



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
02.01.2008 Bulletin 2008/01

(51) Int Cl.:
B65D 5/44 (2006.01) **B65D 5/50** (2006.01)
B31B 1/54 (2006.01) **B31B 3/26** (2006.01)
B65B 43/26 (2006.01)

(21) Application number: **07111299.9**

(22) Date of filing: **28.06.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(71) Applicant: **Smurfit Kappa GSF B.V.**
9665 PX Oude Pekela (NL)

(72) Inventor: **van Eijndhoven, Peter Paul**
3771 JW, Barneveld (NL)

(74) Representative: **van Loon, C.J.J. et al**
VEREENIGDE
Johan de Wittlaan 7
2517 JR Den Haag (NL)

(30) Priority: **29.06.2006 NL 1032086**

(54) **Folding apparatus and method for setting up a package with elongated corner reinforcements from a blank**

(57) The invention relates to a folding apparatus and a method for setting up a package with relatively elongated corner reinforcements (7) from a blank. To that end, the folding apparatus (10) comprises a number of folding stations with movable folding shoes (22,32), allowing corner reinforcing panels of the blank to be folded over in successive folding steps for forming corner reinforcements of a desired form. At least one of the folding shoes is subdivided into several mutually independently

movable sub-shoes (32A,B,C). Immediately after they have ceased to contribute to folding over and retaining a corner reinforcing panel in folded-over position, they can be returned to an initial position in order to thus be ready for a new corner reinforcing panel. Thus, this new corner reinforcing panel can enter the respective folding station even before the previous corner reinforcing panel has completely left this station. As a result, corner reinforcing panels can be processed within a short space of time and be supported until the end of the folding station.

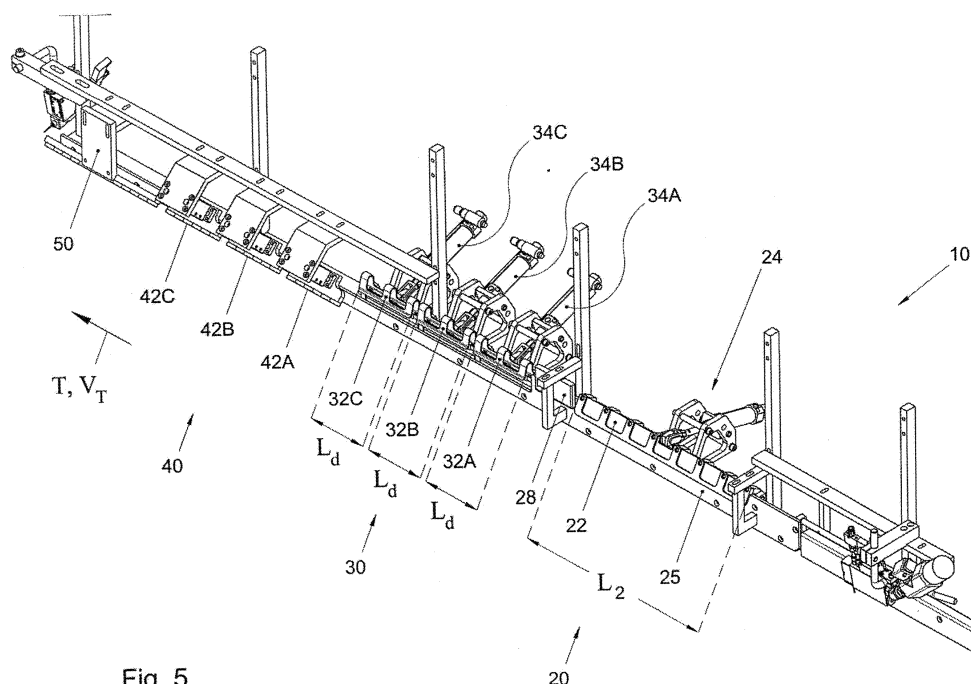


Fig. 5

Description

[0001] The invention relates to a folding apparatus and a method for setting up a package with tubular corner reinforcements from a blank.

[0002] As a rule, such corner reinforcements are formed by directing a blank along a number of successive folding stations, at which stations corner reinforcing panels of the blank are folded over, in successive folding steps, along folding lines provided to that end. Thereto, each folding station comprises a folding shoe, which is movable between an initial position and an end position and which preferably extends over the entire length of the fold to be realized. At the end of their folding movement, the respective folding shoes are held in their end position until the corner reinforcing panel has completely passed the respective folding shoes. What is prevented in this manner is that the folded-over panel can bounce back or is folded back by the return movement of the folding shoe. Then, the folding shoe is returned to the initial position and the folding shoe is ready for folding a subsequent corner reinforcing panel. In order to prevent this next panel from reaching the folding shoe prematurely, the blank part between the corner reinforcing panels is to have a length that is greater than the length of the corner reinforcing panels. The fact is that when the length of this blank part is smaller than or equal to the length of the corner reinforcing panels, a subsequent corner reinforcing panel will enter the folding shoe at the moment the previous corner reinforcing panel is still present in, or just leaves the folding shoe, respectively. The folding shoe then still needs to be returned to its initial position, which takes time. During this period, the blank will travel a particular distance. The blank part between successive corner reinforcements must therefore have a length that is at least equal to the length of the corner reinforcing panels, increased by the distance travelled by the blank during the return movement of a folding shoe. From this, it follows that the known folding apparatus imposes considerable limitations to the dimensions of the packages to be set up, in particular to the height of the package (determined by the length of the corner reinforcements) against the width or length of the package (determined by the minimum distance required between successive corner reinforcing panels).

[0003] The invention contemplates providing a folding apparatus with which the drawbacks of the known folding apparatus are obviated, while maintaining the advantages thereof. In particular, the invention contemplates providing a folding apparatus with which, from a blank, a package can be set up with relatively long corner reinforcements, when compared to a length and width measurement of the package.

[0004] To this end, a folding apparatus according to the invention is characterized by the features according to claim 1.

[0005] Owing to the subdivision of the folding shoe into several mutually independently movable sub-shoes, each sub-shoe can be returned undisturbedly to its initial position as soon as the corner reinforcing panel has passed this sub-shoe. The fact is that then, this sub-shoe is no longer needed for retaining the panel and preventing it from bouncing back, and, moreover, the sub-shoe can be returned without disturbing the corner reinforcing panel. The sub-shoe can therefore be returned to its initial position at a very early stage, so that a subsequent corner reinforcing panel can enter the folding station before the preceding corner reinforcing panel has completely left this station. As a result, corner reinforcing panels can be processed much quicker in succession and the blank distance between successive corner reinforcing panels can be accordingly shortened, while these corner reinforcing panels can still be retained until the end of a folding station to prevent bouncing back.

[0006] The required length of the blank part between successive corner reinforcing panels (and hence the length or width measurement of the bottom panel) can therefore be reduced by reducing the length of the sub-shoes. The fact is that the required length between successive corner reinforcing panels is equal to the length of a sub-shoe increased by the distance which the blank travels during the return movement of the sub-shoe. Additional advantage of a smaller sub-shoe is that it will be lighter and can therefore be returned quicker so that the distance the blank will travel during this movement will be smaller too.

[0007] Further, the length of the corner reinforcing panels (and hence the height of the package) can be increased, by increasing the number of sub-shoes, until they can jointly bridge the entire length of a corner reinforcing panel.

[0008] Thus, with the folding apparatus according to the invention, packages of almost any dimension can be set up, by subdividing the folding shoes into a suitable number of sub-shoes of suitable length.

[0009] The invention further relates to a method for setting up a package with elongated corner reinforcements from a blank, in particular packages whose height measurements of the corner reinforcements are considerably greater than the remaining package measurements.

[0010] In the further subclaims, further advantageous embodiments of an apparatus device and method according to the invention are described. In clarification of the invention, exemplary embodiments of an apparatus and method according to the invention, and packages manufactured therewith will be described in further detail with reference to the drawing. In the drawing:

Fig. 1 shows a blank that can be set up into a package as shown in Fig. 2 with a folding apparatus according to the invention;

Fig. 2 shows a package with corner reinforcements set up from the blank of Fig. 1;

Fig. 3A schematically shows, in cross-section, the corner reinforcement at the beginning and the end of the second folding step;

Fig. 3B schematically shows a second folding station according to the invention, during performance of a second folding step;

Fig. 4A schematically shows, in cross-section, the corner reinforcement at the beginning and the end of the third folding step;

Fig. 4B schematically shows a third folding station according to the invention, during performance of a third folding step;

Fig. 5 shows, in perspective top plan view, an apparatus according to the invention with two successive folding stations and a pressing-on station;

Figs. 6A-D schematically show, in top plan view, cross-sections of different corner reinforcing variants that can be realized with an apparatus according to the invention; and

Figs. 7A-C schematically show three successive folding steps of an alternative folding manner for realizing a corner reinforcement according to Fig. 6B or 6C.

[0011] Fig. 1 shows an exemplary embodiment of a blank 1 from which, with the aid of a method and apparatus according to the invention, a package 2 can be set up as shown in Fig. 2. Where, in the continuation of this description "an inside" or "folding inwards" of the blank is mentioned, the top side of the blank 1 visible in Fig. 1 is meant, while the term "outside" or "folding outwards" of the blank 1 refers to the underside, which is not visible in Fig. 1.

[0012] The blank 1 comprises a substantially rectangular bottom panel 4, which is provided on pair-wise opposite sides with first sidewall panels 5 and second sidewall panels 6. Further, four corner reinforcing panels 7 are provided, which are connected along first folding lines 11 to the first sidewall panels 5, on opposite sides thereof. By means of a second and third folding line 12, 13, the corner reinforcing panels 7 are subdivided into an initial strip 7A, a middle strip 7B and an end strip 7C, respectively. In alternative embodiments, the corner reinforcing panels 7 can be subdivided into more strips. The blank 1 can further comprise a lid panel 9, provided on opposite sides with third sidewall panels 8 and connected by a third side to one of the first sidewall panels 5, to a side thereof remote from the bottom panel 4.

[0013] Relevant to the present invention are the dimensions of the different blank parts in the direction of the arrow T, i.e. the conveying direction of the blank 1 during setting up thereof in a folding direction. As can be seen in Fig. 1, in this conveying direction T, the bottom panel 4 has a dimension B that is considerably smaller than the dimension H of the adjoining first sidewall panels 5 and the corner reinforcing panels 7. As can be seen in Fig. 2, in this manner, a package 2 is obtained with a relatively great height H when compared to the dimensions B, L of the bottom panel 5.

[0014] Further, the second and third sidewall panel 6, 8 each have a dimension W in a direction at right angles to the conveying direction T that is preferably approximately half the height H mentioned, so that these sidewall panels 6, 8 together can form one closed sidewall of the package 2. Preferably, the corner reinforcing panels 7 have the same dimension W so that, from a viewpoint of material use, the blank 1 has an efficient, rectangular contour. A result of this dimensioning is that the corner reinforcements 3 have a relatively slim shape. The described package 2 is suitable as, for instance, outer package for so-called "bag-in-box"-packages, wherein, in the package 2, an inside bag formed from a foil material can be included, as shown and described in, for instance, NL 1 029 146 and NL 1 029 147 of applicant.

[0015] The corner reinforcing panels 7 can be folded over with a folding apparatus 10 according to the invention for forming substantially tubular corner reinforcements 3, with a cross-section closed upon itself, as shown in Fig. 6A. This folding over is carried out in a number of successive folding steps, in successive folding stations, which will presently be described in further detail, with reference to Figs. 3, 4 and 5.

[0016] In a first folding step, the corner reinforcing panels 7 are folded over along the first folding line 11, through an angle α of approximately 90 degrees, so that the corner reinforcing panel 7 extends substantially at right angles to the first sidewall panel 5, as shown in interrupted lines in Fig. 3a. This first folding step can be carried out on a conventional folding station (not shown), with a folding shoe that extends over virtually the entire length H of the corner reinforcement to be formed.

[0017] In a second folding step, the end strip 7C of the corner reinforcing panel 7 is folded inward along the third folding line 13, in the direction of the first sidewall panel 5, through an angle β of approximately 135 degrees, as shown in Fig. 3A.

[0018] This second folding step is carried out when a second folding station 20 is passed through, as shown in Figs. 3B and 5. To this end, the second folding station 20 comprises a folding shoe 22, which is suspended in a pivotal manner about a pivot 21 extending substantially parallel to the conveying direction T, and drive means 24 which allow the folding shoe 22 to be pivoted about this pivot 21 between an initial position I and an end position II, as shown in Fig. 3B. The folding shoe has a length L_2 which is preferably equal to the height H of the corner reinforcements 3, so that, upon folding, the corner reinforcements can be supported over the entire length. In the exemplary embodiment shown, the drive means 24 comprise a piston cylinder assembly, but, in alternative exemplary embodiments, can of course be designed differently. In the exemplary embodiment shown, the folding station 20 further comprises two guide plates 23,

25. These extend on either side of the corner reinforcing panel 7 which, in use, is fed along the folding station 20, as far as the third folding line 13 in this panel 7, so that the strips 7A, 7B will be more or less confined between these guide plates 23, 25 and cannot bend along when strip 7C is folded over. Furthermore, the guide plate 25 which, in use, is located at the inside of the corner reinforcing panel 7, can function as a stop for the folding shoe 22 and can be provided to that end with a bevelled top edge 27, as shown in Fig. 3b. Here, the angle of the bevel can substantially correspond to the desired folding angle, in the exemplary embodiment shown approximately 45 degrees.

[0019] After the outer strip 7C has been folded over, the folding shoe 22 is returned to the initial position I (see Fig. 3B). It can be seen in the Figure that this return movement can be carried out without disturbing the folded-in corner reinforcing panel 7, so that this return movement can be carried out with the panel 7 (at least partially) still present in the folding shoe 22. In order to prevent the folded over strip 7C from bouncing back to the original, unfolded condition, contiguous to the second station 20, a fixing element 28 is provided (see Fig. 5), which is arranged in the bounce-back trajectory of strip 7C and hence prevents it from bouncing back. Further, between the second and third folding station, one or more glue applicators 29 (not shown) can be provided for the application of glue against an outside of the folded-over end strip 7C.

[0020] In the third folding step, the corner reinforcing panel 7 is folded inwards along the second folding line 12 through an angle γ which, in the exemplary embodiment shown of Fig. 4A, is approximately 135 degrees. As a result, the previously folded-over end strip 7C, the outside provided with glue, comes to lie against the first sidewall panel 5, preferably such that an end edge of this strip 7C is at a short distance from the first folding line 11. Thus, a tube closed (virtually) upon itself with a triangular cross-section is formed.

[0021] This third folding step is carried out in a third folding station 30, as shown in Figs. 4B and 5. The third folding station 30 comprises a folding shoe 32, which is subdivided into a number of sub-shoes 32A,B,C. In the exemplary embodiment shown, these sub-shoes 32A,B,C have a substantially U-shaped cross-section, so that they can grip around the folded-over top edge of the corner reinforcing panel 7. Each sub-shoe 32A,B,C has a length L_d and is pivotally arranged about a pivot 31 which extends substantially parallel to the conveying direction T. The sub-shoes 32A,B,C are mutually independently pivotable between an initial position I and an end position II, with the aid of drive means 34A,B,C provided therefor. These drive means 34A,B,C can comprise, for instance, a piston cylinder assembly, as shown, but can naturally comprise other drive techniques too, such as electromechanical or pneumatic drive means.

[0022] At the start of the third folding step, all sub-shoes 32A,B,C are in the initial position I. When the corner reinforcing panel 7 is located in front of the sub-shoes 32A,B,C, they are simultaneously moved towards their end position II. In order to prevent the corner reinforcing panel 7 from bouncing back, the sub-shoes 32A,B,C are preferably held in the end position II mentioned, until the corner reinforcement 3 has left the folding station 30. However, this is impossible with a blank 1 as shown in Fig. 1, wherein the length B of the bottom panel 4 between successive corner reinforcing panels 7', 7" is shorter than the length H of the corner reinforcing panels 7', 7". With such dimensions, a subsequent corner reinforcing panel 7" will arrive at the third station 30 before the previous corner reinforcing panel 7' has completely left this station 30. However, owing to the sub-shoes 32A,B,C, according to the invention this is no problem as the first sub-shoe 32A (viewed in conveying direction T) can be returned immediately after the first corner reinforcing panel 7' has passed this sub-shoe 32A. As a result, the following corner reinforcing panel 7" can enter the station 30. The following sub-shoes 32B,C can be pivoted open in a corresponding manner directly after the first corner reinforcing panel 7' has passed. When the following corner reinforcing panel 7" is located entirely in the third folding station 30, then, the sub-shoes 32A,B,C can be simultaneously moved to the end position II. Etc.

[0023] Thus, the corner reinforcements 3 can be realized having a length H which is considerably greater than the length B of a panel 4 located, viewed in conveying direction T, between successive corner reinforcing panels 7', 7". The minimum length B_{min} required of such an intermediate panel 4 can be determined on the basis of the following formula:

$$B_{min} \geq L_d + v_T * T_s + C \quad (1)$$

wherein L_d is the length of a sub-shoe 32A,B,C, v_T is the conveying velocity of the blank 1, T_s is the time required for returning a sub-shoe 32A,B,C from the end position II to the initial position I, and C is a safety factor, which can have a constant value or depend on, for instance, the conveying velocity v_T .

[0024] Suppose, for instance, that the conveying velocity V_T of the blank is 1 m/s and the sub-shoes 32 require a time T_s of 30 milliseconds for returning to the initial position I. During this time, the blank 1 moves over a distance $v_T * T_s + 30$ mm. The minimum length B_{min} of the intermediate panel must therefore be at least 30 mm longer than the length L_d of the sub-shoe 32A,B,C, and preferably even slightly longer, which can be guaranteed by the safety factor C.

[0025] Conversely, with formula (1), a maximum length $L_{d,max}$ of the sub-shoes and the required number thereof can be determined, when the blank dimensions B, H, the conveying velocity VT and the withdrawal time T_s of the sub-shoes 32 is known. Suppose, for instance, that the bottom length B is 200 mm, the conveying velocity V_T is 1 m/s and the

withdrawal time T_s is 30 msec. It then follows from the formula (1) that the length $L_{d,max}$ of a sub shoe can be, at most 170 mm ($L_{d,max} \leq B - v_T \cdot T_s - C \Rightarrow L_{d,max} \leq 200 - 30$ mm) and is preferably somewhat shorter, in view of the safety factor C. Suppose that the length H of the corner reinforcements is 300 mm, two sub-shoes can suffice, that can each have a length of 150 mm. When a length H of 400 mm is desired, three sub-shoes are required, which may each have a length L_d of approximately 130 mm. When a length of 500 mm is desired, either three sub-shoes, which then, can each have a length L_d of approximately 165 mm, may just suffice, or, what is safer in such a case, four sub-shoes can be utilized, each having a length L_d of approximately 120 mm.

[0026] In addition to or instead of the length L_d of the sub-shoes and/or the number of sub-shoes, naturally also the conveying velocity v_T of the blank 1 can be varied. However, this conveying velocity will often be fixed, at least be imposed by a following process step, for instance the filling of the set-up packages.

[0027] After leaving the third folding station 30, the corner reinforcement 3 passes through a fourth folding or pressing-on station 40 (see Fig. 5), which is designed for pressing the corner reinforcement formed in the previous steps into its end position. This fourth folding or pressing-on station 40 has a similar structure as the third folding station 30, i.e. three movably arranged press-on elements 42A,B,C, mutually independently drivable by means of drive means suited to that end (not shown). Here, the number of press-on elements 42 and the drive thereof is similar to that of the sub-shoes 32 in the third folding station 30. Therefore, separate discussion seems unnecessary.

[0028] After this, the corner reinforcements 3 formed can further be guided along a fixedly arranged pressing element 50, in order to allow the glue sufficient time to dry. To this end, the length of this pressing element 50 can vary, depending on, inter alia, the conveying velocity v_T , the glue used and the required time for drying, etc.

[0029] As stated, with the apparatus 10 and method described hereinabove, tubular corner reinforcements 3 can be realized with a triangular cross-section substantially closed upon itself, as shown in Fig. 6A. However, it will be clear that with relatively limited modifications in the number of folding steps and folding stations, the folding direction (inwards or outwards) and/or the folding angle (α , β , γ), many alternative corner reinforcements can be realized, with different cross-sections. Three possible exemplary embodiments thereof are shown in Figs. 6B-D. Naturally, many other variant embodiments are possible.

[0030] For instance, a corner reinforcement 103 according to Fig. 6B can be formed on an apparatus 10 similar to the one described hereinabove. The first folding step can even be performed completely analogously. With the second folding step, an end strip 107C can be folded outwards around a third folding line 113 (instead of inwards as shown in Fig. 3A), through an angle β' which will be smaller than the angle β shown in Fig. 3A. During the third folding step, the middle strip 107B can be folded inwards through an angle γ' , along the second folding line 112, in a manner similar to the one shown in Figs. 4A and 4B. Here, the folding shoe can have a somewhat adapted cross-sectional shape in order to extend about the folded over top edge 107B,C. In this case too, the folding shoe of the third folding station can be divided into a number of sub-shoes, when the length H of the corner reinforcement 103 is greater than the length B of the intermediate bottom panel. Optionally, the folding shoe of the second folding station too can be subdivided into several sub-shoes, in order to retain the fold formed during this station for as long as possible.

[0031] Alternatively, the corner reinforcement 103 shown in Fig. 6B can be realized according to the three folding steps shown in Figs. 7A-C. Here, the first folding step can, once more, be analogous to the above-described first folding step. During the second step, the middle strip 107B with the end strip 107C on it is folded inwards around the second folding line 112, through an angle β' of approximately 90° , with the aid of a folding shoe (now shown) and an internal folding shoe 125. During the third folding step, the middle strip 107B is folded further around the second folding line 112 and at the same time, the end strip 107C is folded in opposite direction, around the third folding line 113, so that this end strip 107 comes to lie against the first sidewall panel 5. To that end, the folding shoe 132 of the third folding station 130 can have an angular shape as shown in Figs. 7B,C and is preferably subdivided into a number of sub-shoes according to the invention. Alternatively, the folding shoe 132 can be designed in one piece. In that case, a fixing element can be arranged immediately after the folding shoe 132, which can take over the folded-over panel 107 from the folding shoe 132 and can prevent bouncing back, so that the folding shoe 132 can be returned in a manner comparable to that as described for the fixing element 28 in Fig. 5. Further, after the third folding station 130, once more, a press-on station 140 can be provided with movable press-on elements 142, in order to press and fix the corner reinforcement into its end position.

[0032] The corner reinforcement 203 according to Fig. 6C can be realized according to the same two manners of folding and with comparable folding means as the corner reinforcements 103 of Fig. 6B. This third corner reinforcing variant 203 offers the advantage that it takes up minimal space in the package 2, and can be appropriately contiguous in case the package is intended for rectangular products.

[0033] With above-mentioned variant embodiments the blank can always be passed along the successive folding stations at a constant conveying velocity. Alternatively, when passing through the folding stations, the conveying velocity can be adapted or the conveyance can even be temporarily stopped. Especially when realizing the corner reinforcement variant 103 according to Fig. 6B, stopping offers advantages, in particular upon accurate positioning of the end strip 107C. This can be understood as follows. When the end strip 7C, 107C, 207C is brought into contact with the first

sidewall panel 5, between the two surfaces, frictional forces will be formed whose processing direction is opposite to the conveying direction T. The frictional forces apply a moment to the corner reinforcement 3, 103, 203 that will have the corner reinforcement to rotate around an axis extending at right angles to the first sidewall panel 5, and intersecting the first folding line 1, 11, 211. In the variant embodiment according to Fig. 6B, this moment is the greatest as the distance
 5 A between the frictional forces and the rotation axis is the greatest. As a result, the end strip 107C runs a relatively great risk of being fixed in a rotated or, viewed in the conveying direction, rearward displaced position relative to the first folding line 111, which adversely affects the strength of the corner reinforcement realized. All this can be prevented by temporarily stopping the conveyance of the blank, so that the frictional forces and the moment are zero. With the variant embodiments according to Figs. 6A and C, the above-mentioned problems occur to a far lesser degree, as the frictional moment is
 10 smaller and, moreover, the end strips 7C, 107C, respectively, abut against the first folding line 11, 211 or are at a small distance thereof, so that these strips 7C, 107C hardly have space, if at all, for rotation.

[0034] Finally, Fig. 6D shows a corner reinforcement 303 with a substantially square cross-section closed upon itself. Such a corner reinforcement 303 can be realized by means of four successive folding steps, while, successively, an initial strip 307A, an end strip 307D, a first middle strip 307C and a second middle strip 307B are folded inwards through
 15 an angle of approximately 90 degrees.

[0035] The invention is not limited in any manner to the exemplary embodiments represented in the specification and the drawings. All combinations of (parts of) embodiments described and/or shown are understood to fall within the inventive concept. Furthermore, many variations thereon are possible within the framework of the invention as outlined by the claims.

[0036] For instance, the sub-shoes can be driven by one common drive means, while suitable mechanisms or electronic delay means can be provided for moving the sub-shoes in the correct order and at the desired intervals. Further, parts of the corner reinforcing panels can be folded over against each other and be, optionally, glued so that when, thereupon, the corner reinforcing panel is set up in one of the above-described manners, a corner reinforcement is obtained with sides of at least partly double-walled or multi-walled design. The folding shoe of the second folding station in Fig. 5 can
 25 also be subdivided into sub-shoes so that the fixing element 28 can be omitted.

[0037] These and many variants are understood to fall within the framework of the invention as set forth in the following claims.

30 Claims

1. A folding apparatus, comprising a number of folding stations, designed to set up a package with relatively elongated corner reinforcements from a blank with corner reinforcing panels, wherein these corner reinforcing panels are folded over in a number of successive folding steps, along folding lines provided therefor, with the aid of folding shoes
 35 movably arranged in the folding stations, wherein the folding shoes have a length which substantially corresponds to that of the fold to be realized, wherein at least one of the folding shoes is subdivided into several sub-shoes, which are mutually independently movable.
2. A folding apparatus according to claim 1, wherein drive means of the folding shoes are designed for having them
 40 simultaneously carry out a folding movement, as if they were one folding shoe.
3. A folding apparatus according to claim 1 or 2, wherein drive means of the sub-shoes are designed for returning them one by one after a folding movement.
4. A folding apparatus according to claim 3, wherein the drive means are designed for returning the respective folding
 45 shoes in an order in which they are passed through by the corner reinforcing panel to be folded over.
5. A folding apparatus according to any one of the preceding claims, wherein drive means of the sub-shoes are designed for returning a sub-shoe following a folding movement, after a corner reinforcing panel folded over therewith has
 50 completely passed this respective sub-shoe.
6. A folding apparatus according to any one of the preceding claims, wherein at least the folding shoe of the last folding station is subdivided into sub-shoes.
7. A folding apparatus according to any one of the preceding claims, wherein a distance between two successive corner reinforcing panels of a blank conveyed, during use, along the folding stations, is smaller, measured in this conveying direction, than the length of the folding shoes.

8. A folding apparatus according to any one of the preceding claims, wherein a length (L_d) of the sub-shoes meets the following formula

$$L_d \leq B - v_T * T_s - C$$

wherein

B is the distance between two successive corner reinforcing panels of a blank which is conveyed, in use, along the folding apparatus;

v_T is the conveying velocity of said blank;

T_s is the time required for returning the respective sub-shoe following a folding movement; and

C is a safety factor which can depend on v_T or can have a constant value.

9. A folding apparatus according to any one of the preceding claims, wherein the number of folding shoes (N) into which the folding shoe is subdivided meets the following formula:

$$N = \frac{H}{B - v_T * T_s} \text{ wherein N is rounded off to the nearest whole number, and wherein:}$$

H is the length of the corner reinforcing panels which, in use, are conveyed along the folding apparatus, measured in the conveying direction;

B is the distance between two successive corner reinforcing panels of a blank which, in use, is conveyed along the folding apparatus;

v_T is the conveying velocity of said blank;

T_s is the time required for returning the respective sub-shoe following a folding movement.

10. A folding apparatus according to any one of the preceding claims, wherein all folding shoes are designed for carrying out a folding movement inwards.

11. A folding apparatus according to any one of claims 1 - 9, wherein at least one of the folding shoes is designed for carrying out a folding movement outwards, and the remaining folding shoes are designed for carrying out a folding movement inwards.

12. A folding apparatus according to any one of claims 1 - 10, comprising three folding stations, designed for carrying out three successive folding steps, wherein, in use, a corner reinforcing panel passed along these folding stations is folded over along three respective folding lines for forming a tubular corner reinforcement with a triangular cross-section.

13. A method for setting up a package with relatively elongated corner reinforcements from a blank, wherein corner reinforcing panels of this blank are directed along successive folding shoes, which fold the panels over by means of a folding movement along respective folding lines, wherein at least one of the folding shoes is subdivided into sub-shoes which are returned one by one after a folding movement.

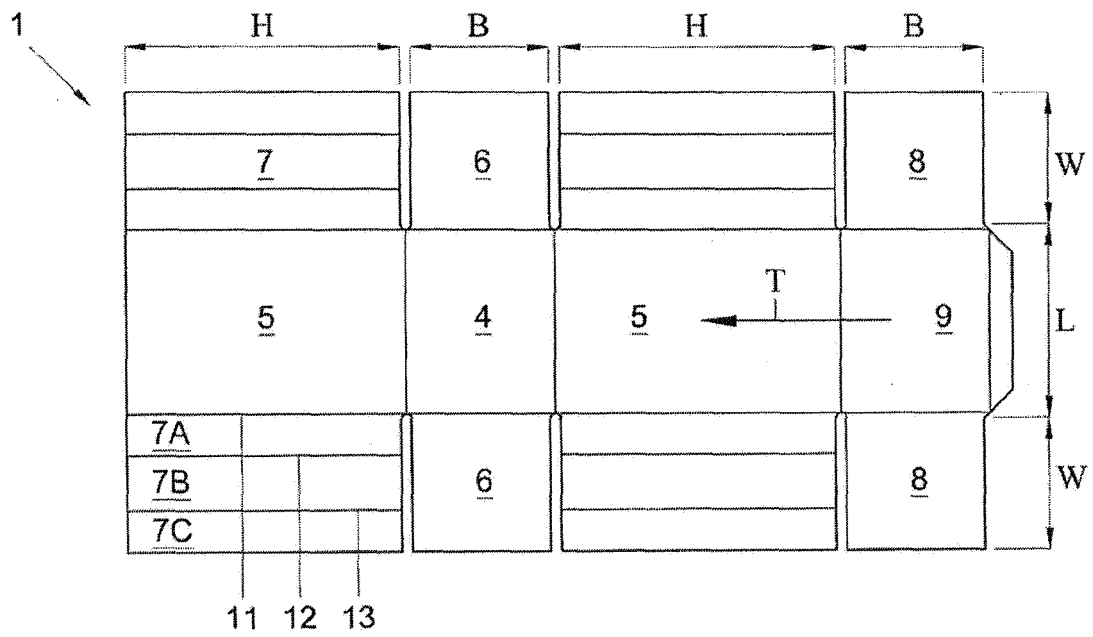


Fig. 1

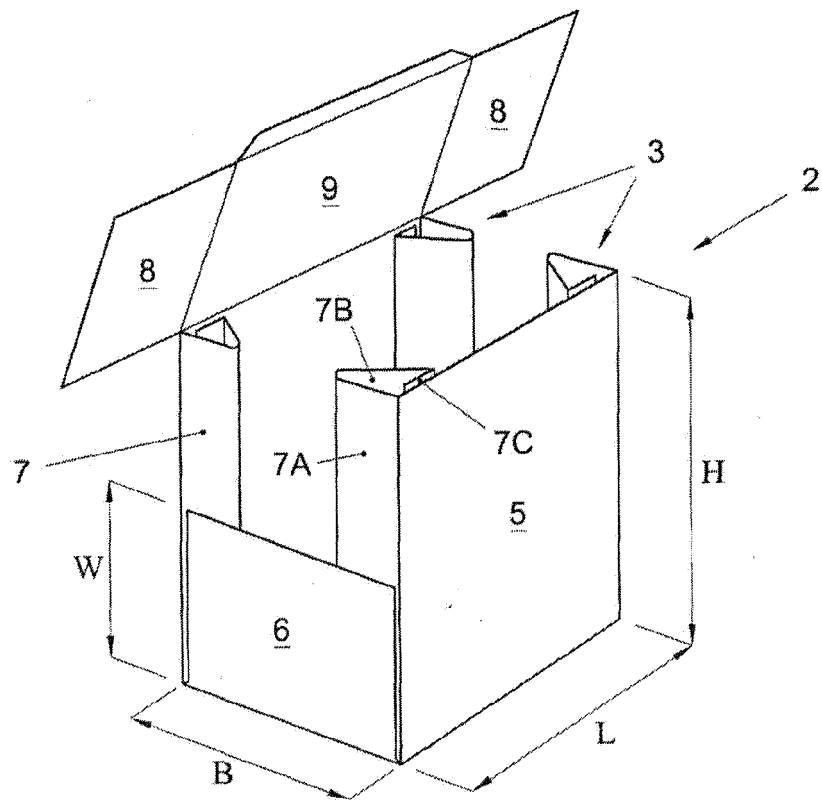


Fig. 2

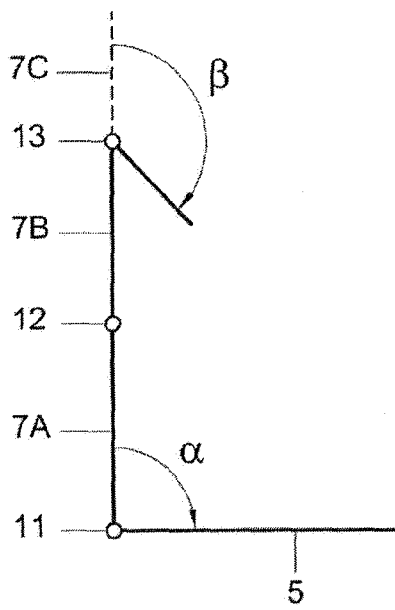


Fig. 3A

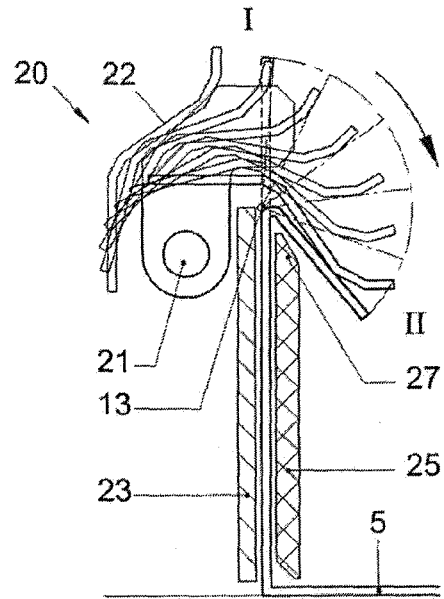


Fig. 3B

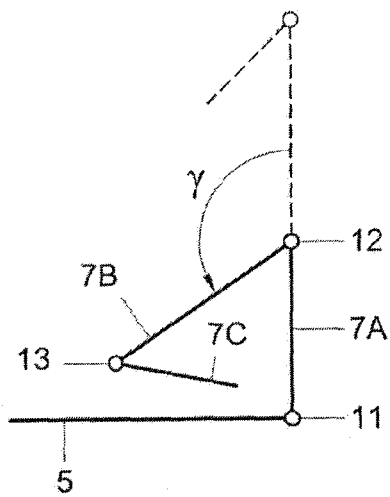


Fig. 4A

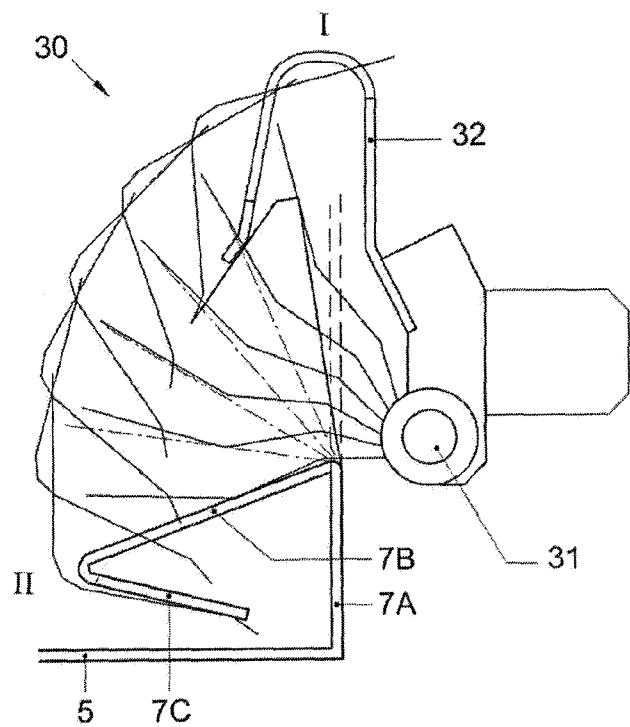


Fig. 4B

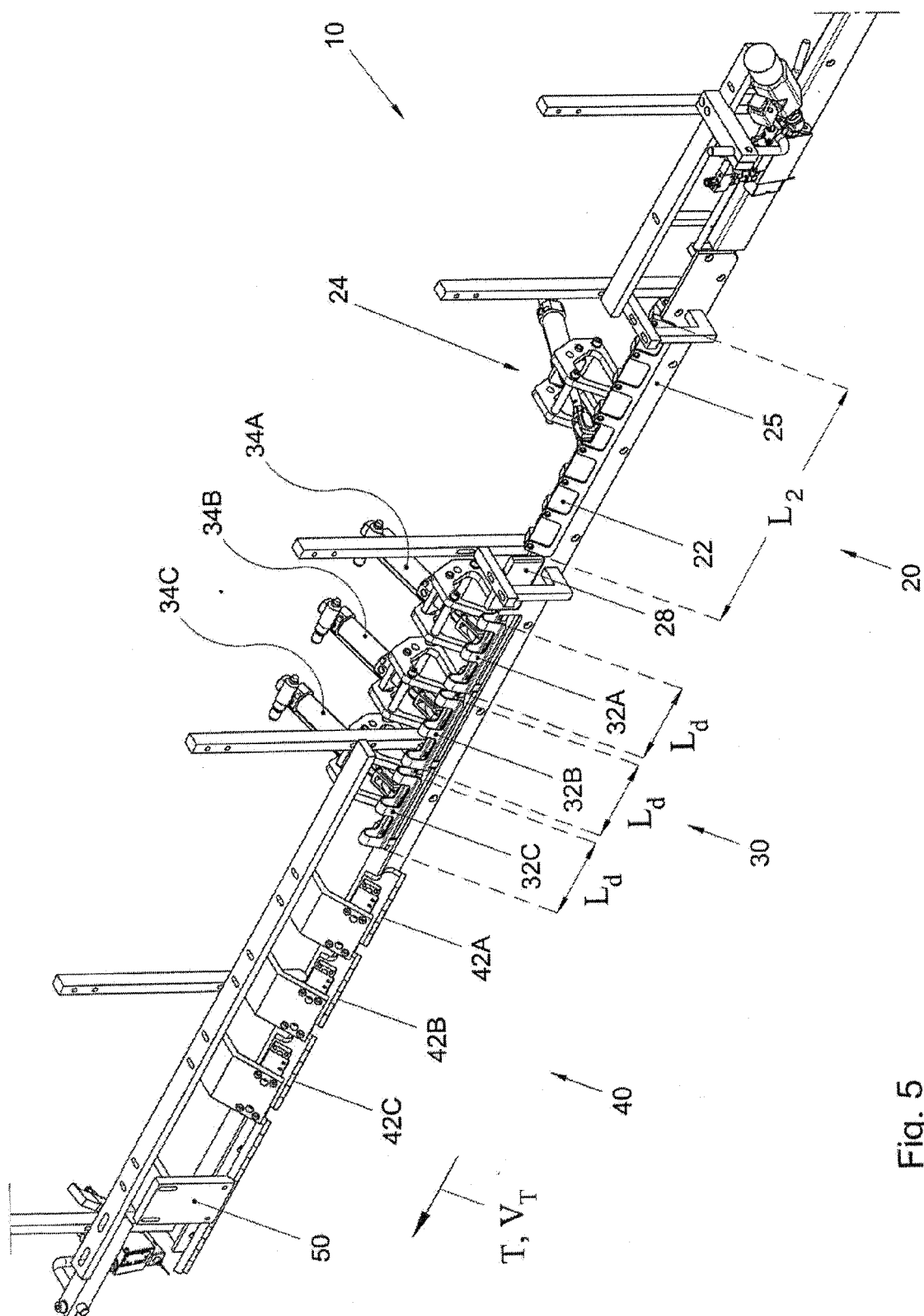


Fig. 5

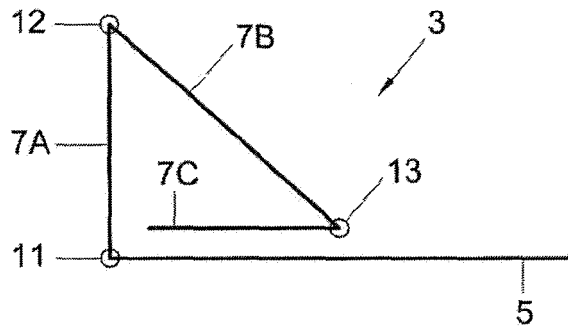


Fig. 6A

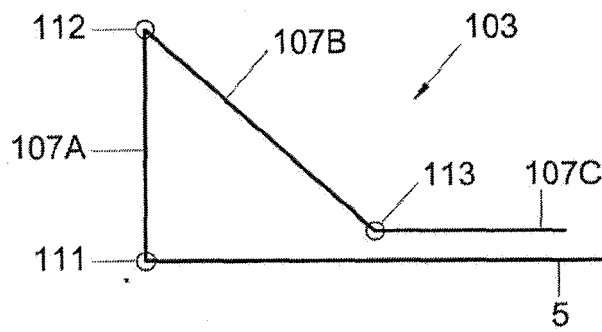


Fig. 6B

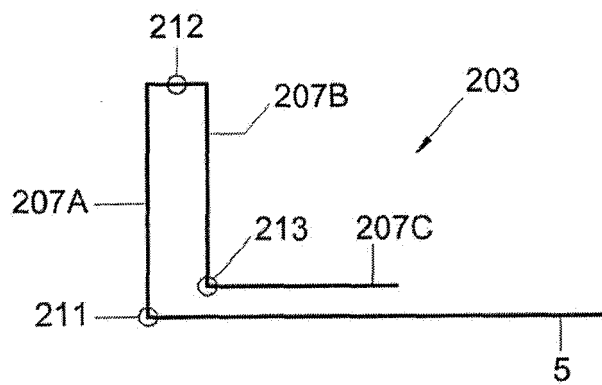


Fig. 6C

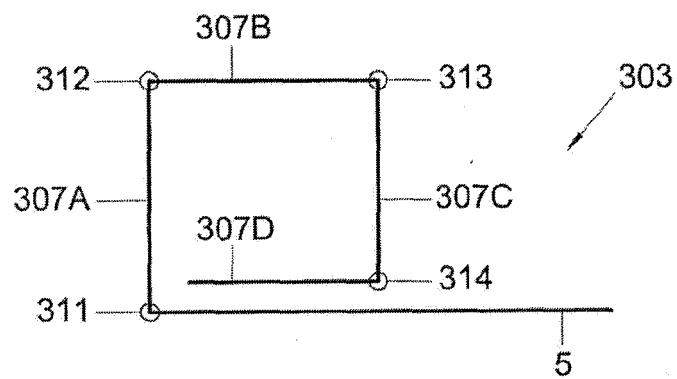


Fig. 6D

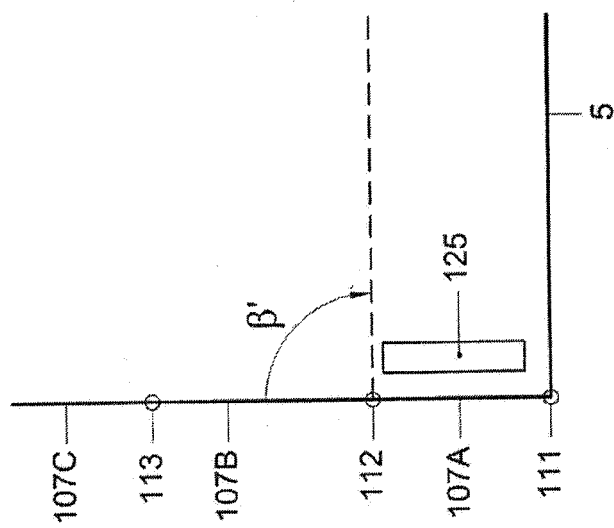


Fig. 7A

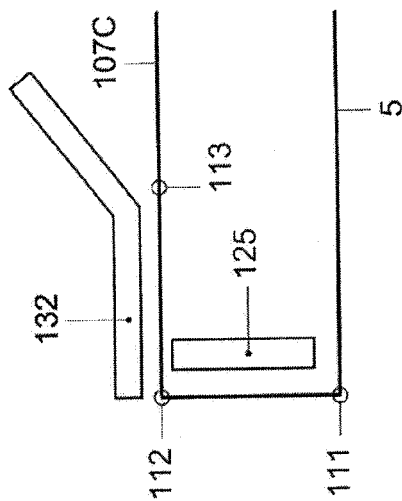


Fig. 7B

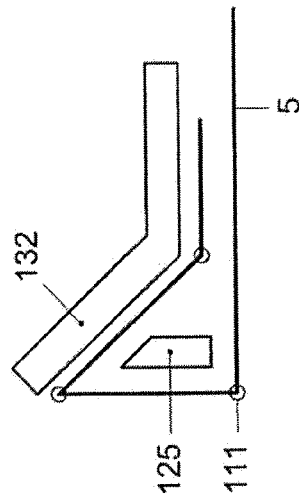


Fig. 7C



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 11 1299

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 3 626 660 A (DORFMANN OSKAR) 14 December 1971 (1971-12-14) * column 1, line 31 - column 3, line 2 * * column 5, line 6 - column 8, line 30; figures 1-9 *	1-13	INV. B65D5/44 B65D5/50 B31B1/54 B31B3/26 B65B43/26
A	US 2003/066871 A1 (DALRYMPLE BRUCE H [US]) 10 April 2003 (2003-04-10) * abstract; figures 1,2 *	1,13	
A	FR 1 054 991 A (IMPRIMERIE DES ARCHIVES) 15 February 1954 (1954-02-15) * figure 5 *	1,13	
A	FR 1 492 259 A (VERRERIES APPLIQUEES) 18 August 1967 (1967-08-18) * page 2, line 23 - page 4, line 5; figures 1-8 *	1,13	
			TECHNICAL FIELDS SEARCHED (IPC)
			B65D B31B B65B
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		24 September 2007	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			

4
EPO FORM 1503 03.82 (P04C01)

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

EP 07 11 1299

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

24-09-2007

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 3626660	A	14-12-1971	NONE	
US 2003066871	A1	10-04-2003	US 2004171468 A1	02-09-2004
FR 1054991	A	15-02-1954	NONE	
FR 1492259	A	18-08-1967	NONE	

REFERENCES CITED IN THE DESCRIPTION

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

Patent documents cited in the description

- NL 1029146 [0014]
- NL 1029147 [0014]