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(54) **APPARATUS AND PROCESS FOR COVERING CARDBOARD BOXES HAVING UNJOINED CORNERS**

(57) The present invention relates to the sector of the production of covered cardboard boxes such as, in particular but not necessarily, folding carton or micro corrugated cardboard, and more precisely relates to an apparatus provided with means for stabilizing the sides of boxes not previously joined. The invention further extends to a method according to which the apparatus operates.

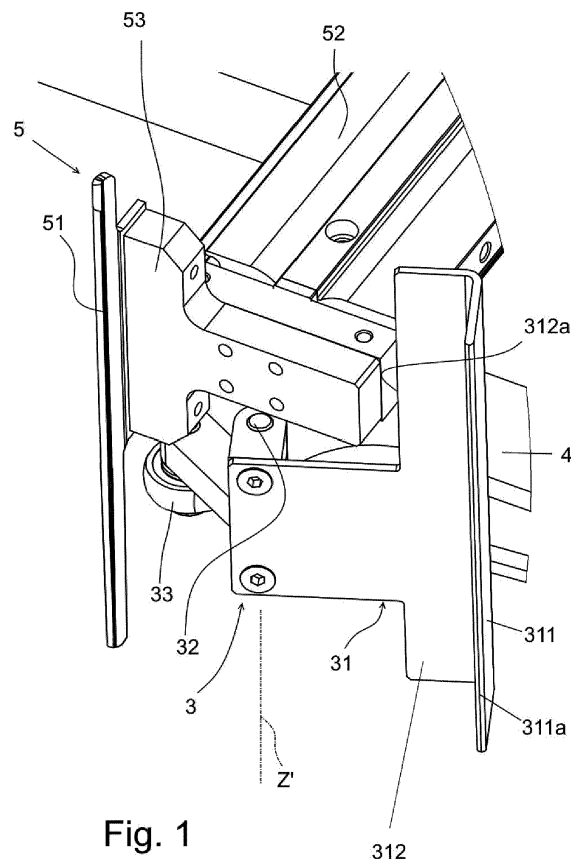


Fig. 1

Description

[0001] The present invention relates to the field of the production of paper covered boxes made of cardboard such as, in particular but not necessarily, folding carton or micro corrugated cardboard, and more precisely it relates to an apparatus provided with novel features specifically in relation to the paper covering unit and step, when boxes with previously unjoined corners are processed. The invention further extends to a method according to which the apparatus operates.

[0002] Numerous types of apparatuses are known for forming packaging boxes, in which the boxes themselves are formed by folding flat blanks made of paper-based material, undergoing the action of a so-called mould or pad, which is vertically movable in a reciprocating manner and consists of a block having a shape corresponding to the box to be made.

[0003] The folding of the blank about the mould, along both transversal and longitudinal folding lines with respect to the aforesaid feeding direction, occurs by pressure with respect to underlying fixed abutment and guide means against which the blank abuts by being pushed in top-bottom direction by the mould itself.

[0004] At this point, there is a need to mutually join the open flaps of the box at the edges in a so-called corner joining step. The box is finally transported toward centring systems that take care of positioning it with respect to a sheet of covering paper, on which an adhesive substance was distributed beforehand, and a so-called covering machine wraps or envelops the cardboard box with the covering paper, as for example generally shown in connection with the wrapping machine of document US3802280.

[0005] With regard specifically to the joining step, the known technique provides various systems.

[0006] According to a first and very common traditional system, use is made of portions of heat-seal tape which are applied over the contact line between the two open flaps to be joined.

[0007] With this system, the application of the tape generates an additional layer of material (the tape itself) which in turn causes a surface irregularity; it is an irregularity which remains and is noted after the arrangement of the covering paper, whose glossy finish may highlight the ridge that forms due to the effect of the tape portion. Also, the required application of pressure may cause deformations and subsequent irregularities which can be noticed on the finished box.

[0008] A further aspect of this known system is in connection with the application time of the heat heat-seal tape, generally of about 0.6 sec, which results in a limitation to the speed and productivity of the machines which implement this type of solution. Also the need to perform an initial heating of the machine has an unfavourable effect in terms of time consumption.

[0009] To summarize, while ensuring an overall reliable operation, the traditional system with tape portions may result in significant criticalities under certain circum-

stances.

[0010] Systems have also been proposed in which the joining of the flap edges occurs by applying hot glue through the thickness of the material, again after the box forming step. In particular, the glue is applied prior to moulding, on the blank in a stationary and flat condition. However, to confer stability to the joined corners, these systems require carrying out slanting bevels on the edges, which makes the manufacturing technique of the blanks more laborious. Furthermore, the application of the adhesive to the stationary blank prior to moulding significantly slows down the production speed. In general, also for this hot glue application system through the thickness, the already mentioned problem arises in connection with the need for pre-heating the machine.

[0011] Finally, boxes are also known in which the joining is omitted precisely to avoid appearance-related problems, and the structural stabilization of the box is transferred to the covering sheet alone. The box thus obtained has more modest solidity characteristics, which however remain adequate for certain uses, in which on the contrary the aesthetic cleanliness deriving from the complete absence of joining elements or materials is of particular value and appreciation.

[0012] In greater detail, after the step of centering the box (in this case with free or unjoined corners) to the covering paper, the cardboard box with the bottom adhering to the paper is transferred to the covering station with the lateral walls of the box kept in the vertical position by a series of metal guides.

[0013] In the covering station, and this is valid in general for known covering operations also with boxes already joined at the corners, a mould that reciprocates in the vertical direction (and having slightly smaller dimensions than those of the final box) is inserted into the box, engaging with it and moving the same downwards so as to make it cooperate at various heights with fixed folders that, by abutment, carry out the required folds on the covering paper sheet. In an equally known way the mould comprises two superimposed modules, which can be distanced from one another along the movement axis. Accordingly, when a first module (the lower one, i.e. the actual mould) remains inside the box, pressing the bottom of it, the upper module (or counter-mould) can be lifted so as to allow the folding of the covering sheet above the upper edges of the side walls of the box.

[0014] During all these operations, the box that has not been joined at the corners is by nature unstable, and technical solutions must be used that keep all the lateral walls well stuck against the mould, guaranteeing adequate stability and dimensional precision, and therefore ensuring that the paper adheres to the outer walls of the box correctly.

[0015] According to the known art, the aforesaid technical solutions include some technical measures, all unsatisfactory to various extents. In a first of these, use is made of vacuum. In particular, channels are formed inside the mould through which a suction reaches the sides

of the mould, attracting the flaps of cardboard resting thereon, through suitable holes with a shallow counter-bore such as to realize the required suction effect.

[0016] Despite its mechanical simplicity, this system is not free from problems. In particular, when the so-called half-cut or V-shaped groove of the coupling edges of the side flaps/walls on the corners are not performed perfectly, and in particular with a perfectly correct depth, there ensues a significant reopening force that suction cannot completely overcome, and pursuant to which the flaps tend to come detached from the mould. The failed adherence of the box to the mould therefore generates a marked qualitative and structural decline of the finished box. Moreover, the absence of an external mechanical constraint compromises the certainty of the correct positioning of the flaps; in fact, any failure or ineffectiveness of the suction cannot be verified, and if this occurs, the box continues towards the subsequent covering steps, which are performed incorrectly generating waste boxes or even creating jamming problems on the machine.

[0017] Expedients of a mechanical nature have also been proposed. Among those, there is in particular the use of small elastic clips, that withhold the flaps in close adhesion onto the mould, in the upper area of the mould itself (and therefore on the upper edges of the cardboard flaps). A physical contrast to the reopening of the flaps is generated, of a passive nature, i.e. not driven by any actuator.

[0018] Because of such passive nature, the main difficulty with this system is related with its fine-tuning. A tuning that is too loose risks to cause an imperfect adhesion of the flaps, while on the contrary clips with a too tight set-up may clamp the cardboard, marking or notching it, with also in this case negative effects in terms of product quality. Finding the perfect balance between these two demands, and having a reasonable confidence that such a balance will be maintained as production advances, is extremely difficult and, where theoretically possible, it becomes in practice unacceptably expensive.

[0019] Known systems are therefore unsatisfactory overall because of the specific problems highlighted above, and however more generally speaking because of the difficulty in preventing so-called "bulging", i.e. deviation of the planarity of the side walls of the box, for boxes with relatively unusual proportions and dimensional characteristics (e.g. boxes in which the flaps have one clearly prevalent dimension with respect to another).

[0020] On the other hand, the devising of mechanical systems that can combine quality and a reliable result with simplicity and productive economics also clashes with another restricting factor, that is, the need not to interfere with the space required for receiving and moving the box and the structural components of the machine necessarily employed to support the box and to control the covering operations. Furthermore, the risk of marks or scratches being made on the box must be minimised, as well as that of not causing additional processing times that slow down the cycle and reduce productivity.

[0021] The object of the present invention is to overcome this state of the art, by providing an apparatus and process that, specifically in relation to a covering station/unit directed to boxes with previously unjoined corners, can lead to obtaining boxes of high quality standards, with high reliability and with structurally and functionally simple mechanical systems, as well as being able to prevent the obstruction of the folding movements of the covering sheet and interferences with the other functional components of the machine.

[0022] Such results are achieved with the apparatus and process for covering boxes with unjoined corners according to the present invention, whose essential features are defined respectively by claims 1 and 11 here attached. Other important additional features are defined by the dependent claims.

[0023] The characteristics and advantages of the apparatus and process for covering cardboard boxes with unjoined corners according to the present invention will be apparent from the following description of embodiments thereof, provided by way of non-limiting example with reference to the appended drawings wherein:

- Figure 1 is an axonometric view of a thrusting device of the apparatus according to the invention, in an open or inactive position, integrated with a scraping device in the inactive or retracted position;
- Figure 2 is an axonometric view of the thrusting device of Figure 1, in a closed or active position,
- Figure 3 and Figure 4 are plan views from above of the device of the previous figures, with the thrusting device in the active position and the scraping device respectively in the inactive position and in the active position; and
- Figures 5a to 5h show subsequent operating steps of a process for covering a box, with figures 5d to 5g that relate in particular to the steps that make use of thrusting devices such as that shown in figures 1 to 4 (the devices being omitted in Figures 5a, 5b, 5c, 5h), figures 5f and 5g being plan views from above, the others being axonometric depictions.

[0024] With reference to the above figures, for better context and understanding of the invention it is appropriate to start from a brief description of the known parts of the apparatus, and of the likewise known first steps of the covering process. For this descriptive introduction reference is made in particular to Figures 5a to 5c which in fact show a covering unit or station with a box in the first steps of its covering.

[0025] The box is indicated with A, and can be obtained in a known way by erecting a flat blank having a bottom A1, two first side walls A2, A3 and two second side walls A4, A5, opposite one another two by two and erected orthogonally from the bottom A1. In the previous production step the box A has been coupled to a covering sheet B arranged, here again, with traditional techniques below the bottom A1. The sheet B has been pre-glued and is

located, at the start of the covering process, in the appointed region as shown in Figure 5a, outstretched in a flat extension and showing, separated by appropriate folding lines, various portions B1-B5 adapted to cover respectively the bottom A1 and the side walls A2-A5. The latter are erected by folding but, clearly, not stabilized to each other, a corner joining step being omitted in this type of boxes, being it replaced by the binding action of the covering sheet.

[0026] From at least some of the side portions B2-B4 of the covering sheet, tuck-in flaps extend flexibly, to be tucked-in around the corners and edges of the box side walls. More precisely in the example, according to a typical but not limiting solution, such tuck-in flaps comprise on each of the two first portions B2, B3, i.e. the portions intended to be erected for covering the pair of first side walls of the box (the mutually opposite walls that are erected first), two flaps for wrapping the corners indicated respectively with B2a, B2b, B3a, B3b (the latter being indeed only visible in other figures which will be discussed below). These flaps are actually intended to be turned around respective sides/corners of the respective first side walls A2, A3 which are covered by the respective sheet portion B2, B3, to adhere beyond the corner itself on the second side walls A4-A5, before the second covering sheet portions B4, B5 are in turn erected to complete the covering.

[0027] Still with reference to figures 5a to 5c, the covering apparatus as a whole according to the invention has general characteristics that can be considered alike those of the prior art, providing in particular a mould 1 with a lower mould module 11 and a counter-mould 12, reciprocatingly movable according to a moulding direction Z, and a plate (not shown here) for supporting the box, in turn movable according to direction Z with known driving systems. The plate extends over a plane XY or orthogonal to the moulding direction Z. The aforesaid movements are in themselves in accordance with the traditional techniques and insofar they are not specifically described below must be considered as known and obvious to a person skilled in the art. This is also equally applicable to the movements of the mould module and of the counter-module which indeed in some of the figures to which reference will be made below (see namely figures 5d and 5e) are not even shown, albeit unrealistically, for the sake of illustrative clarity, in particular to clearly display the inside the box and the covering operations on all the corners of the box.

[0028] Once the assembly as described above has reached the support plate in the starting position (Figure 5a), with the sheet B partially supported also by auxiliary plates 13, it undergoes the action of the mould 1, with the lower mould module 11 and the counter-mould 12 that descend together along the direction Z until they are inserted in the box, striking against the inside of the bottom A1 of the same box itself (Figure 5b), and proceeding further until the first portions B2, B3 of the covering sheet B are made to hit respective first cylindrical brushes 2

(Figure 5c). The brushes 2 thus fold, stretch and press such first sheet portions B2, B3 on respective first side walls A2, A3 of the box. Therefore, in this step, the first two side portions B2, B3, are glued to the box, with the related corner-wrapping flaps B2a, B2b, B3a, B3b that remain open in this step, coplanar to the portions B2, B3 from which they extend, each in the immediate vicinity of a corner of the box.

[0029] Now with reference in particular to figures 2 to 4 and 5d to 5g, the main aspect of the present invention comes into action at this point, and notably relates to the reliable and precise stabilization of the second walls A4, A5 against the mould 1 before and during the wrapping of the corners by the flaps B2a, B2b, B3a, B3b, i.e. the step that irreversibly stabilizes the connection between the side walls of the box and that must therefore be performed with utmost accuracy.

[0030] According to the invention, thrusting means 3 are provided, arranged beyond (and below) the folding means of the first portions of the sheet, namely the brushes 2, and comprising a member that is movable between a rest or inactive position, in which the member clears a region swept by the portions of the sheet B still extended, thus avoiding blocking them, and an active position in which with a side entry with respect to the forming direction it is able to exert a pressure on the outside of a second wall A4 or A5, thrusting it onto the mould, pressure that affects an area of the wall itself not interfering with the area to be wrapped by the corresponding wrapping flap.

[0031] Preferably, the aforesaid member is rotatable about an axis of rotation incident with the plane XY, even more preferably as in the present embodiment an axis Z' substantially parallel to the moulding direction Z. The member, indicated with 31, can therefore in this case and still advantageously take a configuration, when seen in section over a plane orthogonal with the axis of rotation, at a square angle or an angled profile also at an angle different from 90°.

[0032] As can be noted clearly from Figures 1 to 4, the member 31 in the present example therefore has a distal wing 311 with an edge 311a along which the contact for thrusting the second wall of the box is exerted in the active position (figures 2, 3 and 4), and a proximal wing 312 angled with respect to the distal wing 311 and through which the member is supported via a hinge 32 that materialises the axis of rotation Z' and that is suitably spaced from the region occupied/swept by the second portions B4, B5 still stretched out. The hinge 32 links the member with a fixed structural element of the apparatus, indicated by the number 4 and visible in particular in Figure 2. The movement between the active position and the inactive one (Figure 1), in which the member 31 opens towards the outside with a rotation over plane XY and frees the just mentioned passage or sweeping region of the sheet B, is controlled by a first linear actuator 33 which is articulated between a crank 34 integral with the proximal wing 312 and the fixed structural element 4.

[0033] Still with reference to the example, four identical

thrusting devices 3 are envisaged, although with different orientations, one for each corner of the base of the box and as such adapted to carry out its action in proximity to the relative vertical corner and in association with the folding of the corresponding wrapping flap, folding which will be described below. Also in this connection, however, the described arrangement is not to be intended as limitative.

[0034] Focusing then on the folding of the wrapping flaps, each thrusting device 3 is associated here in a single operating unit with a scraping device 5, in turn supported by the structure of the apparatus and comprising an appropriately shaped scraping blade 51, with a longitudinal extension along the direction Z and adapted to translate in a crosswise direction X aligned with the corresponding second side wall A4, A5 of the box, actually to enter into abutment on the wrapping flap, fold it and smooth it on such wall. The reciprocating motion of the scraping blade 51 is activated by its own (second) linear actuator 52, between a retracted position (Figure 3) and a maximum advancement position (Figure 4), both in the space that separates the box from the thrusting member 31 in the active position. An arm 53 supports the scraping blade 51, which connects the blade 51 to a movable head of the linear actuator 52 with a certain lateral projection (i.e. crosswise with reference to the actuation direction). To prevent mechanical interference between the devices, the actuator 52 of the scraping blade 51 is arranged above the hinge 32 of the thrusting device, and the arm 53 has freedom of movement in a fracture 312a formed on the proximal wing 312 of the thrusting member 31.

[0035] It is now possible to return to the operating sequence, controlled as obvious to a person skilled in the art, by a logical control system of the apparatus. Therefore, specific reference is made to Figures 5d to 5h, as well as the already commented Figure 5c.

[0036] In fact, starting again from the situation of Figure 5c, the assembly of the sheet and box is at a lower height with respect to the initial one, beyond the first cylindrical brushes 2 that have carried out the covering of the first side walls A2, A3, leaving open the flaps that will wrap the corners B2a, B2b, B3a, B3b, while the second portions B4, B5 of the sheet are still coplanar to the bottom portion B1, in view of a subsequent and final folding by still underlying second cylindrical brushes 6. As mentioned, it is at this height, to be considered as a wrapping station, that the thrusting devices 3 and the scraping devices 5 are arranged and come into operation. Figure 5b shows both the devices in the inactive (or open/retracted) position, having allowed the passage of the box and sheet assembly, and in particular of the second stretched out portions B4, B5 of the latter.

[0037] Figure 5e shows the subsequent step. The thrusting members 31 of the thrusting devices 3 are rotated (as also indicated by the arrows) to the active position, pressing gently on the second side walls A4, A5 of the box in adherence to the mould (not shown here, as mentioned), in an area of the walls themselves that

cannot be reached and therefore not affected by the scraping blades in the active position, thus ensuring perfect geometric conformity and the perfect matching of the second walls with the first walls. Maintaining this active position, and therefore making the arrangement of the walls of the box definitely stable, the scraping devices come into action (Figure 5f), with the blades 51 that advance to their active position, closing the wrapping flaps B2a, B2b, B3a, B3b around the corners and on the aforesaid walls.

[0038] It is right in this step that the advantageous outcome of the invention is displayed, as the the walls of the box kept in reliable contiguity to the mould are fundamental to guarantee the perfect adhesion of the covering paper, wrapping the corner in aesthetically correct and mechanically robust way. Even minimal deviations between the coupling edges of the walls, in turn the consequence of orthogonality defects, are prevented by the invention, thus avoiding a "bellows" type connection by only a small bridge of sheet, with unacceptable creasing from an aesthetic point of view and a factor of significant structural weakening.

[0039] With the return of the devices 3, 5 to the inactive position (Figure 5g) the covering cycle can be completed (Figure 5f) with the further descent of the box interacting with the second brushes 6 that complete the folding of the covering sheet B making the second portions B4, B5 adhere to the related walls A4, A5. This is therefore a return to ordinary operation, the upper flaps of paper sheet being tucked-in inside the box, with known methods and technologies not subject to the present invention and of which a detailed description is clearly not necessary herein.

[0040] The advantages of the invention are clear from the present description. The thrust on the side walls on which the corners are wrapped by the covering sheet, carried out by active devices with sideways entry/movement, allows rigorous and reliable position control, ensuring the optimal quality of the finished product. The thrusting devices are structurally and functionally simple and, for their being inherently active and controllable, are free from the fine-tuning problems shown by known clips.

[0041] As mentioned, constructive solutions that are different from the advantageous one described and illustrated above can be made use of. The variations can affect both the movement kinematics of the thrusting devices (which could also be of a translational or roto-translational type), and the number and shape of thrusting devices, this number being clearly also and especially a function of the specific configuration of the flat blank.

[0042] The drawings clearly depict the machine in a simplified way, inasmuch necessary for the understanding of the present invention, being it clear that, in reality, the components specifically intended to reduce the present invention into practice can be associated and integrated with other structural elements of the known type (some of which are for example noticeable in Figure 5h) and however not inherently linked with the functional

steps here under consideration.

[0043] The present invention has been described herein with reference to preferred embodiments thereof. It is to be understood that there can be other embodiments that relate to the same inventive core within the scope of protection of the attached claims.

Claims

1. A box covering apparatus for the production of covered cardboard boxes, comprising: moulding means (1) reciprocating in a moulding direction (Z), adapted to be inserted inside a box (A) having side walls erected from a base bottom (A1) but not previously joined at the corners, and to move said box along said moulding direction (Z); first and second fixed folding means (2, 6), arranged in sequence along said moulding direction (Z) and adapted to cooperate with said moulding means (1) to fold in sequence first and second portions of a pre-glued covering sheet (B) arranged under the box (A) over respective side walls of the same box (A); scraping means (5) arranged between said first and second fixed folding means (2, 6) along said moulding direction, adapted to move forward and retract along a crosswise direction to and from an active position in order to fold respective corner-wrapping flaps of said first portions around said corners; and stabilizing means for stabilizing at least some of said walls of the box with respect to said moulding means, **characterized in that** said stabilizing means comprise thrusting means (31), arranged in association with said scraping means (5) and movable between an inactive position, in which they clear a region swept by said second portions (B4, B5) of said sheet (B) in a stretched out condition before folding, and an active position in which by entering sideways with respect to said moulding direction (Z) they are adapted to thrust at least some of said side walls of the box (A) against said moulding means (1) during an active phase of said scraping means (5), exerting a thrust over an area of the same wall which is not affected by said scraping means in said active position, and drive means (33) adapted to drive said thrusting means between said positions.
2. Apparatus according to claim 1, wherein said thrusting means comprise at least one thrusting member (31) pivotally supported around an axis of rotation (Z') incident on a plane (XY) normal to said moulding direction (Z).
3. Apparatus according to claim 1 or 2, wherein said axis of rotation (Z') of said pivoting thrusting member (31) is substantially parallel to said moulding direction (Z).
4. Apparatus according to claim 2 or 3, wherein said at least one thrusting member (31), in a sectional view over a plane orthogonal with the axis of rotation, has a generally angled profile arrangement, at a square angle or at an angle greater or less than 90°.
5. Apparatus according to claim 4, wherein said thrusting member (31) comprises a distal wing (311) with an edge (311a) adapted to exert the thrusting contact of a relative box wall in said active position, and a proximal wing (312) at an angle with respect to said distal wing (311) and on which the member is supported via a hinge (32) materializing said axis of rotation (Z') and spaced from said region swept by said second sheet portions (B4, B5) in the stretched out position, said hinge (32) constraining said thrusting member (31) to a fixed structural member (4) of the apparatus.
6. Apparatus according to claim 5, wherein said drive means (33) comprise, for said at least one thrusting member (31), a linear actuator (33) hinged between said fixed structural element (4) and a crank (34) integral with said proximal wing (312).
7. Apparatus according to claim 5 or 6, wherein said scraping means comprise for each thrusting member (31) a scraping blade (51) adapted to shift between its active position and a retracted position, both in a space that separates the box from said thrusting member (31) in its active position, said scraping means further comprising a second linear actuator (52) for actuating said blade (51) and an arm (53), connecting said blade (51) to said second linear actuator and projecting sideways with respect to the direction of actuation, said second actuator (52) being arranged over said hinge (32) of said thrusting means (3), said arm (53) being movable within a fracture (312a) formed in said proximal wing (312) of said thrusting member (31).
8. Apparatus according to claim 7, wherein said scraping blade (51) is shaped with a longitudinal extension along said moulding direction (Z) and is adapted to translate in a crosswise direction (X).
9. Apparatus according to any of the claims from 3 to 8, wherein a number of identical thrusting members (31) are provided, one for each base angle of said box and each associated with its own scraping means (51).
10. Apparatus according to claim 9, comprising four units, each with a thrusting member (31) and a scraping means (51), arranged in mutually opposing pairs.
11. A box covering method carried out with an apparatus according to any of the previous claims, wherein said

thrusting means move from said inactive position to said active position in a wrapping station downstream of, according to said moulding direction (Z), a folding step of at least one first portion (B2, B3) of said covering sheet (B) over a respective first wall (A2, A3) of said box, thrusting sideways at least a second wall (A4, A5) of the box; said scraping means (5) moving then to their active position while the thrusting means (3) are still in the active position; subsequently, the scraping means and the thrusting means move to their inactive position, and finally the box leaves said wrapping station still according to said moulding direction to carry out the folding of at least one second portion (B4, B5) of said covering sheet on the relative second wall (A4, A5) of the box.

12. The method according to claim 11, wherein the box comes to said wrapping station with two mutually opposed first portions (B2, B3) of said covering sheet (B) folded over respective first walls (A2, A3) of said box, said thrusting means (3) thrusting two mutually opposed second walls (4, 5) before said scraping means (5) fold respective pairs of wrapping flaps (B2a, B2b, B3a, B3b) of said second portions (B2, B3) of said sheet.

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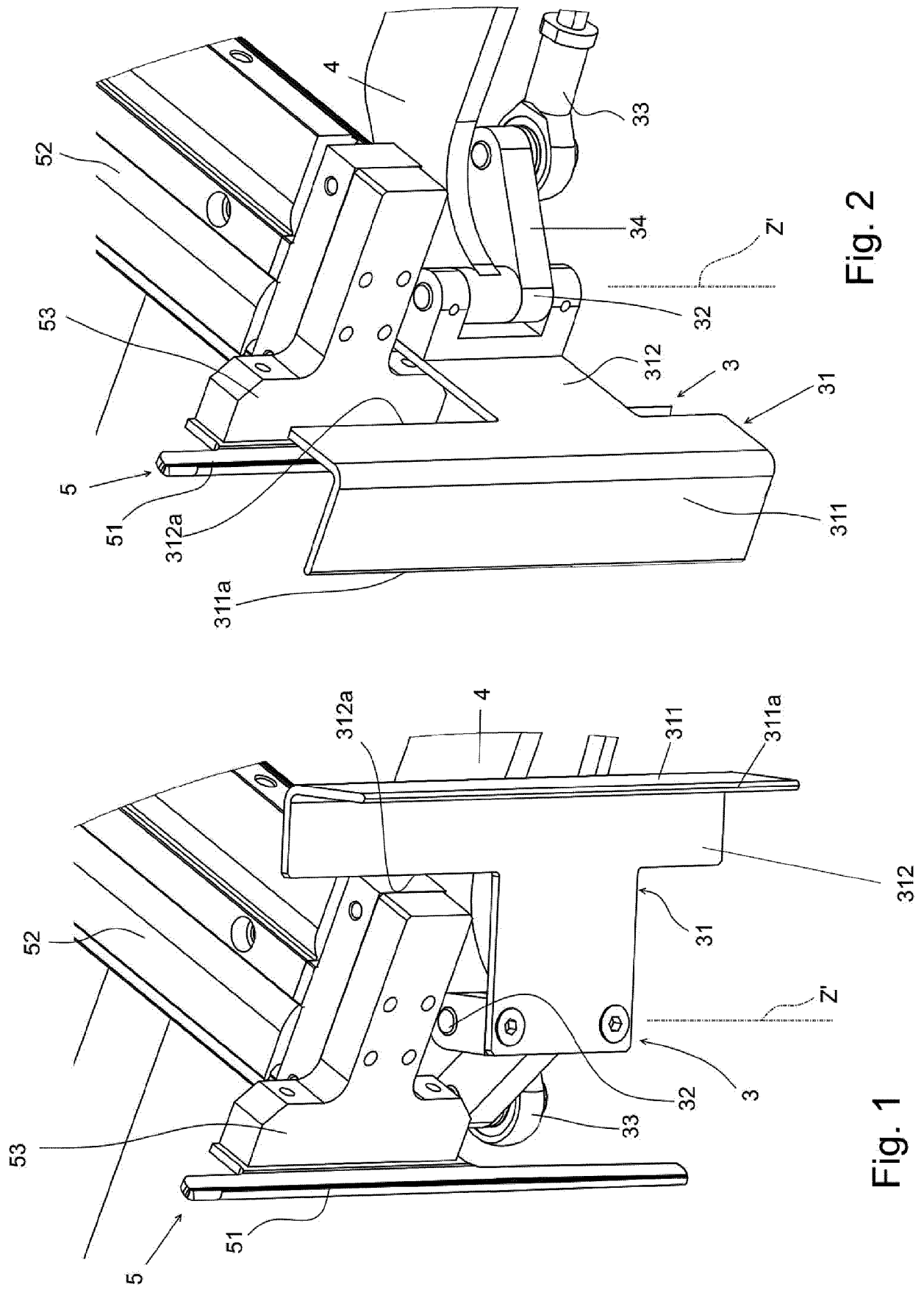
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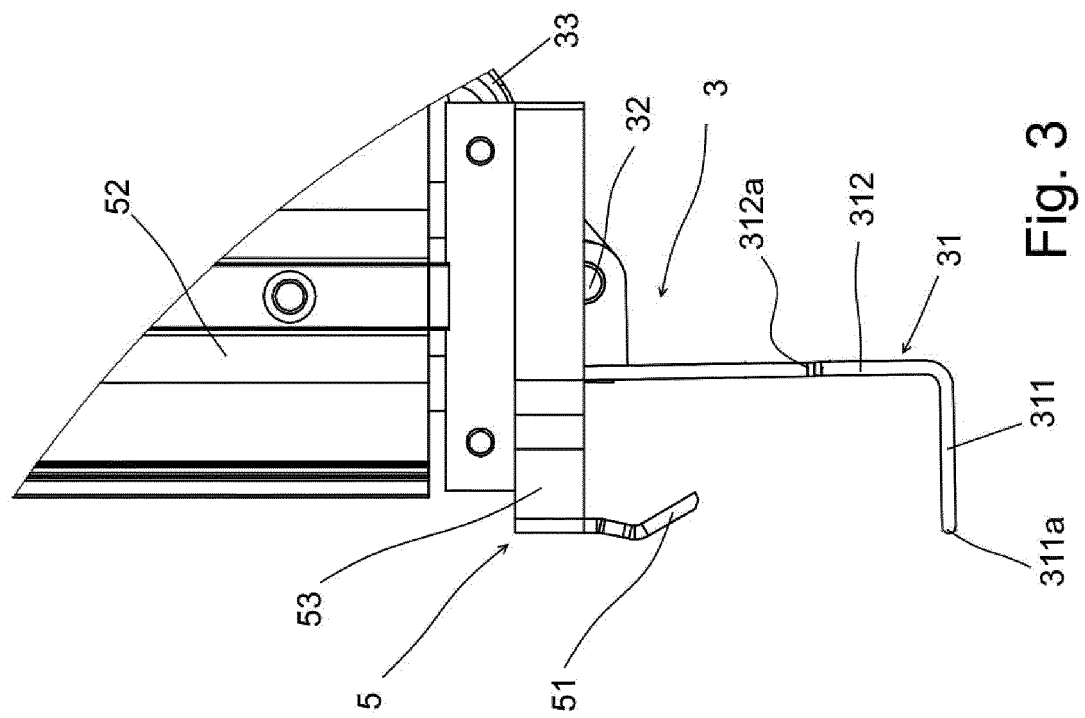
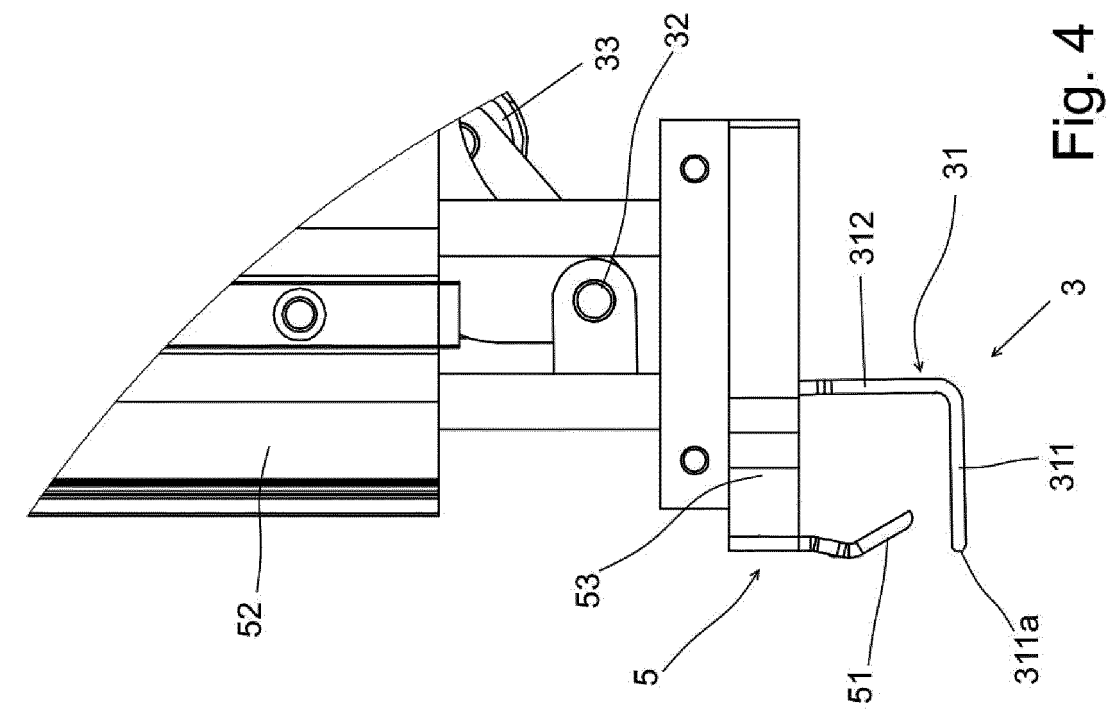
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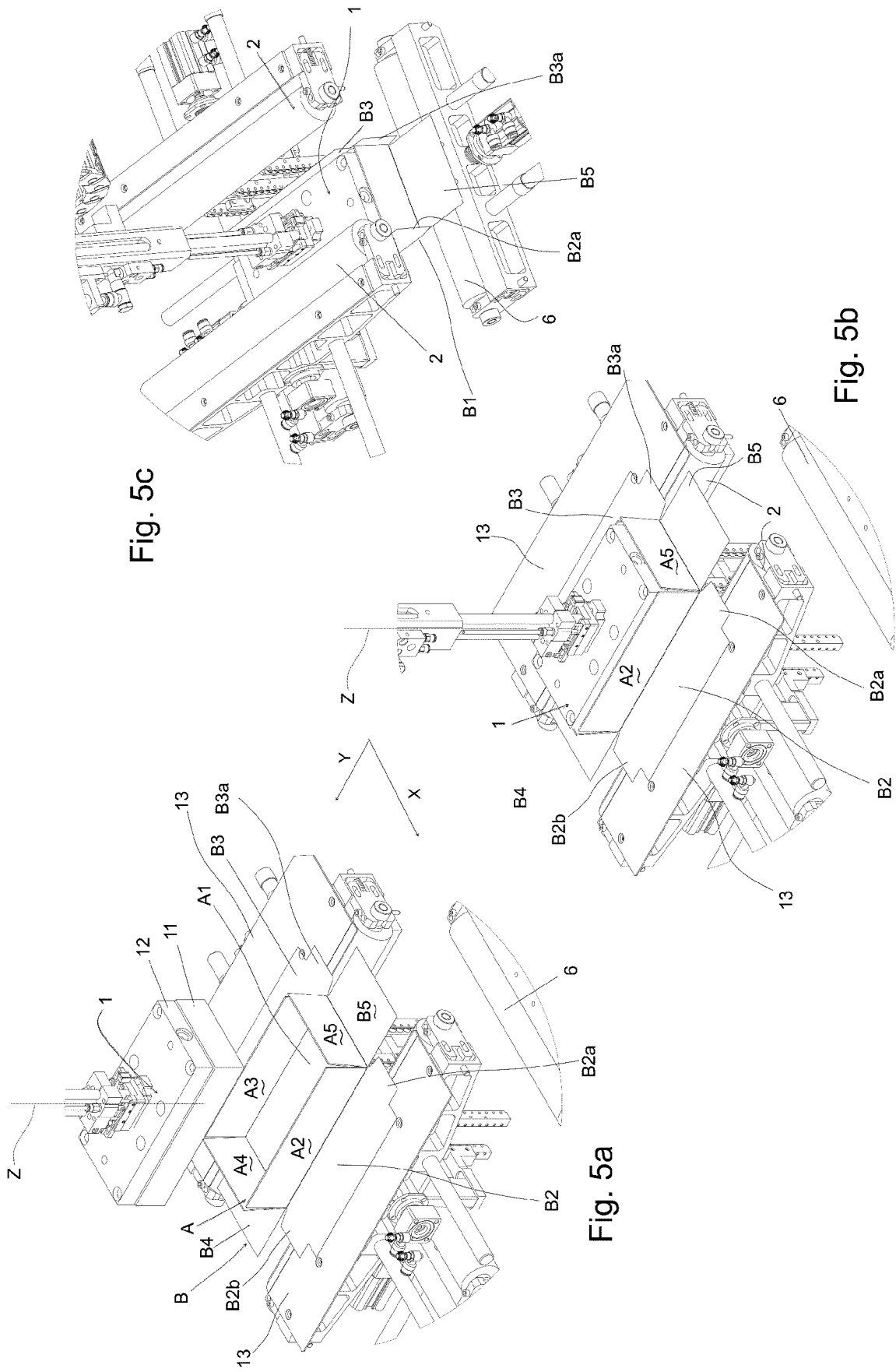
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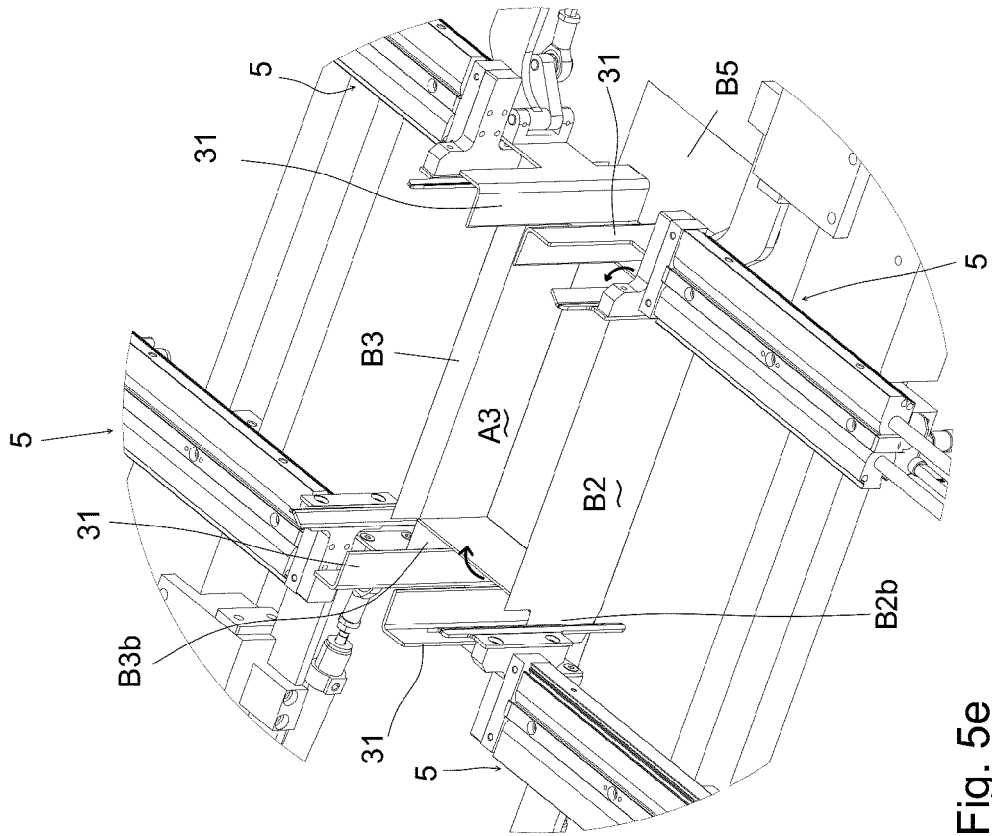


Fig. 5e

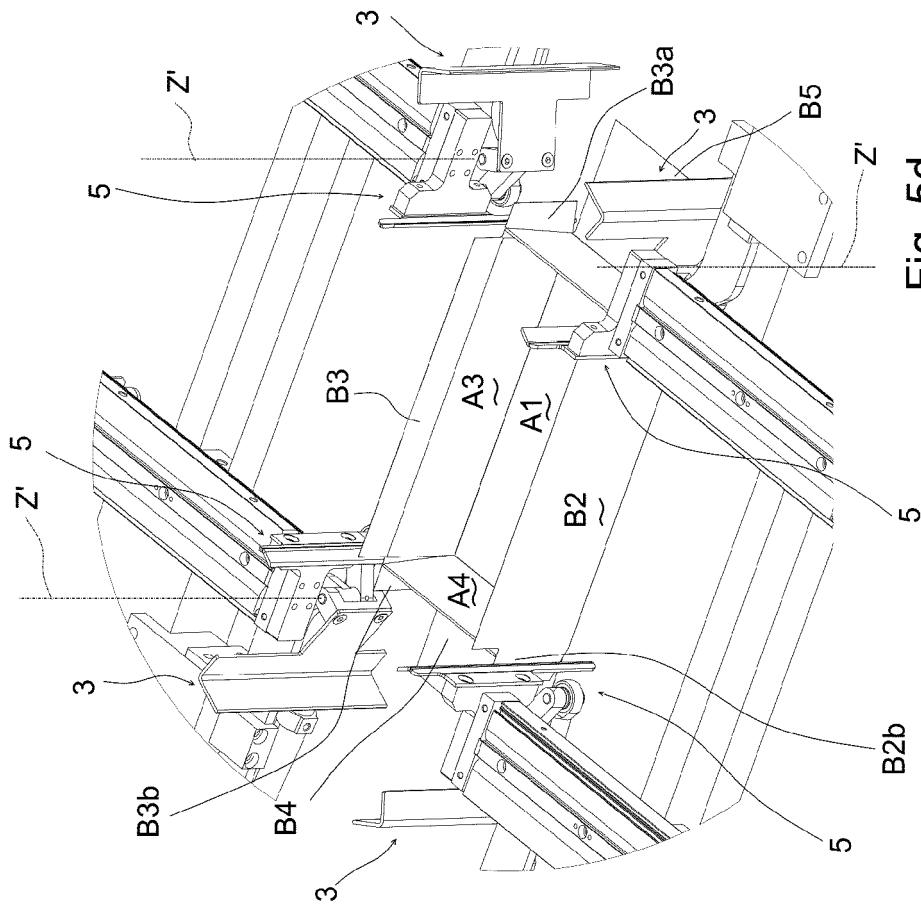


Fig. 5d

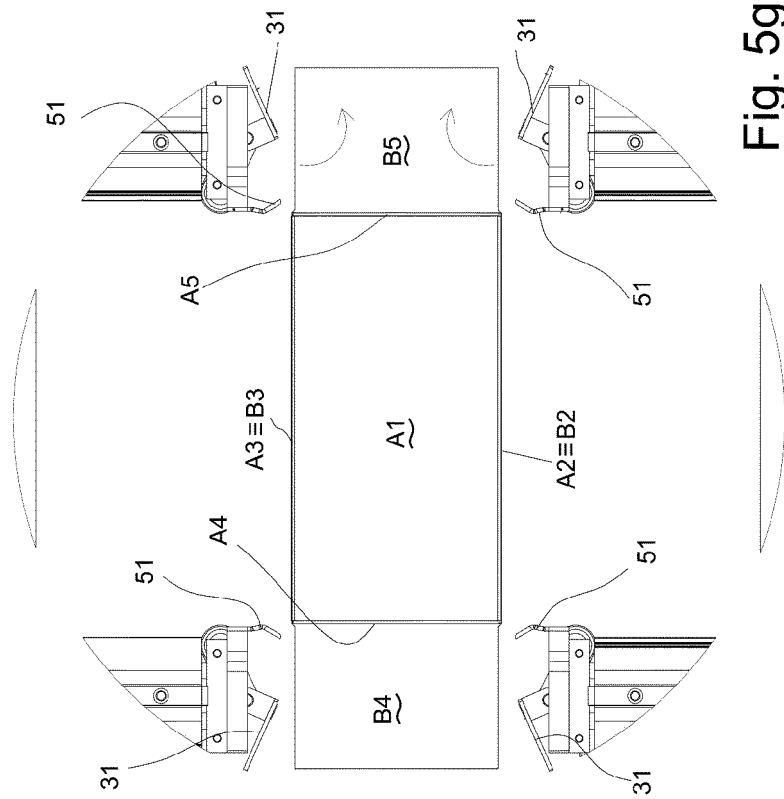


Fig. 5f

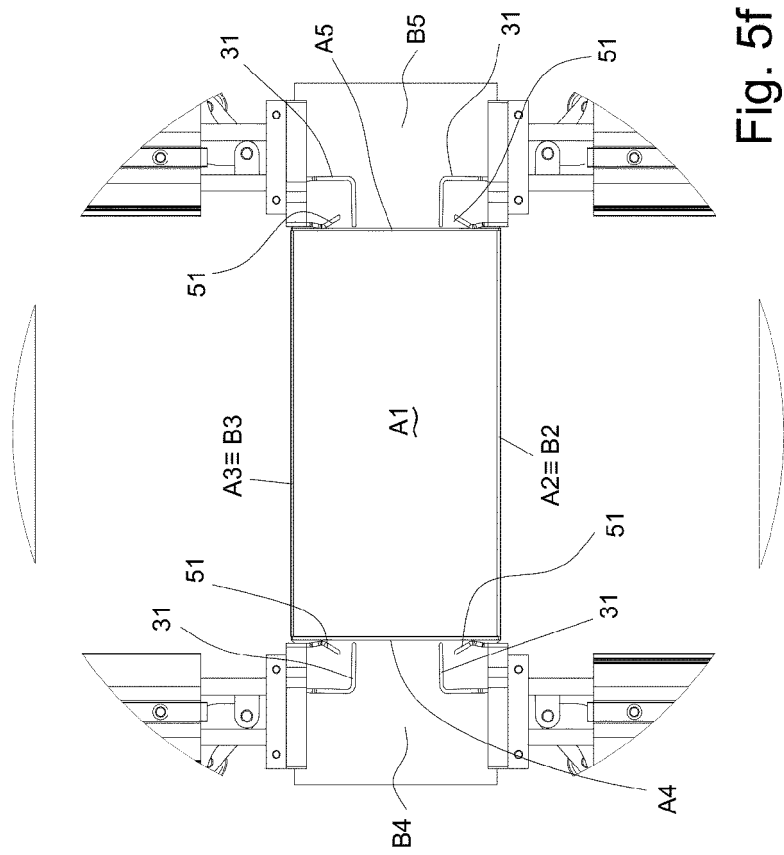
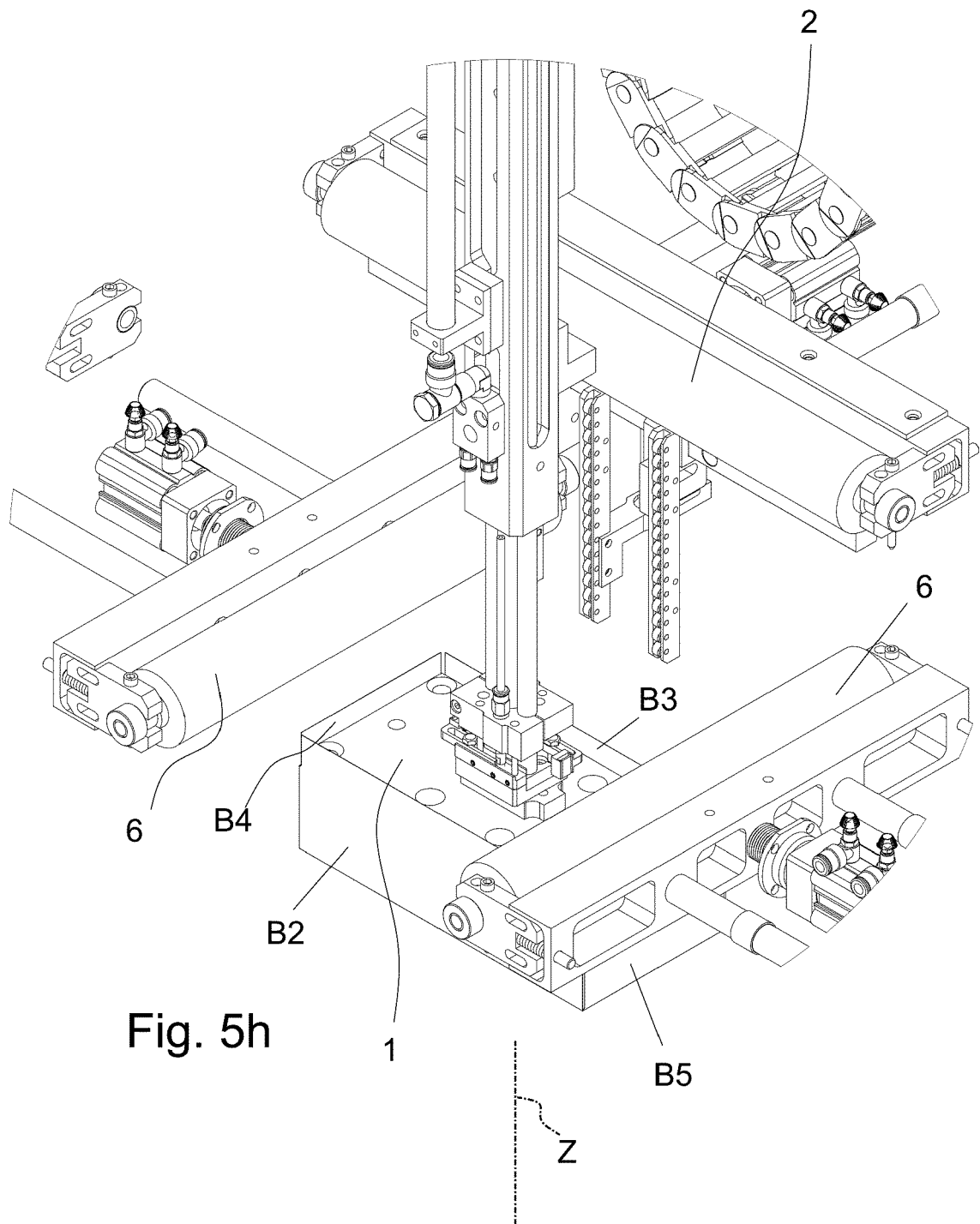


Fig. 5g





EUROPEAN SEARCH REPORT

Application Number
EP 19 15 9411

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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