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(54) A THERMOFORMED PLASTIC TRAY

(57) A thermoformed plastic tray 20 comprises a bottom wall 2, sidewalls 3 extending upwardly from the bottom wall along the circumference thereof, a flange 4 connected to the sidewalls at a side remote of the bottom wall and denesting knobs 11 each comprising a recess 14 positioned at an edge between the sidewalls and the flange. The denesting knobs are provided with undercuts causing the recess to be wider at a bottom thereof than at the flange. A first part 21 of at least one of the sidewalls extends under a first angle A0 between 0 and 5 degrees with the vertical over a distance L0 from the flange being larger than a distance C from the flange to the bottom of the recess. A second part of the at least one of the sidewalls is located between the first part and the bottom, which second part extends under a second angle A1 being larger than the first angle.

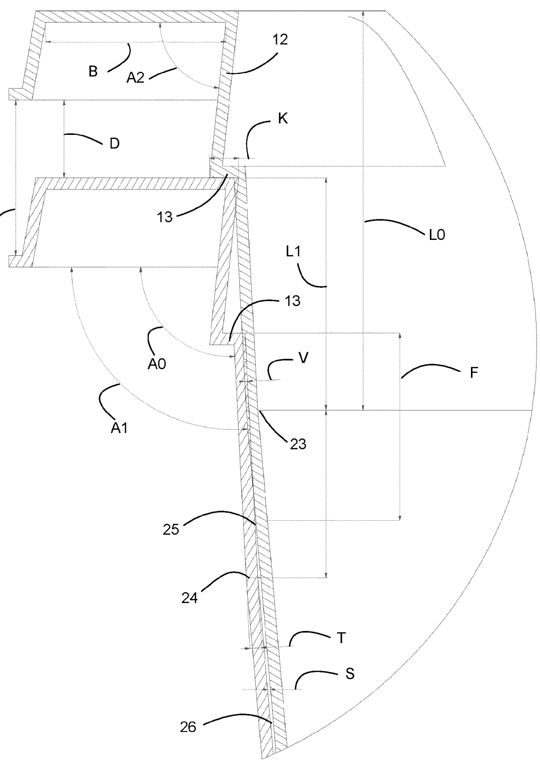

Fig. 7E

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Description

FIELD OF THE INVENTION

[0001] The invention relates to a thermoformed plastic tray comprising a bottom wall, sidewalls extending upwardly from the bottom wall along the circumference thereof, a flange connected to the sidewalls at a side remote of the bottom wall and denesting knobs each comprising a recess positioned at an edge between the sidewalls and the flange, which denesting knobs are provided with undercuts causing the recess to be wider at a bottom thereof than at the flange.

BACKGROUND OF THE INVENTION

[0002] Such thermoformed plastic trays are being used as packaging for example for food. The tray can be a holder for products and/or a lid for such a holder. To transport empty trays, the trays are being stacked and nested. When stacking the trays upon each other, the denesting knobs of an upper tray rest on the flange of a lower tray.

[0003] When the nested trays are identical, the denesting knobs of the nested trays are aligned and located above each other. Due to the undercuts of the recesses, the supporting surface of the denesting knob resting on the flange of the lower tray is larger than without undercuts.

[0004] If the undercutting is relatively small, there is still a risk that when a force is applied on a stack of trays, for example when dropping the stack of trays in a denesting machine, that a knob of an upper trays passes the knob of a lower tray into the recess thereof. In such case, automatically denesting of these trays is not possible.

[0005] If the undercutting is relatively large, the thermoformed tray must be made using relatively complicated and expensive moulds having movable inserts, since otherwise it is not possible to remove the tray from the mould due to the large undercutting.

[0006] To have a small angle at the undercutting and still have a sufficient large supporting surface, the distance between the flange and the bottom of the recess can be enlarged. However, this has the disadvantage that the distance between the trays is also enlarged and that less trays can be stacked in a certain volume.

[0007] Another disadvantage is that a play will be present between the trays due to which the upper tray is movable in a plane parallel to the flange of the lower tray, whereby a knob of the upper tray can easily pass the knob of the lower tray into the recess thereof.

[0008] All these aspects become more relevant when the thickness of the foil from which the thermoformed tray is being thermoformed, is being reduced. The knobs can easier being deformed and will more likely pass knobs of a lower tray. Furthermore, the supporting surface being partly determined by the foil thickness will become smaller which also contributed to a larger play and a larger risk that the knobs will pass each other.

[0009] To fill the trays with the desired products, the trays need to be denested. This is only reliably possible if the risk that the trays will get stuck in one another is reduced.

[0010] By the above described trays, all trays are identical and are stacked in the same orientation on top of each other.

[0011] In another manner of stacking trays, stacked trays differ with respect to each other in the location of the knobs and/or the orientation of the trays. Such nested trays are not identical whereby one set of trays have the knobs at first positions whilst a second set of trays have the knobs at second positions, whereby alternately trays from the first set and second set are stacked on each other. By such stack of trays the knobs are not located above each other. This can also be realised by identical trays whereby the knobs are located at asymmetrical positions and alternating stacking trays with one orientation on trays with another orientation. In such case there is a risk that when stacking two stacks on each other that the lower tray of the upper stack is identical or has the orientation as the upper tray of the lower stack, in which case these two trays will get stuck into each other.

[0012] An operator must be careful when placing a stack of trays on another stack of trays that the lower tray of the upper stack is different from the upper tray of the lower stack. In the production of this kind of trays, a relatively complex device for mounting the different trays on top of each other is needed. Furthermore, if the trays are not identical, several different moulds cavities are needed due to which the production costs will be higher.

SUMMARY OF THE INVENTION

[0013] At least one of the objects of the invention is to provide a tray which can easily be made with knobs having recesses with undercuttings but without the need of complicated moulds, can be made of relatively thin foils, can easily be stacked and denested with no or a reduced risk of two trays getting stuck in another.

[0014] This object is accomplished with the tray according to the invention in that a first part of at least one of the sidewalls extends under a first angle between 0 and 5 degrees with the vertical over a distance from the flange being larger than a distance from the flange to the bottom of the recess, whilst a second part of the at least one of the sidewalls is located between the first part and the bottom, which second part extends under a second angle being larger than the first angle.

[0015] By thermoforming with relatively simple moulds, the main part determining the main part of the sidewalls must have a certain angle to be able to release the thermoformed tray from the mould without damaging the just formed tray and without the need of special movable inserts or other kind of equipment. This certain angle depends amongst others on the height of the tray and determines the minimum size of the second angle.

[0016] Despite this desired certain angle, the first part is provided with a smaller angle. Since this first part is relatively small, it will not hinder the release of the formed tray from the mould. Due to the first parts, an upper tray being nested in a lower tray will rest with its knobs on the flange of the lower tray, whilst the outer side of the first part of the upper tray will rest against the inner side of the first part of the lower tray. Due to the friction between the first parts no play is present between an upper tray and a lower tray and undesired movement of knobs of an upper tray into the recesses of a lower tray is impeded and prevented. On the other side, the friction is low enough to easily remove the upper tray from the lower tray either manually or by a denesting machine.

[0017] Since the second part extends under a larger angle and the transition from the first part to the second part of the upper tray is located above the transition from the first part to the second part of the lower tray a gap will be present between the seconds parts. Due to this gap there is no risk that an undesired amount of underpressure will occur between the two trays during denesting.

[0018] An embodiment of the tray according to the invention is characterized in that the tray is thermoformed from a plastic sheet being 0,5 millimetre or thinner.

[0019] Such a thin sheet has a number of advantages. Less plastic is needed which reduces the costs of the tray as well as the impact on the environment. Furthermore, a tray made of a thinner sheet has the advantage that in production the tray will cool down faster so that the time to produce a tray is reduced. Also, the weight of the tray is reduced so that more trays can be transported within a box having a predetermined weight.

[0020] Another embodiment of the tray according to the invention is characterized in that the first wall extends along the circumference of the tray.

[0021] In this manner the first part can be relatively small whilst still a relatively large surface is obtained being in contact with another tray when nested.

[0022] Another embodiment of the tray according to the invention is characterized in that the second angle is at least 4 degrees, wherein the second angle being larger than the first angle.

[0023] Such an angle of at least 4 degrees makes it easy to separate thermoformed trays having any desirable height from the mould.

[0024] Another embodiment of the tray according to the invention is characterized in that the difference between the first angle and the second angle is between 1 and 5 degrees.

[0025] With such small difference the transition from the first to second part is hardly visible, so that it will not influence the appearance of the tray.

[0026] Another embodiment of the tray according to the invention is characterized in that the undercut extends under an angle of -1 and -10 degrees with the vertical.

[0027] By such an angle it is possible to separate the thermoformed tray from the mould without the need of additional tools are movable inserts in the mould.

[0028] Another embodiment of the tray according to the invention is characterized in that the first part extends over a distance from the flange between 4 and 20 millimetre.

[0029] Such a distance forms a relatively small strip near the flange.

[0030] Another embodiment of the tray according to the invention is characterized in that the tray is formed with a mould comprising at least a single part defining the outer sides of the tray.

[0031] By having such a single part, the mould is relatively simple and can be made at low costs. Since no movable inserts or ejectors are being used, no marks of such kind of inserts or ejectors are visible on the tray. The single part can be made as a whole or can be made out of different sub parts.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032] The thermoformed plastic tray according to the invention will further be explained with reference to the drawings, wherein,

figure 1A and 1B are a cross section and enlarged part of a first embodiment of two nested trays of the prior art,
figure 2A and 2B are a cross section and enlarged part of a second embodiment of two nested trays of the prior art,
figure 3A and 3B are a cross section and enlarged part of a third embodiment of two nested trays of the prior art,
figure 4A and 4B are a cross section and enlarged part of a fourth embodiment of two nested trays of the prior art,
figure 5A and 5B are a cross section and enlarged part of a fifth embodiment of two nested trays of the prior art,
figure 6A and 6B are a cross section and enlarged part of a sixth embodiment of two nested trays of the prior art,
figure 7A-7J are different views of a first embodiment of stacked trays according to the invention,
figure 8A-8H are different views of a tray according the first embodiment of the invention,
figure 9A-9F are different views of a second embodiment of a tray according to the invention,
figure 10A-10B are different views of a third embodiment of a tray according to the invention,
figure 11A-11B are different views of a fourth embodiment of a tray according to the invention.

[0033] In the drawings, like reference numerals refer to like elements.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0034] Figure 1A and 1B are a cross section and enlarged part of a theoretical model of a first embodiment of two nested trays 1 of the prior art. Each thermoformed plastic tray 1 comprises a bottom wall 2, sidewalls 3 extending upwardly from the bottom wall 2 along the circumference thereof, a flange 4 connected to the sidewalls 3 at a side remote of the bottom wall 2.

[0035] The sidewall 3 extends under an angle with the vertical and under an angle A1 the horizontal 5. By this embodiment, the angle A1 is 95 degrees so the angle with the vertical extending perpendicular to the horizontal is 5 degrees.

[0036] At a side of the flange 4 on a side remote of the wall 3, the flange 4 is provided with a downward bend wall 6 and a small wall 7 extending parallel to flange 4. The tray 1 is being made from a foil, whereby after the tray 1 is formed in the foil, the tray 1 is cut out of the foil along outer side 8 of the small wall 7

[0037] The width B of the flange by this embodiment is 4,6 millimetre. The distance between two normally nested trays 1 is C being 5,2 millimetre in this embodiment.

[0038] The distance between a lower surface of the wall 6 of the flange 4 of the upper tray 1 and the upper surface of the flange 4 of the lower tray is D being 3,2 millimetre in this embodiment. This distance D determines the maximum thickness of a tool to be inserted in the gap 9 between two normally nested trays 1 to denest the trays 1 fro each other.

[0039] By normally nested trays 1, upper tray 1 is moved so far in the direction of the bottom 2 of the lower tray 1 till the wall 3 of the upper tray 1 rests at least partially against the wall 3 of the lower tray 1 at contact locations 10. At each contact location 10 the outer diameter E of the upper tray 1 is the same as the inner diameter E of the lower tray 1. By the embodiment as shown in figures 1A, 1B the upper tray 1 rests over a distance F of nearly the full height H of the tray 1 against the lower tray 1. This has the disadvantage that if the trays 1 are pressed into each other due to friction between the walls 3 of the nested trays 1 over the distance F, it will take a relatively large force to separate the trays 1 from each other. The height F is determined by the angle A1 and the thickness T of the wall 3.

[0040] In this theoretical model the thickness T of the wall 3, the flange 4 and the wall 6 are all identical and are equal to the thickness T of the foil from which the tray 1 is being made, In practice the local thickness may vary. By this embodiment the thickness T is 0,5 millimetre.

[0041] Figure 2A and 2B are a cross section and enlarged part of a theoretical model of a second embodiment of two nested trays 1 of the prior art.

[0042] The only difference between tray 1 of the embodiment as shown in figures 1A and 1B and the tray 1 of the embodiment as shown in figures 2A and 2B is that the thickness T is 0,3 millimetre instead of 0,5 millimetre. The height H is the same.

[0043] Due to the smaller thickness T, the upper tray 1 can moved further into the lower tray 1, so that the distance F will be larger. Due to the larger distance F it will be even more difficult to separate the trays 1 from each other.

[0044] By this embodiment A1 is 95 degrees, B is 4,6 millimetre, C is 3,1 millimetre, D is 1,1 millimetre. The distance D of the gap 9 of 1,1 millimetre requires a relatively precise tool to be inserted into the gap 9.

[0045] To prevent the sidewalls 3 of the nested trays 1 to have a large contact surface over a distance F, trays according to the prior art embodiments as shown in the figures 3A-6B have been provided with denesting knobs 11. The denesting knobs 11 also provide a constant spacing between the flanges 4 of the stacked trays 1, which facilitates the mechanical separation of the trays 1 from each other.

[0046] Figure 3A and 3B are a cross section and enlarged part of a theoretical model of a third embodiment of two nested trays 1 of the prior art.

[0047] The tray 1 is similar to tray 1 of the first embodiment except that it is provide with a number of denesting knobs 11. Each denesting knob 11 is provided with a first knob wall 12 connected to the flange 4 and extending under a sharp angle A2 with the flange 4. This sharp angle A2 forms an undercut. The denesting knob 11 is further provided with a second knob wall 13 connected between the first knob wall 12 and the wall 3 of the tray 1. On the inner side of the tray 1, the knob walls 12, 13 define a recess 14 being wider at a bottom near the knob wall 13 than at the flange 4.

[0048] By the embodiment as shown in the figures 3A and 3B, A1 is 95 degrees, A2 is 84 degrees, B is 4,6 millimetre, C is 6 millimetre, D is 4 millimetre, T is 0,5 millimetre. Since the trays 1 are spaced apart over 6 millimetres instead of over 5,2 millimetres as by the first embodiment of figures 1A, 1B, the wall 3 of the upper tray 1 will not rest against the wall 3 of the lower tray 1 but the movement of the upper tray 1 into the lower tray 1 will be stopped when the knob wall 13 of the upper tray 1, rests on the flange 4 of the lower tray 1. By the dimensions of this third embodiment, the knob wall 13 of the upper tray 1 rests over a distance K of 1,2 millimetre on the flange 4 of the lower tray 1. Furthermore a space 26 with a distance S of 0,1 millimetre will be present between the walls 3 of the nested trays 1.

[0049] Figure 4A and 4B are a cross section and enlarged part of a theoretical model of a fourth embodiment of two nested trays 1 of the prior art.

[0050] The only difference between tray 1 of the embodiment as shown in figures 3A and 3B and the tray 1 of the embodiment as shown in figures 4A and 4B is that the thickness T is 0,3 millimetre instead of 0,5 millimetre. Due to the smaller thickness, the distance K is also smaller and is 1 millimetre. The distance S of the space 26 between the walls 3 of the nested trays 1 is 0,2 millimetre so larger than at the third embodiment.

[0051] Figure 5A and 5B are a cross section and enlarged part of a theoretical model of a fifth embodiment of two nested trays 1 of the prior art.

[0052] The only difference between tray 1 of the embodiment as shown in figures 4A and 4B and the tray 1 of the embodiment as shown in figures 5A and 5B is that the height of the knob wall 12 is reduced so that the distance C is 4 millimetre and the distance D is 2 millimetre. By doing so the distance K is 0,6 millimetre and the distance S of space 26 is 0,1 millimetre. The distance S is now the same as by the third embodiment.

[0053] Although the dimensions of the tray 1 as such are as desired, the distance K is relatively small, especially taken into account that the dimensions as shown are theoretical dimensions and that in practice by forming the tray 1 all sharp edges between transition from one wall to another wall be rounded. Due to rounded transitions in reality the distance K will be even less than 0,6 millimetre.

[0054] Such a small distance K has the disadvantage that the knob 11 of the upper tray 1 can easily slide from the flange 4 into the recess 14 under a slight deformation of both trays 1. Hereby the flange 4 of the upper tray 1 may even come in abutment with the flange 4 of the lower tray. It will be clear that in such a case separation of the trays 1 become difficult especially in automated processes. When using even thinner foils than 0,3 millimetre the problem will get even worse.

[0055] Figure 6A and 6B are a cross section and enlarged part of a theoretical model of a sixth embodiment of two nested trays 1 of the prior art.

[0056] The only difference between tray 1 of the embodiment as shown in figures 5A and 5B and the tray 1 of the embodiment as shown in figures 6A and 6B is that the angle A1 of the wall 3 is 93 degrees instead of 95 degrees. As can be seen the walls 3 of the nested trays 1 will overlap over a distance V being 0,1 millimetre by this embodiment. Figures 6A and 6B show theoretically nested trays 1. When the trays 1 with the dimensions as shown in figure 6A will be made and nested, this would only be possible under deformation of the relatively thin walls 3 whereby the nested trays 1 will be stuck into each other.

[0057] The trays 1 as described above are all prior art trays.

[0058] The trays 20 according to the invention as will be shown here below differ from the prior art trays 1 in that the first parts 21 of the sidewalls 3 extends under a first angle A0 between 0 and 5 degrees with the vertical over a distance from the flange 12 being larger than a distance from the flange 4 to the bottom of the recess 14, whilst a second part 22 of the sidewalls 3 is located between the first part 21 and the bottom 2, which second part 22 extends under a second angle A1 being larger than the first angle A0.

[0059] Figures 7A-7J show different views of a first embodiment of trays 20 according to the invention.

[0060] Figure 7A shows a perspective view of two nested trays 20 comprising bottom walls 2, sidewalls 3, flanges 4 and four denesting knobs 11. The denesting knobs 11 are located in each corner of the rectangular trays 20.

[0061] Figure 7B shows a top view of the two nested trays 20 as shown in figure 7A.

[0062] Figures 7C and 7G show cross sections as indicated in figure 7B of the nested trays 20 at a corner and in the middle of a sidewall 3 respectively.

[0063] Figures 7D and 7E show enlarged cross sections as indicated in figure 7C of a tray 20 of a theoretical model,

[0064] Figures 7F shows an enlarged cross section as indicated in figure 7C of a tray 20 in practice,

[0065] Figures 7H and 7J show enlarged cross sections as indicated in figure 7G of a tray 20 of a theoretical model and in practice respectively.

[0066] Each wall 3 of the tray 20 comprises a first part 21 of the sidewalls 3 extending under a first angle A0 between 90 and 95 degrees with the horizontal, being 93 degrees in this embodiment. The first part 21 of the wall 3 of the tray 20 extends over a distance Lo from the top of the flange 4, L1 being 10,3 millimetres in this embodiment. At the knob 11 the first part 21 extends over a distance L1 from the lower side of the knob wall 13, being 6 millimetre in this embodiment and equal to Lo-C-T. Furthermore, in this embodiment A2 is 84 degrees, B is 4,6 millimetre, C is 4 millimetre, D is 2 millimetre, K is 0,8 millimetre and T is 0,3 millimetre. A second part 22 of the sidewalls 3 is located between the first part 21 and the bottom 2, which second part 22 extends under a second angle A1 being larger than the first angle Ao. In this embodiment A1 is 95 degrees.

[0067] At a distance Lo of the flange 4 the transition 23 from the first part 21 of the upper tray 20 to the second part 22 thereof is located. At a distance Lo of the flange 4 the transition 24 from the first part 21 of the lower tray 20 to the second part 22 thereof is located. Since the transition 24 is located at a distance C below the transition 23, and the second part 22 extends under a larger angle A1 than the first part 21, a wedge shaped opening 25 is located between the transitions 23, 24, whilst a space 26 with a constant distance S is located below the lower transition 24. In the theoretical model of figure 7E the first walls 21 partly overlap over a distance V being 0,1 millimetre near the knob wall 13 of the lower tray 20 and 0 at a distance F thereof.

[0068] In practice, as can be seen in the figures 7F and 7J, all edges at transitions between the walls 7, 6, 4, 12, 13, 21, 22 and 2 are not abrupt as in the theoretical models but are rounded with an outer curvature 27 having a radius of for example 1 millimetre. Due to the curvatures the distance K for example is smaller than 0,8 at the theoretical model. Furthermore, due to the relatively thin walls 21, 22 of 0,3 millimetre, the walls 21 will deform and will not overlap but pressed against each other over the distance F, preventing the upper tray 20 and the knobs 11 thereof to move further into the lower tray 20 than the position as shown in figures 7F and 7J.

[0069] Since the difference between the angles A1 and A0 is only 2 degrees in this embodiment a user of the tray 20 can hardly see the transition 23, 24 and the tray 20 seems to have flat continues sidewalls 3.

[0070] Having an angle A2 of 84 degrees of the knob 11 provides a slight undercut making it possible to use simple moulds comprising at least a single part defining the outer sides of the tray without the need of movable inserts in this single part. In this manner the moulds can be relatively cheap, which will reduce the costs of the trays 20.

[0071] Figures 8A-8H show different views of the tray 20 according to the invention as shown in the figures 7A-7J.

[0072] Figure 8A shows a perspective view of the tray 20.

[0073] Figure 8B shows a top view of the tray 20 as shown in figure 8A.

[0074] Figures 8C and 8F show cross sections as indicated in figure 8B of the tray 20 at a corner and in the middle of a sidewall 3 respectively.

[0075] Figures 8D and 8E shows an enlarged cross section as indicated in figure 8C of a tray 20 of a theoretical model and in practice respectively.

[0076] Figures 8G and 8H shows an enlarged cross section as indicated in figure 8F of a tray 20 of a theoretical model and in practice respectively.

[0077] Figures 9A-9D show different views of a second embodiment of nested tray 20 according to the invention.

[0078] Figure 9A shows a perspective view of the nested trays 20.

[0079] Figure 9B shows a top view of the nested trays 20 as shown in figure 9A.

[0080] Figure 9C shows cross section as indicated in figure 9B of the tray 20 at a corner thereof.

[0081] Figure 9D shows an enlarged cross section as indicated in figure 9C of the tray 20 of a theoretical model thereof,

[0082] Figure 9E shows an enlarged exaggerated cross section as indicated in figure 9C of the tray 20 of a practical model thereof,

[0083] Figure 9F shows an enlarged exaggerated cross section as indicated in figure 9C of the tray 20 of a practical model thereof,

[0084] By this second embodiment, A0 is 93 degrees, A1 is 98 degrees, A2 is 84 degrees, B is 4,6 millimetre, C is 4 millimetre, D is 2 millimetre, K is 0,8 millimetre, T is 0,3 millimetre, L0 is 10,3 milimetre, L1 is L0-C-T so 6 millimetre.

[0085] By this embodiment the walls 21 of the upper and lower tray 20 are located against each other below the knobs 11 and along the sides of the walls 3 between the knobs 11. In figure 9D the walls 21 partly overlap but in practice the walls 21 will deform and press against each other so that there will be no play between the first parts 21 of the side walls 3. The first parts 21 of the side walls 3 support the function of the knobs 11 and thereby preventing the nested trays 20 to get stuck in each other. At the overlapping walls 21, the distance S is negative in the theoretical model. In practice the walls 21 are in abutment with each other so the distance S will be zero.

[0086] As can be seen in the figures 9E and 9F, the wall 21 of the upper tray 1 rests over a distance F against the wall 21 of the lower tray 1. At the knobs 11 the distance F is about the distance C smaller than the distance F at a location on the side walls 3 between the knobs 11.

[0087] Due to the wall 6 providing a beading profile the flange 4 is relatively rigid despite the relative thin thickness thereof.

[0088] If no undercut would be present and the angle A2 would be 90 degrees, due to the curvatures 27 the distance K would be less than the thickness T of the knob wall 12 so would be less than 0,3 millimetre. With such distance K, the knobs 11 op the upper tray 20 will not sufficiently be supported by the flange 4 of the lower tray 21 at the rounded transition between the flange 4 and the knob wall 12 thereof.

[0089] The tray 20 according to the invention has the advantage that the foil from which the tray 20 is being made can be relatively thin so being 0,5 millimetre, preferably less so for example 0,3 millimetre or even less, like 0,2 millimetre, whilst still being made with relatively cheap moulds and having good nesting and denesting features due to the first part and second part of the sidewalls 3 having different angles A0 and A1 in combination with denesting knobs 11 having an undercut with a relatively large angle A2 between 80 and 89 degrees with the horizontal being -1 and -10 degrees with the vertical. With the right dimensions and locations of the knobs 11 and the first parts 21 of the side walls 3, the knobs 11 of the upper tray 20 will be located and positioned on the flange 4 of the lower tray about the same time as the first parts 21 of the side walls 3 of the upper tray 20 comes in abutment with and deforms the first parts 21 of the side walls 3 of the lower tray 20 so that the knobs 11 of the upper tray 20 are prevented from entering the recesses 14 of the knobs 11 of the lower tray 20. It is also possible that the first parts 21 of the side walls 3 of the upper tray 20 comes in abutment with and deforms the first parts 21 of the side walls 3 of the lower tray 20 a little bit earlier than that the knobs 11 of the upper tray 20 will be located and positioned on the flange 4 of the lower tray. In this manner, there will be no play at the moment that the knobs 11 of the upper tray 20 will abut the flange 4 of the lower tray 20.

[0090] Figures 10A and 10B show different views of a fifth embodiment of nested trays 20 according to the invention. Figure 10A shows a cross section of stacked trays 20 at the denesting knobs 11, whilst figure 10B shows a cross section of stacked trays 20 at the sidewalls 3. The transition between the first part 21 of sidewall 3 and the second part 22 of sidewall 3 is formed by a horizontally extending flange 28.

[0091] Figures 11A and 11B show different views of a fourth embodiment of nested trays 20 according to the invention. Figure 11A shows a cross section of stacked trays 20 at the denesting knobs 11, whilst figure 11B shows a cross section of stacked trays 20 at the sidewalls. The first part 21 of sidewall 3 comprises two subparts 21', 21". The first subpart 21' is connected to the flange 4, whilst the second subpart 21" is connected to the first subpart at transition 29 and to the second part 22 of the side wall 3 at transition 23, 24. The first subpart 21' extends under a first angle A01, the second subpart 21" extends under a second angle A02, wherein the angle A02 is larger than the angle A01 but smaller than 5 degrees with the vertical. The second part 22 of the sidewalls 3 extends under a third angle A1 being larger than the first and second angles A01, A02.

[0092] If desired the first part 21 can be divided in more subparts. In the same manner the second part 22 can be divided into subparts.

[0093] If the difference between the angles A0 and A1 is relatively small, for example between 2 and 5 degrees, the transition is hardly visible and the sidewall 3 will seems to have a flat appearance.

[0094] Preferable the first wall 21 extends along the whole circumference of the tray 20 so that along the whole circumference nested trays 20 are being in contact which each other at the first walls 21 of the upper and lower trays 21.

[0095] It is also possible that the walls 21 of the upper and lower tray 20 are not in abutment with each other at the knobs 11 but only along the sides of the side walls 3 between the knobs 11.

[0096] The trays 20 can be made of any suitable thermoplastic like Amorphous Polyethylene Terephthalate (A-PET), Polystyrene (PS), Polypropylene (PP) being transparent so that the products located inside a tray 20 are visible or being opaque so that the products are hidden from view.

[0097] The knobs 11 can be located at corners of the trays 20 but can also be located at a distance thereof. The knobs 11 of each tray 20 can be located at the same position so that the knobs 11 of nested trays 20 will be aligned or can be located at different positions so that the knobs 11 of nested trays 20 will not be aligned.

[0098] As mentioned above, preferably the undercut extends under an angle A2 of - 1 and -10 degrees with the vertical. The plastic from which the tray is being moulded shrinks during the moulding process. If the plastic shrinks more, a larger undercut is possible whilst still being able to easily remove the tray from the mould. For example Polypropylene (PP) shrinks more than Polyethylene Terephthalate (PET), so the undercut by PP can be larger than by PET.

LIST OF REFERENCE SIGNS

[0099]

1	tray
2	bottom wall
3	side wall
4	flange
5	horizontal
6	wall
7	wall
8	outer side
9	gap
10	location
11	denesting knob
12	first knob wall
13	second knob wall
14	recess
21	first part of side wall
22	second part of side wall
20	tray
23	transition
24	transition
25	opening
26	space
27	curvature
28	flange
29	transition
A0	angle
A01	angle
A02	angle
A1	angle
A2	angle
B	width
C	distance
D	distance
E	diameter
F	distance
H	height
K	distance
Lo	distance
L1	distance
S	distance
T	thickness
V	distance

Claims

1. A thermoformed plastic tray (20) comprising a bottom wall (2), sidewalls (3) extending upwardly from the bottom wall (2) along the circumference thereof, a flange (4) connected to the sidewalls (3) at a side remote of the bottom wall (2) and denesting knobs (11) each comprising a recess (14) positioned at an edge between the sidewalls (3) and the flange (4), which denesting knobs (11) are provided with undercuts causing the recess (14) to be wider at a bottom thereof than at the flange (4), **characterized in that** a first part (21) of at least one of the sidewalls (3) extends under a first angle (A0) between 0 and 5 degrees with the vertical over a distance (Lo) from the flange being larger than a distance (C) from the flange (4) to the bottom of the recess (14) , whilst a second part of the at least one of the sidewalls (3)

is located between the first part and the bottom, which second part extends under a second angle (A1) being larger than the first angle (A0).

2. A tray (20) according to claim 1, **characterized in that** the tray (20) is thermoformed from a plastic sheet being 0,5 millimetre or thinner.

3. A tray (20) according to claim 1 or 2, **characterized in that** the first wall extends along the circumference of the tray.

4. A tray (20) according to one of the preceding claims, **characterized in that** the second angle (A1) is at least 4 degrees, wherein the second angle (A1) being larger than the first angle (A0).

5. A tray (20) according to one of the preceding claims, **characterized in that** difference between the first angle (A0) and the second angle (A1) is between 1 and 5 degrees.

6. A tray (20) according to one of the preceding claims, **characterized in that** the undercut extends under an angle (A2) of -1 and -10 degrees with the vertical.

7. A tray (20) according to one of the preceding claims, **characterized in that** the first part extends over a distance from the flange (4) between 4 and 20 millimetre.

8. A tray (20) according to one of the preceding claims, **characterized in that** the tray (20) is formed with a mould comprising at least a single part defining the outer sides of the tray (20).

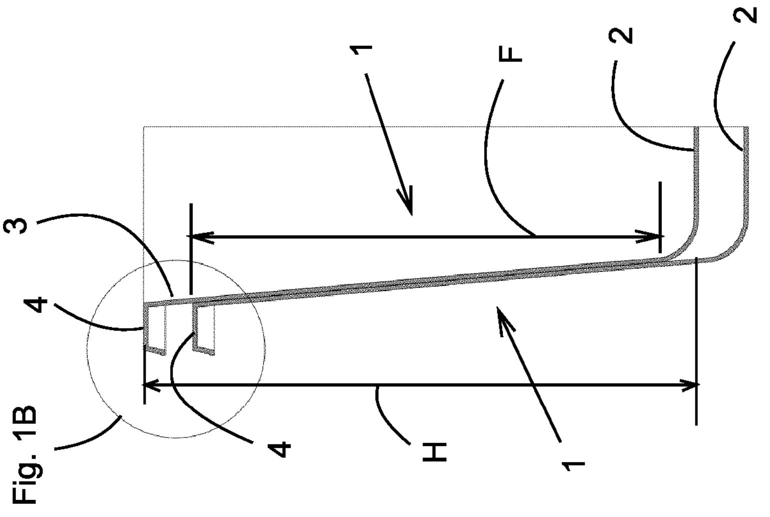


Fig. 1A

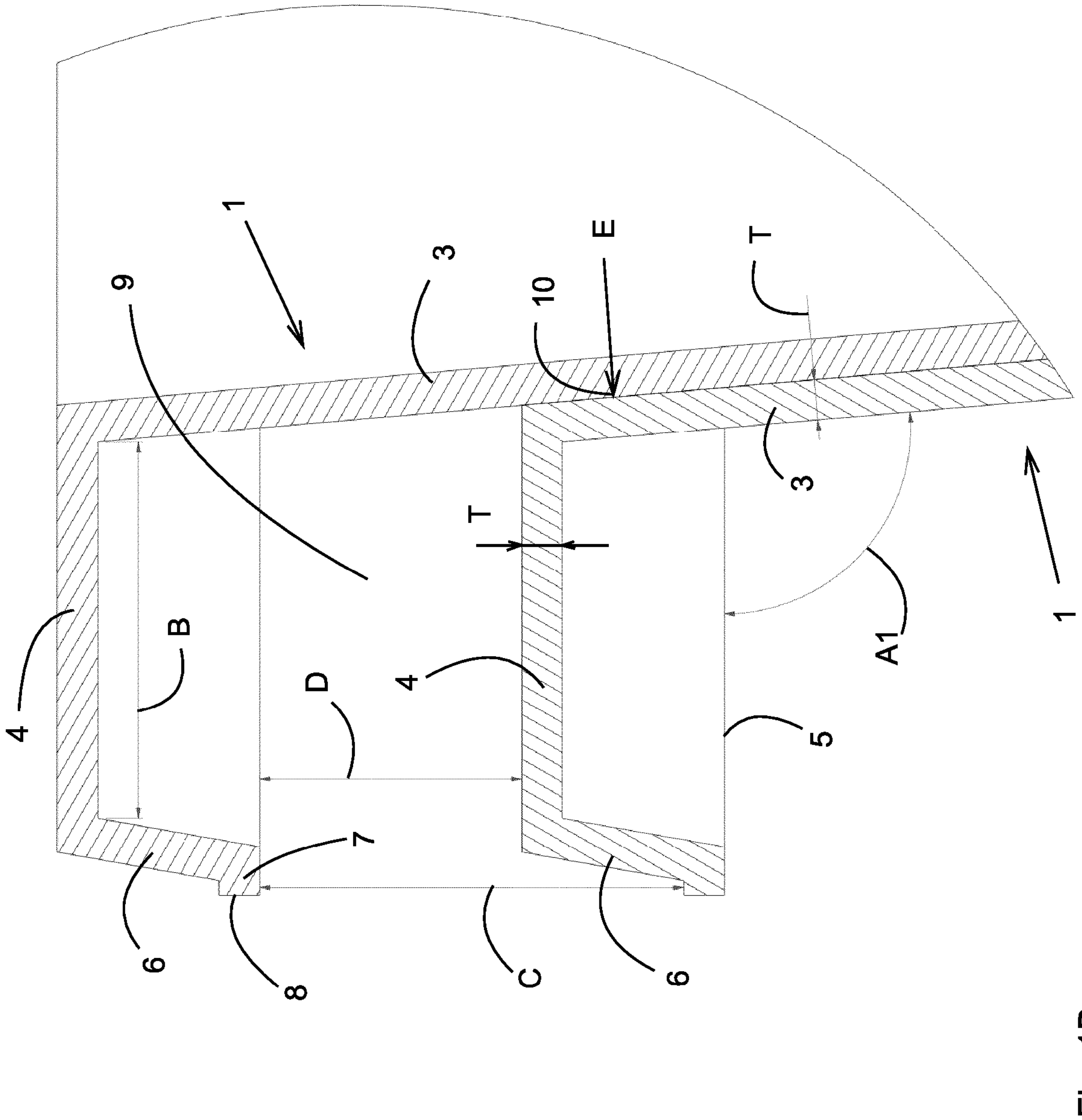


Fig. 1B

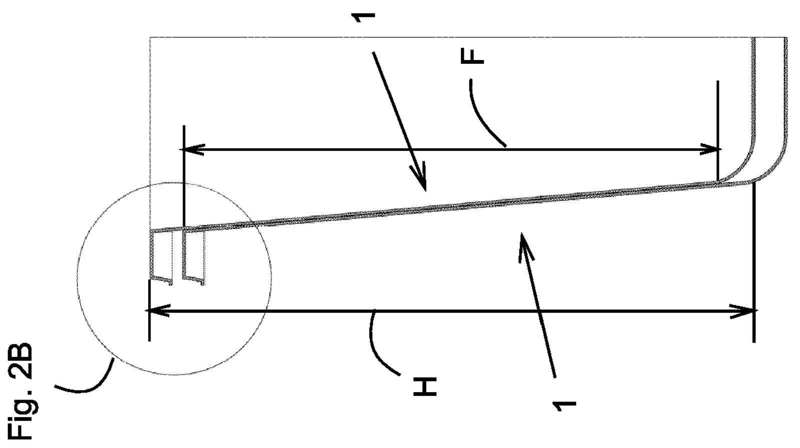


Fig. 2A

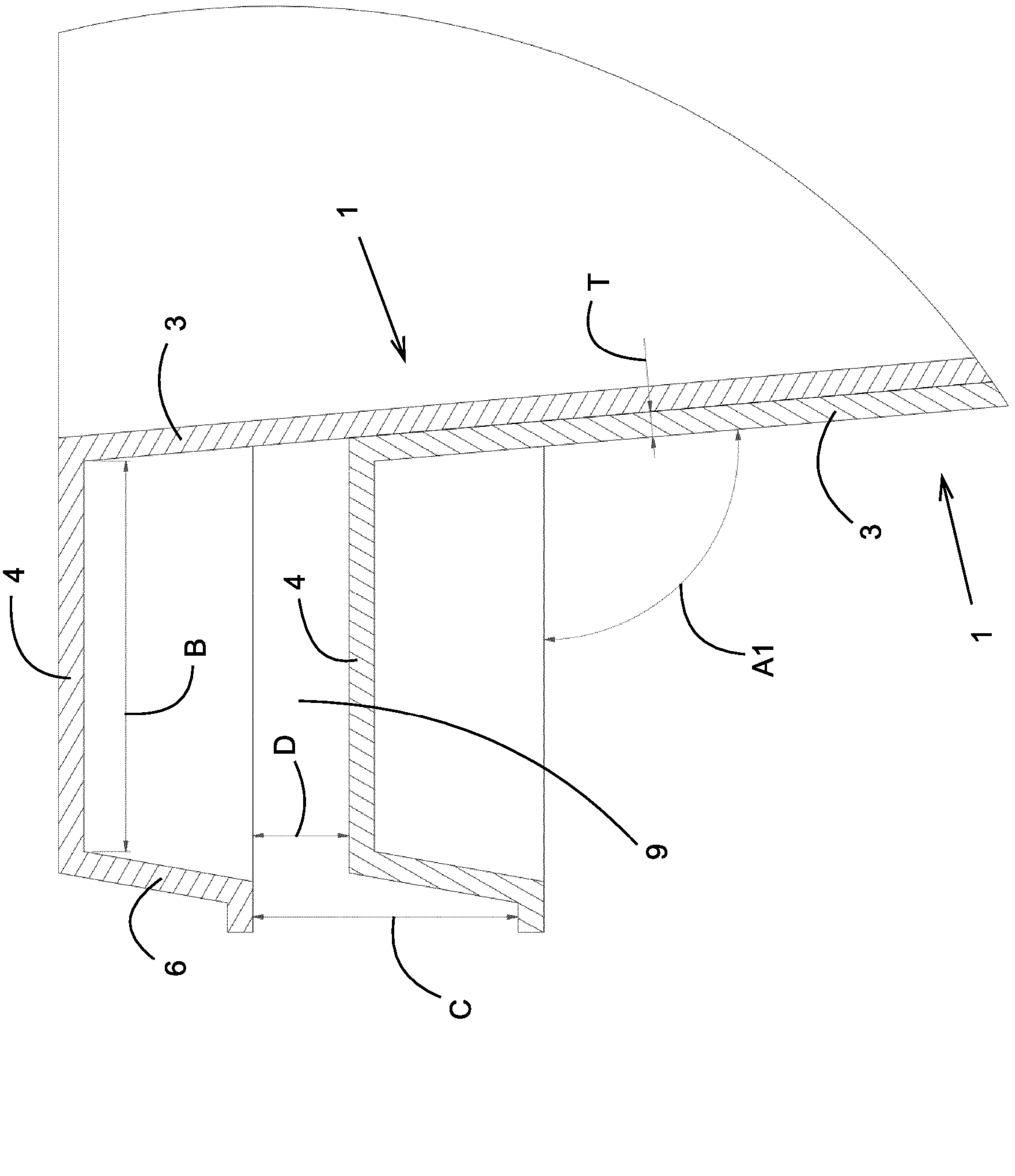


Fig. 2B

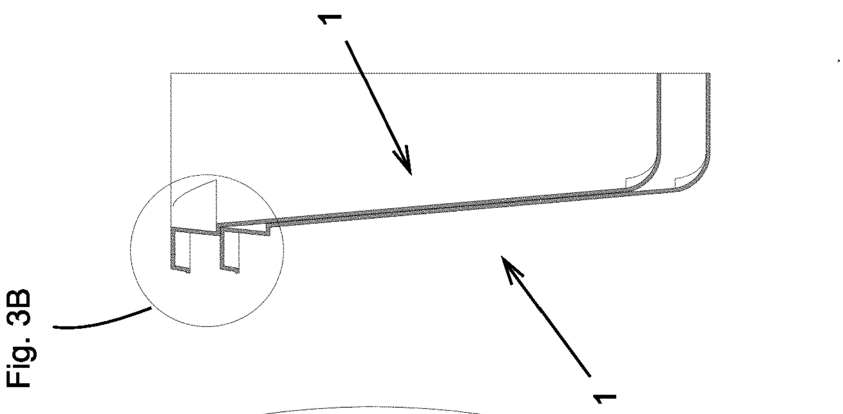


Fig. 3A

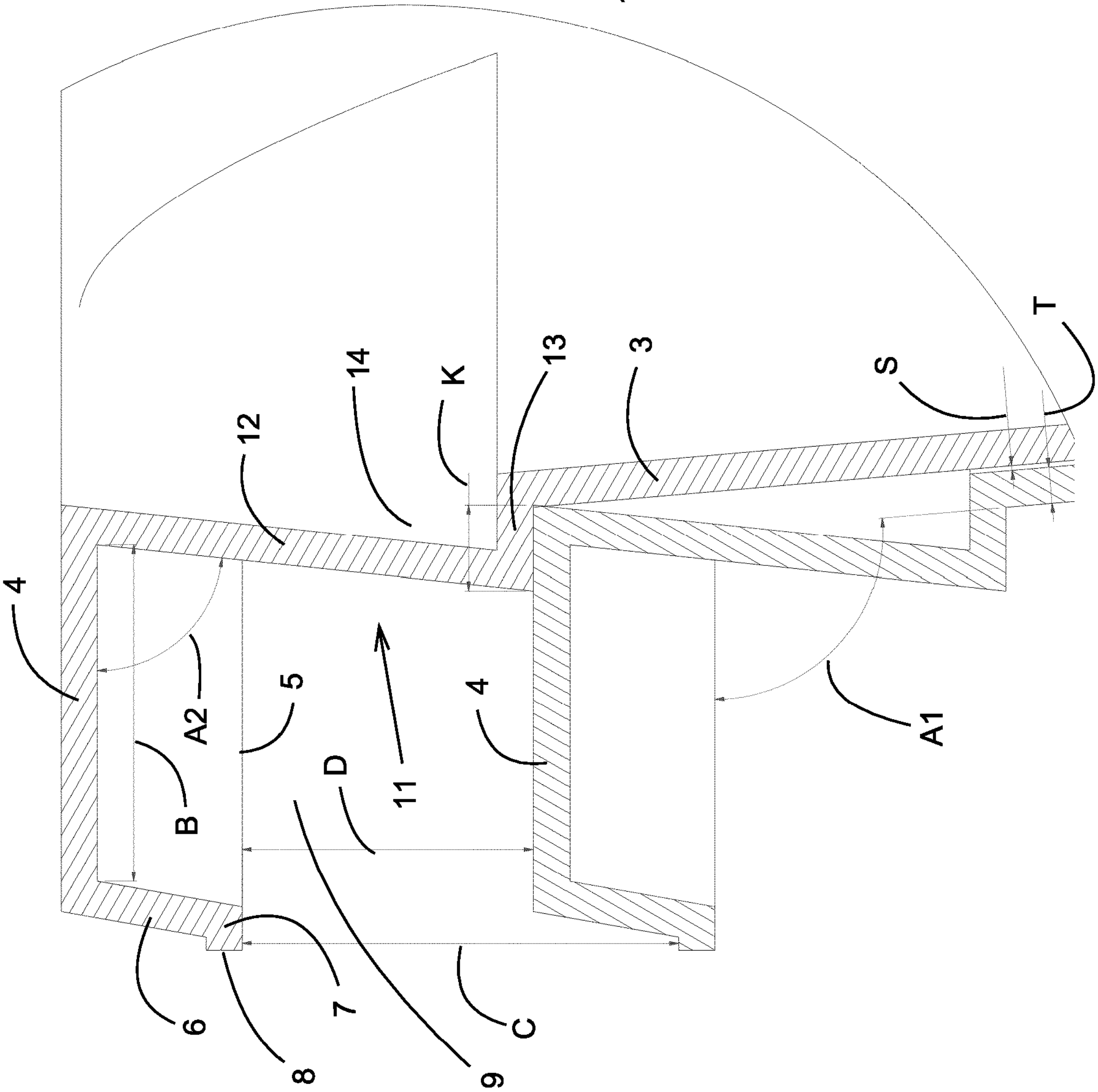


Fig. 3B

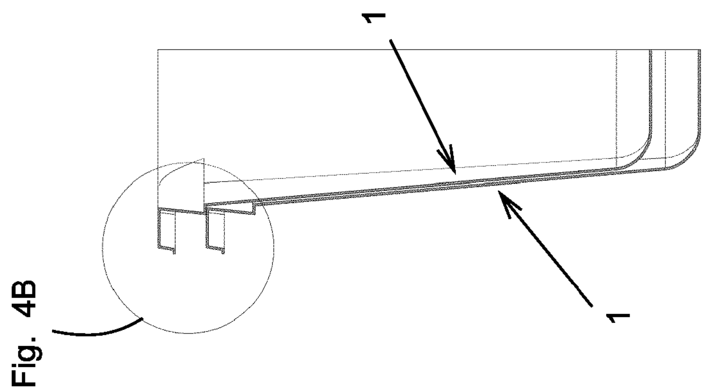


Fig. 4A

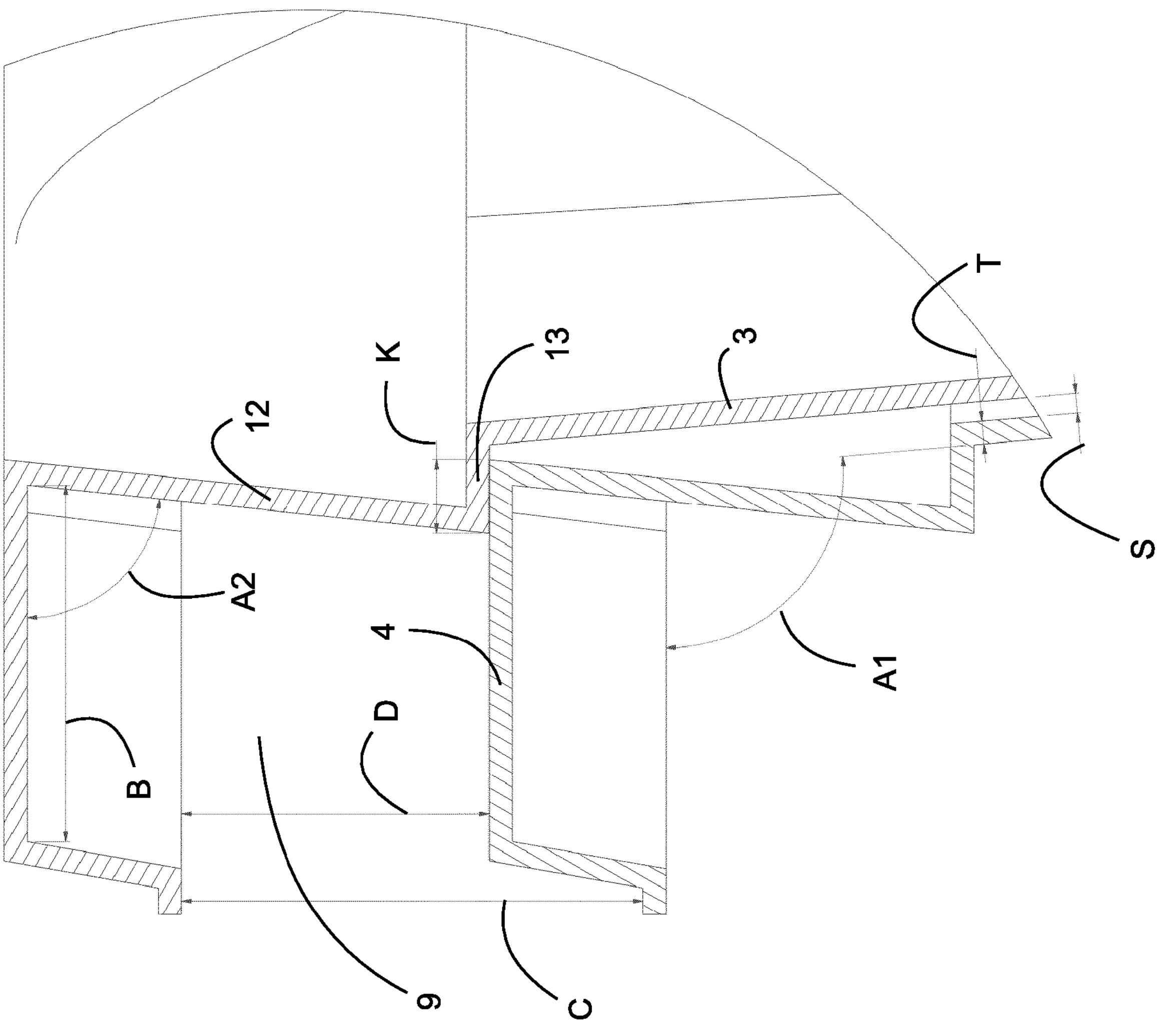
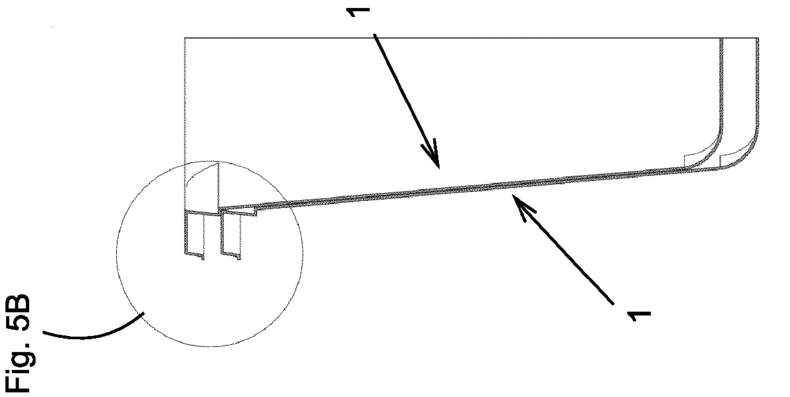


Fig. 4B



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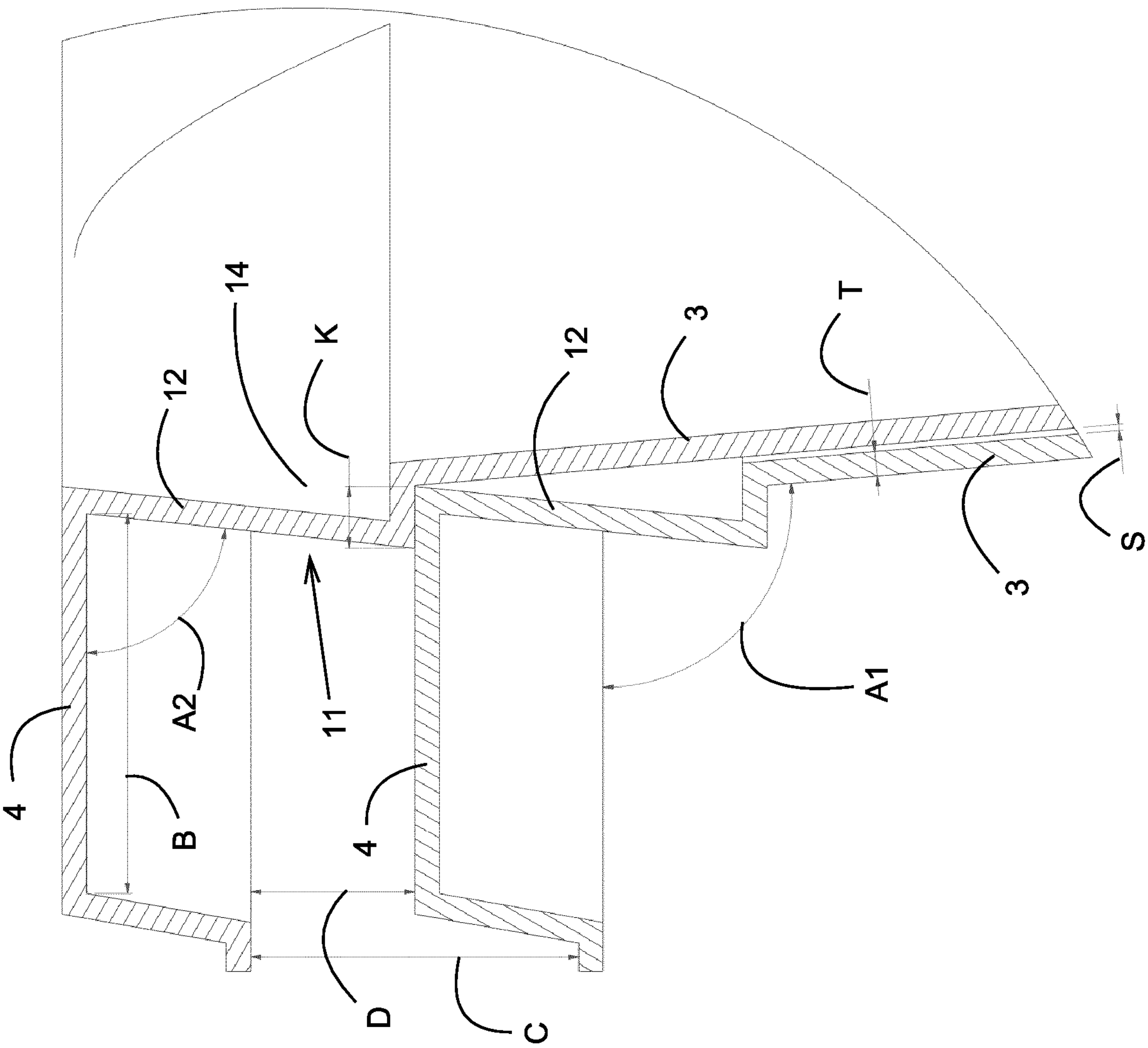


Fig. 5B

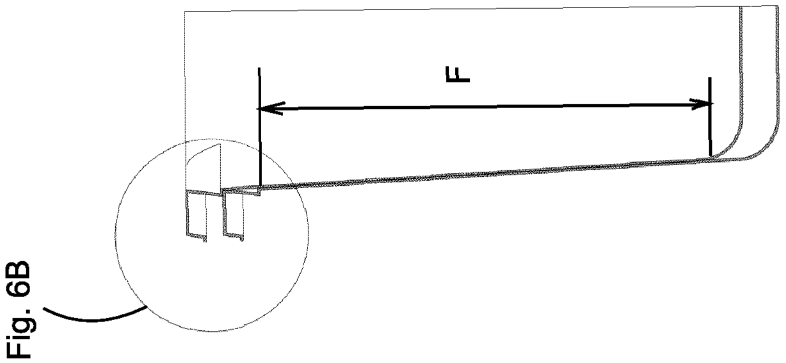


Fig. 6A

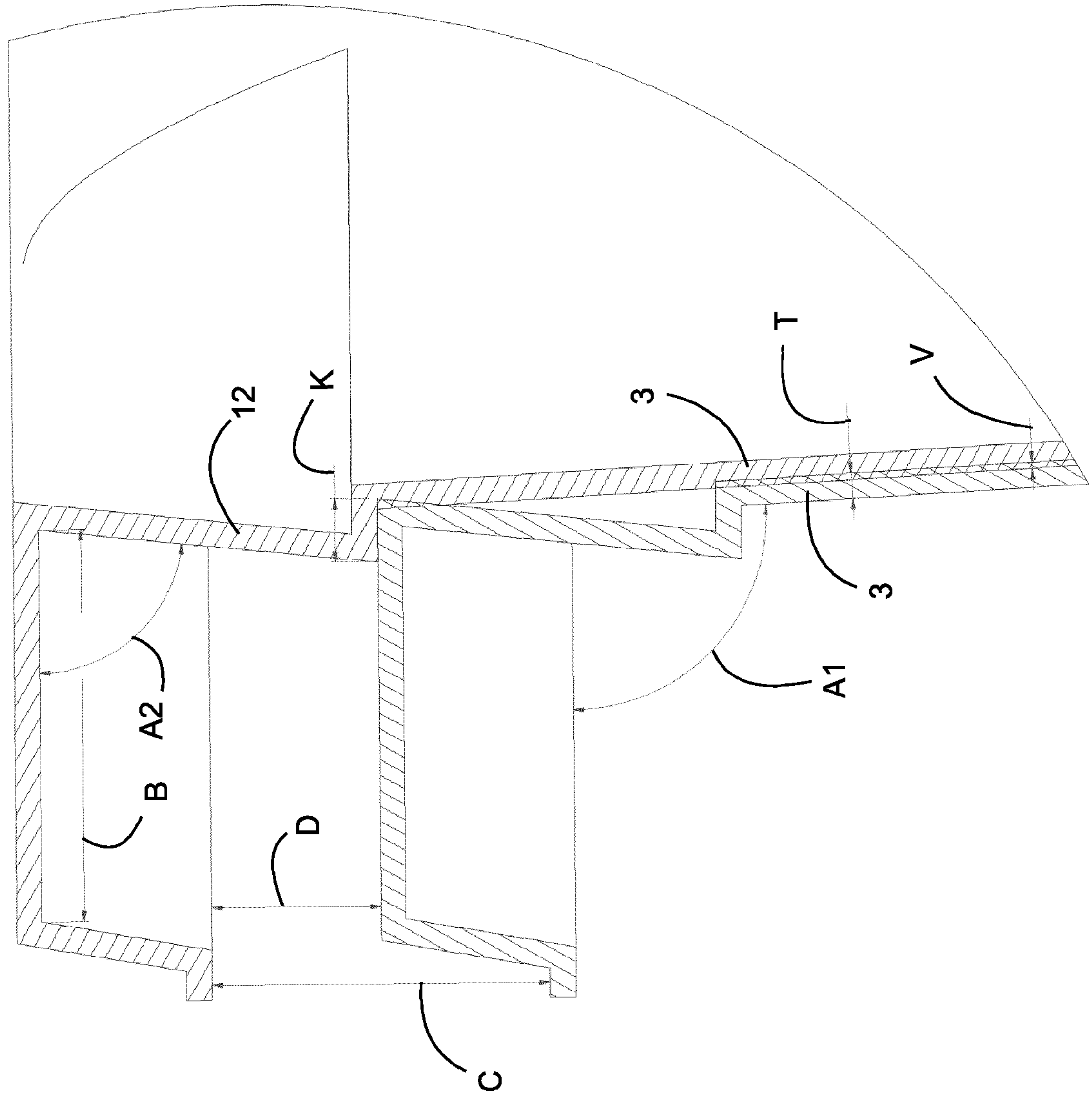


Fig. 6B

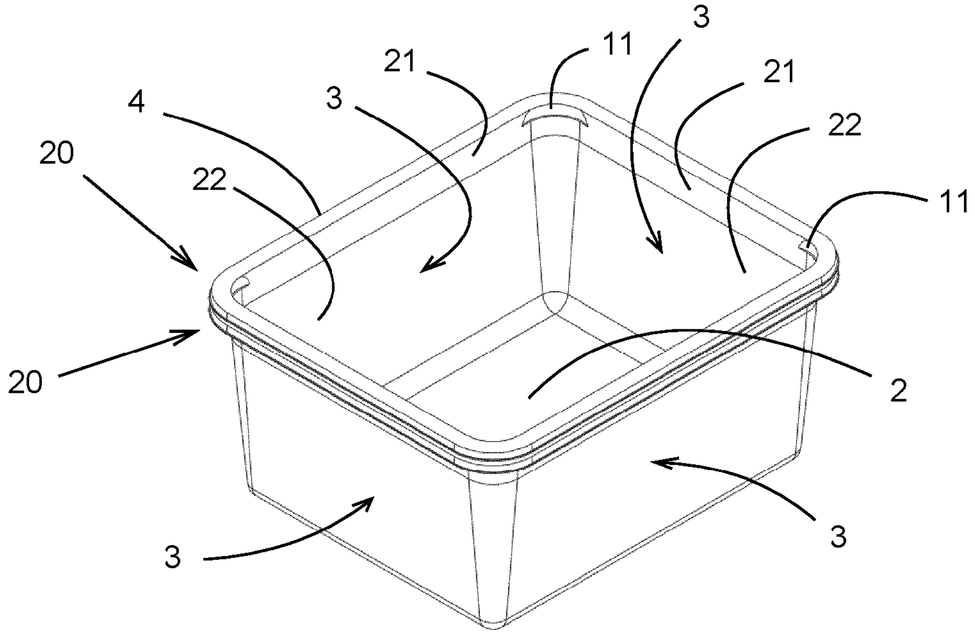


Fig. 7A

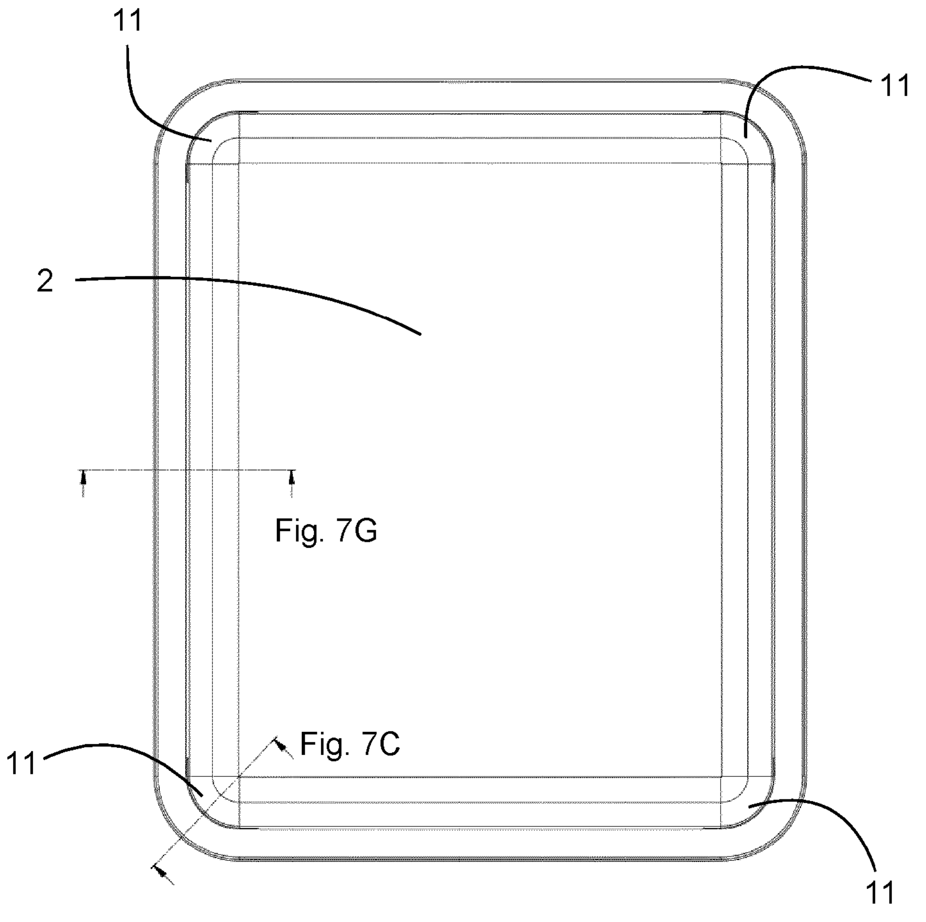


Fig. 7B

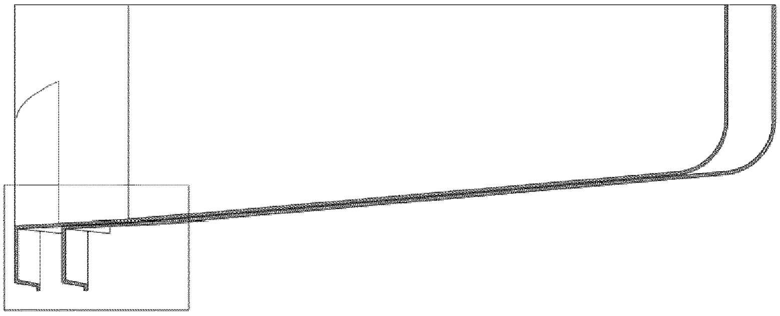


Fig. 7G

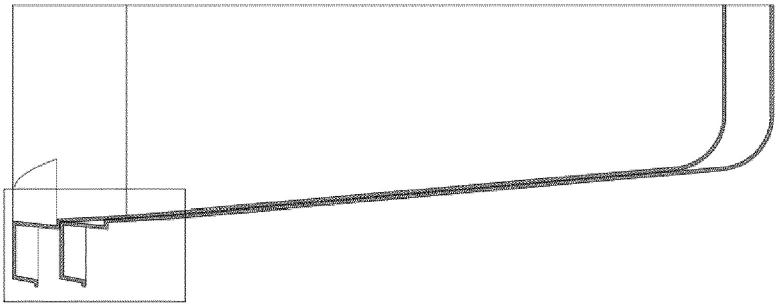


Fig. 7C

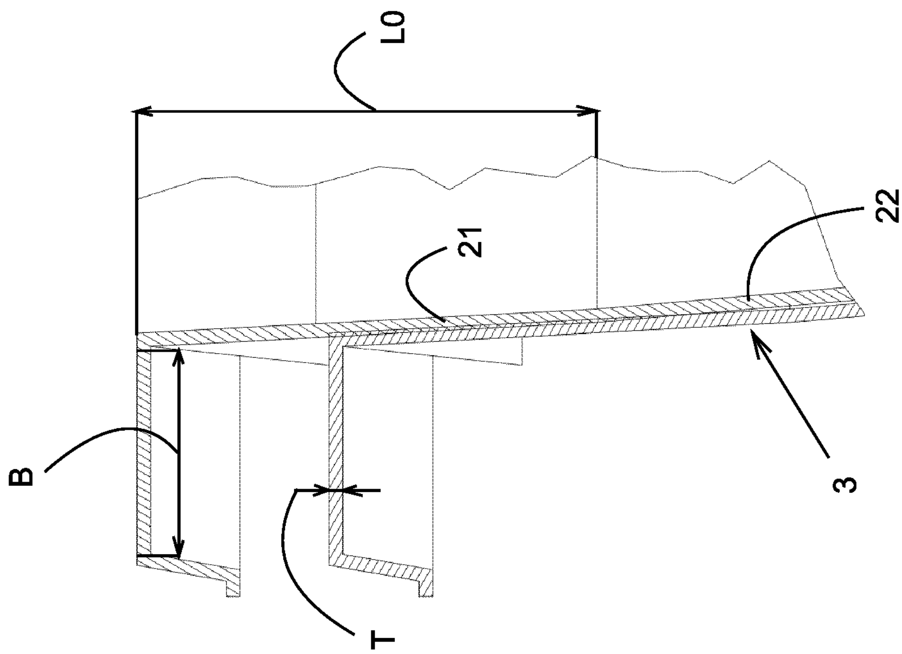


Fig. 7H

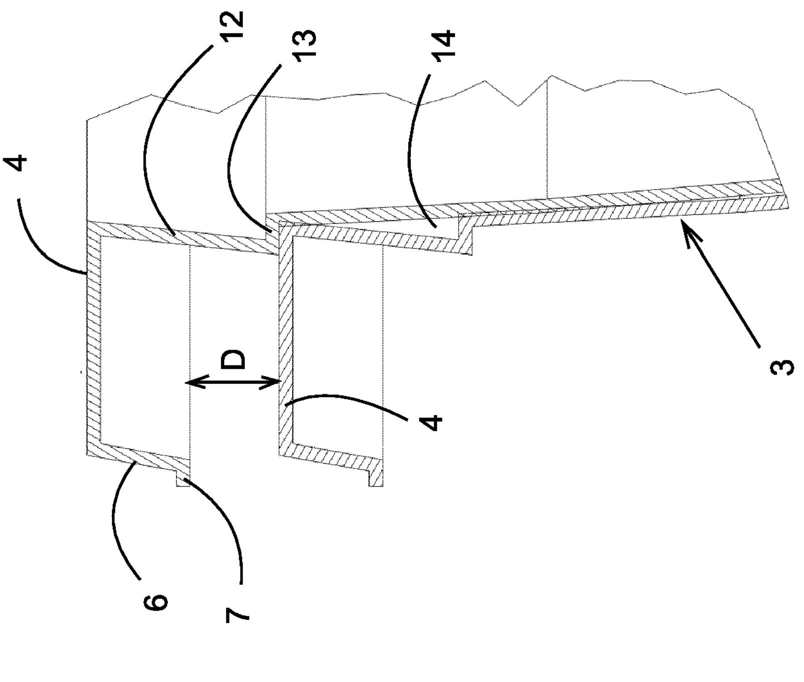


Fig. 7D

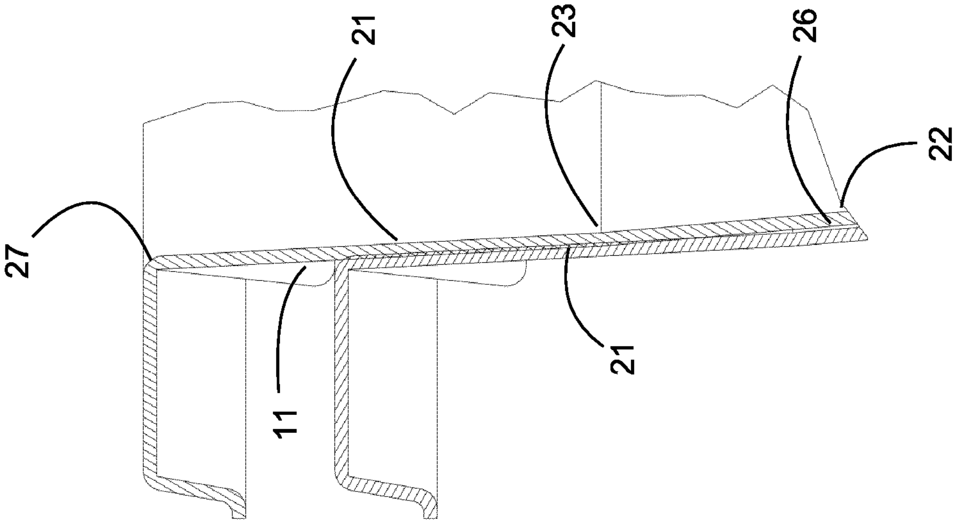


Fig. 7J

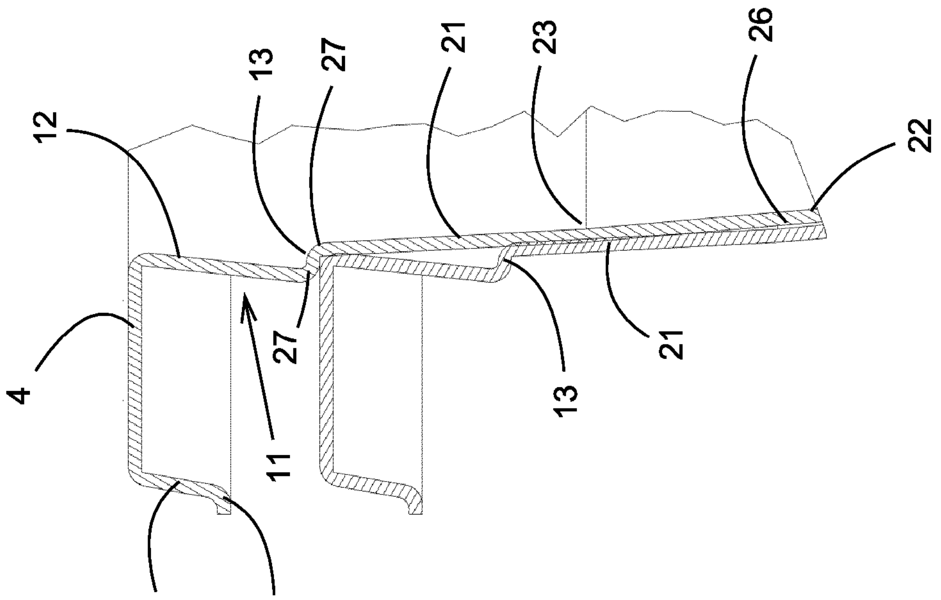


Fig. 7F

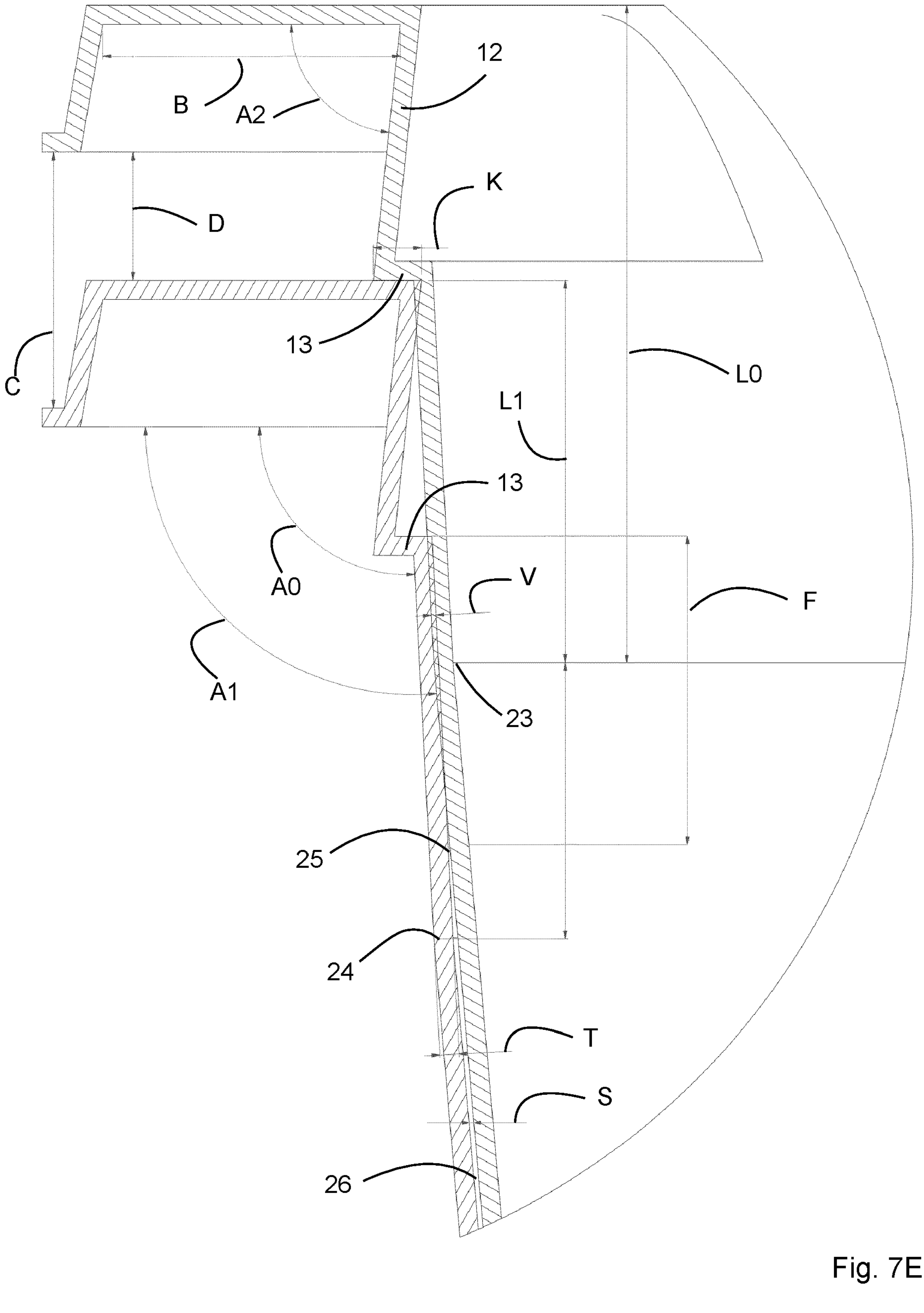


Fig. 7E

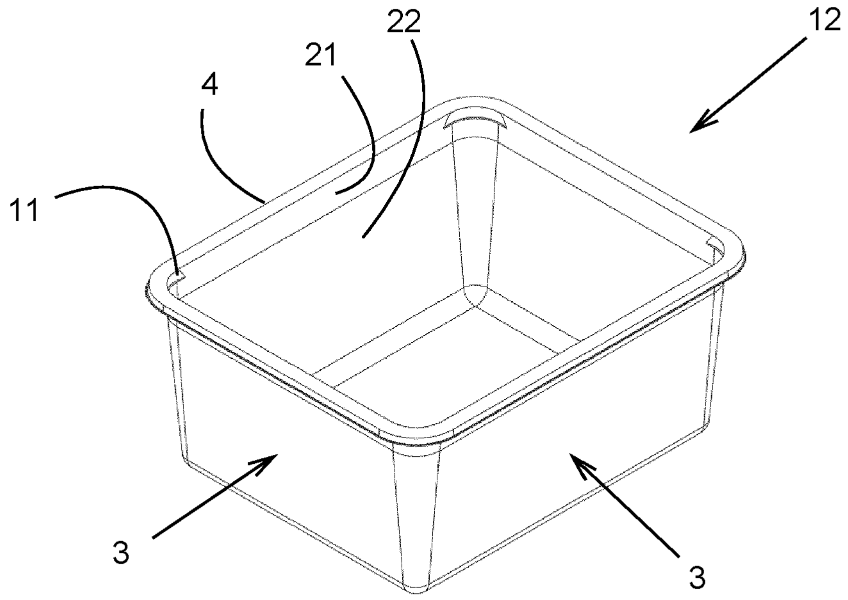


Fig. 8A

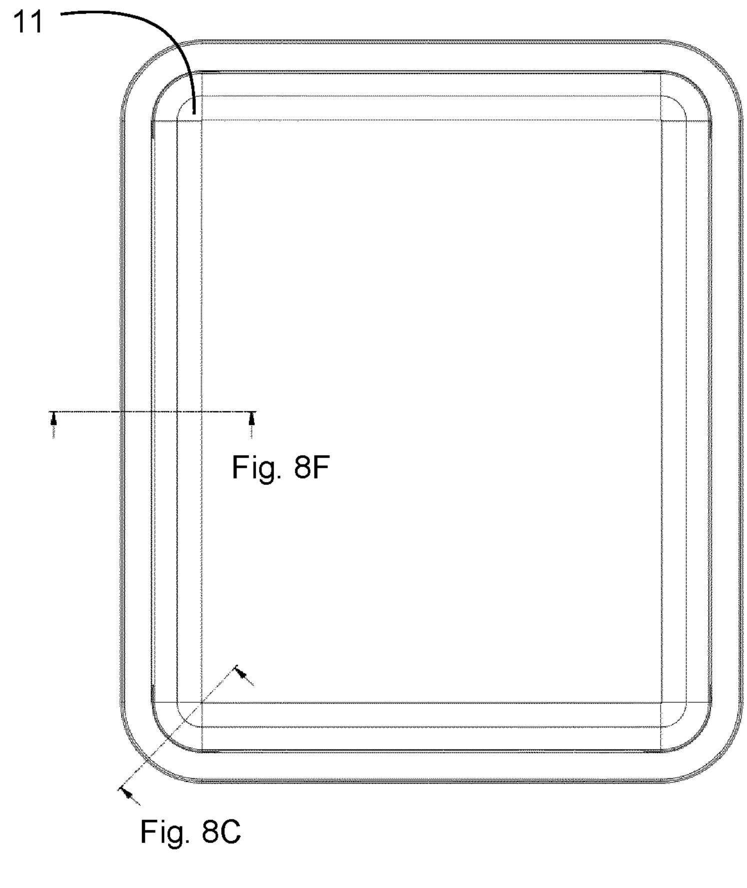
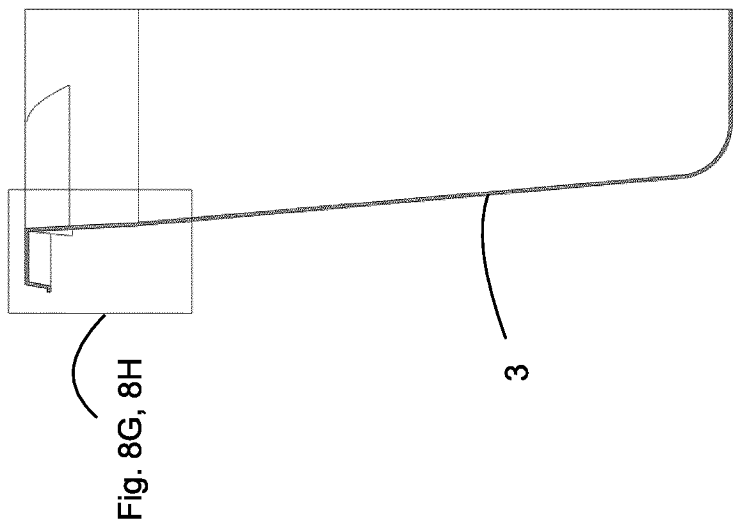


Fig. 8B

Fig. 8F



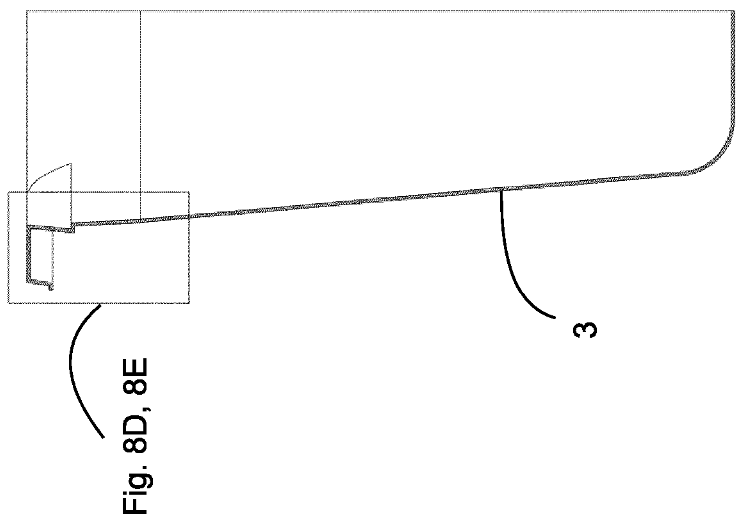
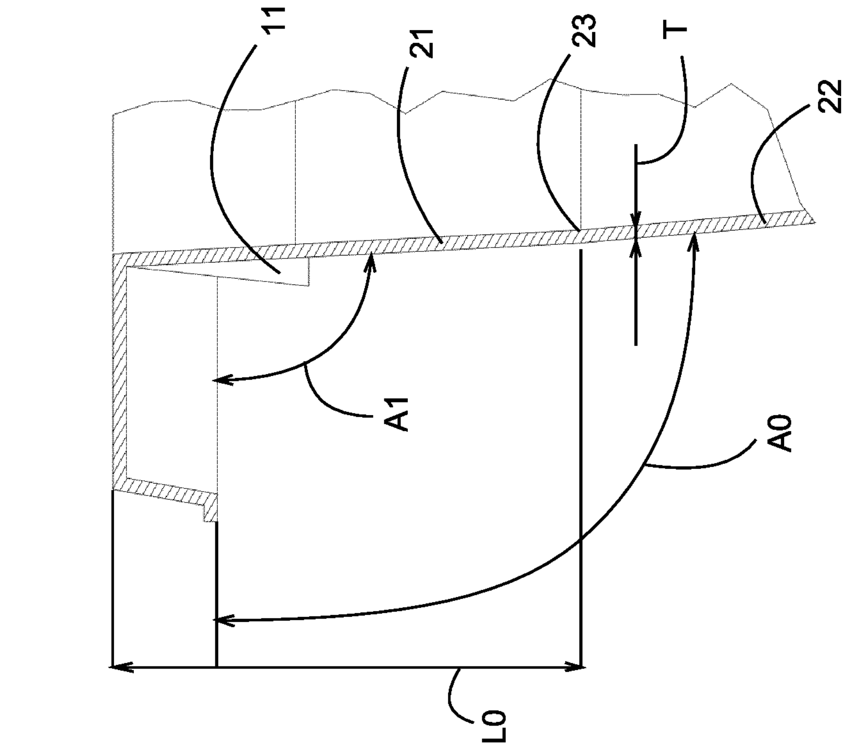


Fig. 8C



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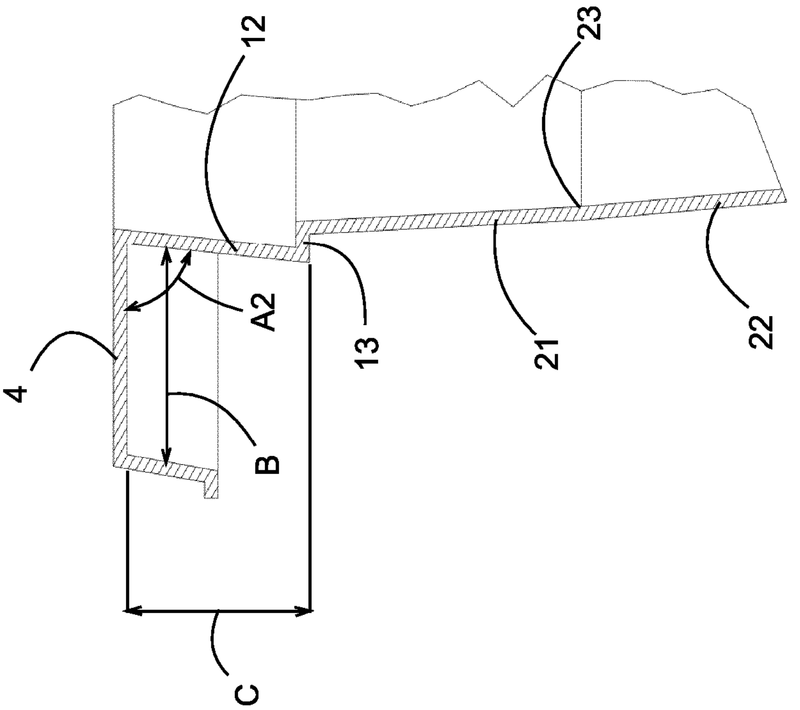

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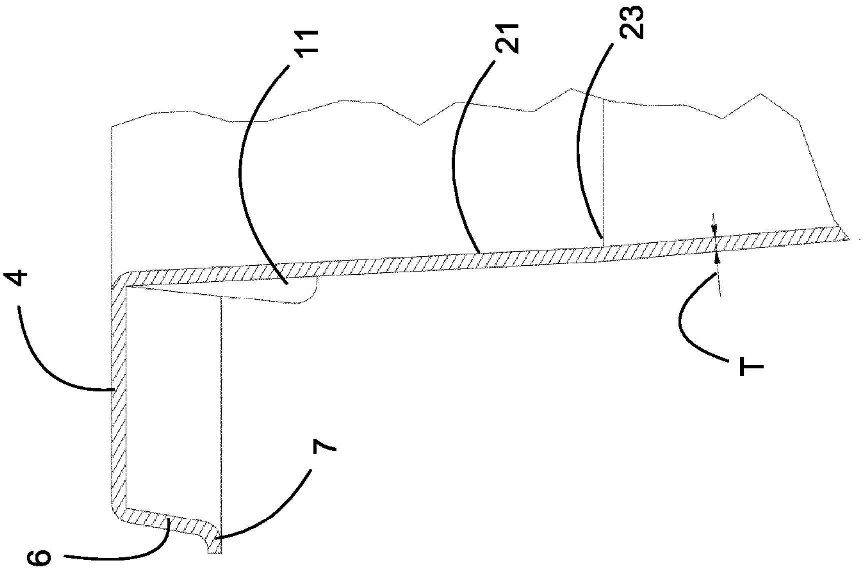

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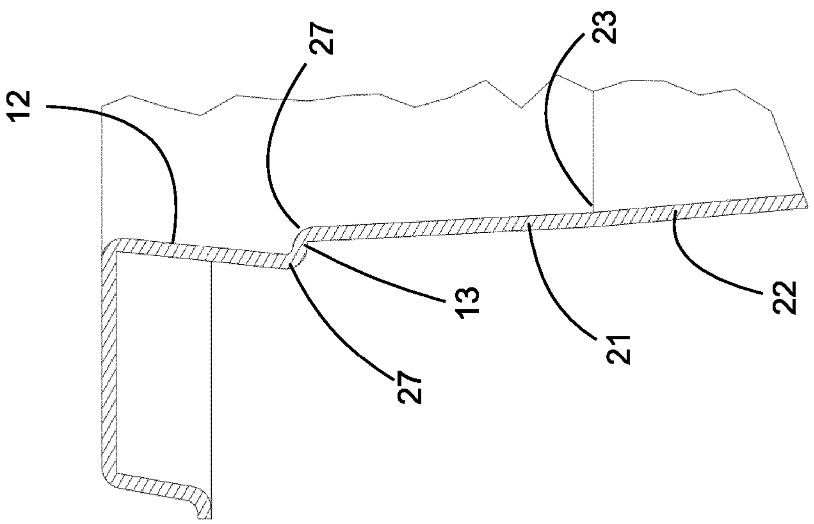

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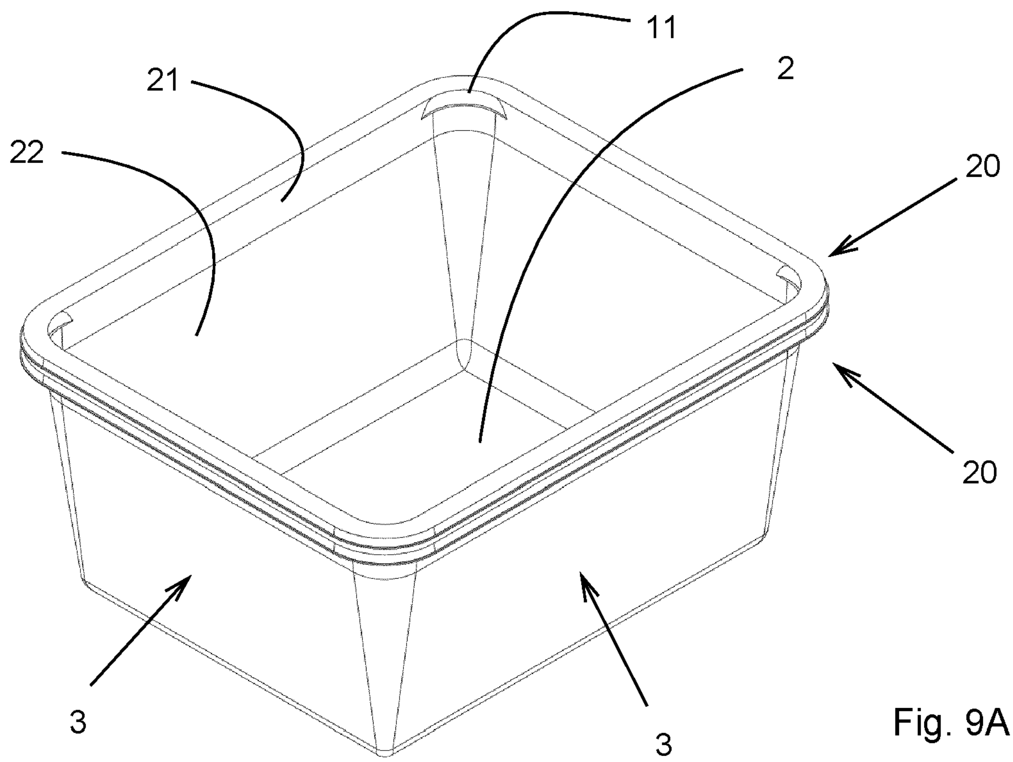


Fig. 9A

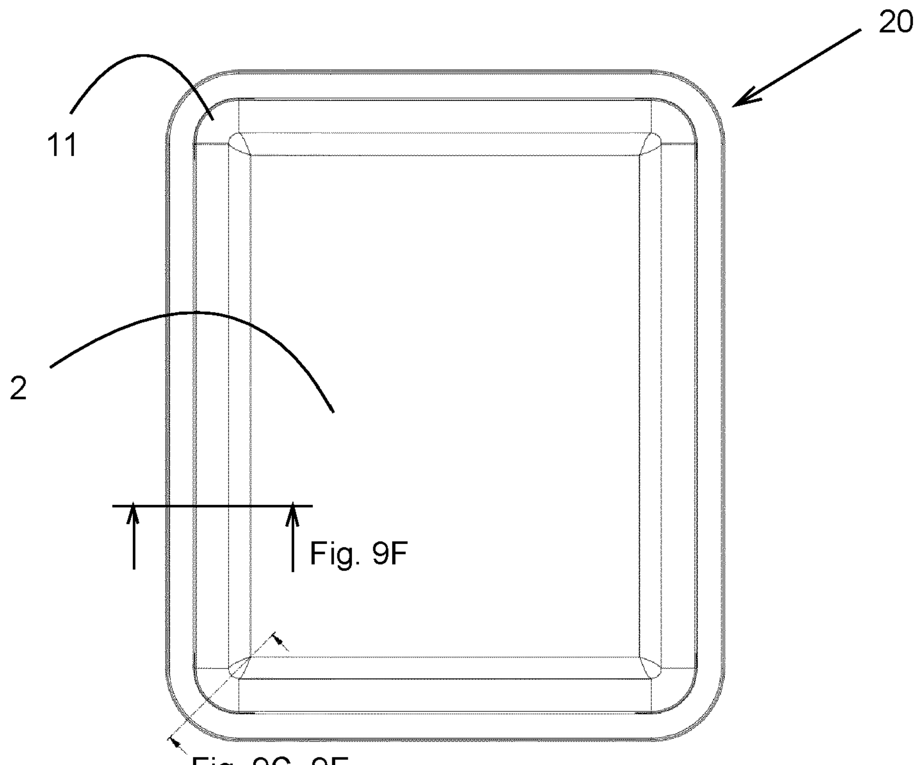


Fig. 9B

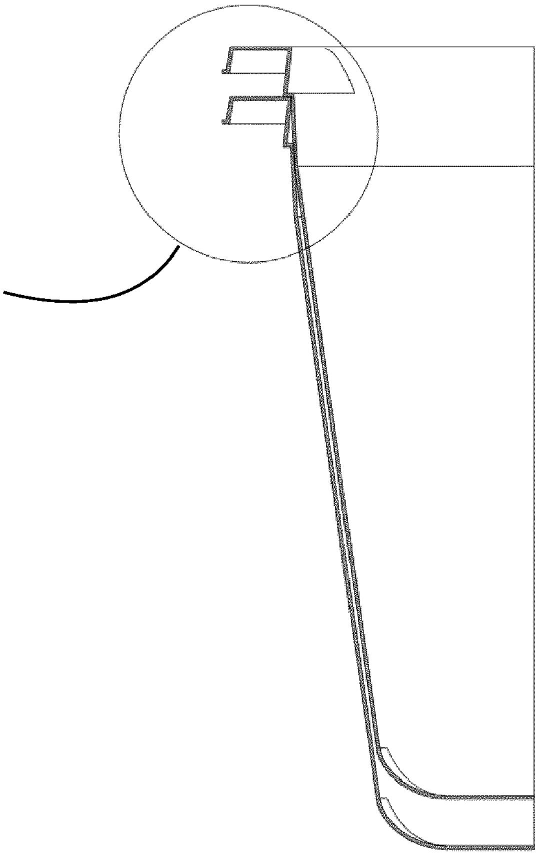
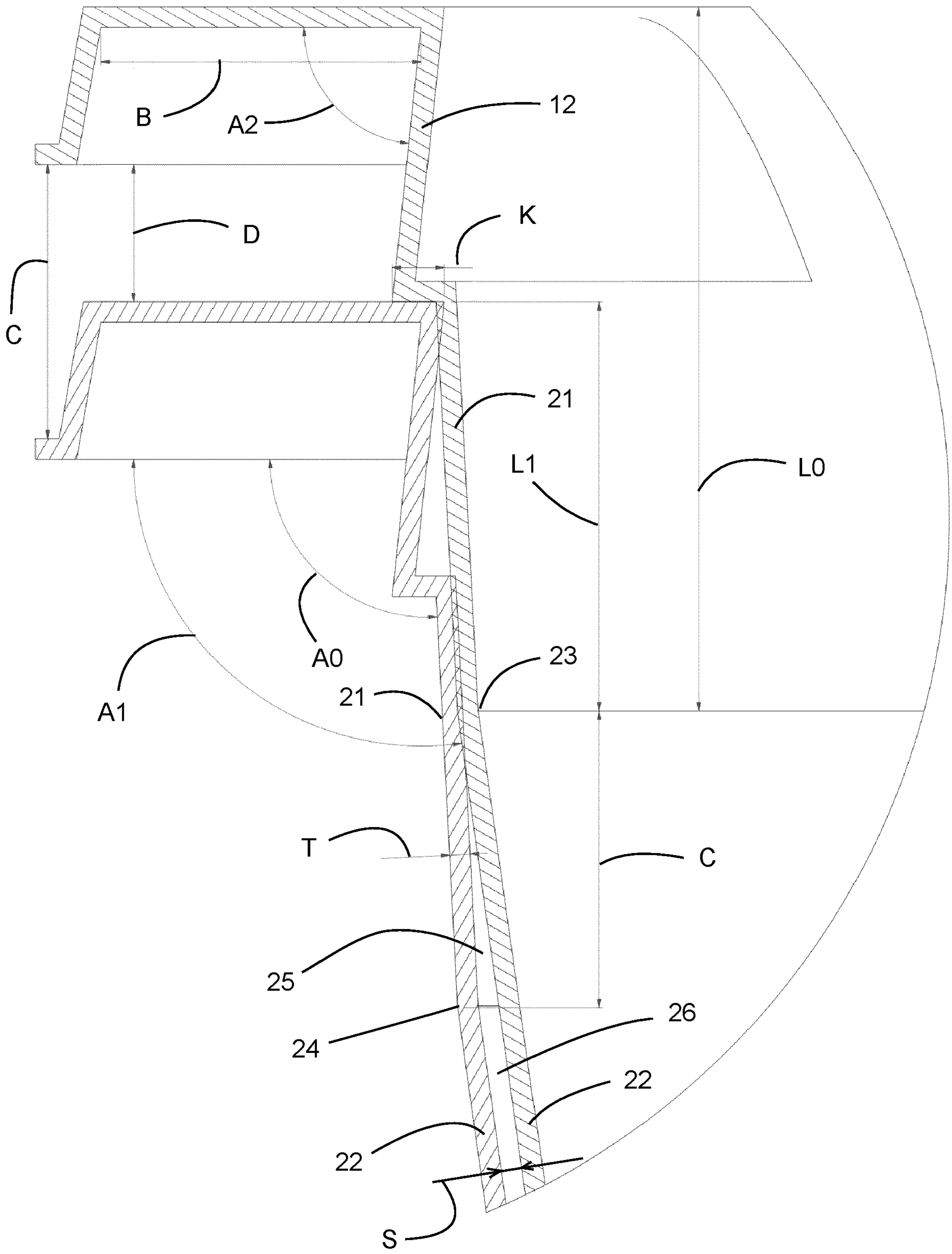


Fig. 9D

Fig. 9C



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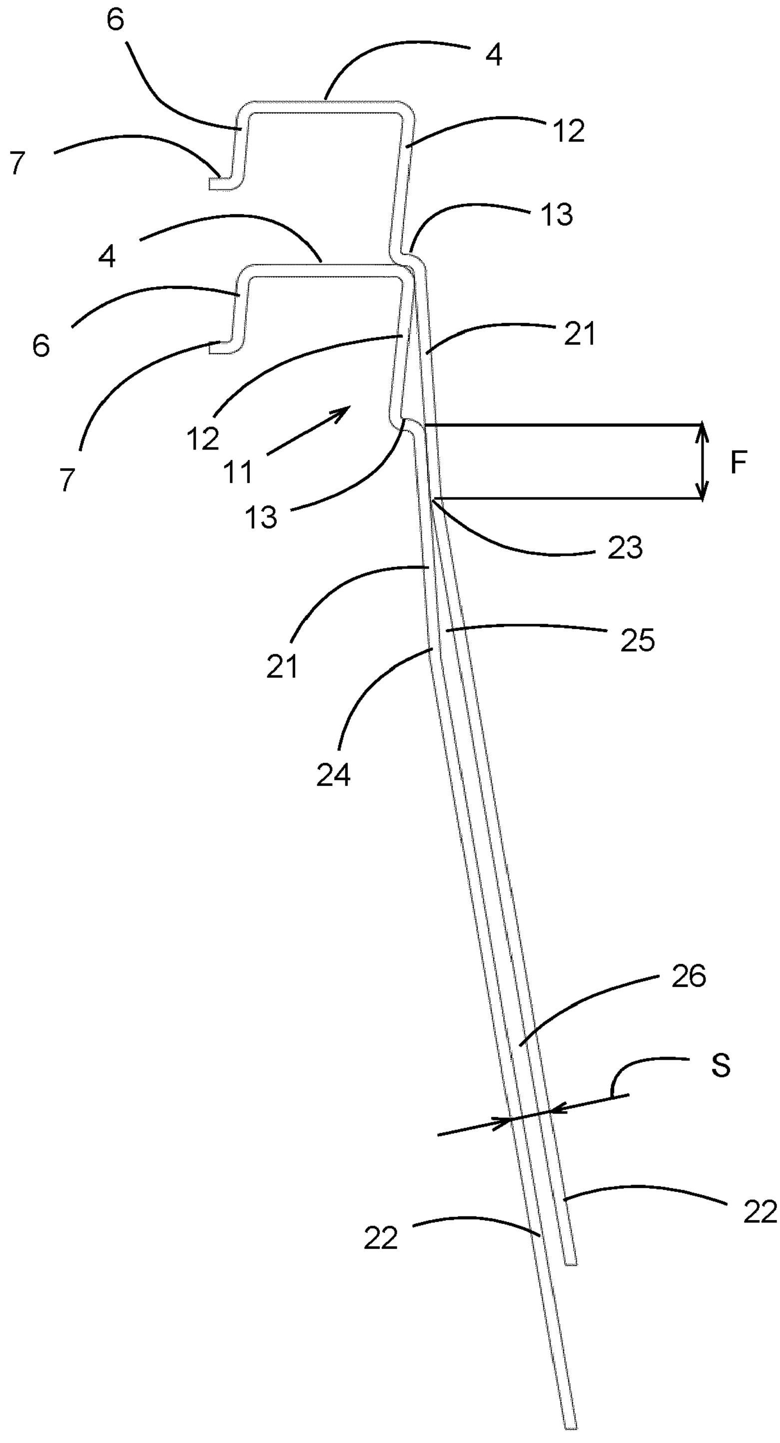

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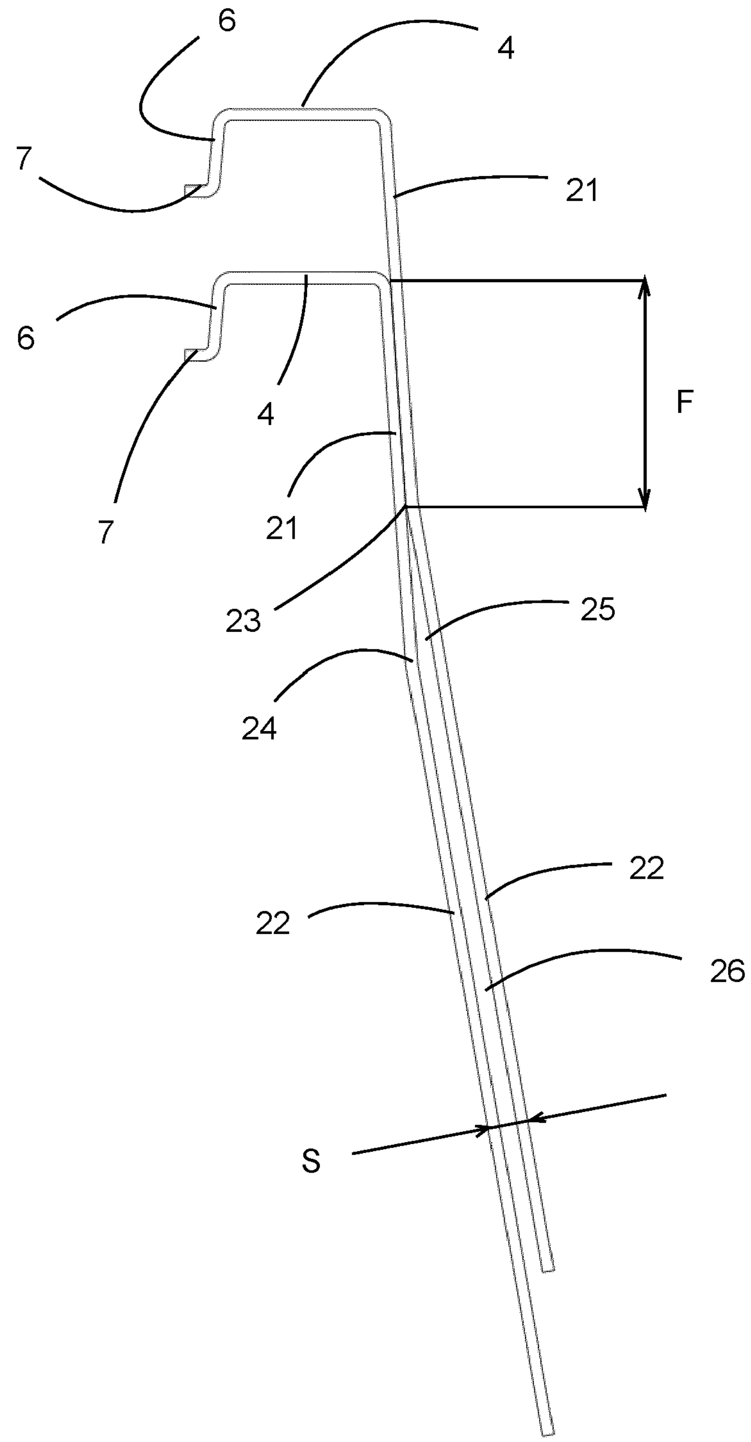


Fig. 9F

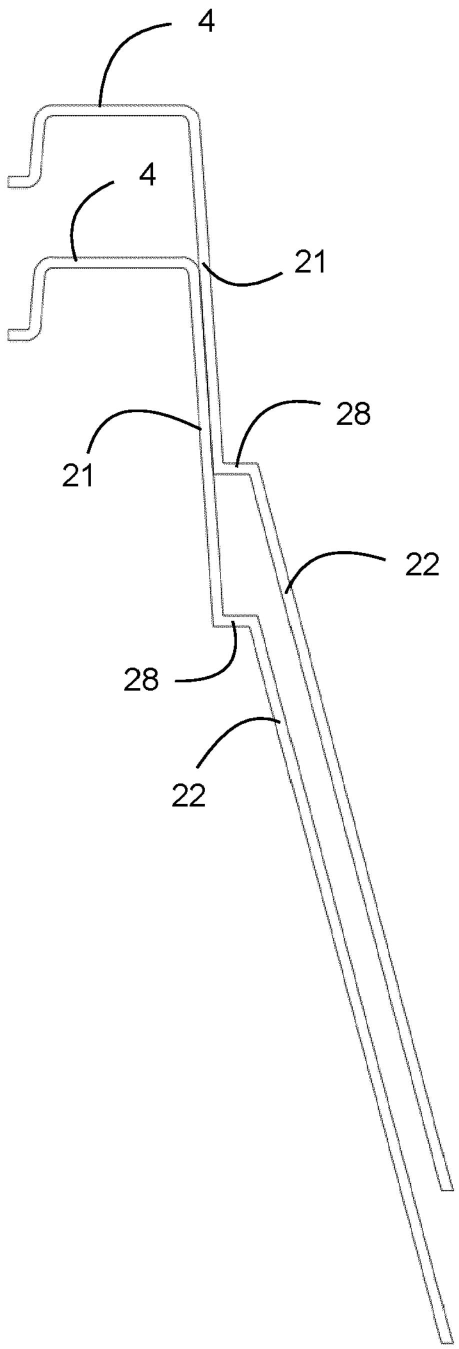


Fig.10B

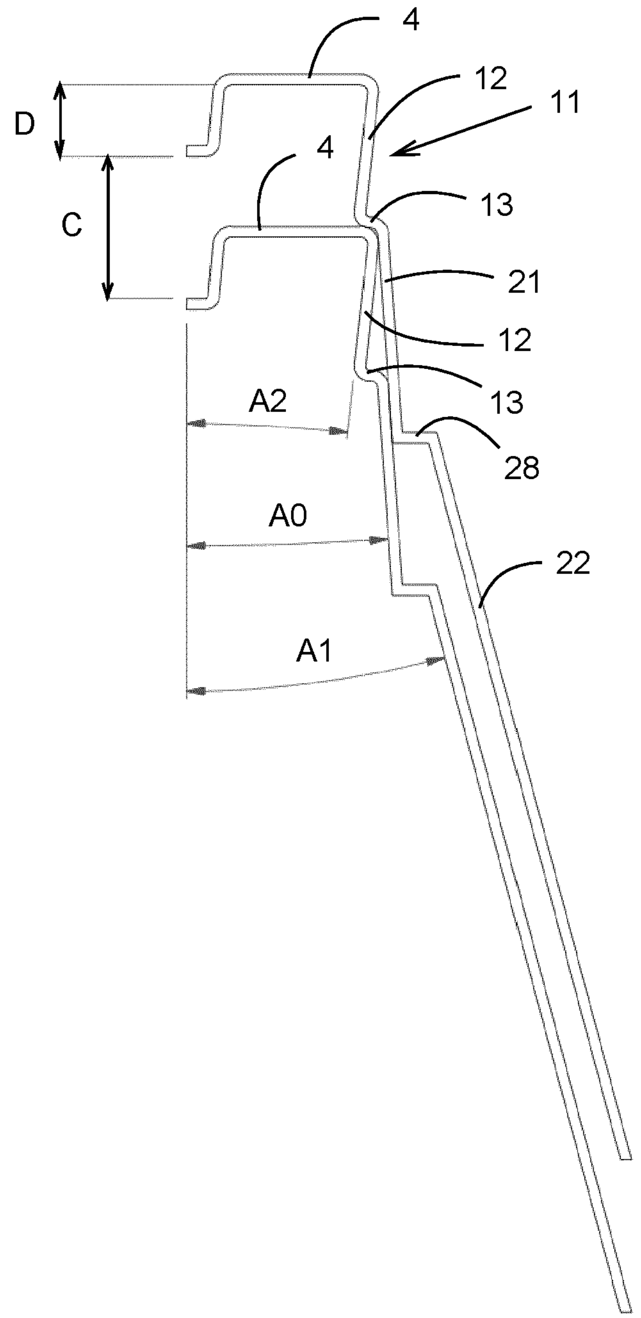
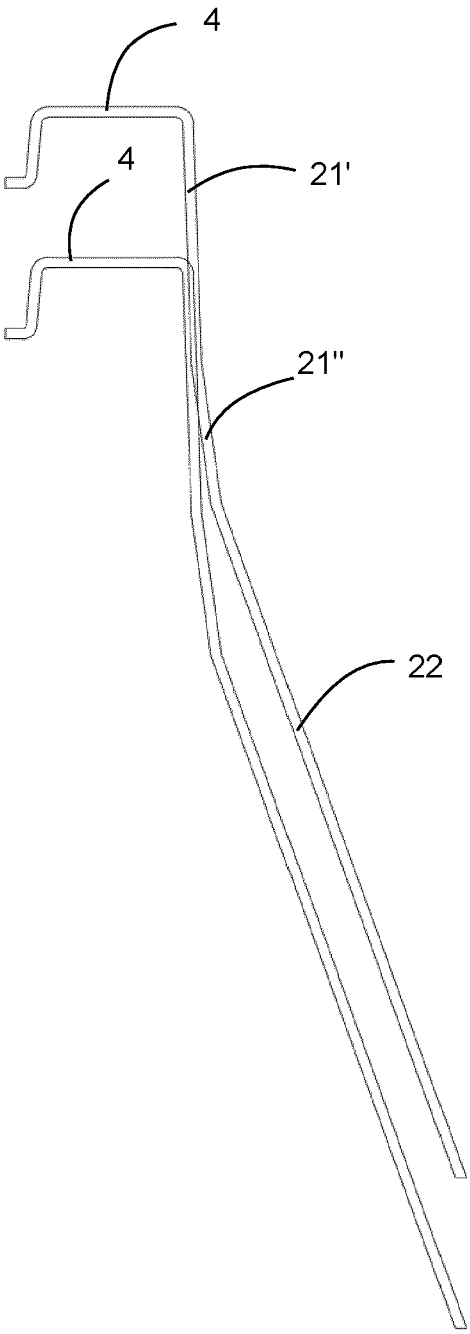


Fig.10A



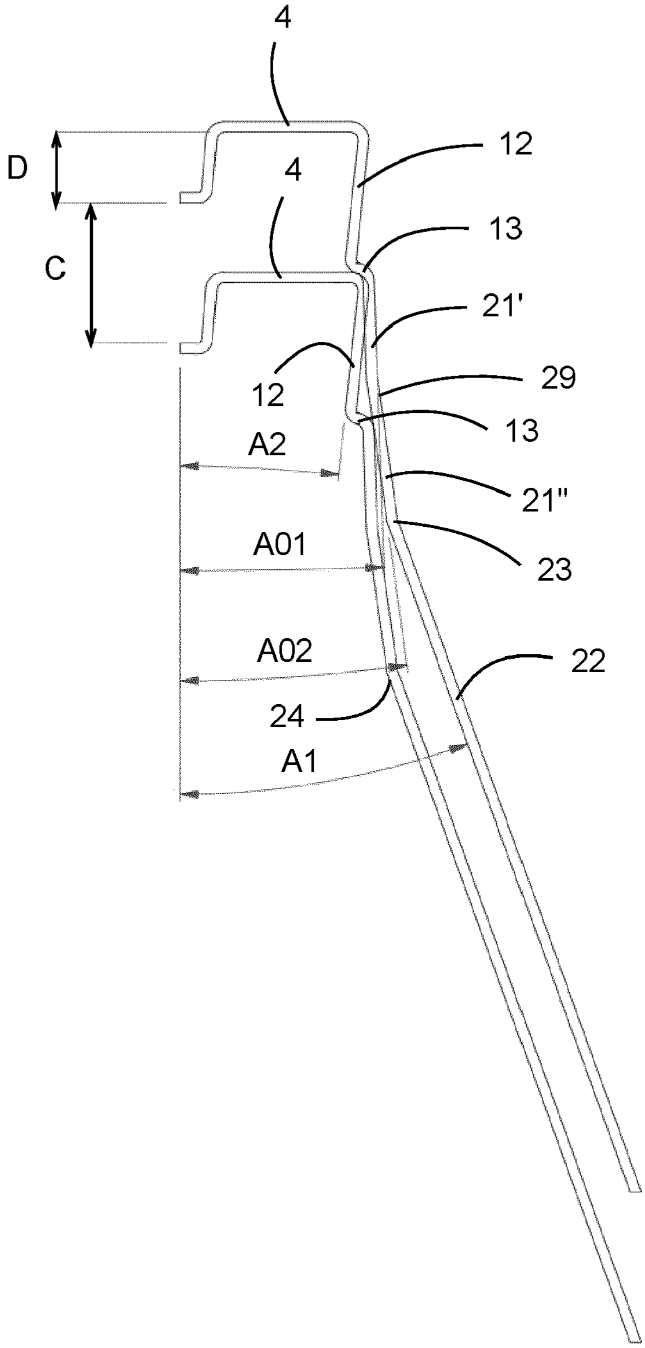


Fig.11B

Fig.11A

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EUROPEAN SEARCH REPORT

Application Number
EP 21 21 0536

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2019/329934 A1 (LEE BYUNG KOOK [KR] ET AL) 31 October 2019 (2019-10-31) * paragraphs [0012], [0033] - [0037]; figures *	1-8	INV. B65D1/34 B65D21/02 B65D1/26 B65D1/40
A	GB 1 525 133 A (MARS LTD) 20 September 1978 (1978-09-20) * page 3, line 100 - page 4, line 120; figures 1-4 *	1-8	
A	EP 2 801 536 A1 (VERSTAPPEN VERPAKKINGEN B V [NL]) 12 November 2014 (2014-11-12) * paragraphs [0023] - [0025], [0036] - [0044]; figures 1-4 *	1-8	
			TECHNICAL FIELDS SEARCHED (IPC)
			B65D

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	8 April 2022	Serrano Galarraga, J

CATEGORY OF CITED DOCUMENTS

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