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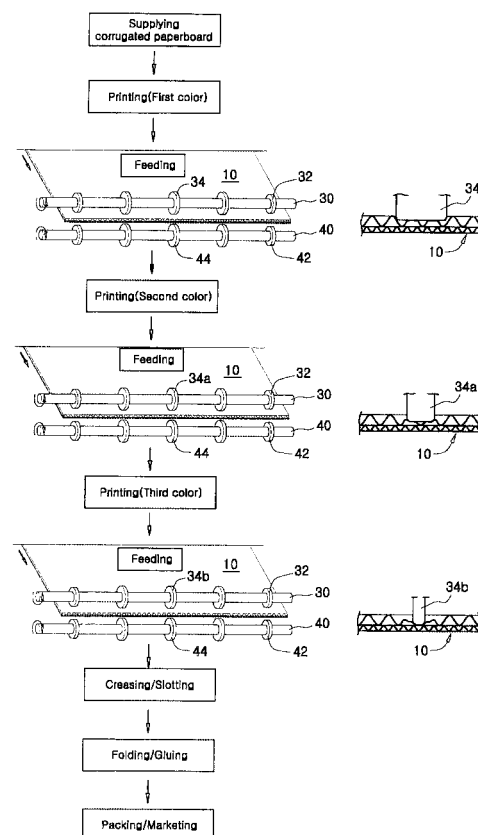
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(54) **Apparatus and method for producing corrugated-paperboard box**

(57) Disclosed are an apparatus and a method for producing a corrugated-paperboard box. The apparatus is characterized by: feeding means(30, 40; 32, 42) for feeding a corrugated paperboard (10); printing means for printing a predetermined pattern on the corrugated paperboard(10) which is fed by the feeding means(30, 40; 32, 42); creasing and slotting means for forming at least one main crease and at least one slot on the corrugated paperboard(10) which is printed with the predetermined pattern by the printing means; preliminary crease forming means(34, 44) disposed upstream of the creasing and slotting means, for forming a plurality of preliminary creases along the same linear region on the corrugated paperboard(10) in a multi-stepwise manner such that the plurality of preliminary creases are gradually decreased in their widths and each preliminary crease has a width which is no less than that of the main crease, the main crease being formed on the last preliminary crease of the plurality of preliminary creases; and folding and gluing means for folding and gluing a corrugated-paperboard box blank which is formed with the main crease and the slot by the creasing and slotting means, thereby enabling the production of the corrugated-paperboard box.

FIG 4



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a corrugated-paperboard box wherein flute restoring force which is induced around a main crease, is reduced and thereby a bulging phenomenon does not occur in the corrugated-paperboard box and dimensional stability is enhanced, and more particularly, the present invention relates to an apparatus and a method for producing a corrugated-paperboard box, wherein a plurality of preliminary creases or fold lines which have gradually decreasing widths and gradually increasing depths, are overlappingly formed in a multi-stepwise manner along a linear region where a corrugated-paperboard box blank is to be folded, in the course of feeding a corrugated paperboard by feeding means, which is printed with a predetermined pattern, whereby a cause of dimensional unstableness which can be generated by a cumulative error due to folding position deviations upon folding the corrugated-paperboard box blank, is eliminated, and productivity is improved and high value added is accomplished.

Description of the Related Art

[0002] Generally, packing boxes are divided into paper boxes and corrugated-paperboard boxes. A paper box is produced using a single paperboard which has a certain stiffness. The paper boxes are used for packing goods such as clothes, confectionaries or the like, which are free from shocks applied thereto from the outside. A corrugated-paperboard box is produced in such a manner that at least one corrugated medium which has a shock-absorbing property, is intervened between a pair of liners, thereby to secure a shock-absorbing space between the pair of liners. The corrugated-paperboard boxes are used for safely protecting packed articles from shocks which are applied thereto from the outside while the articles are transported or stored.

[0003] Such corrugated-paperboard boxes can be produced using a double-faced single-medium corrugated paperboard or a double-faced double-medium corrugated paperboard, depending upon a kind of an article to be packed. In the case of a double-faced double-medium corrugated paperboard, as the corrugated paperboard which is wound around a roll, is fed, an outer surface of a first liner which is adhesively laminated on a first corrugated medium having a dense flute structure, is printed with a predetermined pattern. Thereupon, as shown in FIG. 1, the corrugated paperboard 10 which is printed with the predetermined pattern, is guided between an upper feeding roll 22 and lower feeding means 26. The upper feeding roll 22 is shaped in the form of a cylindrical column. The lower feeding means 26 in-

cludes a plurality of feeding rolls 24 which are fitted around a rotating shaft in a manner such that the plurality of feeding rolls 24 can guide the corrugated paperboard 10 to a subsequent process in a state wherein they elastically support a printed surface of the corrugated paperboard 10.

[0004] By repeatedly implementing these printing processes and feeding processes, a multicolored printing pattern is formed on the corrugated paperboard 10. Then, a creasing and slotting process for forming at least one crease or folding line and at least one slot is performed, thereby to define a linear folding region on an outer surface of a second liner which is adhesively laminated on a second corrugated medium having a sparse flute structure. Thereafter, a resultant corrugated-paperboard box blank is supplied to a folding guider (not shown), to experience a folding process for folding the corrugated-paperboard box blank along the linear folding region. Next, by implementing a gluing process for gluing both ends of the corrugated-paperboard box blank to each other, a desired corrugated-paperboard box is accomplished.

[0005] However, the conventional apparatus for producing a corrugated-paperboard box, constructed as mentioned above, suffers from defects in that, when the corrugated paperboard 10 printed with the predetermined pattern is fed, only the upper feeding roll 22 shaped in the form of a cylindrical column and the lower feeding means 26 including the plurality of feeding rolls 24 which guide the corrugated paperboard 10 to the subsequent process in a state wherein they elastically support the printed surface of the corrugated paperboard 10, are used. Therefore, the upper feeding roll 22 and the lower feeding means 26 merely feed the corrugated paperboard 10 on a plane. Moreover, because only some portions (three portions in FIG. 1) of the corrugated paperboard 10 are pulled by the upper feeding roll 22 and the lower feeding means 26 thereby to be fed, when performing the creasing and slotting process, the likelihood of mismatch between both ends of the corrugated-paperboard box blank as shown in FIGs. 3a and 3b, is increased.

[0006] FIG. 2 is a cross-sectional view illustrating folding position deviations each of which is defined by a distance between a desired folding position and an actual folding position corresponding to a position of a valley portion, nearest to the desired folding position, of an innermost corrugated medium, when folding a corrugated-paperboard box blank along a pre-scored crease or fold line. That is to say, in order to fold a corrugated paperboard 10 along preset positions depending upon a size of a corrugated-paperboard box to be produced, creases or folding lines are formed at the preset positions. These preset positions are designated by points A, B and C in FIG. 2 for ease of reference.

[0007] In FIG. 2, an inner corrugated medium 13 is sandwiched between an inner liner 11 and an intermediate liner 12, and an outer corrugated medium 15 is

sandwiched between the intermediate liner 12 and an outer liner 14 an outer surface of which is printed with a predetermined pattern. The inner corrugated medium 13 which has a large pitch and a large flute height, reveals superior foldability to the outer corrugated medium 15 which has a small pitch and a small flute height. Therefore, the corrugated paperboard 10 is folded downward at the points A, B and C in a manner such that each folded portion of the corrugated paperboard 10 defines a V-shaped contour rather than a 180°-rotated V-shaped contour. In the case that the folding positions of the corrugated paperboard 10 are set by an interval between the points A and B, a folding position deviation of d1 is engendered, thereby inducing final mismatch between both ends of a corrugated-paperboard box blank as shown in FIG. 3a. This folding position deviation d1 is represented by a distance between the point A and an actual folding point which corresponds to a position of a valley portion, nearest to the point A, of the inner corrugated medium 13.

[0008] In the case that the folding positions of the corrugated paperboard 10 are set by an interval between the point B and the point C which is given on a flute peak, a folding position deviation of d2 is engendered. Therefore, even if a number of corrugated-paperboard boxes are continuously produced in the same producing line, as can be readily seen from FIG. 3b, actual dimensions of the finally produced corrugated-paperboard boxes, irregularly vary depending upon a feeding direction and an order of the corrugated paperboards 10. Namely, by comparing abnormally folded states of the corrugated-paperboard boxes as shown in FIGs. 3a and 3b with a normally folded state of the corrugated-paperboard box as shown in FIG. 3c, a person skilled in the art will readily recognize that the folding position deviations function as a primary factor which adversely affects product standardization.

[0009] In addition, mismatch between both ends of a corrugated-paperboard box blank is induced even in the case that the corrugated paperboard 10 is folded at the point B of FIG. 2, which is given on a flute bottom. In other words, although the crease or folding line is formed at a subsequent creasing and slotting process on the corrugated paperboard 10 which has undergone several printing processes and feeding processes, as best shown in the circle D in FIG. 2, two adjoining flute peaks of the inner corrugated medium 13 are brought into close contact with each other, thereby to resist being folded. Hence, a so-called "double folding phenomenon" in which a portion of the corrugated paperboard 10 is also folded above the point D in addition to the folding at the point D, occurs. And, due to this, a bulging phenomenon and dimensional unstableness of the corrugated-paperboard box blank frequently take place.

SUMMARY OF THE INVENTION

[0010] Accordingly, the present invention has been

made in an effort to solve the problems occurring in the related art, and an object of the present invention is to provide an apparatus and a method for producing a corrugated-paperboard box, in which a preliminary crease forming process is additionally conducted while a corrugated paperboard is fed, whereby a corrugated-paperboard box blank is allowed to be accurately folded along a main crease which is formed in a creasing and slotting process, when a subsequent folding and gluing process is performed, thereby effectively eliminating the possibility of dimensional accuracy of the corrugated-paperboard box blank to be deteriorated.

[0011] In order to achieve the above object, according to one aspect of the present invention, there is provided an apparatus for producing a corrugated-paperboard box, characterized by: feeding means for feeding a corrugated paperboard; printing means for printing a predetermined pattern on the corrugated paperboard which is fed by the feeding means; creasing and slotting means for forming at least one main crease and at least one slot on the corrugated paperboard which is printed with the predetermined pattern by the printing means; preliminary crease forming means disposed upstream of the creasing and slotting means, for forming a plurality of preliminary creases along the same linear region on the corrugated paperboard in a multi-stepwise manner such that the plurality of preliminary creases are gradually decreased in their widths and each preliminary crease has a width which is no less than that of the main crease, the main crease being formed on the last preliminary crease of the plurality of preliminary creases; and folding and gluing means for folding and gluing a corrugated-paperboard box blank which is formed with the main crease and the slot by the creasing and slotting means, thereby enabling the production of the corrugated-paperboard box.

[0012] According to another aspect of the present invention, the feeding means comprises a pair of guide shafts for guiding feeding of the corrugated paperboard, and two pairs of feeding rolls fitted around and at both ends of the pair of guide shafts, respectively, for feeding the corrugated paperboard while elastically supporting both ends of the corrugated paperboard; and the preliminary crease forming means comprises at least one flute blunting roll fitted around one guide shaft between one pair of feeding rolls, for forming at least one preliminary crease having a width which is no less than that of the main crease, on a crease-forming surface of the corrugated paperboard, and at least one tension roll covered by a rubber envelope and fitted around the other guide shaft between the other pair of feeding rolls, for elastically supporting a printed surface of the corrugated paperboard while the preliminary crease is formed by the flute blunting roll, the tension roll being arranged opposite to the flute blunting roll.

[0013] According to still another aspect of the present invention, the feeding means includes a plurality of feeding sections which are sequentially disposed, each

feeding section comprising the pair of guide shafts and the two pairs of feeding rolls; the preliminary crease forming means includes a plurality of preliminary crease forming sections which are sequentially disposed, each preliminary crease forming section comprising the at least one flute blunting roll and the at least one tension roll; and flute blunting rolls of the plurality of preliminary crease forming sections are gradually decreased in their widths and gradually increased in their diameters, in a manner such that the last preliminary crease formed by the last preliminary crease forming section has a width which is no less than that of the main crease.

[0014] By the features of the present invention, due to the fact that the plurality of preliminary creases are formed by being sequentially pressed with slight force by the flute blunting rolls in a manner such that they are gradually decreased in their widths and each preliminary crease has a width which is no less than that of the main crease, flute restoring force which is induced around the main crease on the corrugated paperboard, is reduced, whereby a bulging phenomenon does not occur in the corrugated-paperboard box blank while performing a folding and gluing process therefor. Consequently, it is possible to provide a corrugated-paperboard box of good quality, having dimensional stability.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The above objects, and other features and advantages of the present invention will become more apparent after a reading of the following detailed description when taken in conjunction with the drawings, in which:

FIG. 1 is a diagrammatic view for explaining conventional apparatus and method for producing a corrugated-paperboard box;

FIG. 2 is a cross-sectional view illustrating folding position deviations each of which is defined by a distance between a desired folding position and an actual folding position corresponding to a position of a valley portion, nearest to the desired folding position, of an innermost corrugated medium, when folding a corrugated-paperboard box blank along a pre-scored crease or fold line;

FIGs. 3a through 3c are partial enlarged front views illustrating corrugated-paperboard boxes which are produced by the conventional method as shown in FIG. 1, wherein FIGs. 3a and 3b show abnormally folded states of corrugated-paperboard boxes and FIG. 3c shows a normally folded state of a corrugated-paperboard box;

FIG. 4 is a diagrammatic view for explaining an apparatus and a method for producing a corrugated-paperboard box in accordance with an embodiment of the present invention; and

FIG. 5 is an enlarged front view illustrating a detailed structure of preliminary crease forming

means used in the apparatus according to the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0016] Reference will now be made in greater detail to a preferred embodiment of the invention, an example of which is illustrated in the accompanying drawings. Wherever possible, the same reference numerals will be used throughout the drawings and the description to refer to the same or like parts.

[0017] FIG. 4 is a diagrammatic view for explaining an apparatus and a method for producing a corrugated-paperboard box in accordance with an embodiment of the present invention, and FIG. 5 is an enlarged front view illustrating a detailed structure of preliminary crease forming means used in the apparatus according to the present invention. As shown in FIGs. 4 and 5, the apparatus for producing a corrugated-paperboard box according to the present invention includes feeding means for feeding a corrugated paperboard, printing means for printing a predetermined pattern on the corrugated paperboard which is fed by the feeding means, creasing and slotting means for forming a plurality of main creases and a plurality of slots on the corrugated paperboard which is printed with the predetermined pattern by the printing means, and folding and gluing means for folding and gluing a corrugated-paperboard box blank which is formed with the main creases and the slots by the creasing and slotting means, thereby enabling the production of the corrugated-paperboard box.

[0018] Preliminary crease forming means is disposed upstream of the creasing and slotting means, for continuously forming a plurality of preliminary creases along the same linear region on the corrugated paperboard in a multi-stepwise manner such that the plurality of preliminary creases are gradually decreased in their widths and each preliminary crease has a width which is no less than that of the main crease. Each main crease is formed on the last preliminary crease of the plurality of continuously formed preliminary creases.

[0019] The preliminary crease forming means comprises a plurality of preliminary crease forming sections which are sequentially disposed. Each preliminary crease forming section is structured in a manner such that the plurality of continuously formed preliminary creases which are gradually decreased in their widths are formed on the corrugated paperboard and the last preliminary crease which is formed by the last preliminary crease forming section has a width which is no less than that of the main crease. The preliminary crease forming means are arranged around a pair of upper and lower feeding shafts 30 and 40 which guide feeding of the corrugated paperboard 10.

[0020] Two pairs of feeding rolls 32 and 42 are fitted around and at both ends of the pair of feeding shafts 30 and 40, respectively, for feeding the corrugated paper-

board 10 while elastically supporting both ends of the corrugated paperboard 10. A plurality of flute blunting rolls 34 are fitted around the upper feeding shaft 30 between one pair of feeding rolls 32, for transversely forming a plurality of preliminary creases having a width which is no less than that of the main crease, on a crease-forming surface of the corrugated paperboard 10. A plurality of tension rolls 44 each of which is covered by a rubber envelope, are fitted around the lower feeding shaft 40 between the other pair of feeding rolls 42, for elastically supporting a printed surface of the corrugated paperboard 10 while the plurality of transversely formed preliminary creases are formed by the plurality of flute blunting rolls 34, respectively. The plurality of tension rolls 44 are arranged opposite to the plurality of flute blunting rolls 34, respectively.

[0021] It is preferred that the preliminary crease forming means is also disposed along with the feeding means, thereby enabling a feeding task of the corrugated paperboard 10 and a preliminary crease forming task to be simultaneously implemented.

[0022] When explaining operations of the apparatus for producing a corrugated-paperboard box constructed as mentioned above, with reference to FIG. 4, first, as the corrugated paperboard 10 which is wound around a roll, is fed, an outer surface of a first liner of the corrugated paperboard 10 which is adhesively laminated on a first corrugated medium having a dense flute structure, is printed with a first predetermined color pattern. Then, the corrugated paperboard 10 which is printed with the first predetermined color pattern, is fed to a next printing arrangement. At this time, the corrugated paperboard 10 is, as concretely shown in FIG. 5, fed by the feeding means in which the two pairs of feeding rolls 32 and 42 are fitted around and at both ends of the pair of upper and lower feeding shafts 30 and 40, respectively.

[0023] Out of the pair of upper and lower feeding shafts 30 and 40, the upper feeding shaft 30 is provided with the plurality of flute blunting rolls 34 which press a plurality of flutes on the crease-forming surface of the corrugated paperboard 10 with slight force to widen the plurality of flutes, thereby reducing flute restoring force which is induced around each of the main creases on the corrugated paperboard 10. Also, the lower feeding shaft 40 is provided with the plurality of tension rolls 44 each of which is covered by the rubber envelope in a manner such that the tension roll 44 can absorb impact force which is applied to the corrugated paperboard 10 by the flute blunting roll 34 while elastically supporting the printed surface of the corrugated paperboard 10.

[0024] Then, the corrugated paperboard 10 which is guided between the pair of upper and lower feeding shafts 30 and 40 constituting next feeding means, is sequentially printed with a second predetermined color pattern and a third predetermined color pattern. The corrugated paperboard 10 which is printed in these ways, is repeatedly formed with second and third plurality of preliminary creases in the same manner as in the

above-described first preliminary crease forming section. However, in these second and third preliminary crease forming sections, as the corrugated paperboard 10 is fed through feeding means including plurality of flute blunting rolls 34a and 34b which are narrower in width and larger in diameter than the flute blunting roll 34 of the first preliminary crease forming section, the second and third plurality of preliminary creases are sequentially and transversely formed along the same linear regions where the corrugated-paperboard box blank is to be folded.

[0025] Due to the fact that the plurality of preliminary creases which are continuously and transversely formed along the same linear regions on the corrugated paperboard by the above-described processes, are defined by being repeatedly pressed by the plurality of flute blunting rolls which are sequentially changed from a wider and shallower roll to a narrower and deeper roll, flutes around the main creases are stably blunted without causing a change in a shape of the corrugated-paperboard box, which is otherwise induced by an abrupt forming of the main creases.

[0026] Further, by forming the plurality of preliminary creases, it is also possible to effectively avoid mismatch between both ends of the corrugated-paperboard box blank by preventing the fed corrugated paperboard 10 from fluctuating. This is enabled by the fact that the corrugated paperboard 10 is grasped, against fluctuation, at the linear regions parallel defined one to another on a plane, on which the plurality of preliminary creases are formed, while being fed.

[0027] Therefore, after repeatedly performing the printing processes and the feeding processes as described above, by forming the main creases on the corrugated paperboard 10 on which the plurality of preliminary creases are formed and slotting the corrugated paperboard 10, the corrugated paperboard 10 which is sufficiently reduced in its flute restoring force around the main creases, is accurately folded on the main creases irrespective of positions of the flutes relative to the positions of the main creases. By this, it is possible to provide the corrugated-paperboard box which is of good quality and is standardized, without experiencing a bulging phenomenon of the corrugated paperboard and an inferior factor due to double folding phenomenon.

[0028] The preliminary crease forming step comprises first through Nth preliminary crease forming processes. The preliminary crease forming step is implemented from the first preliminary crease forming process toward the Nth preliminary crease forming process in a manner such that the preliminary creases are gradually decreased in their widths and the preliminary crease which is formed by the Nth preliminary crease forming process has a width which is no less than that of the main crease.

[0029] More preferably, the preliminary crease forming step is implemented while the corrugated paperboard 10 is fed.

[0030] As a result, by the apparatus and method for

producing a corrugated-paperboard box according to the present invention, advantages are provided in that, since a plurality of preliminary creases or fold lines which have gradually decreasing widths and gradually increasing depths, are overlappingly formed in a multi-
 5 stepwise manner along a linear region where a corrugated-paperboard box blank is to be folded, in the course of feeding a corrugated-paperboard which is printed with a predetermined pattern, flute restoring force which is induced around a main crease on the cor-
 10 rugated-paperboard box blank, is reduced, whereby a bulging phenomenon does not occur in the corrugated-paperboard box blank while performing a folding and gluing process therefor. Thus, a cause of dimensional unstableness which can be generated by a cumulative
 15 error due to folding position deviations upon folding the corrugated-paperboard box blank, is eliminated. Consequently, productivity is improved and high value added is accomplished, and it is possible to provide a cor-
 20 rugated-paperboard box of good quality.

Claims

1. An apparatus for producing a corrugated-paperboard box, characterized by:

feeding means(30, 40; 32, 42) for feeding a corrugated paperboard(10);
 printing means for printing a predetermined pattern on the corrugated paperboard(10) which is fed by the feeding means(30, 40; 32, 42);
 creasing and slotting means for forming at least one main crease and at least one slot on the
 35 corrugated paperboard(10) which is printed with the predetermined pattern by the printing means;
 preliminary crease forming means(34, 44) disposed upstream of the creasing and slotting
 40 means, for forming a plurality of preliminary creases along the same linear region on the corrugated paperboard(10) in a multi-stepwise manner such that the plurality of preliminary
 45 creases are gradually decreased in their widths and each preliminary crease has a width which is no less than that of the main crease, the main crease being formed on the last preliminary crease of the plurality of preliminary creases;
 50 and
 folding and gluing means for folding and gluing a corrugated-paperboard box blank which is formed with the main crease and the slot by the creasing and slotting means, thereby enabling
 55 the production of the corrugated-paperboard box.

2. The apparatus as claimed in claim 1, characterized

in that the feeding means comprises a pair of guide shafts(30, 40) for guiding feeding of the corrugated paperboard(10), and two pairs of feeding rolls(32, 42) fitted around and at both ends of the pair of guide shafts(30, 40), respectively, for feeding the corrugated paperboard(10) while elastically supporting both ends of the corrugated paperboard (10); and wherein the preliminary crease forming means comprises at least one flute blunting roll(34) fitted around one guide shaft(30) between one pair of feeding rolls(32), for forming at least one preliminary crease having a width which is no less than that of the main crease, on a crease-forming surface of the corrugated paperboard(10), and at least one tension roll(44) covered by a rubber envelope and fitted around the other guide shaft(40) between the other pair of feeding rolls(42), for elastically supporting a printed surface of the corrugated paperboard(10) while the preliminary crease is formed by the flute blunting roll(34), the tension roll(44) being arranged opposite to the flute blunting roll(34).

3. The apparatus as claimed in claims 1 or 2, characterized in that the feeding means includes a plurality of feeding sections which are sequentially disposed, each feeding section comprising the pair of guide shafts(30, 40) and the two pairs of feeding rolls(32, 42); wherein the preliminary crease forming means includes a plurality of preliminary crease forming sections which are sequentially disposed, each preliminary crease forming section comprising the at least one flute blunting roll(34) and the at least one tension roll(44); and wherein flute blunting rolls (34) of the plurality of preliminary crease forming sections are gradually decreased in their widths and gradually increased in their diameters, in a manner such that the last preliminary crease formed by the last preliminary crease forming section has a width which is no less than that of the main crease.
4. A method for forming a corrugated-paperboard box, characterized by the steps of:

feeding a corrugated paperboard(10);
 printing a predetermined pattern on the corrugated paperboard(10) while it is fed;
 forming a plurality of preliminary creases along the same linear region on the corrugated paperboard(10) in a multi-stepwise manner such that the plurality of preliminary creases are gradually decreased in their widths;
 forming at least one main crease and at least one slot on the corrugated paperboard(10) which is printed with the predetermined pattern, in a manner such that the main crease is formed on the last preliminary crease of the plurality of preliminary creases and each preliminary crease has a width which is no less than that of

the main crease; and
folding and gluing a corrugated-paperboard
box blank which is formed with the main crease
and the slot, thereby enabling the production of
the corrugated-paperboard box.

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5. The method as claimed in claim 4, characterized in
that the preliminary crease forming step comprises
first through Nth preliminary crease forming proc-
esses; and wherein the preliminary crease forming
step is implemented from the first preliminary
crease forming process toward the Nth preliminary
crease forming process in a manner such that the
preliminary creases are gradually decreased in
their widths and the preliminary crease which is
formed by the Nth preliminary crease forming proc-
ess has a width which is no less than that of the
main crease.
6. The method as claimed in claims 4 or 5, character-
ized in that the preliminary crease forming step is
implemented while the corrugated paperboard(10)
is fed.

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FIG 1

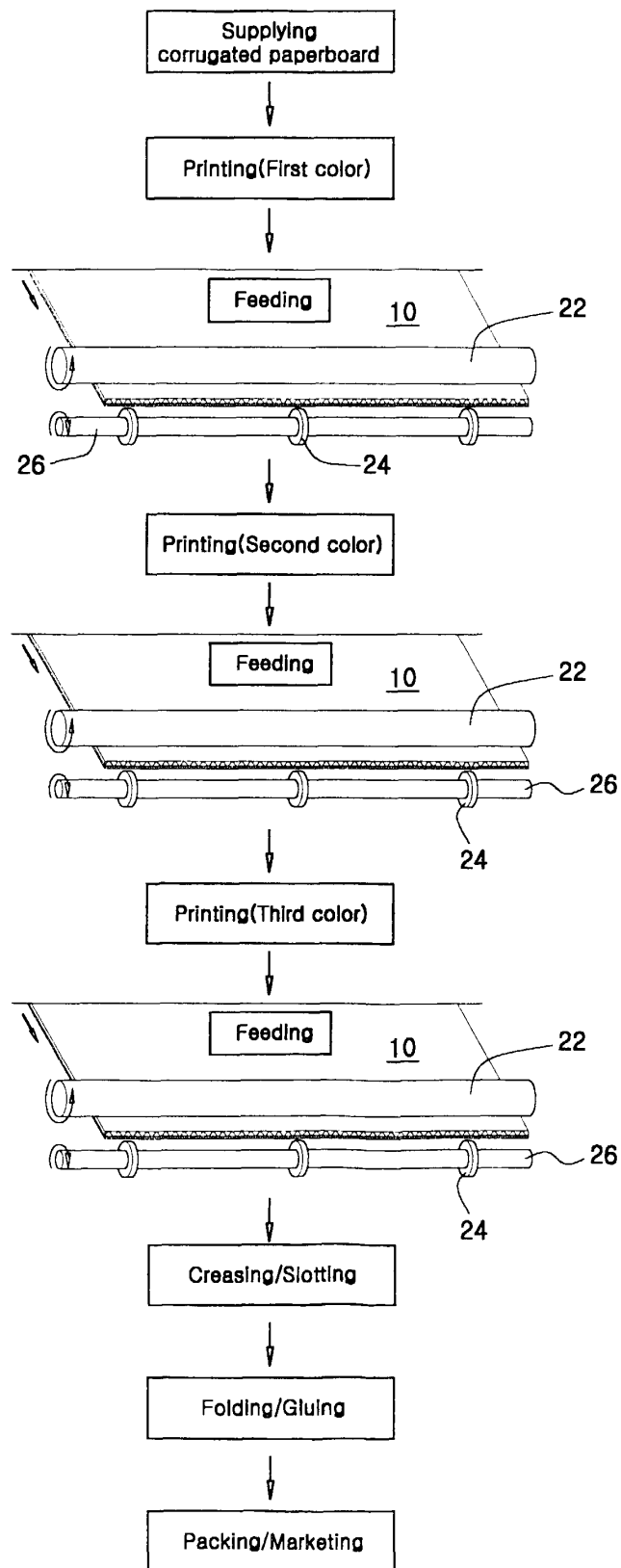


FIG 2

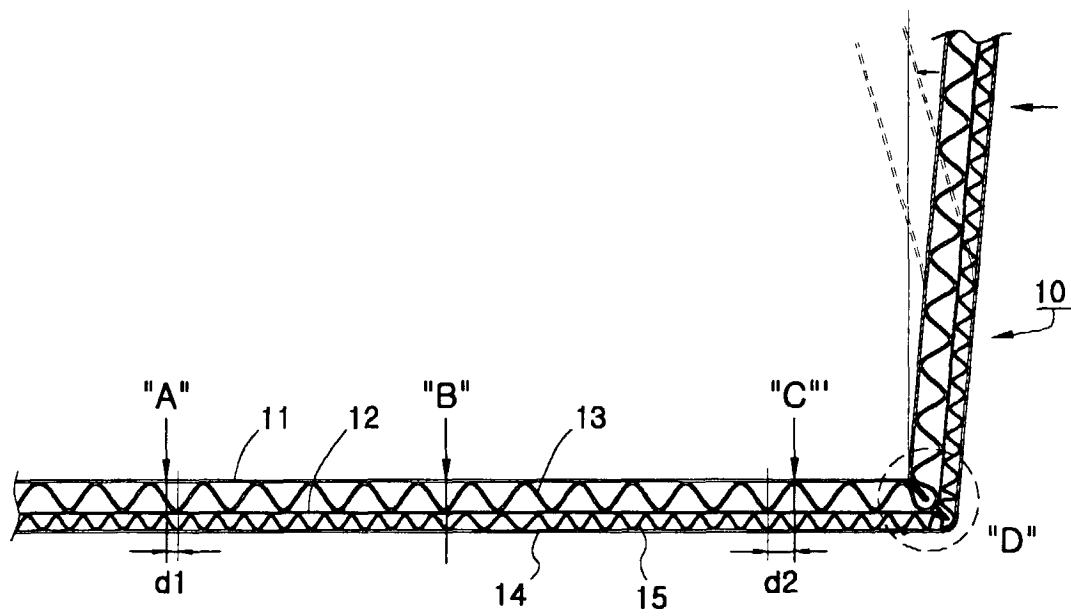


FIG 3a

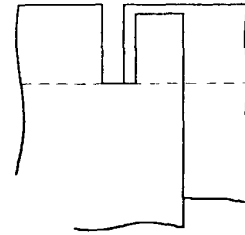
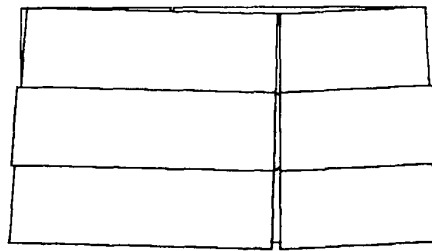


FIG 3b

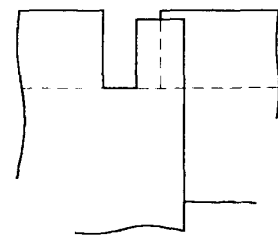
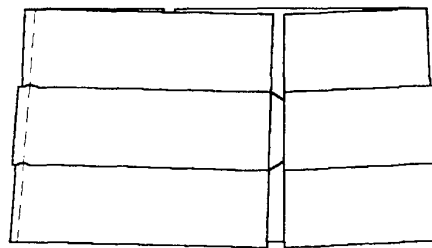


FIG 3c

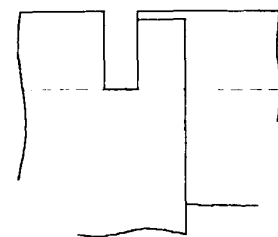
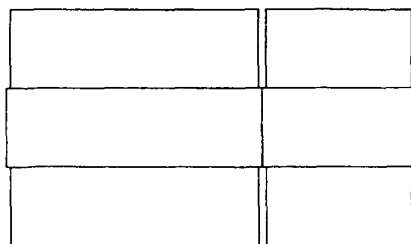


FIG 4

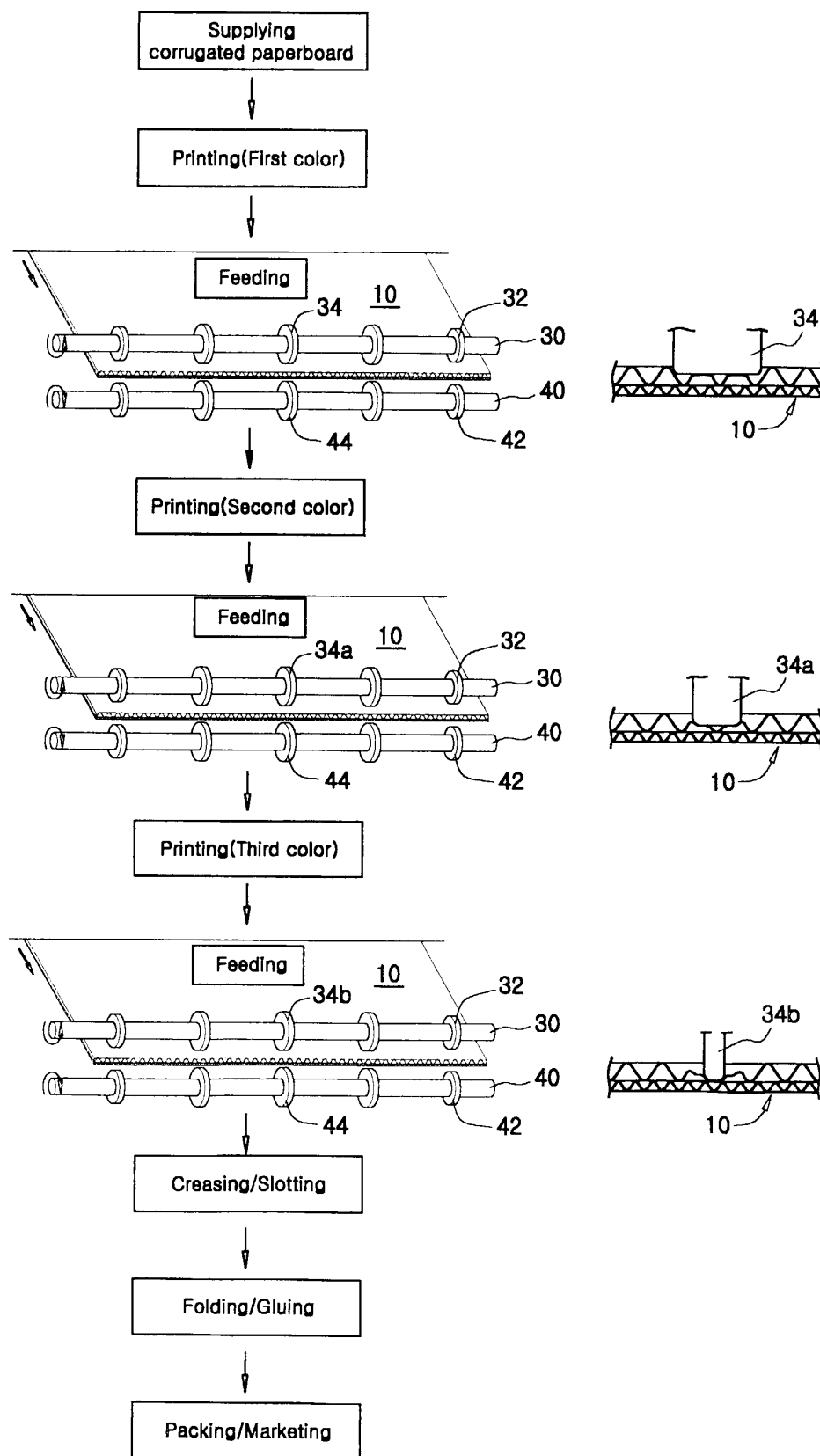


FIG 5

