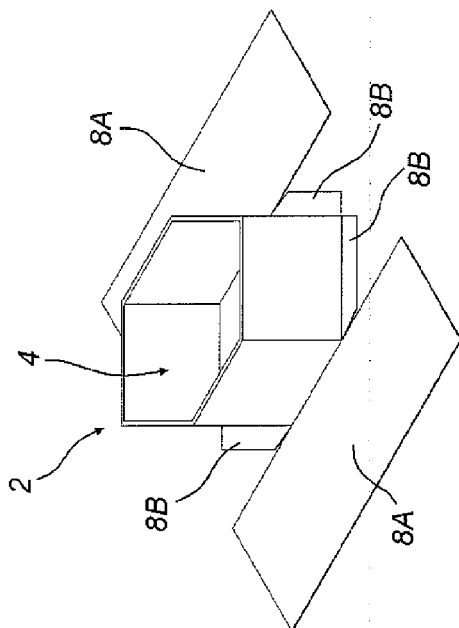


FIG. 28

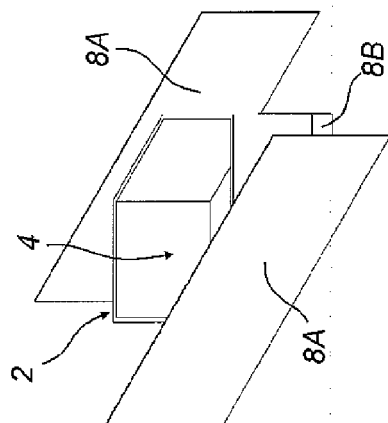


FIG. 29

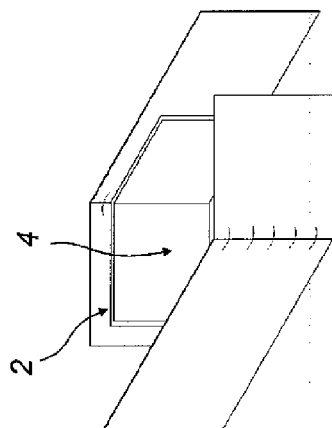


FIG. 30

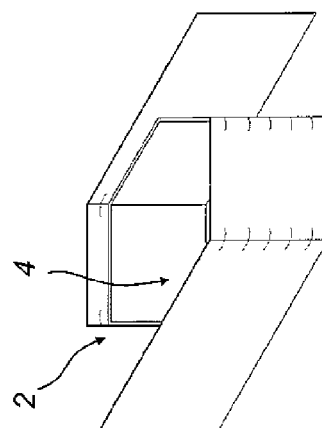


FIG. 31

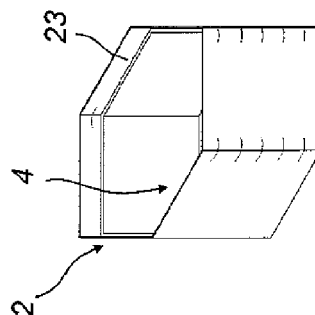


FIG. 32

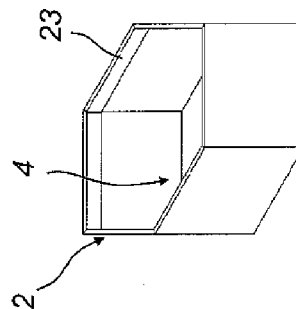


FIG. 34

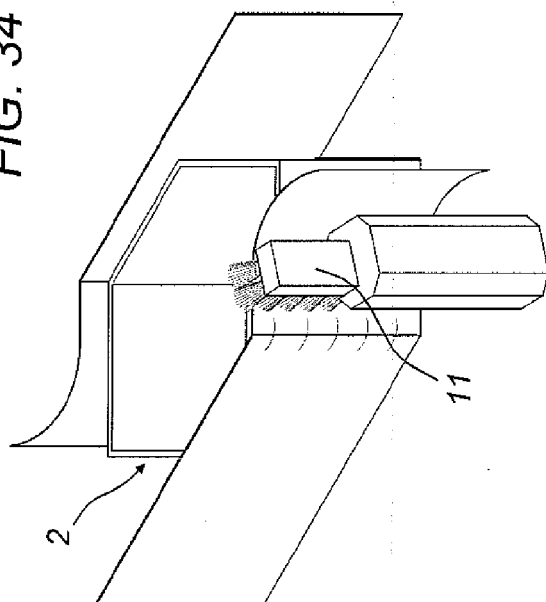


FIG. 33

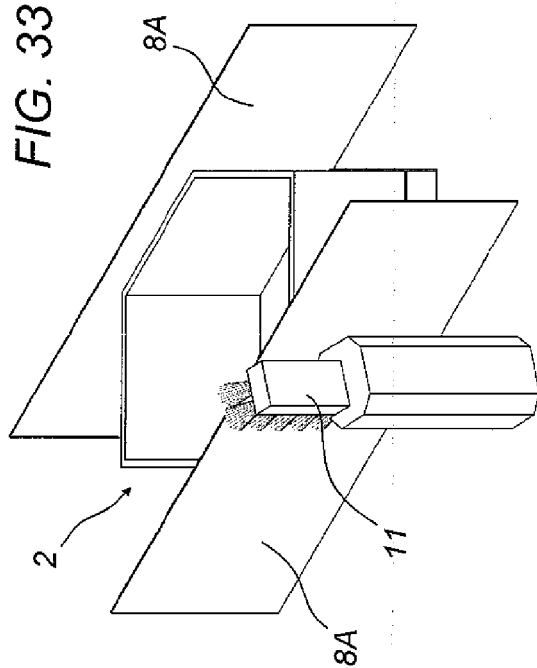
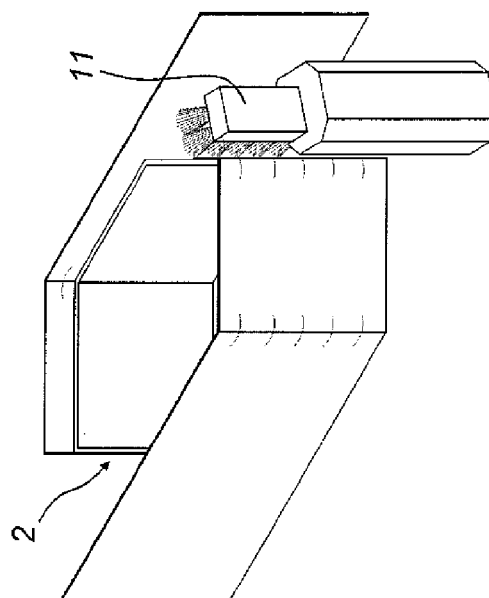


FIG. 35





EUROPEAN SEARCH REPORT

Application Number
EP 10 15 1991

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2 574 127 A (SILBY MARTIN V) 6 November 1951 (1951-11-06) * the whole document *	1-11	INV. B31B15/00 B31B1/48 B65D5/00
X	US 1 829 063 A (SECKENDORF RICHARD P) 27 October 1931 (1931-10-27) * the whole document *	1-11	
A	US 2 246 858 A (PHELPS CHARLES A) 24 June 1941 (1941-06-24) * the whole document *	1,9	
A	WO 2007/129201 A (EMMECI S R L [IT]; BASSI GINO [IT]) 15 November 2007 (2007-11-15) * abstract *	1,9	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			B31B B65D
1	Place of search Munich	Date of completion of the search 28 April 2010	Examiner Farizon, Pascal
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

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

EP 10 15 1991

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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28-04-2010

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 2574127	A	06-11-1951	NONE	
US 1829063	A	27-10-1931	NONE	
US 2246858	A	24-06-1941	NONE	
WO 2007129201	A	15-11-2007	EP 2018264 A2	28-01-2009

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 2574127 A [0033]
- US 1829063 A [0035]