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(54) **STACK OF PAPER SHEETS, DISPENSER HAVING SUCH A STACK AND METHOD FOR FORMING SUCH A STACK**

(57) The present disclosure concerns a stack of paper sheets particularly for use as dispenser napkins, the stack comprising a plurality of folded sheets (30), each folded sheet (30) being folded along a first folding line (13) so that a part of a free edge opposite to the first folding line (13) is located on an outer surface of the folded sheet (30) and inward of the outer peripheral edges of the folded sheet (30), whereby a starter fold (16) is formed, each folded sheet (30) being further folded along a second folding line (18) non-parallel to the first folding

line (13), the second folding line (18) separating the folded sheet (30) in two panels connected at the second folding line (18), wherein two consecutive folded sheets (30) are interfolded so that one panel (19) of one folded sheet (30) is disposed between two panels (19, 21) of the consecutive folded sheet (30). The present disclosure further concerns a method for manufacturing such a stack and folding the sheets included in the stack as well as a dispenser containing such a stack.

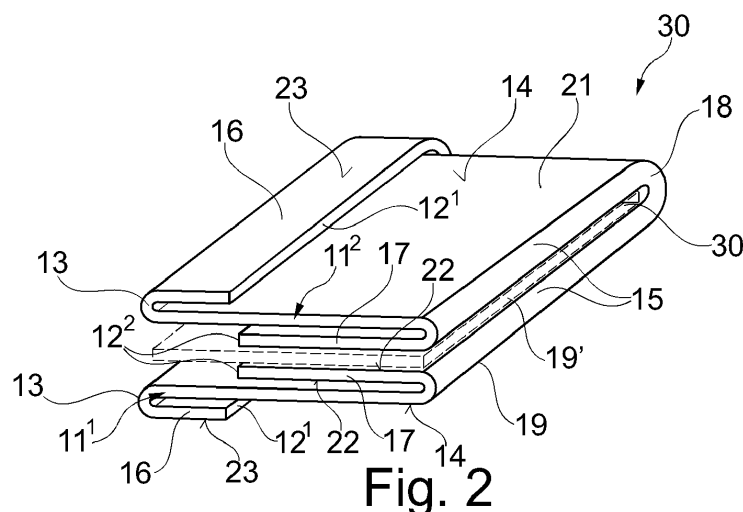


Fig. 2

Description

TECHNICAL FIELD

[0001] The present disclosure relates to a stack of folded paper sheets, particularly a stack of interfolded paper sheets and even more particular tissue paper sheets. The disclosure further relates to a dispenser having such a stack and a method for forming such a stack, particularly for folding of the individual sheets and their interfolding. The present disclosure is particularly applicable to table napkins, more particular dispenser napkins, but may also be employed for other applications such as paper towels.

BACKGROUND

[0002] One such stack is disclosed in US 2014/0057069 A1. The folded sheets of the stack disclosed therein are first folded in half along a longitudinal centerline. Subsequently, the sheets are folded along two parallel folding lines which are perpendicular to the longitudinal centerline in opposite directions so as to obtain a Z-folding. The Z-folding is used for interfolding the consecutive sheets within the stack. In particular, one of the two parallel folding lines separates the sheets in two panels and one panel of a consecutive sheet is sandwiched or disposed between the two panels of previous sheet, whereby the interfolding is obtained. The other one of the two parallel folding lines forms a starter fold enabling easier grabbing of a sheet not already protruding from a dispensing opening.

[0003] The above stack or particularly the folded sheets thereof use three folds about three folding lines achieving $\frac{1}{4}$ of the size of the base sheet.

[0004] Yet, the opening of the sheets is perceived less than optimum. In particular, when gripping the starter fold and withdrawing the sheet from a dispenser, the sheet only opens along the two parallel folding lines used for interfolding and, therefore, only doubles in size.

SUMMARY

[0005] In view of the aforesaid, it is desired to provide a stack of folded paper sheets, a dispenser and a method wherein the individual sheets are easily unfolded when being withdrawn from the stack. In particular embodiments, the individual sheets have a size after being unfolded corresponding to more than twice the times their size before withdrawal from the stack (i.e. compared to the folded sheet).

[0006] It is also desired to obtain easier unfolding while maintaining interfolding of the individual folded sheets and presenting a starter fold.

[0007] Also, it is desired to provide a stack, a dispenser having a stack and a method for forming a stack, the stack having a relatively small footprint, without impairing interfolding of the individual folded sheets, presenting a

starter fold and/or easy unfolding of the individual folded sheets when being withdrawn from the stack.

[0008] At least one of the above objects is solved by a stack of folded paper sheets as defined in claim 1, a dispenser having such a stack as defined in claim 10 and a method for forming a stack of folded paper sheets as defined in claim 11.

[0009] According to an aspect a stack of folded paper sheets is used as table napkins, more particular dispenser napkins. In this context, dispenser napkins are to be understood as napkins which are presented to a user via a dispenser, wherein the napkins are withdrawn from the dispenser one by one. Yet, other applications for examples as towels are conceivable as well. In particular embodiments, tissue paper (see also ISO 12625-1) is used as material for the folded sheets. The stack comprises a plurality of individual sheets. Each folded sheet may have a rectangular shape. Each folded sheet may be folded as a sheet of one or more paper layers or plies without any fold. The base sheet may as well have a rectangular shape. In this context, rectangular includes quadratic as well as rectangles having rounded corners. Each base sheet may be constituted from one or more plies. Further, each base sheet may be folded a plurality of times to form the folded sheet. The term "folded sheet" is to be understood as the completely folded sheet in the stack. According to this aspect, each of the folded sheets is at least folded along a first folding line so that a part of a free edge opposite to the first folding line is located inward of the outer peripheral edges and on an outer surface of the folded sheet, whereby a starter fold is formed. In one embodiment, the part of the free edge is located on a top surface of the folded sheet in the stack or, to put it differently, on a top surface of the folded sheet facing upwards in the stack. A starter fold is to be understood as a fold having a free edge presented to a consumer for instance via a dispensing opening to facilitate initial removal of the sheets from a dispenser. For example, the starter fold may provide a free edge located on the top of each folded sheet centrally or offset to the outline of the folded sheet. According to an embodiment, the width of the starter fold perpendicular to the first folding line is at least 10 mm or at least 20 mm. The maximum width is mainly governed by the total width of the folded sheet in a direction perpendicular to the first folding line. According to an embodiment, the maximum width is chosen to allow for at least 10 or at least 20 mm of "free surface" on top of the folded sheet other than the starter fold to provide sufficient space for the fingers gripping the free edge. As regards the terminology "first folding line", "second folding line", etc, it is to be understood that first, second, etc. does not indicate the order in which the folds are made during the manufacturing process but only serves to differentiate between different folding lines. Moreover and according to this aspect, each folded sheet is further folded along one or more second folding lines non-parallel to the first folding line. Preferably, the second folding line/-

s intersect/-s the starter fold. As a result, also the starter fold is folded along or about the second folding line/-s. If one second folding line is present, the folded sheet is separated in two panels connected at the second folding line. It is to be understood, that each folded sheet may be folded along two of the second folding lines forming a Z-shape and having three panels or even more than two of the second folding lines forming an accordion like shape and having more than three panels. If only one second folding line is present, the second folding line separates the sheet in only two panels which are connected at the second folding line forming a U-shape. Considering a Z-shape, two second folding lines are present, wherein one of the second folding lines separates the sheet in a first panel and a second middle panel and the other one of the second folding lines separates the sheet in the second middle panel and a third panel. Moreover, two consecutive folded sheets in the stack are interfolded or interleaved so that at least one panel of one sheet is disposed between two panels of the previous and/or consecutive sheet. Comfortable withdrawing of the folded sheets from a dispenser is enabled by interfolding the consecutive sheets. In particular, when the consumer pulls a folded sheet out of a dispensing opening of the dispenser, the immediate next (consecutive) folded sheet is also subject to a pulling force making the immediate next folded sheet partially protrude from the dispensing opening and being partially unfolded. The next user can then easily access this protruding sheet.

[0010] According to this aspect, it is possible to use the first and second folding line to reduce the footprint of each folded sheet compared to the base sheet and, thereby the stack. At the same time, because the first and second folding line are non-parallel, unfolding of each folded sheet after being withdrawn from the stack or dispenser is simplified and enhanced compared to the prior art in that the at least partially unfolded sheet is more than double the size of the folded sheet after being withdrawn from the stack. Even further, the used folding lines have a double function, namely the first folding line additionally serves for creating the starter fold and the second folding line additionally serves for interfolding the consecutive folded sheets within the stack.

[0011] According to an embodiment, the first folding line may extend perpendicular to the second folding line. The use of perpendicular folding lines for this purpose provides for ease of manufacture. In this manner, one of the folding lines may be formed during the manufacturing process in the machine direction (MD), i.e. parallel to the machine direction, whereas the other one of the folding lines may be formed in the cross machine direction (CD), i.e. transverse to the machine direction. As a consequence, the combination of standard machinery or elements thereof may be used to fold the sheets and form the stack.

[0012] As explained earlier, the second folding line may intersect the starter fold. According to an embodiment, the second folding line intersects the starter fold

at a longitudinal center of the starter fold (the longitudinal direction is parallel to the free edge and the first folding line). The latter is particularly the case if only one second folding line is present centrally separating the folded sheet in only two panels. Further, the starter fold may extend along the two panels on surfaces of the panels facing away from each other. This is particularly the case if the starter fold is formed by folding the sheet about the first folding line before folding the sheet about the second folding line for interfolding with the starter fold being located on top of the sheet and the folding about the second folding line is performed towards the back of the sheet.

[0013] Moreover, each folded sheet may be further folded along a third folding line parallel to the first folding line forming a backfold, the backfold and the starter fold being located on opposite sides of the sheet particularly before folding the sheet about the second folding line. As the starter fold, the second folding line may intersect the backfold. In particular, the second folding line may intersect the back fold at a longitudinal center of the backfold, the longitudinal direction being parallel to the third folding line. The folded sheets of the stack form a number of plies or layers in the height direction of the stack, wherein one sheet has a plurality of plies or layers in the height direction at least because of the folding process. The backfold provides for the advantage, that the number of plies or layers of the stack is the same at the edge of the first folding line and the edge of the third folding line. Accordingly, the stack is more stable. In addition, this simplifies compression of the stack, if compression thereof is desired. Furthermore, if the folded sheet is already protruding from the dispensing opening, the user has two possibilities to grip the sheet, because the starter fold and the backfold somewhat protrude in opposite directions forming a "Z" at the protruding edge. Accordingly, the folded sheet is easy to grip and unfold. The backfold further reduces the footprint of the folded sheet.

[0014] In certain embodiments, a width of the starter fold perpendicular to the first folding line and a width of the backfold perpendicular to the third folding line sum up to a total width between and perpendicular to the first folding line and the third folding line. Accordingly, the same number of plies over the height of the stack may be achieved not only at the outer edges corresponding to the first and third folding line, but over the entire area (in plan view) of the stack.

[0015] Further, the backfold may extend along the two panels on surfaces of the panels facing each other. To put it differently, the starter fold can be located at one side (e.g. outer side) of the folded sheet, i.e. the sheet folded about the second folding line, whereas the backfold is located at another opposite side (e.g. inner side) of the folded sheet. To put it differently, the intermediately folded sheet, that is the sheet before being folded about the second folding line, has two opposite surfaces. The starter fold is located on one of the two surfaces and the backfold is located on the other of the two surfaces. After folding about the second folding line, the starter fold is

located on an outer side, that is surfaces of the panels facing away from each other, and the backfold is located on an inner side, that is surfaces of the panels facing towards each other. Accordingly, the backfold does not interfere with the starter fold. Hence, the freedom of design of the starter fold is enhanced and it can be ensured that a user can easily grab the free edge of the starter fold. In addition, once a sheet protrudes from the dispensing opening the user has two possibilities for gripping the sheet at either the starter fold or the backfold for unfolding to the "full" area or at least a larger area.

[0016] Moreover, the free edge of the starter fold may be formed by a fourth folding line. Thus, the fourth folding line is parallel to the first folding line. Because of the fourth folding line, the footprint of the stack may be further reduced as compared to folded sheets having only two or only three folding lines. Moreover, using the fourth folding line as the free edge of the starter fold provides for a starter fold consisting of at least two layers or plies connected at the fourth folding line, i.e. the free edge of the starter fold. Thus, a more stable starter fold can be obtained which can be gripped more easily. Also the appearance of the starter fold is enhanced as compared to a two ply starter fold wherein the two plies are unconnected at the free edge. If a backfold is present, the backfold may be formed by two plies or layers. In this case, the layers may be unconnected at the free edge of the backfold.

[0017] In one embodiment, the fourth folding line is a half fold of the base sheet. Yet, the fourth folding line may well be a quarter fold of the base sheet. In this context a half/quarter fold is a fold by which the base sheet is folded so as to have only half/quarter of its original completely unfolded size.

[0018] Furthermore, the fourth folding line may be parallel to the first folding line and the optional third folding line. Thus, two/three of the three/four folding lines can be manufactured in the machine direction enabling manufacture at short cycle time.

[0019] An even further aspect concerns a dispenser having a housing accommodating a stack as described above and a dispensing opening, the free edge of the starter fold of the first (uppermost or top) folded sheet in the stack being accessible via the dispensing opening. In a particular example, the free edge of the starter fold is visible through the dispensing opening. Thus, it can be ensured that the first folded sheet of a new stack can be readily extracted from the dispenser through the dispensing opening and because of the interfolding apply a pulling force to the consecutive folded sheet, whereby the consecutive folded sheet is pulled out of the dispensing opening automatically. Accordingly, the consecutive folded sheet protrudes from the dispensing opening and is readily accessible for the next user. As the dispensers are usually refilled even in cases before all of the folded sheets are dispensed, it may happen that two or more of the stacks are contained in the container, the two stacks being not interfolded at their interface. Thus, the folded

sheets are folded identically so that each of the folded sheets of the stack has the starter fold. Thus, at the interface between an upper and a lower stack, where the first folded sheet of the lower stack is not automatically pulled out of the dispensing opening when withdrawing the last folded sheet of the upper stack, the user can again use the starter fold of the first folded sheet of the lower stack for withdrawing the first folded sheet of the lower stack through the dispensing opening.

[0020] An even further aspect relates to a method for forming a stack of folded paper sheets for use as table napkins or other applications as mentioned above. The stack may have the configuration as described above. As a result, any features described with respect to the stack and/or the dispenser above may also be combined with the following method. The method comprises a) folding a plurality of sheets to form a plurality of intermediate folded sheets, each folded along a first folding line so that a free edge opposite and parallel to the first folding line is located inward of the outer peripheral edges of the intermediate folded sheet, wherein a starter fold is formed. Inward of the outer peripheral edges of the intermediate folded sheet in this context means that the free edge is located in a distance to the outline of the intermediate folded sheet in a plan view. In an example, the free edge may be located at a center between opposite peripheral edges or off-center. After the step a) intermediate folded sheets are obtained. The method further comprises, after step a), the step b): subsequently folding the intermediate folded sheets along a second folding line non-parallel to the first folding line forming a folded sheet, whereby a part of the free edge of the starter fold is located inward of the outer peripheral edges of and on an outer surface of the folded sheet, wherein the second folding line separates the folded sheet in two panels connected at the second folding line and step c): interfolding two consecutive folded sheets so that at least one panel of one folded sheet is disposed between the two panels of the previous and/or consecutive folded sheet. The steps b) and c) may be performed concurrently, wherein consecutive folded sheets, folded about the second folding line, are concurrently interfolded, or one after the other. Commonly used technologies for making a stack of interfolded or interleaved paper sheets include where the second folding line is parallel with the machine direction (length folding) or perpendicular with the machine direction (cross folding). The preferred technology for the invention is cross folding which facilitates introduction of the first, third and fourth folding lines through length folding. Cross folding to achieve interfolding is often denoted by Interfold, Multifold or Single-fold. Also if there is some ambiguity as to the definitions of these terms, interfold often refers to when two webs are interleaved and multifold when only a single web is used. Single-fold refers to when the folded paper sheet has only one second folding line. Single-fold was historically made on interfold lines using two webs but recently technologies were introduced that are capable of producing

single-fold also from a single web. With two webs the webs are cut separately to generate two streams of sheets of equal length and the cut is positioned so as not to coincide between the two webs and combined into one stream. The stream of cut sheets is folded alternately so as to form a stack of separate sheets where one or more panels of each sheet are interleaved with the panels of an adjacent sheet. With a single web, the web is cut in sheets of commonly equal length which are made to partially overlap through a retardation and displacement of the trailing edge of one sheet relative to the leading edge of the following thus generating a stream of sheets partially overlapping. The overlapping can be so that the trailing edge sheet always ends up on the same side of the leading edge sheet or that it ends up on alternating sides. That stream is then folded alternately to so as to form a stack of separate sheets where one or more panels are interleaved. With one or two webs any number of panels can be made. And also can the first or last panel be made smaller than the other. With only two panels is normally required either a solution with two webs or a single web solution where the displacement of the trailing edge of the stream of sheets is alternately located as described above. This is a prerequisite to achieve an interleaving.

[0021] The method may also comprise the step of folding the sheets about a third folding line parallel to the first folding line for forming a backfold as described above. The backfold and the starter fold are located on opposite sides of the sheet after folding and before step b). The step of folding the sheets about a third folding line may be performed before or after the step a), but before the step b).

[0022] The method may further comprise the step of folding the sheets along a fourth folding line before the step a). As explained above, the fourth folding line may be parallel to the first folding line and the optional third folding line. Further, the fourth folding line may be a half fold or a quarter fold of the base sheet.

[0023] For ease of manufacture, the web for producing the sheets or sheets are fed in a machine direction and the first folding line, the optional third folding line and the optional fourth folding line are parallel to (extend along or in) the machine direction and the second folding line is (extends) transverse (perpendicular) to the machine direction (in the cross machine direction).

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] Further features, embodiments and examples are explained in the following detailed description referring to the accompanying drawings. The drawings show in:

Figure 1A-C: a process of folding a sheet and forming a stack according to a first embodiment;

Figure 2: a perspective view of one folded sheet of

the stack of figure 1;

Figure 3A-D: a process of folding a sheet and forming a stack according to a second embodiment;

Figure 4: a perspective view of one folded sheet of the stack of figure 3;

Figure 5: a perspective view of one folded sheet of a stack according to a third embodiment;

Figure 6: a perspective view of one folded sheet of a stack according to a fourth embodiment;

Figure 7: a perspective view of one folded sheet of a stack according to a fifth embodiment;

Figure 8: a perspective view of one folded sheet of a stack according to a sixth embodiment;

Figure 9: a perspective view of one folded sheet of a stack according to a seventh embodiment; and

Figure 10: a schematic side view of the folded sheets of Figure 9 showing the interfolding.

DETAILED DESCRIPTION OF PARTICULAR EMBODIMENTS

[0025] The same reference numerals have been used for the same or similar elements throughout the various embodiments disclosed in figures 1A to 10. In order to avoid repetition these elements have not always been described anew in all of the embodiments. Further it is noted that folding lines extending in the machine direction (MD) are perpendicular to folding lines extending in the cross machine direction (CD) in the embodiments.

[0026] Figures 1A-C and 2 show a first embodiment. Each folded sheet 30 of the first embodiment is $\frac{1}{4}$ in size compared to the completely unfolded sheet (in the following referred to as base sheet 10).

[0027] Figure 1A shows a perspective of the base sheet 10. The base sheet 10 has a rectangular shape having a first pair of parallel peripheral edges 11¹ and 11² and a second pair of parallel peripheral edges 12¹ and 12². The base sheet may consist of one or more paper plies.

[0028] The base sheet 10 is folded about a first folding line 13 indicated by the broken line in figure 1A. In particular, the left hand peripheral edge 12¹ is folded about the first folding line 13 towards an upper surface 14 of the base sheet 10 as indicated by the arrow.

[0029] As a result, a starter fold 16 is formed on the upper surface 14 of the base sheet 10 and later the outer side of the folded sheet 30. The starter fold 16 has a free edge corresponding to the left hand peripheral edge 12¹ and is connected to the remainder of the base sheet 10 at the first folding line 13. The free edge of the starter

fold 16 is located within the outline of the thus obtained intermediate folded sheet 20.

[0030] Further, the base sheet 10 is folded about a third folding line 15 indicated by the broken line in figure 1A. In particular, the right hand peripheral edge 12² is folded about the third folding line 15 towards a lower surface of the base sheet 10 (opposite to the upper surface 14) as indicated by the arrow.

[0031] As a result, a backfold 17 is formed on the back surface of the base sheet 10 and later the inner side of the folded sheet 30. The backfold 17 is connected to the remainder of the base sheet 10 at the third folding line 15. A free edge of the backfold corresponds to the right hand peripheral edge 12² of the base sheet 10.

[0032] It is also clear from the above, that the first folding line 13 and the third folding line 15 are parallel to the peripheral edges 12¹ and 12².

[0033] In a particular embodiment of the manufacturing process a web having a total width W corresponding to the length of the peripheral edges 11¹ and 11² is fed in a machine direction (MD) parallel to the peripheral edges 12¹ and 12². Subsequently, a plurality of sheets may be formed by cutting the web in a cross machine direction (CD) to form the peripheral edges 11¹ and 11². The folding about the first folding line 13 and the third folding line 15 may be achieved in the machine direction (MD) either concurrently, before or after the mentioned cutting.

[0034] Thus, one obtains an intermediate folded sheet 20 as shown in figure 1B.

[0035] Subsequently and as shown in figure 1B, the intermediate folded sheet 20 is folded about a second folding line 18 towards the back in figure 1B as shown by the arrow. In the manufacturing process, this folding about the second folding line 18 is performed in the cross machine direction (CD). Thereby, the intermediate folded sheet 20 is separated into a first panel 19 and a second panel 21 by the second folding line 18.

[0036] Accordingly a folded sheet 30 as shown in figure 2 is obtained. At this stage, the peripheral edges 11¹ and 11² may be congruent in plan view. Thus, the outline of the folded sheet 30 is delimited by the first folding line 13, the second folding line 15 parallel thereto, the second folding line 18 perpendicular to the first folding line and the second folding line as well as the peripheral edges 11¹ and 11² parallel to the second folding line. Particularly considering figure 2 it becomes apparent that the free edge of the starter fold 16 formed by the peripheral edge 12¹ is situated inward of the outer peripheral edges 13, 15, 18, 11^{1/2}, i.e. the outline of the folded sheet 30. Thus, the free edge may easily be gripped by a user as will be explained in more detail below.

[0037] Further, the upper surface 14 of the base sheet 10 forms the outer surface of the folded sheet 30. The lower surface opposite to the upper surface 14 forms the inner surface of the folded sheet 30. Thus, the two panels 19, 21, connected at the second folding line 18, form a U-shape.

[0038] The back fold 17 is located on an inner surface

side. In particular, outer surfaces 22 of the backfold 17 facing away from the back surface of the base sheet 10 face each other but are located on an inner surface side of the folded sheet 30.

[0039] The starter fold 16 is located on an outer surface side. In particular, outer surfaces 23 of the starter fold 16 facing the upper surface 14 of the base sheet 10 face away from each other.

[0040] The folding of the intermediate folded sheet 20 about the folding line 18 is used to interfold a plurality of consecutive folded sheets 30 to form a stack 40 as shown in figure 1C.

[0041] In particular and as indicated in figure 2, the two panels 21 and 19 sandwich another panel 19' of a consecutive folded sheet 30' (the panel 19' of the consecutive folded sheet 30' has been indicated only schematically in figure 2). In turn, the consecutive folded sheet 30' sandwiches the panel 19 of the folded sheet 30 and the panel 21'' (not shown) of a further consecutive folded sheet 30'' (not shown) between its panels 19' and 21'. This is repeated to form the stack 40 of a plurality of folded sheets 30.

[0042] Moreover, the width W1 of the starter fold 16, that is the length of a line perpendicular to and connecting the first folding line 13 and the peripheral edge 12¹ and the width W2 of the backfold 17, that is the length of a line perpendicular to and connecting the third folding line 15 and the peripheral edge 12² sum up to the width W3 of the remainder of the base sheet 10, that is the length of a line perpendicular to and connecting the first folding line 13 and the third folding line 15 ($W1+W2=W3$). It is to be understood that in other embodiments the width W1 and W2 do not need to sum up to the width W3. Accordingly, the planar size of the intermediate folded sheet 20 is 50% as compared to the planar size of the base sheet 10. Further, in particular embodiments, the free edge of the starter fold 16 and the free edge of the backfold 17 are congruent in plan view. As a result, the number of layers formed by the plurality of folded sheets 30 over the height H of the stack 40 is the same over the whole planar area of the stack 40. In particular, the number of layers per folded sheet in the height direction is four over the entire planar area. Thereby, a stable and easily compressible stack 40 is achieved.

[0043] As will be apparent from figure 1A, the width W1 is smaller than the width W2. Accordingly, the free edge of the starter fold 16 formed by the peripheral edge 12¹ will be located closer to the peripheral edge (formed by the first folding line 13) of the intermediate folded sheet 20 than to the opposite peripheral edge (formed by the third folding line 15) of the intermediate folded sheet 20. Accordingly, the free edge is off-centered. If the width W1 and W2 is the same and $W1+W2=W3$ and/or if the width W1 is half the width W3, the free edge is centered.

[0044] Further, by folding the intermediate folded sheet 20 about the folding line 18, which is disposed in the center of the intermediate folded sheet 20, the planar size of the folded sheet is reduced to 50% of the planar

size of the intermediate folded sheet 20 and to 25% of the planar size of the base sheet 10. Thus, a stack 40 with a relatively small footprint in plan view can be obtained, which in the present example is only $\frac{1}{4}$ of the original planar size of the base sheet 10. This size reduction is however mainly achieved by folding lines having a further function, namely the function of forming the starter fold 16 (the first folding line 13) and the function of interfolding the consecutive folded sheets 30 (the second folding line 18). Thus, these folding lines have a double function.

[0045] The stack may be accommodated in a dispenser 41 as schematically indicated in figure 1C. The dispenser 41 has a dispensing opening 42, which in the present example may be situated at an outer edge of the dispenser 41 in a plan view.

[0046] The dispenser 41 as shown in figure 1C may have been refilled with a stack 40 recently so that no folded sheet 30 protrudes from the dispensing opening 42. Yet, the free edge of the starter fold 16 formed by the peripheral edge 12¹ is visible and accessible through the dispensing opening 42. If a user intends to withdraw a folded sheet 30 from the dispenser 41, the user can thus readily grab the free edge of the starter fold 16 and withdraw the folded sheet 30 through the dispensing opening 42 and from the dispenser 41. Because of friction forces between the panel 19' of the consecutive folded sheet 30' and the inner surfaces of the panels 19 and 21 of the folded sheet 30, the panel 19' of the consecutive folded sheet 30' is entrained by the withdrawal of the folded sheet 30. As a result, after complete withdrawal of the folded sheet 30, the panel 19' of the consecutive folded sheet 30' protrudes from the dispensing opening 42. Thus, the consecutive folded sheet 30' can be withdrawn even more easily. This process is continued as long as the folded sheets 30 are interfolded. If more than one stack 40 is disposed within the dispenser 41, with the last sheet of the first stack and the first folded sheet of the second stack not being interfolded, the first folded sheet of the second stack will again not protrude from the dispensing opening 42. Yet, in this case, the user can again grab the starter fold 16 of the first folded sheet of the second stack as explained above.

[0047] In addition, when withdrawing the folded sheet 30 from the dispenser 41, the folded sheet 30 is automatically unfolded about the first folding line 13, the second folding line 18 and the third folding line 15. By unfolding about the second folding line 18, the folded sheet 30 already doubles its size again to the intermediate folded sheet 20. The unfolding about the first folding line 13 and the third folding line 50 again doubles the size of the intermediate folded sheet 20 to the full size of the base sheet 10. Accordingly, the user can automatically get the benefit of the full area of the base sheet 10 without having to manually unfold the sheet/napkin.

[0048] Figures 3A-D and 4 show a second embodiment. Each folded sheet 30 of the second embodiment is $\frac{1}{8}$ in size compared to the completely unfolded base

sheet 10.

[0049] The main difference between the first and second embodiment is, that the base sheet 10 is in a first step, shown in figure 3A, folded about a fourth folding line 50 in half as shown by the arrow. Thus, the planar size of the thus folded intermediate folded sheet 1 is reduced by 50% compared to the planar size of the base sheet 10. In the manufacturing process, the fourth folding line 50 is as well created in the machine direction (MD), yet before the formation of the first folding line 13 and the third folding line 15.

[0050] The intermediate folded sheet 1 shown in figure 3B is in principle similar to the base sheet 10 in figure 1A except that it is double layered because of the folding about the fourth folding line 50. As a result, the free edge of the starter fold 16 is formed by the fourth folding line 15. As a consequence, the starter fold 16 is double layered (see figure 4) and the free edge is "closed" in that the two layers of the starter fold 16 are connected by the fourth folding line 50. This configuration provides for a more stable starter fold 16 which is easy to grab.

[0051] To the contrary, the free edge of the backfold 17 is formed by the aligned peripheral edges 12¹ and 12² of the base sheet 10. Hence, also the backfold 17 is double layered, but the free edge thereof is "open" in that the two layers are unconnected.

[0052] After folding about the first folding line 13 and the third folding line 15, one obtains a further intermediate folded sheet 20 as shown in figure 3C in principle corresponding to the intermediate folded sheet 20 of figure 1B. The further intermediate folded sheet 20 is because of $W1+W2=W3$ only 50% in planar size of the intermediate folded sheet 1 and hence only 25% in planar size of the base sheet 10.

[0053] In a next step and as explained with respect to the first embodiment above, the further intermediate folded sheet 20 is then folded about a second folding line 18 extending in the cross machine direction (CD). Thus, the size of the further intermediate folded sheet 20 is further reduced by 50% to obtain the folded sheet 30. In total, the folded sheet 30 is accordingly only 12.5% in planar size of the base sheet 10 in this embodiment.

[0054] In addition and as in the first embodiment, the folding about the second folding line 18 serves to interfold a plurality of folded sheets 30 to form a stack 40 as shown in figure 3D.

[0055] Again because of the configuration of the width $W1$, $W2$ and $W3$, the number of layers over the height H of the stack is the same. In the particular example, the number of layers per sheet is eight over the whole planar area of each folded sheet 30.

[0056] The remainder of the second embodiment is the same as that of the first embodiment and reference is made to the above description.

[0057] A third embodiment is shown in figure 5. The embodiment in figure 5 differs over the first embodiment only in that the backfold 17 is omitted. To put it differently, the base sheet 10 is only folded once about the first fold-

ing line 13 and no folding about the third folding line 15 is performed. The width $W1$ of the starter fold 16 may be increased compared to the first and second embodiment to half the width $W3$ of the remainder of the base sheet 10. Accordingly, the free edge formed by the peripheral edge 12¹ is located in the center of the folded sheet 30 in plan view, that is centrally between the folding line 13 and the peripheral edge 12².

[0058] In this example, the planar size of the base sheet 10 is reduced by $\frac{1}{3}$ when folding the base sheet 10 about the first folding line 13 for forming the starter fold 16. Accordingly, the size of the intermediate folded sheet 20 in this embodiment is about 66% of that of the base sheet 10.

[0059] Afterwards, the intermediate folded sheet 20 is again folded about the second folding line 18 used for interfolding as in the first and the second embodiment. Thereby, the planar size of the folded sheet 30 is only 50% of the planar size of the intermediate folded sheet 20 and only $\frac{1}{3}$ (about 33,3%) of the planar size of the base sheet 10.

[0060] A fourth embodiment is shown in figure 6. As explained with respect to the second embodiment, in this embodiment the starter fold 16 is double layered to provide for a more stable starter fold 16 which is hence easier to be grabbed. The fourth embodiment explains an alternative to achieve such a starter fold 16 even without first folding the base sheet 10 into half as in figure 3A of the second embodiment.

[0061] Similar to the first embodiment one starts from a base sheet 10, folding the base sheet 10 about a first folding line 13 and a third folding line 15. The first folding line 13 and the third folding line 15 separate the base sheet 10 into 3 portions of equal width $W1=W2=W3$.

[0062] Subsequently, the portion folded about the first folding line 13 is again folded in half about a fifth folding line 51 in an opposite direction. The fifth folding line 51 is parallel to the first folding line 13 and hence also the third folding line 15. Accordingly, a starter fold 16 having a width $W4=0.5*W1$ is formed.

[0063] The free edge of the starter fold 16 is formed by the fifth folding line 51. Hence, the free edge is, as in the second embodiment, "closed" in that the two layers forming the starter fold 16 are connected at the fifth folding line 51. In this embodiment, the free edge of the starter fold 16 is again centered relative to the outline between the first folding line 13 and the third folding line 15.

[0064] Further and different to the first embodiment, the backfold 17 extends over the entire inner side of the panels 19, 21. That is, the width $W2$ of the backfold 17 is the same as the width $W3$ of the remainder of the folded sheet 30.

[0065] The planar size of the folded sheet 30 is, in this embodiment, $\frac{1}{6}$ of the size of the base sheet 10.

[0066] A fifth embodiment is shown in figure 7. The fifth embodiment differs from the fourth embodiment only in that also the backfold 17 is folded in half similar to the starter fold 16 in the fourth and the fifth embodiment. For

this purpose, the backfold 17 is after being folded about a third folding line 15 folded in half about a sixth folding line 52 in an opposite direction. Accordingly, the width $W5$ of the backfold 17 is $0.5*W2$ ($W5=0.5*W2$). The benefit of this fifth embodiment compared to the fourth embodiment is that the same number of layers may be achieved over the height H of the stack and over the entire planar area thereof. In particular and considering figure 7, the number of layers per sheet 30 is six over the whole width $W3$. To the contrary, the number of layers in the fourth embodiment in figure 6 is six in the left portion of the width $W3$ and four in the right portion of the width $W3$ (the left and right portion are divided in the center of the width $W3$). Accordingly, the stack formed from sheets 30 as shown in the fifth embodiment would be more stable and can be more easily compressed as compared to the one shown in the fourth embodiment.

[0067] The planar size of the folded sheet 30 is, in this embodiment again, $\frac{1}{6}$ of the size of the base sheet 10.

[0068] A sixth embodiment is shown in figure 8. The sixth embodiment differs from the first embodiment in that the intermediate or middle portion having the width $W3$ of the base sheet 10 is folded about a seventh folding line 53 and an eighth folding line 54 to $\frac{1}{3}$ of its size. In particular, the seventh folding line 53 and the eighth folding line 54 separate the middle portion of the base sheet 10 in three portions of equal width ($W3=3*W6$). Accordingly and as compared to the first embodiment, the footprint of the folded sheet 30 can be further reduced. In particular, the planar size of the folded sheet 30 is only $\frac{1}{6}$ of the planar size of the base sheet 10.

[0069] That remainder of the sixth embodiment is the same as that of the first embodiment.

[0070] Moreover and as will be apparent from the comparison of the first and second embodiments above, any of the third to sixth embodiment may additionally include first folding the base sheet 10 into half along the fourth folding line 50 and only subsequently starting with the folding process described in these embodiments.

[0071] In addition, it is to be understood that in view of the description above the first folding line 13 may be selected so that the free edge of the starter fold 16 is centered or off-centered in all of the above embodiments. Further and if a backfold 17 is present, the width of the backfold 17 can be adjusted as desired. Yet, to achieve the same number of layers over the height H of the stack 40, the width of the backfold 17 is the same as the width of the starter fold 16. In particular embodiments, the free edges of the starter fold 16 and the backfold 17 are aligned or congruent in plan view.

[0072] Moreover, the interfolding has been explained with respect to a U-folded sheet 30. Yet, the interfolding can also be achieved when the intermediate folded sheet 20 is folded in opposite directions about parallel but distanced second folding lines 18, whereby a Z-folded sheet is obtained similar to that described in US 2014/0057069 A1. Such an embodiment is shown in figures 9 and 10. This embodiment is similar to the one described with re-

spect to figures 3 and 4 with the exception that the intermediate folded sheet 20 shown in figure 3C is folded twice about two parallel second folding lines 18. Accordingly and considering the folded sheet 30, a part of the outer surface 23 and, hence, of the free edge 50 of the starter fold 16 is located on the top of the folded sheet 30 in the stack and hence faces upward in the stack. In other words, the free edge 50 of the starter fold 16 is located on top of the top panel 62. The remainder of the starter fold 16, i.e. of the outer surface 23 and the free edge 50, are located on an inner side surface of the folded sheet 30 between the intermediate panel 60 and the bottom panel 61. Similar, the backfold 17 or more particularly its outer surface 22 is located on an inner side surface of the folded sheet 30 between the top panel 62 and the intermediate panel 60 whereas the remainder of the backfold 17 is located on an outer side surface of the folded sheet 30, namely the bottom surface of the bottom part 61 and the facing downward in the stack.

[0073] The interfolding of such folded sheets 30 is shown in figure 10. In particular, one panel, namely the bottom panel 62, of one folded sheet 30 is sandwiched between 2 panels, namely the top panel 61 and the intermediate panel 60 of the consecutive folded sheet 30 and so on. Yet, the interfolding can also be performed as shown in US 2014/0057069 A1 we see intermediate panel 60 and the bottom panel 62 of one folded sheet 30 being sandwiched between the top panel 61 and the intermediate panel 60 of the consecutive folded sheet 30 and so on.

[0074] The remainder of this embodiment is the same as that shown in figures 3 and 4. Of course also the embodiment in figures 1 and 2 and the embodiments in figures 5 to 8 may be embodied in combination with a Z-fold about two second folding lines 18 as shown in figures 9 and 10.

[0075] In view of the above, the described embodiments are not considered exclusive but may be modified and even combined in various ways.

Claims

1. Stack of paper sheets for use as napkins, particularly dispenser napkins, the stack comprising:

a plurality of folded sheets (30),
each folded sheet (30) being folded along a first folding line (13) so that a part of a free edge opposite to the first folding line (13) is located on an outer surface of the folded sheet (30) and inward of the outer peripheral edges of the folded sheet (30), whereby a starter fold (16) is formed,
each folded sheet (30) being further folded along a second folding line (18) non-parallel to the first folding line (13), the second folding line (18) separating the folded sheet (30) in two panels con-

nected at the second folding line (18), wherein two consecutive folded sheets (30) are interfolded so that one panel (19) of one folded sheet (30) is disposed between two panels (19, 21) of the consecutive folded sheet (30).

2. Stack according to claim 1, wherein the first folding line (13) extends perpendicular to the second folding line (18) .
3. Stack according to claim 1 or 2, wherein the starter fold (16) extends along the two panels (19, 21) on surfaces of the two panels facing away from each other.
4. Stack according to any one of the preceding claims, wherein each folded sheet (30) is further folded along a third folding line (15) parallel to the first folding line (13) forming a backfold (17), the backfold (17) and the starter fold (16) being located on opposite sides of an intermediate sheet before being folded about the second folding line.
5. Stack according to claim 4, wherein a width of the starter fold (16) perpendicular to the first folding line (13) and a width of the backfold (17) perpendicular to the third folding (15) line sum up to a total width of the folded sheet (30) between the first folding (13) line and the third folding line (15).
6. Stack according to claim 4 or 5, wherein the backfold (17) extends along the two panels (19, 21) on surfaces of the panels facing each other.
7. Stack according to any one of the preceding claims, wherein the free edge of the starter fold (16) is formed by a fourth folding line (50; 51)).
8. Stack according to claim 7, wherein the fourth folding line (50) is a half fold of a base sheet (10).
9. Stack according to claim 7 or 8, wherein the fourth folding line (50) is parallel to the first folding line (13).
10. Stack according to any one of the preceding claims, wherein the folded sheet is folded about two of the second folding lines (18) separating the folded sheet (30) in three panels (60, 61, 62) connected at the second folding lines (18) .
11. Dispenser (41) having a housing accommodating a stack (40) as defined in any one of the preceding claims and a dispensing opening (42), the part of the free edge of the starter fold (16) being accessible via the dispensing opening (42) .
12. Method for forming a stack of folded paper sheets for use as table napkins, the method comprising the

steps of:

- a) folding a plurality of sheets (10) to form intermediate folded sheets folded along a first folding line (13) so that a free edge opposite to the first folding (13) line is located inward of the outer peripheral edges of the intermediate folded sheet, whereby a starter fold (16) is formed, 5
 - b) folding the intermediate folded sheets along a second folding line (18) non-parallel to the first folding line (13) to form the folded sheets (30), whereby a part of the free edge of the starter fold (16) is located inward of the outer peripheral edges and on an outer surface of the folded sheet, wherein the second folding line separating the folded sheet in two panels (19, 21) connected at the second folding line (18), 10 15
 - c) interfolding two consecutive folded sheets (30) so that one panel (19) of one folded sheet (30) is disposed between the two panels (19, 21) of the consecutive folded sheet (30). 20
13. Method according to claim 12, further comprising the step of folding the sheets along a third folding line (15) parallel to the first folding line (13) forming a backfold (17), so that the backfold (17) and the starter fold (16) are located on opposite sides of the sheet, wherein the step of folding the sheets along the third folding line (15) is performed before step b). 25 30
14. Method according to claim 12 or 13, further comprising the step of folding the sheets along a fourth folding line (50) before the step a). 35
15. Method according to anyone of claims 12 to 14, wherein the sheets are fed in a machine direction (MD) and the first folding line (13) is parallel to the machine direction (MD) and the second folding line is transverse to the machine direction (MD). 40 45 50 55

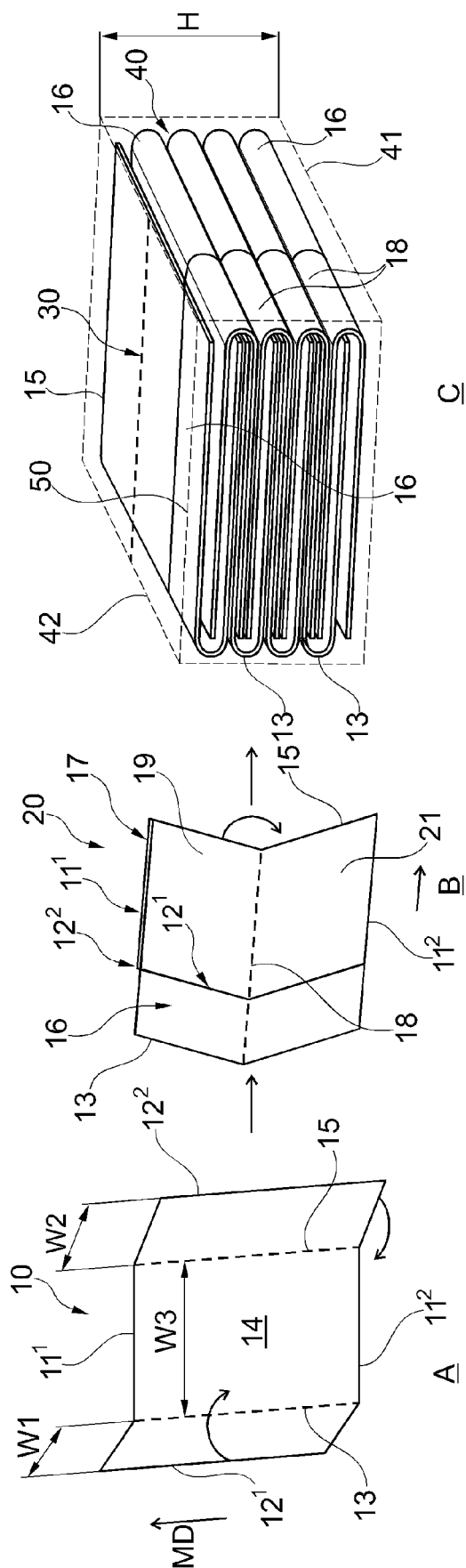


Fig. 1

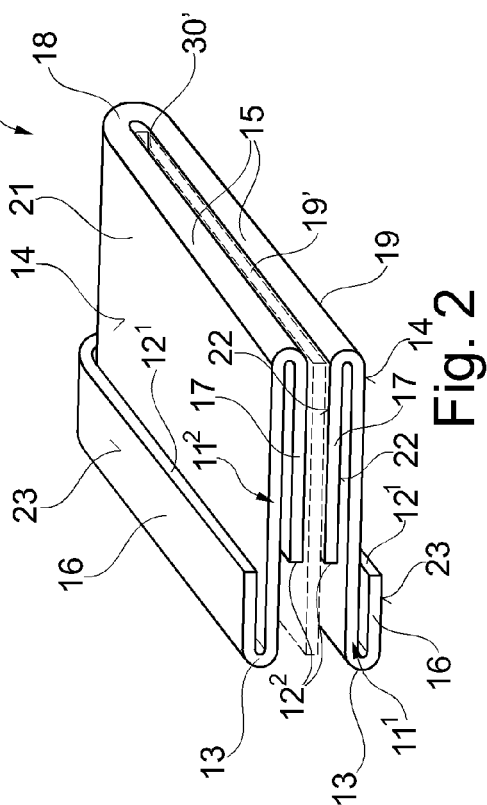
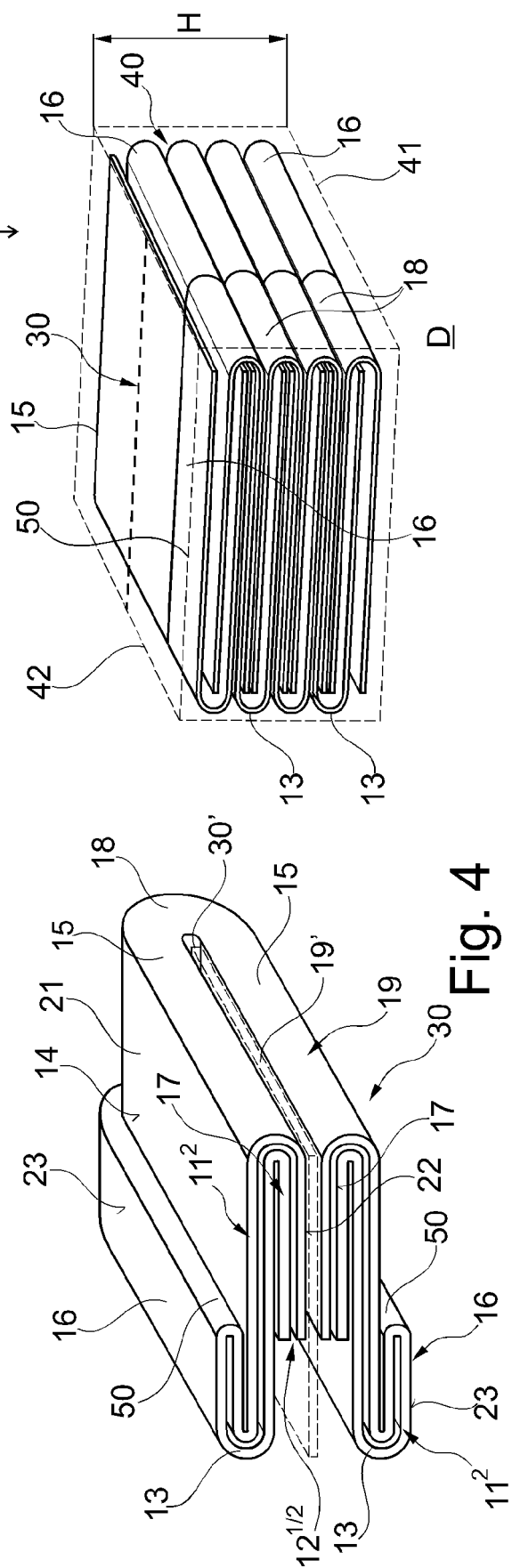
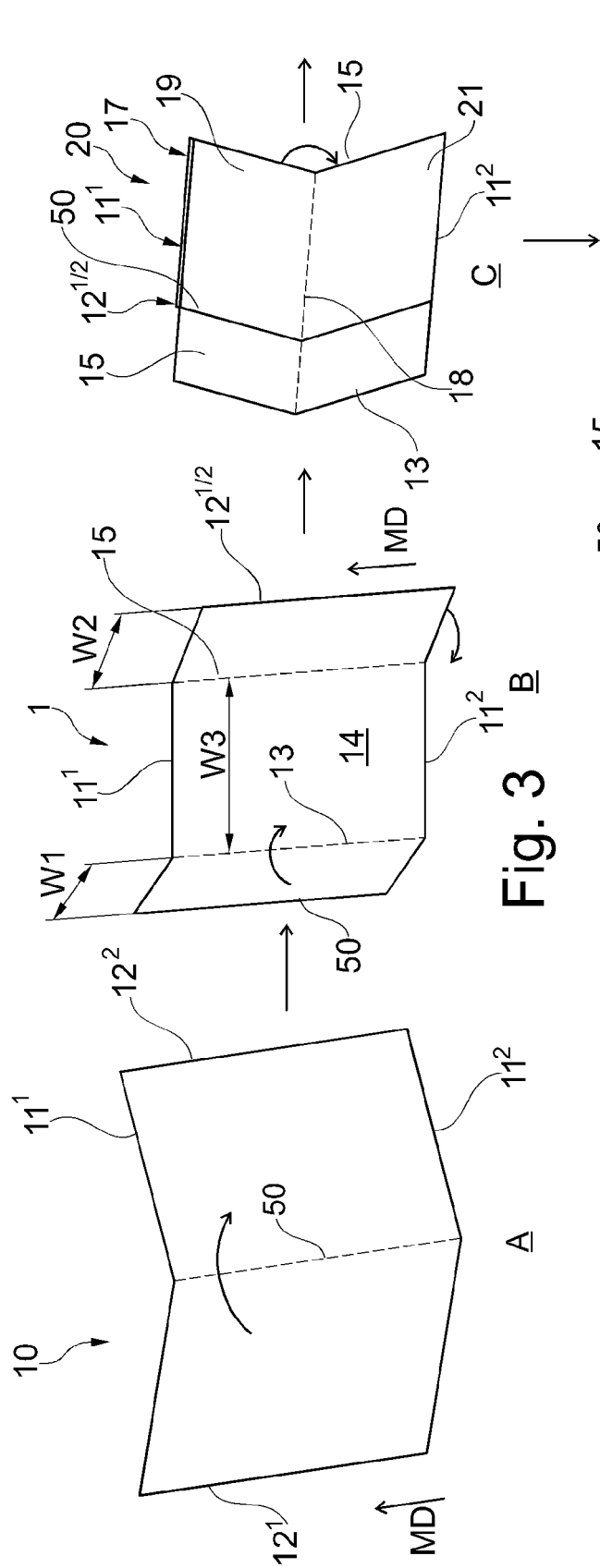
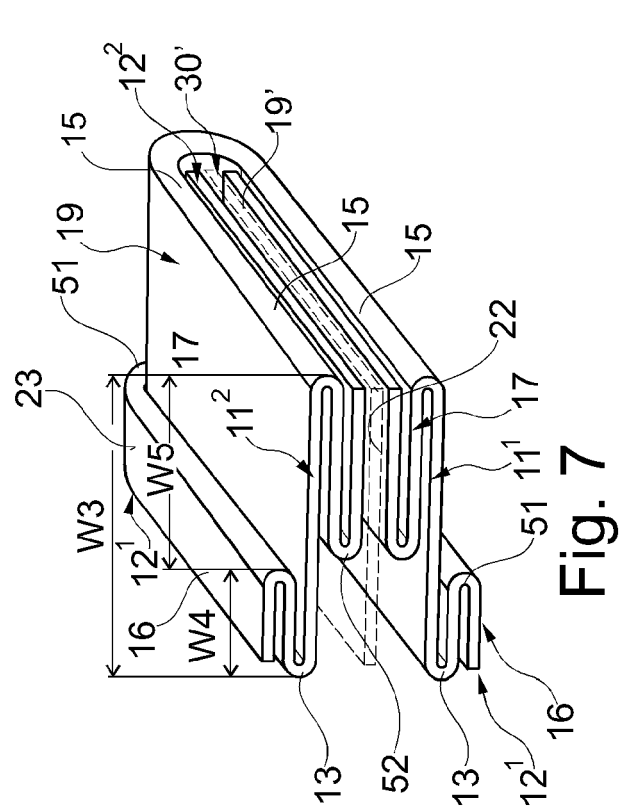
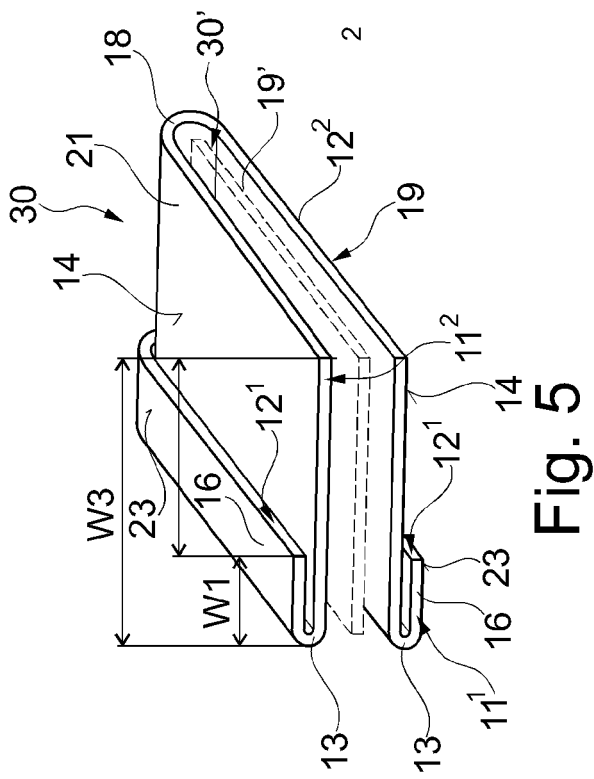
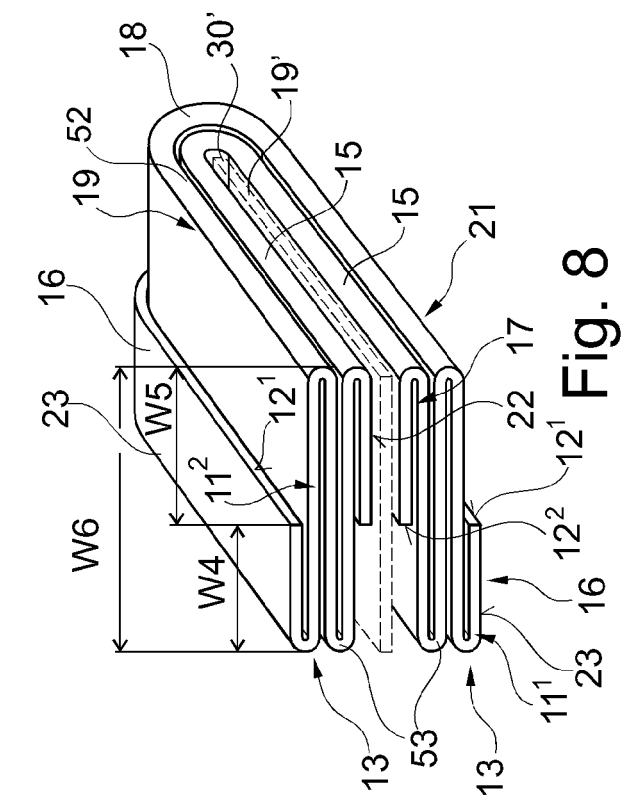
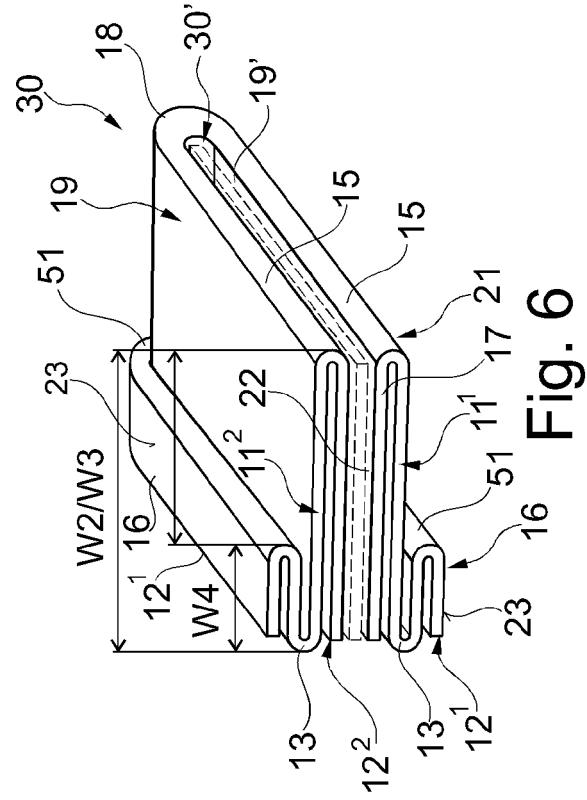


Fig. 2





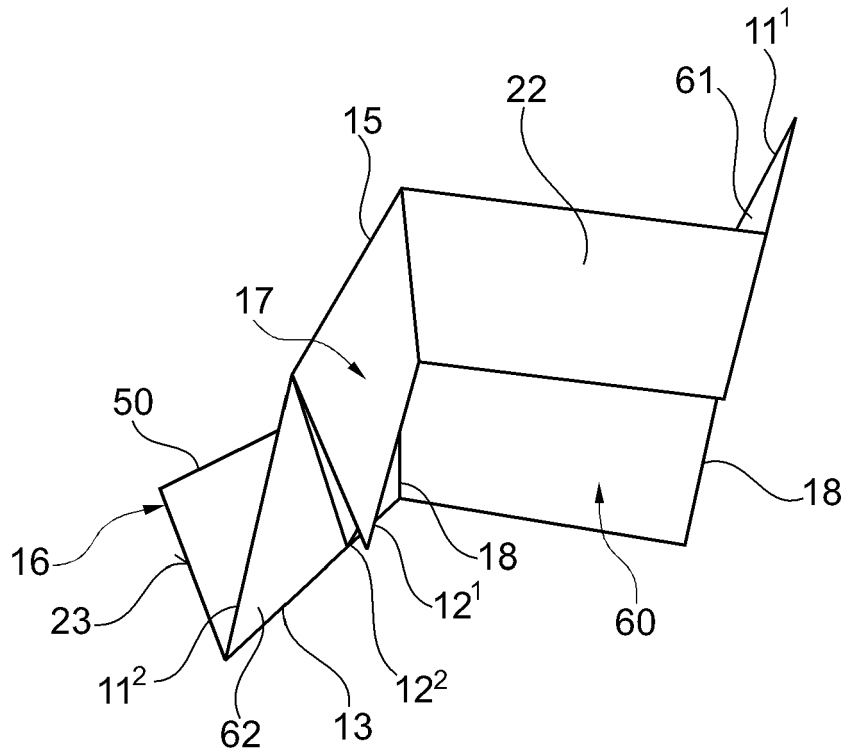


Fig. 9

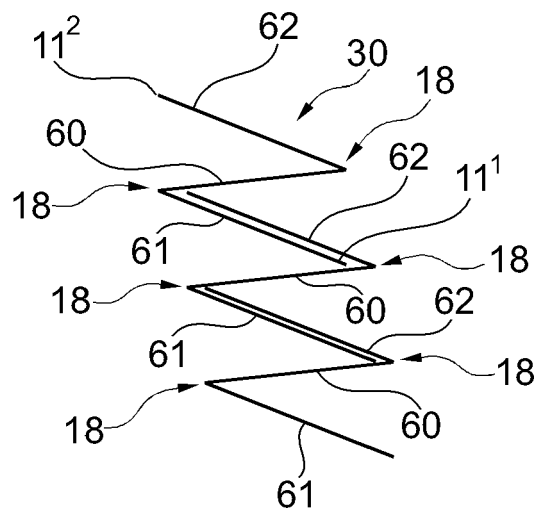


Fig. 10



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 Application Number
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Place of search The Hague		Date of completion of the search 26 June 2020	Examiner van de Beek-Duijker
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