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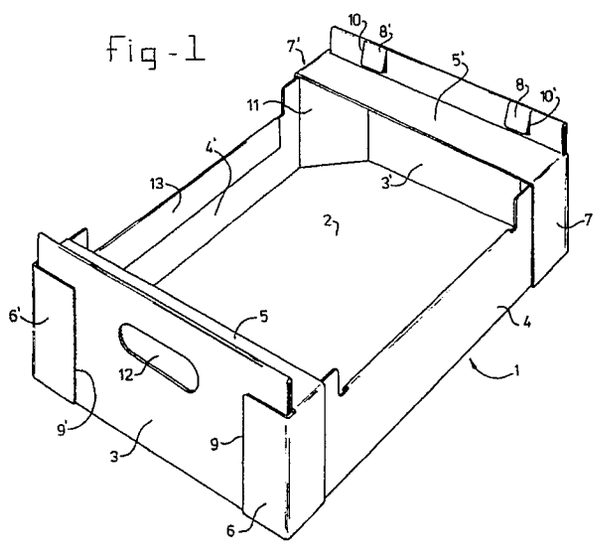
(54) **Blank for the production of a box made of folding sheet material, and box produced of such blank.**

(57) The invention relates to a blank of folding sheet material such as cardboard for the production of a box with flanges (5, 5') running along a first pair of side walls (3, 3') at a distance from the top edge thereof. To improve the stacking strength of such box and to allow that such box can be made of solid cardboard, the blank to make such box is designed such that the flanges (5, 5') are connected to the second pair of side walls (4, 4') by corner pieces (7, 7') which can have extentions (6, 6') so that angle sections are present in the corners of the box. According to the present invention, the box can further be strenghthened by additional corner reinforcements (11), which are also part of the blank. To improve prevention of mutual movement of boxes in a stack, lips (8, 8') can be situated above the flanges (5, 5') at the first pair of side walls (3, 3'), forming stops that can interact with stop edges (9, 9') situated on the outside of the next box placed with the bottom on the flanges mentioned. The blank to make a box according to one of the embodiments of the present invention is designed such that waste of material is minimized.

Fig-1



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The invention relates to a blank of folding sheet material such as cardboard for the production of a box comprising a bottom and two pairs of side walls situated opposite each other and connecting thereto and having flanges running along the first pair of side walls at a distance from the top edge thereof, the blank comprising a bottom panel and two pairs of side wall panels situated opposite each other and connecting by means of fold lines to the bottom panel, the first pair of side wall panels having a first and second fold line, of which the first runs at a distance from the edge of the side wall panel facing away from the bottom panel which corresponds approximately to the width of the flange, and the second fold line runs at a distance parallel to the first fold line, which distance corresponds approximately to the distance of the flange from the top edge of the first pair of side walls of the box. The invention also relates to a box produced from such blank.

The advantage of a box of folding sheet material is that it is fairly simple and cheap to produce. With the aid of flanges running below the upper edges of the box, a relatively broad bearing face is present so boxes of this type can easily and properly be stacked even when they are made of thin walled solid cardboard and without the necessity of a lid. In addition, the parts of the first pair of side walls projecting above the flanges prevent slipping of a box placed on top of the flanges in a direction perpendicular to the lengthwise direction of the flanges and can wedge it between them, so that slipping in the lengthwise direction of the flanges is limited. So these boxes can be stacked rather easily and the boxes in a stack are held against slipping relative to each other during, for example, transportation or transshipment. This means that the transmission of the load stacked on such a box to its side walls is rather convenient, resulting in a box with improved strength compared to boxes without flanges extending below upper edges which are stacked on each other with the bottom placed on the rather narrow sidewall edges of the previous box and which can slip relative to each other.

Furthermore, these parts of the first pair of side walls projecting above the flanges, interacting with a box placed on the flanges, can prevent the box from bulging and thereby losing some load carrying capacity.

In this way it is ensured that the load of a box placed on the flanges is accommodated correctly, while the boxes are prevented from being able to slide relative to each other, which ensures that a good load transmission is maintained during, for example, transportation.

In order to make such a box stackable, it will often be necessary to give the first pair of side walls along which the flanges run a taper in the direction of the bottom of the box.

The known box has a number of additional advantages. For example, handling slits can be provided in a fairly simple manner in the first pair of side walls along which the flanges run. These slits always have to be provided at some distance below the edge of the box, in order to permit sufficient load carrying capacity. In the case of the box according to the present invention this can be achieved by providing the handling slits directly below the flanges. This means that the box need not be of greater height, which is the case with other boxes. Moreover, the second pair of side walls can be freely dimensioned. These walls can be, for example, greatly lowered for, for example, necessary throughflow apertures for air, without the functioning of the box being adversely affected.

A blank and box produced thereof as described in the preamble is known from US-A-2.588.455, BE-A-63.1250 or WO-A-88.02724. According to those patents, the flanges are supported along their innermost edges by strips which are foldable connected to those edges and extend to and terminate at the bottom or the first pair of sidewalls of the box. There, the supporting strip is either glued to the bottom or side wall or abuts against the bottom. According to US-A-2.588.455 the side edges of the supporting strips are connected to the second pair of side walls by flaps foldably connected thereto. To produce such box, the first side wall panel of the blank comprises a third fold line running parallel to the first and second fold lines, closest to and at a distance from the edge of the blank which corresponds to the height of the supporting strip.

However, such known box and blank have also disadvantages. For instance, when rather thin solid card board is used to produce such box, the supporting strip will rather easily bend under load from the flanges, and its loadability will decrease, decreasing the stacking strength of the box. The connection of the supporting strips to the second pair of side wall panels, as at US 2.588.455 doesn't solve this problem correctly. So such box is tipically produced from rather thich corrugated board, which can not be used for packaging moist products such as vegetables or fruit, unless they are coated with a rather expensive coating which also decreases the possibility to recycle the material used in such box. The result of this is that wooden packing cases are still commonly used for packing and transporting relatively heavy products such as, for example, vegetables and fruit. Like cardboard boxes, such packing cases are used only once, and from the point of view of recycling it is therefore preferable to use cardboard boxes rather than wooden packing cases. The packing industry is therefore making assiduous efforts to find a card-

board alternative to such wooden packing cases. Such boxes, which are mass products, are typically produced from a single blank. This gives the advantage that in a folding glueing machine only one feed flow of cardboard need be taken into account. This reduces, inter alia, the risk of faults. The development of a box which can be made from a blank does, however, call for a considerable degree of inventiveness, despite -or perhaps because- a design of a new blank compared to the state of the art seems to simply move fold lines and cutting lines.

The present invention makes a contribution to the problem outlined above. To this end, the present invention provides a blank of the type mentioned in the introduction of the description and a box produced therefrom, in which the first pair of side wall panels further having two first side flaps lying opposite each other which by means of a third fold line running parallel to the side edges of said first pair of side wall panels are foldably fixed to the part of the side wall panel situated between the edge thereof facing away from the bottom panel and the first fold line to form corner pieces at the box.

Thus the flanges are supported in a better way because they are connected to the second pair of side walls at their side edges without intervention of a supporting strip, increasing the strength of the box and allowing that solid card board can now be used. At the same time the corners of the box are strengthened by the corner pieces, improving the loadability of the box in a stack even more. These corner pieces can be inside or outside the box.

Moreover, since the supporting strips for the flanges are no longer necessary, the material consumption of a blank according to the present invention is decreased by two times the height of those strips when compared to blanks according to the patents mentioned. Thus the invention yields a recycable product with improved strength and efficient to produce.

In order to further strengthen the box according to the present invention, it is preferable when the first side flaps of the first pair of side wall panels of the blank according to the present invention have a fold line running approximately parallel to the first and second fold line to form extended reinforcement corner pieces. Then, additional angle sections extend along the height of the box and in the corners and are connected thereto, which are very effective in compression. These reinforcement corner pieces can be situated on the inside or on the outside of the box, or on the inside along one side wall and on the outside along the other.

To even further strengthen the box according to the present invention, it is preferred to provide an additional corner reinforcement next to the reinforcement corner pieces inside the box in the corners where the side walls connect to each other. This further increases the bearing capacity of the box according to the present invention. To this, the first pair of side wall panels of the blank to produce such box has second side flaps lying opposite each other which are foldably fixed thereto between the edge of the first pair of side wall panels lying against the bottom panel and the second fold line to form additional corner reinforcements in the box. Such blank has a rather complex design, but still consumes as much material as blanks according to the present invention with less features to strengthen the corners, since the second side flaps are situated in an area of the blank which is normally wasted. These second side flaps can have two additional parallel fold lines lying at a distance from each other, to produce corner pieces with triangular cross section, which are very strong in compression.

This final preferred form of the box according to the present invention, with the reinforcement corners and the additional corner reinforcements, has a large amount of material in the corners, which is beneficial for the bearing capacity. The stacking strength of such box, made of about 1 mm. thick solid cardboard is comparable to that of a typical wooden packing case.

It is possible to make the box according to the present invention in the form of a so-called "ready box", so that empty boxes can be folded up and then put into the ready state by means of a simple folding movement.

In order to make this possible, it is necessary for the second pair of side walls to have fold lines running from the bottommost corner points at an angle of approximately approximately 45° to the bottom edge of the second pair of side walls, and for the flanges to have fold lines running from the corner points at the side of the first pair of side walls at an angle of approximately 45° to the bottom edge of this first pair of side walls.

The box according to the present invention can also be formed in such a way that thickened parts or lips are situated above the flanges at the first pair of side walls, of which the edges form stops which can interact with stop edges located on the outside of the next box placed with the bottom on the abovementioned flanges. This measure ensures that a stacked box is virtually immovable in the plane of the flanges.

If the part of the reinforcement corner pieces running along the first pair of side walls is provided on the outside of the box, the sides thereof can form the stop edges which can interact with the thickened parts or lips above the flanges of the box on which it is situated.

The invention will now be explained in greater

detail with reference to the appended drawings, showing some non-limiting preferred embodiments, in which:

Fig. 1 shows a perspective view of a box according to the present invention;

Fig. 2 shows a part of a blank in top view for the production of a box according to the present invention;

Fig. 3 shows in perspective view a part of the blank of Fig. 2 in a partially folded state;

Fig. 4 shows in perspective view a part of the box of Fig. 1 in another embodiment;

Fig. 5 shows in perspective view a part of the box of Fig. 1 in another embodiment, in which the box is a ready box;

Fig. 6 shows in perspective view a corner piece of the ready box of Fig. 5 in the partially folded-up state;

Fig. 7 shows a part of a blank in top view for the production of a ready box according to the present invention.

Fig. 1 shows a box 1. This box 1 has a bottom 2 which has to carry the product stored in the box. A first pair of side walls 3, 3' lying opposite each other and a second pair of side walls 4, 4' lying opposite each other connect to the bottom 2. Flanges 5, 5', lying approximately at right angles to the walls of this first pair of side walls 3, 3', and projecting into the box 1, run along the first pair of side walls 3, 3' at a distance from the top edge thereof. These flanges 5, 5' thus form a resting surface for the bottom of a box to be placed on said box 1. The part of the first pair of side walls 3, 3' projecting above the flanges 5, 5' prevents a box placed on said box 1 from being able to slip in a direction parallel to the second pair of side walls 4, 4'. In turn, the bottom side of a box placed on said box will prevent the top edges of the first pair of side walls 3, 3' from being able to move towards each other under the load of the contents of the box 1, which can occur if the bottom 2 thereof is not supported. The so-called bulging of the second pair of side walls 4, 4' is avoided in this way, which is beneficial for the bearing capacity of the box 1. By means of the flanges 5, 5' the load of a box placed on said box 1 is transmitted uniformly to the side walls of the box 1. For this, the flanges 5, 5' have to be fixed to the side walls 3, 3' respectively.

In the corners where the respective side walls 3, 3' and 4, 4' connect to each other reinforcement corner pieces 6, 6' and 7, 7' are provided, in this case being located entirely on the outside of the box 1. By means of these corner reinforcements the box 1 is reinforced at the places where the load of boxes placed on said box 1 acts, namely in the corners.

Above the flanges 5, 5' lips 8, 8' project from the face of the first pair of side walls 3, 3' inwards into the box. The edges 10, 10' thereof form stops which can interact with the stop edges 9, 9' of the reinforcement corner pieces 6, 6' and 7, 7' of the next box placed on said box 1, as a result of which that box cannot slip in a direction parallel to the lengthwise direction of the first pair of side walls 3, 3' . A very good nesting of boxes stacked on top of each other is obtained in this way.

Additional corner reinforcements 11 are then provided inside the box in the corners where the side walls connect to each other.

Fig. 1 thus shows a particularly stable box which is preferably very suitable for making out of solid cardboard, but can also be made of other foldable sheet material, and is suitable for being folded from a single blank and glued. Since this box 1 has very strong corners, the bearing capacity is increased greatly compared to existing cardboard boxes, while the production thereof has remained simple.

Such boxes can also be stacked neatly on top of each other and it is ensured that during, for example, transportation the connection between the individual stacked boxes is not lost, so that then also the boxes at the bottom of a stack remain uniformly loaded and will not give way.

As Fig. 1 shows, it is easily possible without further ado to provide handling slits 12 in the first pair of side walls 3, 3', without the side walls having to be additionally raised for this. In addition, it is, of course, also possible to provide apertures for the throughflow of air and the like in the side walls 3, 3' and 4, 4' or the bottom 2. Fig. 1 also shows that a part 13 of the second pair of side walls 4, 4' is simply folded over through 180°, so that large apertures are obtained between the individual boxes stacked on top of each other.

Fig. 2 shows in top view a quarter part of a blank for the production of the box 1 from Fig. 1. The lines of symmetry of the whole blank along which the part shown in Fig. 2 is cut off are indicated by the dashed and dotted lines 50 and 51. Parts of a bottom panel 100, one side wall panel of the first pair of side wall panels lying opposite each other and a side wall panel 101 of the second pair of side wall panels lying opposite each other are shown. The side wall panels 101, 102 connect by means of fold lines 122 , 123 to the bottom panel 100.

The side wall panel 102 has a first fold line 111 and a second fold line 112. The first fold line 111 runs at a distance from the edge 120 of the side wall panel 102 facing away from the bottom panel 100, which distance corresponds approximately to the width of the flange 5, 5' from Fig. 1. The second fold line 112 runs at a distance parallel to the first fold line 111, which distance corresponds approximately to the distance of the flange 5, 5'

from the top edge of the first pair of side walls 3, 3' of the box 1 from Fig. 1. Situated between the first fold line 111 and the second fold line 112 is an opening 105 in the blank, with at one of the edges a lip-shaped element 106 which can form one of the lips 8, 8' in Fig. 1.

For the production of the reinforcement corner pieces 6, 6' and 7, 7' from Fig. 1 the side wall panel 102 also has a first side flap 103 which is foldably fixed, by means of a third fold line 113 running parallel to the side 121 of this side wall panel, to the part of the side 121 of the side wall panel 102 situated between the edge 120 facing away from the bottom panel 101 thereof and the first fold line 111. This first side flap 103 also has a fold line 114 running approximately parallel to the first fold line 111 and the second fold line 112.

For the additional corner reinforcements 11 of the box 1 according to Fig. 1 the side wall panel 102 of the blank of Fig. 2 has a second side flap 104. This side flap 104 is foldably fixed between the edge 122 of the side wall panel 102 lying against the bottom panel 100 and the second fold line 112 to the side 121 thereof. This second side flap 104 also has two additional parallel fold lines 115 and 116 respectively lying at a distance from each other.

Also provided in the side wall panel 102 for the handling slit 12 is such a cut 130 that folding over the part 131 round the fold line 132 produces the handling slit 12. An incision 125 and a fold line 124 are furthermore provided in the side wall panel 101 in order to be able to fold over the part 13 of the side wall 4, 4' from Fig. 1.

Fig. 3 shows how the blank part of Fig. 2 can be folded to a shape corresponding to that of a part of box 1 from Fig. 1. An additional reinforcement at the position of the handling slit 12 can furthermore be achieved by folding the lip 131 in the side wall panel 102 inwards until it is against the bottom side of the flange 5' and glueing it thereon. Of course, the lip 131 can also be removed.

Fig. 4 shows another exemplary embodiment of the present invention. In this case the same reference numbers as those in Fig. 1 are used for the parts of the box 1 which have remained unchanged. The second side flap 104 from Fig. 2 for the additional corner reinforcement 11 is now folded in such a way that the adhesive strip 16 is visible. A lobe 14, 14' also projects through the flange 5'. There are openings 15 in the bottom 2. When boxes 1 are stacked on top of each other the lobes 14, 14' can project through the openings 15, so that the boxes can be fixed relative to each other in the plane of the flanges 5, 5'. A recess is also provided in the flange 5', and in the part of the side wall 3' projecting above the flange 5'.

Fig. 5 also shows another example of an embodiment of the present invention. The parts thereof remaining unchanged from those in Fig. 1 have the same reference numbers. The reinforcement corner pieces 7, 7' are now situated between the second pair of side walls 4, 4' and the additional corner reinforcements 11. Since Fig. 5 shows a ready box as a variant of the present invention, additional fold lines 160, 160'; 161, 161' and 162 are present in the box 1.

The fold lines 160, 160' are situated in the second pair of side wall panels 4, 4' and run from the bottommost corner points thereof at an angle of approximately 45o to the bottom edge of the second pair of side walls 4, 4'.

The fold lines 161, 161' are situated in the flanges 5, 5' and run from the corner points thereof lying at the side of the first pair of side walls 3, 3' at an angle of approximately 45° to the bottom edge of this first pair of side walls 3, 3'.

The fold lines 162 are situated in the additional corner reinforcements 11 on the bisector of the angle between the first and the second pair of side walls 3, 3' and 4, 4' respectively. It is preferable here in the manner known per se to make the part of the additional corner reinforcement 11 in which the fold line 162 is situated (the part between fold lines 115 and 116 in Fig. 7) of such dimensions that in the state in which the box is being used this part remains creased around fold line 162. In this way the tolerances as regards folding and the position of the fold lines can be absorbed, on the one hand, and it also provides the possibility of putting the additional corner reinforcement 11 into the position creased around the fold line 162 after the box is brought into the state for use, as shown in Fig. 5, which improves the dimensional stability of the box.

A part of the second pair of side walls 4, 4' runs through to above the flange 5', which also means that nesting in the plane of the flange 5' of boxes 1 stacked on top of each other is ensured.

In Fig. 6 it can be seen from another perspective view how a corner of the ready box of Fig. 5 can be folded up. The side wall 4' is in this case folded inwards along fold line 160', the additional corner reinforcement 11 folds inwards along the fold line 162 and the flange 5' folds upwards, folding taking place around the fold line 161'. In this way the whole box can be folded together to form a flat pack, the side wall 4' with the part 13 resting on the bottom 2, while the side wall 3' again rests on the side wall 4'.

The blank of Fig. 7 is largely the same as that of Fig. 2. Corresponding parts are therefore numbered the same. Compared with the blank according to Fig. 2, the following fold lines are added:

Fold line 160 in the second side wall panel

101, running at an angle of approximately 45° to the fold line 123 running along the bottom panel 100 from the corner point of the side wall panel 101 at the side of the bottom panel 100.

Fold line 161 in the first side wall panel 102, running at an angle of approximately 45° to the first fold line 111 from the end thereof, in the direction of the edge 120 facing away from the bottom panel 100.

Fold line 162 in the second side flap 104, between the two fold lines 115, 116 and at a distance from them and parallel to them.

When this ready box is being stuck together, the strip 150 of the first side flap 103 goes on the side wall panel 101. A connection must not be made between these parts in the region 171, 171'.

Fig. 7 also shows that the side wall panel 101 is enlarged compared with Fig. 2 until past the dashed line with double dot, so that, inter alia, the part 170 projecting above the flange 5' in Fig. 5 is produced. This can, of course, also be carried out in the case of the blank of Fig. 2. It is also indicated that the flange 5' of Figs. 1, 4 and 5 can be made of a strip of cardboard folded double. For this, the blank of Fig. 7 is extended past the edge 120 along, for example, the dashed lines with double dot 180, 181. In this extended part there is also a fold line 163, which is necessary for the ready box. If desired, the extended part situated between the fold line 163 and the line 180 and 120 can be omitted. The line 120 then becomes a fold line. This can also be achieved in the case of the blank according to Fig. 2, in which case the fold line 163 is not needed. The adjacent part bounded by the dashed lines with double dot 182, 183, 184 can be, for example, cut away or stuck against the side wall panel 101, with the exception of the zones 172, 172'.

It is, of course, clear that the examples of embodiments of the box according to the present invention described above and the blanks to be used for them are not limiting for the scope of the invention. For instance, the additional corner reinforcement 11 can be a flat part, extending from the corner towards the centre of the box, deviding the corner into two parts. All kinds of different combinations of the above-mentioned features are also possible for achieving a box which is within the scope of the invention as described in the appended claims.

It is also immaterial how exactly the edges of a blank run. This is, for example, illustrated by Fig. 7, where different edges extend in a staggered manner.

In essence, according to the present invention a box is provided with improved stacking strength, to be made from a single blank designed to minimise waste of material.

Claims

1. Blank of folding sheet material such as cardboard for the production of a box (1) comprising a bottom (2) and two pairs of side walls (3, 3' ;4, 4') situated opposite each other and connecting thereto and having flanges (5, 5') running along the first pair of side walls (3, 3') at a distance from the top edge thereof, the blank comprising a bottom panel (100) and two pairs of side wall panels (101, 102) situated opposite each other and connecting by means of fold lines (122, 123) to the bottom panel (100), the first pair of side wall panels (102) having a first (111) and second (112) fold line, of which the first (111) runs at a distance from the edge (120) of the side wall panel (102) facing away from the bottom panel (100) which corresponds approximately to the width of the flange (5, 5'), and the second fold line (112) runs at a distance parallel to the first fold line (111), which distance corresponds approximately to the distance of the flange (5, 5') from the top edge of the first pair of side walls (3, 3') of the box (1), **characterised in that** the first pair of side wall panels (102) further having two first side flaps (103) lying opposite each other which by means of a third fold line (113) running parallel to the side edges of said first pair of side wall panels (102) are foldably fixed to the part of the side wall panel (102) situated between the edge (120) thereof facing away from the bottom panel (100) and the first fold line (111) to form corner pieces (7, 7') at the box (1).

2. Blank according to Claim 1, **characterised in that** the first side flaps (103) of the first pair of side wall panels (102) have a fold line (114) running approximately parallel to the first (111) and second (112) fold line to form extended reinforcement corner pieces (6, 6').

3. Blank according to claim 1 or 2, **characterised in that** the first pair of side wall panels (102) has second side flaps (104) lying opposite each other which are foldably fixed thereto between the edge (122) of the first pair of side wall panels (102) lying against the bottom panel (100) and the second fold line (112) to form additional corner reinforcements (11) in the box (1)

4. Blank according to claim 3, wherein the second side flaps (104) have two additional parallel fold lines (115, 116) lying at a distance from each other.

5. Blank according to any of claims 1 - 4, **characterised in that** the second pair of side wall panels (101) has fold lines (160) running from the corner points at the side of the bottom panel (100) and at an angle of approximately 45° to the fold line (123) thereof running along the bottom panel (100), and in that the first pair of side wall panels (102) has fold lines (161) running from the ends of the first fold line (111) thereof, at an angle of approximately 45° to said first fold line (111), to the edge (12) of this first pair of side wall panels (102) facing away from the bottom panel (100).

6. Blank according to any of the preceding claims, **characterised in that** one or more openings (105) with lip-shaped elements (106) at one of the edges are present between the first (111) and the second (112) fold line.

7. Box (1) made of a blank according to any of the preceding claims, having a bottom (2) and two pairs of side walls (3, 3';4, 4') situated opposite each other and connecting thereto, with flanges (5, 5') running along the first pair of side walls (3, 3') at a distance from the top edge thereof, which flanges (5, 5') lie approximately at right angles to the walls of said first pair of side walls (3, 3') and project into the box (1), so that the bottom of the next box placed on this box (1) can rest on the above-mentioned flanges (5, 5'), **characterised in that** reinforcement corner pieces (7, 7') are provided in the corners of the box (1) and are foldably connected to the side edges of the flanges (5, 5') and lie flat on the second pair of sidewalls (4, 4') and are connected thereto .

8. Box according to claim 7, **characterised in that** the reinforcement corner pieces (7, 7') have flaps (6, 6') extending around the corner of the box (1) and connected to the first pair of side walls (3, 3').

9. Box according to claim 7 or 8, characterised in that at least the part of the reinforcement corner pieces (6, 6'; 7, 7') running along the first pair of side walls (3, 3') is situated on the outside of the box.

10. Box according to claim 7, 8 or 9, characterised in that an additional corner reinforcement (11) is provided inside the box in the corners where the side walls connect to each other.

11. Box according to any of the preceding claims 7-10, **characterised in that** the second pair of side walls (4, 4') has fold lines (160) running from the bottommost corner points at an angle of approximately 45° to the bottom edge of said second pair of side walls (4, 4'), and in that the flanges (5, 5') have fold lines (161) running from the corner points at the side of the first pair of side walls (3, 3') at an angle of approximately 45° to the bottom edge of this first pair of side walls (3, 3').

12. Box according to any of the preceding claims 7-11, **characterised in that** thickened parts or lips (8, 8') are situated above the flanges (5, 5') at the first pair of side walls (3, 3'), of which edges form stops which can interact with stop edges (9, 9') situated on the outside of the next box placed with the bottom on the above-mentioned flanges.

13. Box according to claim 12, **characterised in that** the stop edges (9, 9') are formed by the sides of the reinforcement corner pieces (6, 6'; 7, 7') situated on the outside of the box (1).

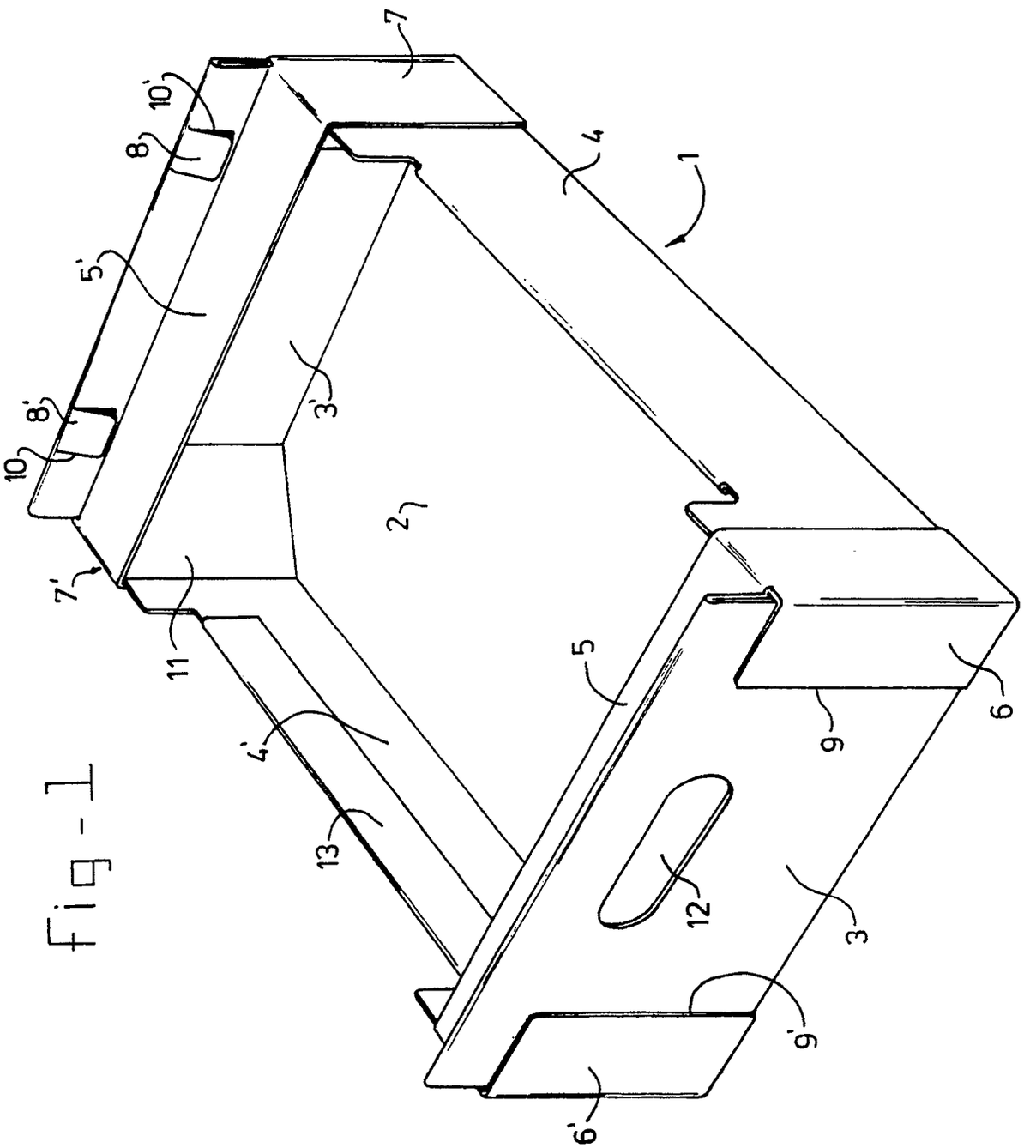
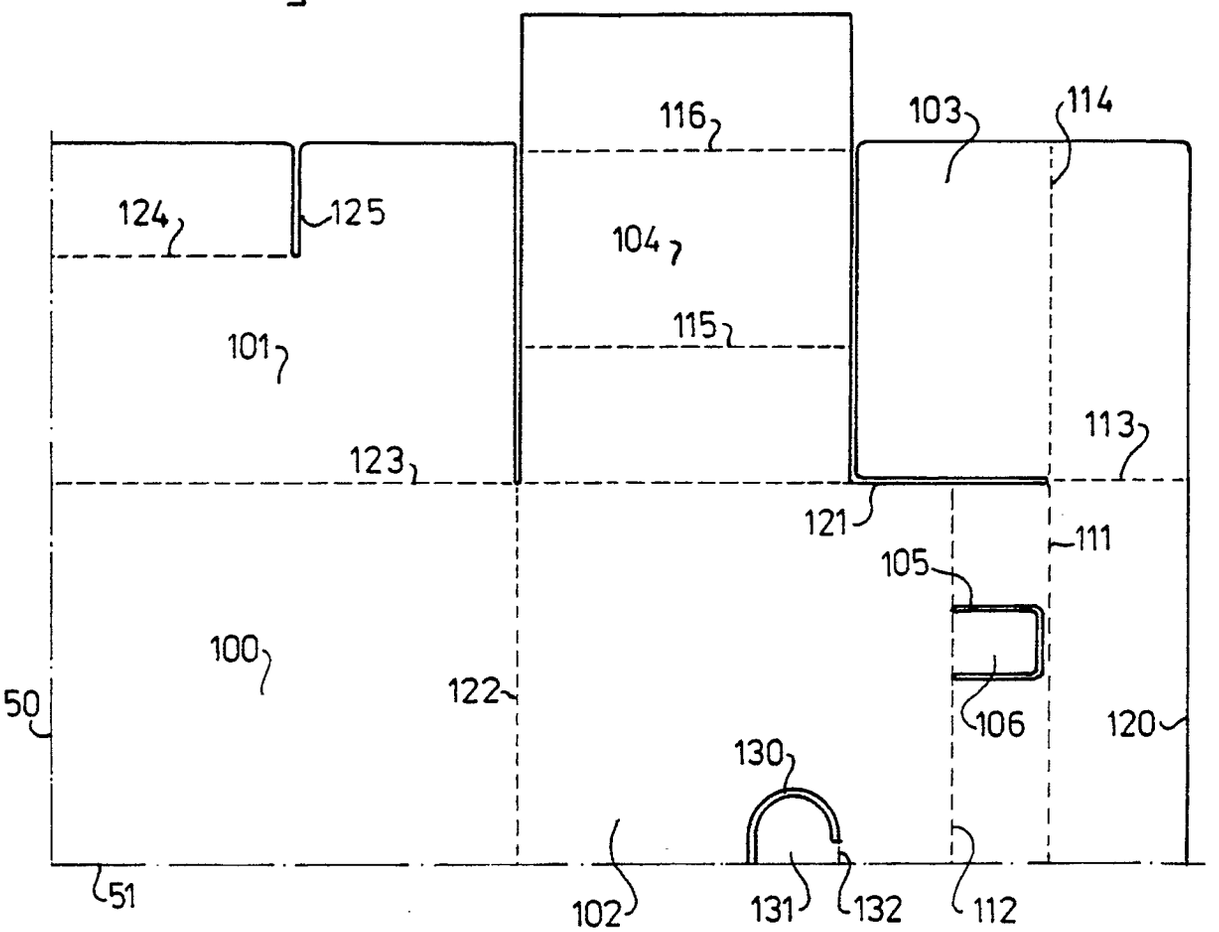


Fig - 1

Fig-2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124
125
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102
131
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112

Fig-3

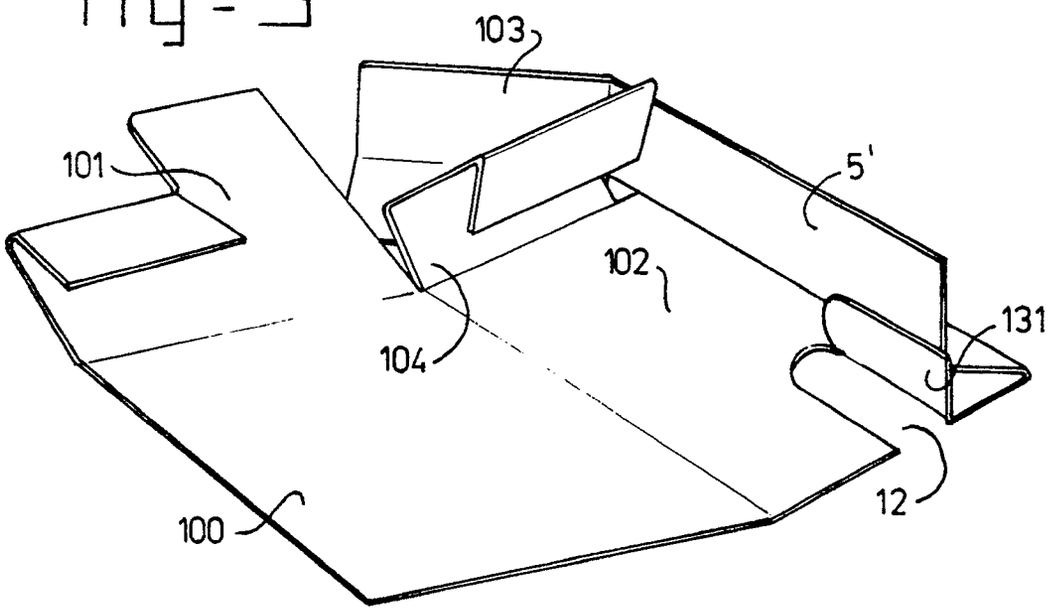

103
101
5'
102
131
104
12
100

Fig - 4

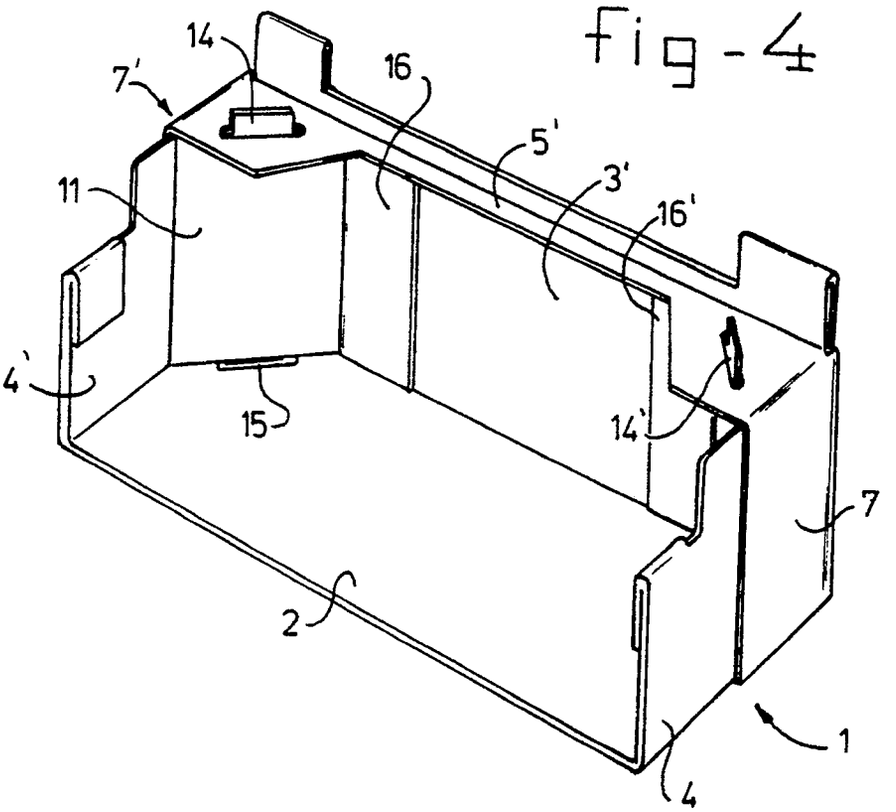


Fig-5

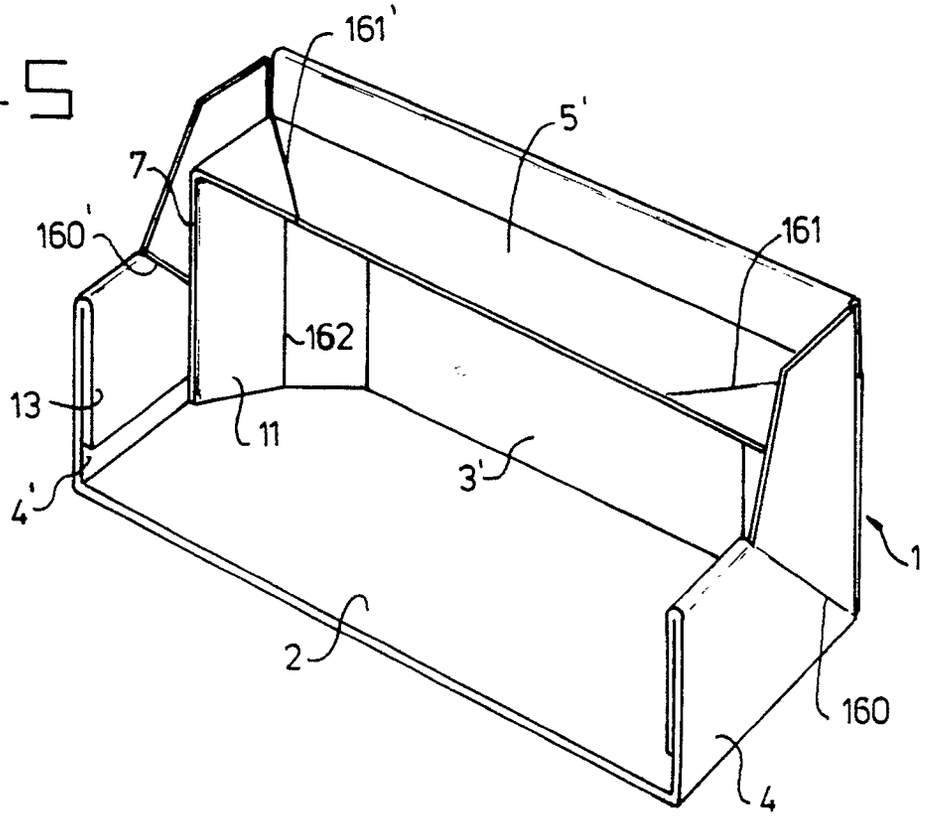


Fig-6

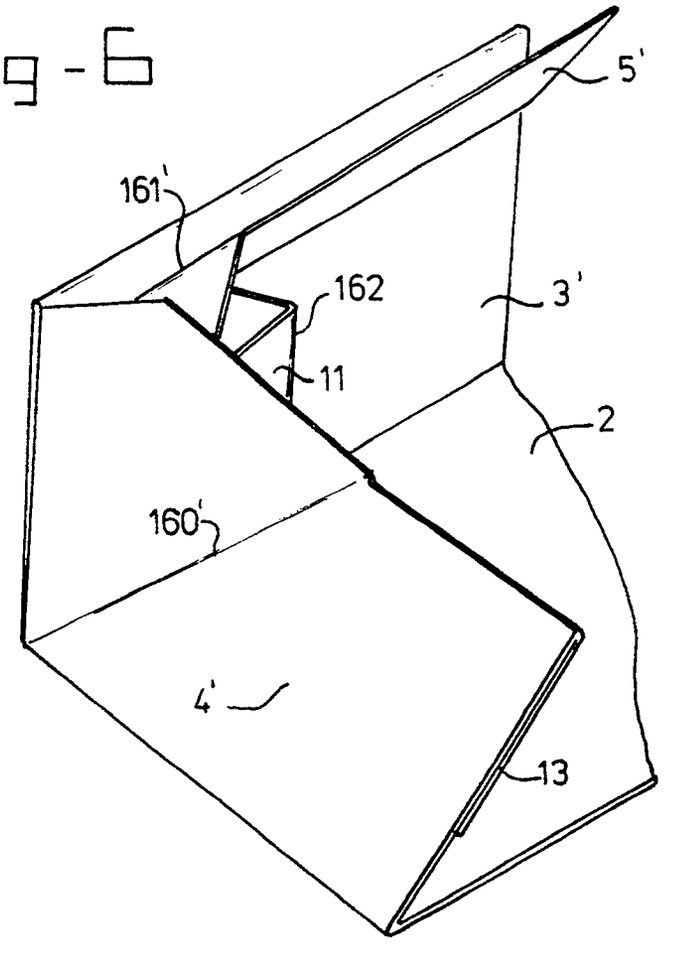
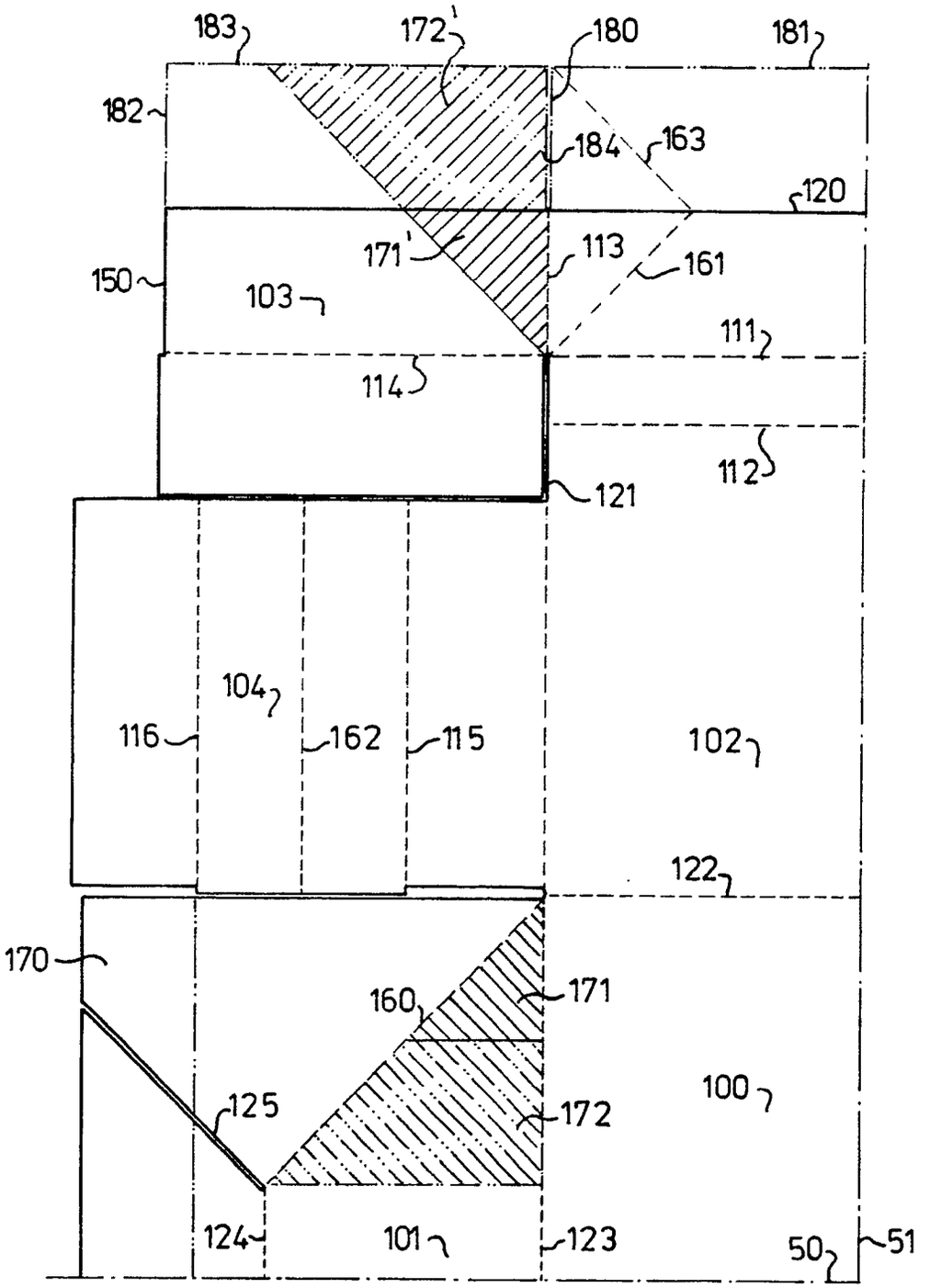


Fig-7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