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**EP 1 649 117 B1**

## Description

**[0001]** The present invention relates to elements for the construction of buildings and other structures.

**[0002]** At present, conventional materials such as bricks and cast concrete blocks are used in order to form walls for buildings and other structures. The normal method of building such walls is to lay a layer of bricks or blocks and then apply a layer of wet cement to the bricks before applying another layer of bricks or blocks on top. This process is repeated until the wall being built has reached the desired height. Whilst building using such materials is not a problem in locations where these materials are freely available, this can pose problems in areas where such items, or the raw materials required to manufacture them, are not so readily available. For example, the construction of accommodation in third world countries or disaster areas can be hampered by the lack of desired materials and building blocks.

**[0003]** A further disadvantage of the aforementioned conventional materials and blocks is that they are inconvenient and costly to transport if it is not possible to source or manufacture the required items locally. This is a problem where speedy construction of structures is required in remote areas by, for example, the armed forces when seeking fortifications in a new area.

**[0004]** GB-A- 2 375 777 discloses hollow constructional elements which are mutually joined by interlocking and which can be filled in situ.

**[0005]** It is an object of the present invention to mitigate or obviate one or more of the disadvantages referred to above, and provide a simple and effective joint between adjacent blocks.

**[0006]** According to a first aspect of the present invention there is provided a blank for forming a building element, the blank comprising:

an elongate body portion having first and second ends and a plurality of transverse fold lines which divide the body portion into a plurality of panels, the panels each having first and second longitudinal edges;

one or more first tab members extending from the first end of the body portion; and

one or more first apertures adjacent the second end of the body portion;

wherein each of said plurality of panels has at least one second tab extending from said first longitudinal edge and a side flange portion adjacent said second longitudinal edge, and wherein each side flange portion is provided with at least one second tab receiving aperture.

**[0007]** Preferably, each side flange portion is divided from its respective panel by a longitudinally extending fold line which extends along the length of the body portion, the longitudinal fold line allowing the side flange portions to be folded substantially perpendicular to their re-

spective panels.

**[0008]** Preferably, the body portion has an end flange portion adjacent the second end thereof, the at least one first aperture being formed in the end flange portion. Preferably, the end flange portion is divided from the body portion by one of the plurality of transverse fold lines, the transverse fold line allowing the end flange portion to be folded substantially perpendicular to the body portion.

**[0009]** Preferably, the ends of each side flange portion are chamfered. Most preferably, each chamfer is at substantially 45 degrees to the longitudinal fold line.

**[0010]** Preferably, the body portion has three transverse fold lines which divide the body portion into four panels. In one embodiment, the transverse fold lines are spaced such that the first and third panels are substantially square. In an alternative embodiment the transverse fold lines are spaced such that each panel is substantially square.

**[0011]** Preferably, each first and second tab has substantially right-angled corners. Alternatively, each first and second tab has rounded corners.

**[0012]** Preferably, each panel is stamped to provide a strengthening formation thereon. Preferably, the formation is substantially X-shaped. Alternatively, each panel is provided with a third aperture for receiving a reinforcing means therethrough.

**[0013]** Preferably, the building element is a building block.

**[0014]** Preferably, the blank is formed from sheet metal, most preferably galvanised steel. Alternatively, the blank is formed from a plastics material.

**[0015]** According to an aspect of the present disclosure, there is provided a building block formed from the blank according to the first aspect of the present invention.

**[0016]** According to a further aspect of the present disclosure there is provided a method of forming a building block from the blank according to the first aspect of the invention, the method comprising the steps of:

folding each side flange portion along the longitudinal fold line until each side flange portion lies substantially perpendicular to its respective panel;

folding the body portion along each transverse fold line until adjacent panels lie substantially perpendicular to one another and the first and second ends of the body portion are adjacent one another; and locating the at least one first tab in the corresponding at least one first aperture and bending the at least one tab such that the first and second ends of the body portion are secured together.

**[0017]** According to a second aspect of the present invention, there is provided a building element comprising:

a body portion having first and second ends and comprising a plurality of integrally formed panels adapted

to define the perimeter of the building element, wherein each panel has first and second longitudinal edges;

at least one first connecting member adapted to be attached to the panels adjacent their first longitudinal edges;

at least one second connecting member adapted to be attached to the panels adjacent their second longitudinal edges; and

a third connecting member adapted to be attached to the body portion adjacent the first end thereof; wherein the first and second connecting members are provided with first and second attachment means, respectively, each of the attachment means being adapted to attach the building element to an adjacent building element, and wherein the third connecting member is adapted so as to engage the second end of the body portion.

**[0018]** Preferably, the building element further comprises a fourth connecting member adapted to be attached to the body portion adjacent the second end thereof, wherein the third and fourth connecting members are adapted so as to be mutually engagable.

**[0019]** Preferably, the first and second connecting members are each formed from a single piece of material and each is adapted to follow the perimeter of the building element. Alternatively, the building element comprises a plurality of first and second connecting members attached to each longitudinal edge of each panel.

**[0020]** Preferably, each of the connecting members is attached to the body portion using an attachment method selected from the group comprising riveting, gluing and crimping. Alternatively, each of the connecting members is provided with a plurality of engagement teeth and each panel includes a plurality of cells, the teeth being adapted to be inserted in the cells. Preferably, each engagement tooth has a first engagement portion projecting in a first direction and a second engagement portion projecting in a second, substantially opposite, direction.

**[0021]** Preferably, each of the second connecting members includes a strengthening rib projecting therefrom.

**[0022]** Preferably, each of the first connecting members includes a strengthening rib projecting therefrom.

**[0023]** In one preferred embodiment, the first attachment means comprises at least one tab projecting from the first connecting member, and the second attachment means comprises at least one aperture adapted to receive the at least one tab of an adjacent building element. In an alternative embodiment, the first attachment means comprises a first fastener element and a detachable fastener member adapted to attach to the first fastener element, and the second attachment means comprises a second fastener element adapted to receive a fastener member of an adjacent building element. In a further alternative embodiment, the first attachment means comprises a detent projecting from the first connecting mem-

ber, and the second attachment means comprises a resilient catch adapted to engage with the detent of an adjacent building element.

**[0024]** Preferably, the third and fourth connecting members are each provided with a resilient engagement member adapted to engage with one another. Alternatively, the third connecting member includes one or more apertures therein, and the fourth connecting member includes one or more tabs projecting therefrom for engagement with the apertures in the third connecting member.

**[0025]** Preferably, the body portion is formed from a single sheet of extruded cellular plastics material having a plurality of cells therein. Most preferably, the plastics material is extruded cellular polypropylene.

**[0026]** In one preferred embodiment, each connecting member is formed from sheet metal. Most preferably, the sheet metal is galvanised steel. Alternatively, the connecting members are formed from a plastics material. In further alternative embodiment, at least one of the connecting members is integrally formed with the body portion.

**[0027]** According to a further aspect of the present disclosure, there is provided a blank for forming a building element, the blank comprising:

an elongate body portion having first and second ends and a plurality of first apertures formed therein; and

first and second side portions integrally formed with the body portion, each side portion being divided from the body portion along a first longitudinally extending fold line;

wherein each side portion has at least one second longitudinal fold line which divides the side portion into at least two sections, and wherein at least one side portion has a plurality of tabs extending laterally therefrom.

**[0028]** Preferably, the blank further comprises first and second end flanges adjacent the first and second ends of the body portion, each end flange divided from the body portion along a transverse fold line.

**[0029]** In a preferred embodiment, the plurality of first apertures are formed in two substantially parallel lines extending longitudinally along the body portion. Preferably, each of the first and second side portions has a plurality of tabs extending laterally therefrom. Preferably, the body portion further includes a pair of second apertures, one of the pair located adjacent the first end of the body portion and the other located adjacent the second end of the body portion. Preferably, the building element is a door lintel.

**[0030]** In an alternative embodiment, the plurality of apertures are formed substantially in a single line extending longitudinally along the body portion. Preferably, the first and second side portions each have a pair of second longitudinal fold lines which divide each side portion into three sections. Preferably, the building element is a win-

dow sill.

**[0031]** Preferably the blank is formed from sheet metal, most preferably galvanised steel. Alternatively, the blank is formed from a plastics material.

**[0032]** Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:-

Fig. 1 is a perspective view of a part pre-formed blank for forming a building block;

Fig. 2 is a perspective view of the building block once formed from the blank of Fig. 1;

Fig. 3 is a top view of the formed building block of Fig. 2;

Fig. 4 is a perspective view of the building block of in Fig. 2 in use;

Fig. 5 is a cross sectional view of the building blocks of Fig. 4 along line V-V;

Fig. 6 is a perspective view of a modified version of the block of Figs.1-5;

Fig. 7 is a cross section view of a wall formed from a number of the modified blocks shown in Fig.6;

Fig. 8 is a side view of the part pre-formed blanks of Fig. 1 as stacked for storage.

Fig. 9 is a plan view of a blank for forming a door lintel; Fig. 10 is a perspective part cut-away view of the formed door lintel;

Fig. 11 is a cross sectional view of the formed door lintel of Fig. 10 along line XI-XI;

Fig. 12 is a perspective view of the door lintel of Figs. 10 and 11 in use;

Fig. 13 is a plan view of a blank for forming a window sill;

Fig. 14 is a perspective view of the window sill of Fig. 13 in use;

Fig. 15(a) is an exploded projected view of a second embodiment of a building block;

Fig. 15(b) is a projected view of the building block of Fig. 15(a) when formed;

Fig. 15(c) is a plan view of the building block of Figs. 15(a) and (b);

Fig. 16(a) is a projected view of a third embodiment of a building block;

Figs. 16(b) and (c) are vertical section detail views through the base and top, respectively, of the building block of Fig. 16(a);

Figs. 16(d) and (e) are horizontal section detail views showing alternative joint arrangements for the corners of the building block of Fig. 16(a);

Fig. 16(f) is a vertical section detail view showing the attachment means for attaching adjacent blocks of the type shown in Fig 16(a);

Fig. 17(a) is a vertical section detail view showing an alternative attachment means for attaching adjacent blocks of the type shown in Fig. 16(a);

Fig. 17(b) is a horizontal section detail view of a further joint arrangement for the corners of the building block of Fig. 16(a);

Fig. 17(c) is a detail view showing stacked blanks for forming the building blocks of Fig. 17;

Fig. 18(a) is a projected detail view of a fourth embodiment of a building block;

Fig. 18(b) is a horizontal section detail view of a corner joint of the fourth embodiment of building block; and

Fig. 18(c) is a vertical section detail view showing the attachment of adjacent blocks of the fourth embodiment.

**[0033]** Referring to the drawings, Fig. 1 shows a blank, or body portion, 10 from which a building element is formed. In this instance, the building element is a building block 12. In this embodiment, the blank 10 is either cut or punched from a sheet of galvanised steel, although it should be understood that any other suitable sheet metal or plastics material may be used.

**[0034]** The blank 10 is divided into two end panels 14,16 and two side panels 18,20 which are integrally formed and connected along three fold lines 22 which extend laterally across the blank 10 at intervals along the length of the blank 10. The fold lines 22 are formed by perforations made in the blank 10 to aid folding during assembly, as will be explained below.

**[0035]** Each of the end and side panels 14-20 has an integral side flange portion 24. Each of the side flange portions 24 is formed on the same first longitudinal edge of the blank 10, as shown in Fig.1. Each side flange portion 24 is connected to its respective end or side panel 14-20 along a fold line 23. Each fold line 23 is created by scoring or using a similar technique on the surface of the blank 10. Fig. 1 shows the blank 10 once the side flange portions 24 have been folded along the fold lines 23 such that they lie substantially perpendicular to their respective end or side panel 14-20. Each side flange portion 24 is also provided with chamfers 26 at either end thereof to allow the blank 10 to be formed into a cuboid shape, as will be described below.

**[0036]** The side flange portions 24 further include tab receiving slots 32 formed adjacent the fold lines 23. In the illustrated embodiment, each end panel 14,16 has one tab receiving slot 32, and each side panel 18,20 has two tab receiving slots 32. However, it should be appreciated that each panel 14-20 may have any number of tab receiving slots 32, as desired.

**[0037]** The end and side panel 14-20 also include integrally formed tabs 34 which lie on the second longitudinal edge of the blank 10, opposite the side flange portions 24 formed at the first longitudinal edge of the blank 10. The tabs 34 protrude laterally from each panel 14,20 so as to be engagable with tab receiving slots 32 in an adjacent block (not shown). In the illustrated embodiment, the end panels 14,16 each have one tab 34, whereas the side panels 18,20 each have two tabs 34. However, it should be appreciated that each of the panels 14-20 may have any number of tabs 34 as desired.

**[0038]** The first end of the blank 10 on the side panel

20 further includes an end flange portion 38. The end flange portion 38 is formed integrally with the side panel 20 and are connected along a fold line 40. As with the fold lines 23 described above, the fold line 40 is formed on the blank 10 by scoring or a similar technique. Prior to final assembly, the end flange portion 38 is folded along fold line 40 so that it lies substantially perpendicular to the side panel 20, as shown in Fig.1

**[0039]** The end flange portion 38 further includes tab receiving slots 42 formed on the end flange portion 38 adjacent the fold line 40. These tab receiving slots 42 are intended to receive tabs 44 integrally formed at the second end of the blank 10 on end panel 14. The tabs 44 protrude longitudinally from the end panel 14 and are adapted to be engageable with the tab receiving slots 42. Although the end panel 14 and end flange portion 38 are illustrated as having two tabs 44 and two slots 42, respectively, it should be appreciated that any suitable number of tabs 44 and corresponding slots 42 may be used.

**[0040]** Fig. 2 illustrates a building block 12 formed from the blank 10 shown in Fig. 1. In the illustrated embodiment, the building block 12 is formed into a substantially cuboid shape by folding each of the panels 14-20 along the fold lines 22. Thus, the end and side panels 14-20 each form a face of the building block 12. The building block is secured in this form by engaging the tabs 44 of the end panel 14 with the tab receiving slots 42 of the end flange portion 38. The end panel 14 lies flush with the side flange portion 38 and the tabs 44 are first manipulated so as to protrude through tab receiving slots 42 and then bent back to fix the end flange portion 38 and end panel 14 together. Depending on the thickness of the sheet of material being used, the tabs can be manipulated either by hand or else by using a suitable tool.

**[0041]** As best illustrated in Fig. 3, the chamfered side flange portions 24 of the blank 10 form a base for the building block that provides additional strength. Fig.3 also shows the arrangement of the slots 32 on the side flange portions 24 once the blank 10 has been formed into the building block 12.

**[0042]** As illustrated in Fig. 4, the building block 12 of Fig. 2 forms one block of a wall 48 of a building or other structure. The blanks 10 are formed into building blocks 12 which are then assembled together. The blocks are laid on top of one another so that the projecting tabs 34 of the lower block locate in the slots 32 of the block being laid on top. The blocks 12 may be laid straight on top of one another, but it is preferable to lay each layer offset from the lower layer by one half block length, as shown in Fig.4. When building the wall 48, fill material (not shown) may be poured down into the hollow blocks 12 in order to provide further strengthening and rigidity. Fig. 4 also illustrates optional facing plates 49 which may be placed atop each block 12 in the uppermost layer of the wall 48 once the fill material has been poured in. The plates 49 are provided with slots (not shown) which engage with the tabs 34 on the uppermost blocks 12.

**[0043]** Fig. 5 illustrates how the building blocks 12 are fixed together in the wall 48 shown in Fig.4. As seen in Figs. 4 and 5, one building block 12 is laid upon another so that the tabs 34 of the lower block 12 engage with the slots 32 in the base of the upper block. As discussed above, the blocks 12 may either be stacked upon one another, or else laid in an offset fashion such that upper block 12 is offset from the lower block 12 by one half length. Once the blocks 12 are in the desired position and the tabs 34 are in the corresponding slots 32, the building blocks 12 are secured together by bending the tabs 34 inwardly until they lie flush with the side flange portions 24 of the upper block, as seen in Fig.5. The tabs 34 may be bent by hand or by using a tool.

**[0044]** Figs. 6 and 7 show views of a modified version of the block described above. The majority of the features of the modified block 500 are shared with the block 12 described above, and will therefore not be described further here. The modification to the block 500 is to introduce additional fixing slots 502,504 on each panel 14-20 to ensure that the blocks 500 remain securely fixed together when formed into a wall. As seen in Fig.6, each panel 14-20 has an upper fixing slot 502 and a lower fixing slot 504. In the illustrated embodiment, the side panels 18,20 have pairs of upper and lower fixing slots 502,504, although they may also have only one upper fixing slot 502 and one lower slot 504 if desired. The upper and lower fixing slots 502,504 are each located adjacent the top and bottom of each panel 14-20, respectively.

**[0045]** Fig.7 shows a number of blocks 500 arranged in a wall. The blocks 500 are arranged upon each other as previously described, with the tabs 34 of the lower block 500 locating in the tab receiving slots 32 of the upper block 500. However, with the modified blocks 500, plastic cable ties 510 are also introduced to hold the blocks 500 together. With the blocks arranged upon one another, the male components of the cable ties 510 are threaded out of the upper block 500 via the lower fixing slots 504 and into the lower block 500 via the corresponding upper fixing slots 502 in the lower block. The male components of the ties 510 are then finally threaded up through the tab receiving apertures 32 in the upper block 500 where they are fastened through the female components of the ties in the bottom of the upper block 500. Once the ties 510 are fastened, the blocks 500 are held together in the wall.

**[0046]** In order to make the blocks 12 easily transportable, the blanks 10 illustrated in Fig.1 are able to be flat packed for easy storage and transportation. Fig. 8 is an end view of the blanks 10 when stored for transportation. The first two blanks 10 are laid so that their longitudinal sides provided with the tabs 34 (the second longitudinal sides, as described above) abut one another. With the blanks 10 laid in this manner, the pre-bent side flange portions 24 of each blank 10 face one another, with the blanks 10 each having a substantially L-shaped profile when viewed end-on, as in Fig.8. Further blanks are then placed one after another on top of these first blanks, such

that the second longitudinal sides of the blanks 10 overlap in the centre of the stack and are interleaved as more blanks are added. Eventually, the stacked blanks 10 will resemble a truncated pyramid shape, as shown in Fig.8, as each new blank is laid upon the previous blank so that the side flange portions 24 of each blank lie flush inside one another. The stack is completed when it is no longer possible to fit a new blank in between the opposing side flange portions of the interleaved blanks. A typical complete stack of blanks 10 such as that shown in Fig.8 would comprise 225 blanks. Furthermore, a typical military airlift pallet would be able to hold eleven stacks, which would be enough to make some 2,475 blocks.

**[0047]** Referring now to Figs. 9-12, it may often be necessary to include a doorway in a wall created from the building blocks 12 described above. Figs. 9-12 illustrate a building element in the form of a door lintel 50 that can be used in combination with a wall of the previously described building blocks in order to form such a doorway.

**[0048]** Fig. 9 shows a blank 54 from which the door lintel 50 is formed. As with the building blocks 12, in the illustrated embodiment the blank 54 is either cut or punched from a sheet of galvanised steel, although any other sheet metal or suitable plastics material may be used. The blank 54 comprises an elongate body, or central, portion 58 and two side portions 64,66 which are integrally formed with the body portion 58. The body portion 58 and side portions 64,66 are connected along a pair of longitudinally extending fold lines 68. The body portion 58 is also provided with a pair of end flange portions 72 which are integrally formed with the body portion 58 at respective ends thereof. Each end flange portion 72 is connected to the body portion 58 along a lateral fold line 70. The fold lines 68,70 may either be perforated or scored in order to aid folding during assembly. The body portion 58 is also provided with a plurality of slots 76,77 which, in the illustrated embodiment, are provided in two substantially parallel lines.

**[0049]** Each side portion 64,66 is divided longitudinally in two by a side portion fold line 78. The longitudinal fold lines 78 are provided by either perforating or scoring the blank 54 in order to aid folding during assembly. Each side portion 64,66 also includes a plurality of tabs 80 formed integrally therewith. The tabs 80 protrude laterally from the free longitudinal edge of each side portion 64,66 and are adapted to be engageable with the tab receiving slots 76,77 in the body portion 58, as will be explained below.

**[0050]** Although in the illustrated embodiment, the body portion 58 is shown to have eight slots in each line of slots 76,77 and the side portions 64,66 are each shown to have eight corresponding tabs 80, it will be appreciated that any appropriate number of slots 76,77 and corresponding tabs 80 may be used.

**[0051]** Figs. 10 and 11 of the drawings illustrate a partial cut-away and cross sectional view, respectively, of the door lintel 50 formed from the blank 54 of Fig. 9. As illustrated, the door lintel 50 is formed by firstly folding

end flange portions 72 downward along lateral fold lines 70 into a position whereby the end flange portions 72 are substantially perpendicular to the body portion 58. Next, the side portions 64,66 are folded firstly along longitudinal fold lines 68 and then along the longitudinal fold lines 78 into a position whereby the tabs 80 of side portions 64,66 are adjacent to tab receiving slots 76,77 of the body portion 58. The tabs 80 can then be located in the slots 76,77 and folded out towards the sides of the body portion 58 by hand or with a tool. Folding the side portions 64,66 in the manner described leaves them having a substantially V-shaped profile, as can be seen best in Fig.11. These V-profiles provide additional strength to the door lintel 50 when in situ.

**[0052]** Fig. 12 illustrates how the door lintel 50 is attached to a wall of building blocks 12 in order to form a doorway in the wall. The door lintel 50 is provided with a locating slot 56 at each end thereof and is attached to the wall by locating the lintel 50 onto a building block 12 on either side of the doorway. The door lintel 50 is positioned on each of the pair of building blocks 12 such that the end flange portions 72 of the lintel 50 enter the blocks 12 and lie flush with the end walls 16 of the building blocks 12. At the same time, the tabs 34 protruding from the end walls 16 of the blocks 12 are engaged with the locating slots 56 of the lintel 50. Once the lintel 50 is successfully located, it is secured in place by bending the tabs 34 of the building blocks 12 so that they are substantially flush with the body portion 58 of the lintel 50.

**[0053]** Referring now to Figs. 13 and 14, it will also sometimes be desirable to include one or more windows in a wall of the building blocks. Fig. 13 shows a blank 84 from which a window sill 86 is formed. The blank 84 is either cut or punched from a sheet of galvanised steel, although any other suitable sheet metal or plastics material may be used.

**[0054]** The blank 84 comprises a body portion 88 integrally formed with first and second side portions 94,96. The body portion 88 and side portions 94,96 are connected along a first pair of longitudinal fold lines 98. As with the previous embodiments described, the fold lines may be perforated or scored onto the blank 84 to aid folding. The body portion 88 is also provided with integral end flange portions 87 at either end thereof. The end flange portions are connected to the body portion 88 along respective lateral fold lines 85. The body portion 88 also includes a plurality of tab receiving slots 89 aligned longitudinally thereon.

**[0055]** The second side portion 96 is divided into three sections 96A-96C by a further two longitudinal fold lines 91,93 which run along the second side portion 96 substantially parallel to longitudinal fold lines 98. Again, the fold lines 91,93 are perforated or scored on the blank 84 to aid folding during assembly. The first side portion 94 is also divided into three sections 94A-94C by an additional two longitudinal fold lines 95,97 which also run substantially parallel to the longitudinal fold lines 98.

**[0056]** The first side portion 94 further includes tabs

99 formed integrally with the outermost section 94C of the side portion 94. The tabs 99 protrude laterally from the outer edge of the outermost section 94C and are adapted to be engageable with the tab receiving slots 89 in the body portion 88.

**[0057]** As with the previously described embodiments, the number of tabs 99 and corresponding slots 89 may be greater or less than eight, depending on the requirements of the particular application.

**[0058]** Fig. 14 illustrates a window sill 86 formed from the blank 84 shown in Fig. 13. The window sill 86 is formed by firstly folding end flange portions 87 downward along lateral fold lines 85 until they lie substantially perpendicular to the body portion 88.

**[0059]** Next, the first side portion 94 is folded downwards relative to the body portion 88 along longitudinal fold line 98 until the first side portion 94 is substantially perpendicular to the body portion 88. The intermediate and outermost sections 94B,94C of the first side portion 94 are then folded inwardly along fold line 95 by substantially 90 degrees relative to the inner section 94A, and the outermost section 94C is then folded inwardly by 90 degrees relative to the intermediate section 94B along fold line 97. This folding forms the first side portion 94 into a substantially cuboidal shape, as seen best in Fig. 12, from where the tabs 99 of the first side portion 94 can be engaged with the tab receiving slots 89 of the body portion 88. Once engaged with the slots 89, the tabs 99 are bent by hand or using a tool so that they lie flush with the upper surface of the body portion 88.

**[0060]** Once the first side portion 94 has been folded into its desired shape to form the load-bearing "body" of the window sill 86, the second side portion 96 can be folded to form the protective "canopy" of the window sill 86. To create the canopy, the second side portion 96 is folded downwards relative to the body portion 88 along longitudinal fold line 98 until it lies at substantially 90 degrees to the body portion 88. Next, the intermediate and outermost sections 96B,96C of the second side portion 96 are bent upwardly relative to the inner section 96A along fold line 91 until the intermediate section 96B lies at angle of approximately 45 degrees relative to the inner section 96A, as seen best in Fig. 14. Finally, the outermost section 96C is folded downwards relative to the intermediate section 96B along fold line 93 until the outermost section 96C lies in a plane substantially parallel to that of the inner section 96A. As an option, the outermost section 96C may also be provided with a further longitudinal fold line (not shown) which allows a lip to be formed on the outermost section 96C such that a rounded edge is provided. The window sill is then ready to be attached to a wall of building blocks, such as that shown in Fig. 14.

**[0061]** Figs 15(a)-(c) show a second embodiment of a building block in accordance with the present invention. In this second embodiment, the block 100 has a body portion 101 and four separate connecting members 102-108. The connecting members 102-108 are formed from a different material to that of the body portion 101,

unlike in the first embodiment where the entire block is formed from a single sheet of material. Fig. 15(a) shows the separate components from which the building block 100 is formed. In this embodiment, the connecting members 102-108 are either cut or punched from a sheet of galvanised steel, although it should be understood that any other suitable sheet metal or plastics material may be used. The body portion 101 is formed from an extruded cellular plastics sheet. An example of a suitable sheet from which to form the body portion 101 is the extruded cellular polypropylene sheet manufactured under the Trade Mark CORREX by Kayserberg Plastics of Gloucester, United Kingdom. However, it should be understood that the body portion 101 may alternatively be formed from a variety of other suitable materials including, by way of example, the paper-covered polymer sheet material manufactured under the Trade Mark PARATEN by Frantschach AG of Vienna, Austria.

**[0062]** The body portion 101 is divided into two end panels 114,116 and two side panels 118,120 which are integrally formed and connected along three fold lines 122 which extend laterally across the body portion 101 at intervals along the length thereof. The fold lines 122 are formed by perforations made in the body 101 to aid folding during assembly, as will be explained below. The fold lines can also be provided in these materials by way of slots through the material or else by reducing the thickness of the panels at certain points to facilitate bending of the panels into the required shape.

**[0063]** A lower connecting member 102 is adapted to be fixed to the bottom longitudinal edge of the body 101. The lower connecting member has four integral flange portions 124 which correspond to each of the end and side panels 114,116,118,120 of the body 101. Each of the flange portions 124 lies substantially perpendicular to the lower connecting member 102 and is connected thereto along a fold line 123. Each fold line 123 is created by scoring or a similar technique on the surface of the lower connecting member 102. Each side flange portion 124 is also provided with chamfers 126 at either end thereof to allow the lower connecting member 102 to be formed into a substantially rectangular shape, as will be described below. The side flange portions 124 further include tab receiving slots 132 formed adjacent the fold lines 123.

**[0064]** An upper connecting member 104 is adapted to be fixed to the top longitudinal edge of the body 101. The upper connecting member 104 includes integrally formed tabs 134. The tabs 134 protrude laterally from the upper connecting member 104 so as to be engageable with the tab receiving slots 132 in the lower connecting member of an adjacent block when the connecting members are fixed to the body 101.

**[0065]** A first end connecting member 106 is adapted to be fixed to a first end of the body 101. The first end connecting member 106 has an integral end flange portion 138 which connects with the end connecting member 106 along a fold line 140. As with the fold lines 123 of

the lower connecting member 102, the fold line 140 is formed on the end connecting member 106 by scoring or a similar technique. Prior to final assembly, the end flange portion 138 is folded along fold line 140 so that it lies substantially perpendicular to the end connecting member 106, as shown in Fig. 15(a).

**[0066]** The end flange portion 138 further includes tab receiving slots 142 formed on the end flange portion 138 adjacent the fold line 140. These tab receiving slots 142 are intended to receive tabs 144 integrally formed on a second end connecting member 108 adapted to be fixed to the second end of the body 101. The tabs 144 protrude longitudinally from the second end connecting member 108 and are adapted to be engageable with the tab receiving slots 142 in the first end connecting member 106. Although the first and second end connecting members 106, 108 are illustrated as having two slots 142 and two corresponding tabs 144, respectively, it should be appreciated that any suitable number of slots 142 or tabs 144 may be used.

**[0067]** The steel connecting members 102-108 and plastics body portion 101 are fixed together prior to form the building block. This fixing can be by any conventional means such as, for example, riveting, adhesion or crimping. In one preferred embodiment, the metal connecting members 102-108 can be folded over the edges of each corresponding panel 114-120 of the body 101 and then crimped in place.

**[0068]** Fig. 15(b) illustrates a building block 100 formed from the components shown in Fig. 15(a). In the illustrated embodiment, the building block 100 is formed into a substantially cuboid shape by folding each of the panels 114-120 and the associated connecting members 102-108 fixed thereto along the fold lines 122. Thus, the end and side panels 114-120 define the outer perimeter and shape of the block, and each form a face of the building block 100. The building block is secured in this form by engaging the tabs 144 of the second end connecting member 108 with the tab receiving slots 142 of the first end connecting member 106. The end panel 114 lies flush with the side flange portion 138 of the first end connecting member 106 and the tabs 144 are first manipulated so as to protrude through tab receiving slots 142 and then bent back to fix the end flange portion 138 and end panel 114 together. Depending on the thickness of the sheet of material being used, the tabs can be manipulated either by hand or else by using a suitable tool.

**[0069]** As best illustrated in Fig. 15(c), the chamfered side flange portions 124 of the lower connecting member 102 form a base for the building block 100 that provides additional strength. Fig. 15(c) also shows the arrangement of the slots 132 on the side flange portions 124 of the lower connecting member 102 once the body 101 has been formed into the building block 100.

**[0070]** Figs. 16(a)-(f) show various detail views of a third embodiment of the building block. The third embodiment of the block, generally designated 200, is similar to the second embodiment in that the body 201 is formed

from an extruded cellular plastics material and is divided into two end panels 214, 216 and two side panels 218, 220. Panels 214-220 are integrally formed and connected along three fold lines (not shown) which extend laterally across the body 201 at intervals along the length thereof.

**[0071]** Where the third embodiment differs from the second embodiment is that the metal connecting members have been replaced with plastic connecting members 202-208. As best shown in Figs. 16(b)-(f), the connecting members 202-208 are provided with substantially U-shaped channels 222. The edge of each panel 214-220 of the body 201 has a tongue 223 extending outwardly along substantially the length thereof. The tongues 223 are sized so as to be held in the channels 222 of the connecting members 202-208. This can be done by snap fit, friction fit or a similar technique. Once the tongues 223 are fitted in the channels 222, the channels 222 can be crimped in order to strengthen the fit between the body 201 and connecting members 202-208. An adhesive may also be applied to the joints for further strength.

**[0072]** Each of the lower and upper connecting members 202, 204 is provided with a number of fasteners for securing adjacent blocks either above or below the block 200. The fasteners of this third embodiment are snap fasteners comprising a male part 232 which is either fixed to, or integrally formed with, the connecting members 202, 204. The fasteners further comprise an elongate fastener strip 234 which is provided with a female part 236 at either end thereof. In order to connect two blocks together, a fastener strip 234 is snap fastened to a pair of corresponding male parts 232 in adjacent blocks. This is best shown in Fig. 16(f), where two side panels 220, 220' are connected via their respective upper and lower connecting members 204, 202 and the fastener strip 234 fastened to the two male parts 232 of the connecting members 204, 202.

**[0073]** As shown in Fig. 16(b), the lower connecting member 202 is provided with a lateral stiffening web 240 which extends inwardly from the channel 222 at substantially 90 degrees. This web 240 provides additional stiffness and rigidity to the block 200 when fully formed and in use. The web 240 is also provided with a locating guide 242 extending downwards therefrom at substantially 90 degrees to the web 240. This guide runs the length of the connecting member 202 and therefore runs around the perimeter of the block 200 when fully formed. The guide 242 ensures that the block 200 will fit correctly on top of a lower block when in use. The guide can be broken midway along each longitudinal side of the block in order to allow blocks to be placed on one another offset by a half block length. This break in the guide ensures that the block 200 will accommodate the connecting member 204 forming the lateral ends of the block below when the offset arrangement is desired.

**[0074]** Figures 16(d) and (e) show alternative arrangements for connecting the side panel 220 and end panel

214 together to form the block 200. In the example shown in Fig. 16(d), each of the first and second end connecting members 206,208 is provided with a first substantially U-shaped channel 222 for accommodating the tongues 223 of the body panels 214,200 and a second substantially U-shaped channel 242. The first and second channels 222,242 of the first end connecting member 206 are formed substantially perpendicular to one another, whereas the first and second channels 222,242 of the second end connecting member 208 are formed substantially parallel with one another. In this way, when the first and second end connecting members 206,208 are brought together, the second channels 242 of each connecting member 206,208 accommodate one another, thus forming a "butcher's grip" connection between the two connecting members 206,208. This ensures that where the block 200 is to be filled with material for rigidity, the connection between the two connecting members 206,208 will resist the increased internal pressure.

**[0075]** The alternative connection shown in Fig. 16(e) is similar to that shown in Fig. 16(d). However, in this alternative connection, the tongue 223' of the end panel 214' is shorter than those previously described. At the same time, the second end connecting member 208' is extended so that the second channel 242' is deeper than those previously described. The first and second end connecting members 206,208 fit together in the same manner as described above, but with the connection being restricted to the same depth as the thickness of the body 201 and connecting members 206,208.

**[0076]** Fig. 16(f) shows a detail view of the connection between adjacent blocks, as described above. Also shown is the web 240 and guide 242 on the lower connecting member 202 of the upper block. It can also be seen in Fig. 16(f) that the web includes a slot 243 located inward of the guide 242. This slot 243 is provided to accommodate the fastener strip 234 when connecting the adjacent blocks.

**[0077]** An alternative means of connecting adjacent blocks is shown in Figs. 17(a)-(c). The connecting members shown in these figures have an L-shaped section, as opposed to the U-shaped section of the connecting members shown in Figs. 16(a)-(f). However, it should be understood that either shape of section can be utilised for the embodiment of connecting member shown in Figs. 17(a)-(c). Connecting members having the L-shaped section can be directly adhered to the body if crimping the connecting members to the body panels cannot easily be accomplished. There would therefore be no need for the tongues and channels on the panels and connecting members, respectively.

**[0078]** In order to fix the adjacent blocks together, as shown in section detail in Fig. 17(a), each upper connecting member is provided with a nib, or detent, 305 which projects inwardly towards the centre of the formed block from the side panel 320. Each lower connecting member 302 has a web 340 which also extends inwardly towards the center of the formed block at substantially 90 degrees

to the lower connecting member 302. Integrally formed with the web 340, and projecting downwardly therefrom, is a resilient catch 342. The catch 342 is adapted to engage the corresponding detent 305 of the upper connecting member 304 such that the connecting members 302,304, and hence the adjacent blocks, are locked together.

**[0079]** Fig. 17(b) shows a further embodiment of the connection between first and second end connecting members 306,308 when forming blocks using the L-section connecting members of Fig. 17. The connecting members 306,308 are first fixed to the side panel 320 and end panel 314, respectively, preferably by adhesion, although alternative fixing methods may be used. Save for the use of L-section connecting members, the connection shown in Fig. 17(b) is substantially the same as that shown in Fig. 16(e). However, the connection shown here differs from that of Fig. 16(e) in that the connecting members 306,308 are each provided with a resilient catch 350. The catches 350 of each connecting member 306,308 snap together in the same "butcher's grip" arrangement described above. Again, this arrangement prevents the formed block from coming apart as a result of internal pressure from fill material inside the block.

**[0080]** Fig. 17(c) shows a detail view of the blanks stored ready to form blocks. It can be seen that the lower connecting members 302 and their webs 340 ensure that the panels (only end panel 314 is shown here) and connecting members can be flat packed ready for transportation to a construction site.

**[0081]** A fourth embodiment of building block is shown in the detail views of Figs. 18(a)-(c). In this embodiment, the body panels are formed as before. As can be seen from Fig. 18(a), the body 401 of the block is formed from panels made of extruded cellular plastics sheet, as before. Although only side panel 420 is shown in Fig. 18(a), each panel is formed the same, and includes a plurality of cells 403 which extend across each panel. An example of the connecting members used in this embodiment is also shown in Fig. 18(a) and is generally designated 402. Connecting members 402 such as that shown can be used for both the upper and lower connecting members of the block. The connecting member 402 is comb-like, in that it has a plurality of spaced apart teeth, or prongs, 422. Although the teeth 422 are spaced apart, they are relatively closely packed such that a number of adjacent teeth 422 can fit inside one cell 403 of the panels. In the example shown the teeth 422 are plate-like in shape, but it should be understood that any suitable shape may be used. All of the teeth 422 of each connecting member 402 are integrally formed with a strengthening rib 440, which runs the length of the connecting member 402. The connecting members 402 can run the length of each panel, or else they can be shortened and only applied at the joints between panels and adjacent blocks.

**[0082]** Fig. 18(b) shows in plan the connection between side panel 420 and end panel 414. As with the previously described embodiments, first and second end

connecting members 406,408 are employed to connect the two panels 420,414 together and hence form the closed block. Each connecting member 406,408 has a toothed portion such as that shown in Fig. 18(a) which fixes the connecting member 406,408 to its respective panel 420,414 via the teeth 422 entering the cells 403 of each panel 420,414. These end connecting members 406,408 are also provided with a resilient catch 450. The catches 450 of each connecting member 406,408 again snap together in the same "butcher's grip" arrangement described above. As before, this arrangement prevents the formed block from coming apart as a result of internal pressure from fill material inside the block.

**[0083]** Fig. 18(c) shows a detail section view of adjacent blocks connected together via side panels 420,420'. Each tooth 422 of each connecting member 402 is attached to the web 440 substantially in the middle thereof. As a result, the web 440 divides each tooth 422 into upper and lower teeth 422a,422b. In Fig. 18(c) it can be seen that the lower teeth 422b of the connecting member 402 slide downwards into the cells 403 of the lower side panel 420. Once the connecting member 402 is fixed in the lower side panel 420 (and other connecting members are located in a similar manner at locations around the upper perimeter of the block 400), the upper block 400' is brought down on top of the first block 400 such that the upper teeth 422a of the connecting member 402 enter the cells 403' of the side panel 420'. As a result, the two adjacent blocks 400,400' are now fixed together and the fix can be further strengthened by the application of an adhesive to either or both the upper and lower teeth 422a, 422b. Where appropriate the connecting members 402 can be modified so as to form joints at the corners of blocks. This can be achieved by introducing appropriately large gaps between sets of teeth and also mitres in the web to allow the connecting members to be bent through the required angle.

**[0084]** It should be understood that although the teeth illustrated in the connecting members 402 are plate-like members, they could also engage with the cellular panels 420 via alternative means. For example, the teeth could be thicker, block-like members dimensioned and spaced so as to directly engage in the cells 403 of the panel 420. The teeth could also be short, rod-like prongs which engage in the cells 403 of the panel 420.

**[0085]** In addition, and as also explained elsewhere in this specification, each of the connecting members described herein, including those shown in Figs. 18(a)-(c) do not necessarily have to be formed in one continuous length to cover the entire perimeter of the building element. Instead, the connecting members can be formed as single members which can attach to the panels of the building element individually. Such individual connecting members can also be provided with strengthening webs having 45 degree cut-away ends, so as to not interfere with adjacent connecting members if fitted at the corners of a building element such as the blocks shown as examples herein.

**[0086]** The present invention provides a number of building blocks which are formed from sheets of metal or plastics, or a combination of the two. The blanks for these blocks can be punched or cut from the sheet of material and then flat packed for easy transportation and storage. The blanks can be transported to locations where raw building materials are in short supply and then assembled in a very straightforward manner using only the builder's hands. If additional supplies are available, such as rivets or adhesives for fixing components, for example, then these may also be used to further improve the strength of the formed building elements. With the present invention, there is therefore no need to source scarce materials or specialist tools to assemble buildings and structures from the building elements according to the present invention.

**[0087]** It should be appreciated that the illustrated building blocks may also be dimensioned so as to form a cube shape, in order that half-size blocks can be used to form a particular shape of wall or structure. As already highlighted above, the first embodiment of building block, the door lintel and the window sill described herein have been formed from a single sheet of galvanised steel, but any other type of sheet metal or suitable plastics material could be used, so long as a suitable weatherproof coating or treatment has been applied. Alternative materials include those used in respect of the second, third and fourth embodiments of the blocks. Furthermore, the tabs of the first embodiment of the block, the lintel and window sill have each been illustrated as being substantially rectangular. However, it should be appreciated that in order to aid engagement with the tab receiving slots, the tabs may have rounded edges.

**[0088]** A further modification to the tabs would be to make them longer so that they can not only fold flush onto a panel or flange, but extend so that they can be folded back upon themselves for extra strength to the join. Alternatively, the tabs could be reduced in length to such an extent that they are merely used as positioning means which engage the tab receiving slots but do not protrude through the slots. In this alternative embodiment, the securing of the building blocks in a wall would be carried out by adding further tab receiving slots adjacent the tabs and the tab receiving slots, and then using wire or plastic ties through the slots to secure the building blocks together.

**[0089]** Although the building blocks have been illustrated as being formed from substantially planar side and end panels, the panels may also be stamped with a formation that adds strength to the panels (e.g. an X-shaped stamp covering the majority of the panel) The panels of the building blocks may also each be provided with one or more punch-out discs. The one or more discs are aligned with a corresponding one or more discs in the opposite panel of the block. If reinforcement of the blocks is desired, the discs can be punched out to allow the blocks to receive reinforcement rods which pass through the blocks to provide additional strengthening.

**[0090]** The buildings and structures made from the blocks may insulated and stabilised by filling each block with a suitable filling material, such as concrete, sand, earth, clay, gravel, rubble or any other similar available material, depending on the availability of such materials in then area of construction. The blocks may also be made thermally insulated or made fire-resistant by inserting appropriate insulating foam or fire-retardant foam into the blocks during construction.

**[0091]** A further application of the blocks would be as part of a flood prevention system. A wall of the blocks forms a first protection layer against the flood, with a lower layer of blocks being anchored in the ground by an appropriate means such as, for example, scaffolding tubes. The tubes pass down through the layered blocks into the ground. The scaffolding tubes can be set in the blocks using cement or the like to fix the tubes in place. In addition to the first wall of blocks, a second wall may be constructed to the rear of the first and waterproofing may be applied to one or both of the walls. The waterproofing may be a sheet membrane, or any other type of waterproofing.

**[0092]** The building blocks can be utilised to form foundations of buildings and other structures. For example, four building blocks could be arranged to form a substantially square base unit, and further blocks could be stacked in a conventional vertical manner on top of the base unit to a suitable height. The building blocks would be filled with cement, or another suitable material and reinforced with typical reinforcing members such as the aforementioned scaffolding tubes or steel reinforcement rods, for example. The flexibility of the arrangement of the blocks means that virtually any configuration of foundation can be achieved.

**[0093]** A wall constructed from the building blocks of the present invention also provides an ideal surface for applying either an internal or external cladding layer. The blocks can be sprayed with a suitable treatment (e.g. for fire-proofing) and then the cladding can be applied to the wall quickly and cheaply by simply using self-tapping screws, or the like, that penetrate the sheet material of the block and fix the cladding thereto.

**[0094]** The blocks may also be utilised to form permanent shuttering (not shown) for the foundations of buildings or the like.

**[0095]** A yet further application of the building blocks is that if the blocks are made from a sufficient thickness and/or type of metal and/or plastics, they can be used to form a building or structure that is resistant to attack. Thus, the blocks can be used to quickly and simply construct military and security installations (e.g. checkpoints). Buildings formed from the blocks would also be less susceptible to ram-raid attacks, where an attempt is made to drive a vehicle through the wall of a building or installation.

**[0096]** Each of the building elements and their separate components described herein can be formed from either sheet metal or plastics, using the techniques re-

ferred to above. In addition, although certain examples given above describe the various components of the elements as being formed separately (e.g. the body portion and connecting members), it should be understood that these components could be integrally formed with one another by punching, moulding or a similar technique. These one-piece elements would be formed with all the necessary fold lines, flutes, chamfers, cells and the like already thereon, so that the elements can be simply folded into shape and clipped or fixed in position.

**[0097]** These and other modifications and improvements may be made to the above without departing from the scope of the present invention as defined by the appended claims.

## Claims

1. A blank for forming a building element, the blank comprising:

an elongate body portion (10) having first and second ends and a plurality of transverse fold lines (22) which divide the body portion (10) into a plurality of panels (14,16,18,20), the panels (14,16,18,20) each having first and second longitudinal edges;

one or more first tab members (44) extending from the first end of the body portion (10); and one or more first tab receiving apertures (42) adjacent the second end of the body portion (10);

**characterised in that** each of said plurality of panels (14,16,18,20) has at least one second tab (34) extending from said first longitudinal edge and a side flange portion (24) adjacent said second longitudinal edge, and wherein each side flange portion (24) is provided with at least one second tab receiving aperture (32).

2. The blank of Claim 1, wherein each side flange portion (24) is divided from its respective panel (14,16,18,20) by a longitudinally extending fold line (23) which extends along the length of the body portion (10), and wherein the side flange portions (23) are adapted to be folded substantially perpendicular to their respective panels (14,16,18,20).
3. The blank of either preceding claim, wherein the body portion (10) has an end flange portion (38) adjacent the second end thereof, the at least one first aperture (42) being formed in the end flange portion (38).
4. The blank of any preceding claim, wherein the end flange portion (38) is divided from the body portion by one of the plurality of transverse fold lines (40),

- and wherein the end flange portion (38) is adapted to be folded substantially perpendicular to the body portion (10).
5. The blank of any preceding claim, wherein one or more of the panels (14,16,18,20) includes a strengthening formation thereon.
6. The blank of any preceding claim, wherein one or more of the panels (14,16,18,20) is provided with a third aperture adapted to receive a reinforcing means.
7. The blank of any preceding claim, wherein the building element is a building block (12).
8. The blank of any preceding claim, the blank being formed from sheet metal.
9. The blank of any of Claims 1 to 7, the blank being formed from sheet plastics.
10. A building block (12) formed from the blank according to any of Claims 1 to 9.
11. A building element comprising:
- a body portion (101,201,401) having first and second ends and comprising a plurality of integrally formed panels adapted to define the perimeter of the building element, wherein each panel has first and second longitudinal edges; at least one first connecting member (104,204,304,402) attached to the panels adjacent their first longitudinal edges; a third connecting member (106,206,306,406) attached to the body portion (101,201,401) adjacent the first end thereof; wherein the third connecting member (106,206,306,406) is adapted so as to engage the second end of the body portion (101,201,401); **characterised in that** said building element further comprises at least one second connecting member (102,202,302,402) attached to the panels adjacent their second longitudinal edges; wherein the first and second connecting members are provided with first and second attachment means, respectively, each of the attachment means being adapted to attach the building element to an adjacent building element ; and the first and second attachment means are integrally formed with their respective first and second connecting members.
12. The building element of Claim 11, further comprising a fourth connecting member (108,208,308,408) attached to the body portion (101,201,401 ) adjacent
- the second end thereof, wherein the third and fourth connecting members are adapted so as to be mutually engagable.
13. The building element of Claim 12, wherein the third and fourth connecting members are each provided with a resilient engagement member adapted to engage with one another.
14. The building element of Claim 12, wherein the third connecting member (106) includes one or more apertures (142) therein, and the fourth connecting member (108) includes one or more tabs (144) projecting therefrom for engagement with the apertures (142) in the third connecting member (106).
15. The building element of any of Claims 11 to 14, wherein the first and second connecting members are each formed from a single piece of material and each is adapted to follow the perimeter of the building element.
16. The building element of any of Claims 11 to 14, wherein the building element comprises a plurality of first and second connecting members attached to each longitudinal edge of each panel.
17. The building element of any of Claims 11 to 16, wherein each of the connecting members is attached to the body portion (101,201,401) using an attachment method selected from the group comprising riveting, gluing and crimping.
18. The building element of any of Claims 11 to 17, wherein the first attachment means comprises at least one tab (134) projecting from the first connecting member (104), and the second attachment means comprises at least one aperture (132) adapted to receive the at least one tab (134) of an adjacent building element.
19. The building element of any of Claims 11 to 17, wherein the first attachment means comprises a first fastener element (232) and a detachable fastener member (234) adapted to attach to the first fastener element (232), and the second attachment means comprises a second fastener element (232) adapted to receive a fastener member (234) of an adjacent building element.
20. The building element of any of Claims 11 to 17, wherein the first attachment means comprises a detent (305) projecting from the first connecting member (304), and the second attachment means comprises a resilient catch (342) adapted to engage with the detent (305) of an adjacent building element.
21. The building element of any of Claims 11 to 16,

wherein the first attachment means comprises a plurality of engagement teeth (422) and the second attachment means comprises a plurality of cells (403), the teeth (422) being adapted to be inserted in the cells (403) of an adjacent building element.

22. The building element of Claim 21, wherein each engagement tooth (422) has a first engagement portion (422a) projecting in a first direction and a second engagement portion (422b) projecting in a second, substantially opposite, direction.
23. The building element of any of Claims 11 to 22, wherein each of the second connecting members (202,302,402) includes a strengthening rib (240,340,440) projecting therefrom.
24. The building element of any of Claims 11 to 23, wherein each of the first connecting members (402) includes a strengthening rib (440) projecting therefrom.
25. The building element of any of Claims 11 to 24, wherein the body portion (101,201,401) is formed from a single sheet of extruded cellular plastics material having a plurality of cells (403) therein.
26. The building element of any of Claims 11 to 25, wherein each connecting member (102,104,105,108) is formed from sheet metal.
27. The building element of any of Claims 11 to 25, wherein the connecting members are formed from a plastics material.
28. The building element of any of Claims 11 to 25, wherein at least one of the connecting members is integrally formed with the body portion.

#### Patentansprüche

1. Ein Rohstück zum Bilden eines Bauelements, wobei das **Rohstück Folgendes beinhaltet:**

einen länglichen Körperabschnitt (10) mit ersten und zweiten Enden und einer Vielzahl von transversalen Falllinien (22), die den Körperabschnitt (10) in eine Vielzahl von Platten (14, 16, 18, 20) teilen, wobei die Platten (14,16,18, 20) jede erste und zweite longitudinale Kanten aufweisen; ein oder mehrere erste Streifenteile (44), die sich von dem ersten Ende des Körperabschnitts (10) erstrecken; und eine oder mehrere Streifen aufnehmende Öffnungen (42) angrenzend an dem zweiten Ende des Körperabschnitts (10);

**dadurch gekennzeichnet, dass** jede der Vielzahl von Platten (14, 16, 18, 20) mindestens einen zweiten Streifen (34) aufweist, der sich von der ersten longitudinalen Kante erstreckt und einen seitlichen Flanschabschnitt (24) angrenzend an der zweiten longitudinalen Kante, und wobei jeder seitliche Flanschabschnitt (24) mit mindestens einer zweiten Streifen aufnehmenden Öffnung (32) versehen ist.

2. Rohstück gemäß Anspruch 1, wobei jeder seitliche Flanschabschnitt (24) von seiner entsprechenden Platte (14, 16, 18, 20) durch eine sich longitudinal erstreckende Falllinie (23), die sich entlang der Länge des Körperabschnitts (10) erstreckt, geteilt wird, und wobei die seitlichen Flanschabschnitte (24) angepasst sind, um im Wesentlichen senkrecht zu ihren entsprechenden Platten (14, 16, 18, 20) gefaltet zu werden.
3. Rohstück gemäß einem der vorhergehenden Ansprüche, wobei der Körperabschnitt (10) einen Endflanschabschnitt (38) angrenzend an dem zweiten Ende davon aufweist, wobei die mindestens eine Öffnung (42) in dem Endflanschabschnitt (38) gebildet ist.
4. Rohstück gemäß einem der vorhergehenden Ansprüche, wobei der Endflanschabschnitt (38) von dem Körperabschnitt durch eine der Vielzahl von transversalen Falllinien (40) geteilt wird, und wobei der Endflanschabschnitt (38) angepasst ist, um im Wesentlichen senkrecht zu dem Körperabschnitt (10) gefaltet zu werden.
5. Rohstück gemäß einem der vorhergehenden Ansprüche, wobei **eine oder mehrere der Platten (14, 16, 18, 20) ein** Verstärkungsgebilde darauf umfasst.
6. Rohstück gemäß einem der vorhergehenden Ansprüche, wobei eine oder mehrere der Platten (14, 16, 18, 20) mit einer dritten Öffnung versehen ist, die angepasst ist, um ein Verstärkungsmittel aufzunehmen.
7. Rohstück gemäß einem der vorhergehenden Ansprüche, wobei das Bauelement ein Baustein (12) ist.
8. Rohstück gemäß einem der vorhergehenden Ansprüche, wobei das Rohstück aus Walzblech gebildet ist.
9. Rohstück gemäß einem der Ansprüche 1 bis 7, wobei das **Rohstück aus Kunststoffplatten gebildet ist.**
10. Ein Baustein (12), der aus dem Rohstück gemäß einem der Ansprüche 1 bis 9 gebildet ist.

11. Ein Bauelement, das Folgendes beinhaltet:

einen Körperabschnitt (101, 201, 401) mit ersten und zweiten Enden und der eine Vielzahl von integral gebildeten Platten beinhaltet, die angepasst sind, um den Umfang des Bauelements zu definieren, wobei jede Platte erste und zweite longitudinale Kanten aufweist;

mindestens ein erstes Verbindungsteil (104, 204, 304, 402), das an den Platten angrenzend an ihren ersten longitudinalen Kanten angebracht ist;

ein drittes Verbindungsteil (106, 206, 306, 406), das an dem Körperabschnitt (101, 201, 401) angrenzend an dem ersten Ende davon angebracht ist,

wobei das dritte Verbindungsteil (106, 206, 306, 406) angepasst ist, um in das zweite Ende des Körperabschnitts (101, 201, 401) einzugreifen;

**dadurch gekennzeichnet, dass** das Bauelement ferner mindestens ein zweites Verbindungsteil (102, 202, 302, 402), das an den Platten angrenzend an ihren zweiten longitudinalen Kanten angebracht ist, beinhaltet;

wobei das erste und das zweite Verbindungsteil mit ersten bzw. zweiten Anbringungsmitteln versehen sind, wobei jedes der Anbringungsmittel angepasst ist, um das Bauelement an einem angrenzenden Bauelement anzubringen;

und das erste und zweite Anbringungsmittel integral mit ihren entsprechenden ersten und zweiten Verbindungsteilen gebildet sind.

12. Bauelement gemäß Anspruch 11, das ferner ein viertes Verbindungsteil (108, 208, 308, 408), das an dem Körperabschnitt (101, 201, 401) angrenzend an dem zweiten Ende davon angebracht ist, beinhaltet, wobei das dritte und das vierte Verbindungsteil angepasst sind, um wechselseitig eingreifbar zu sein.

13. **Bauelement gemäß Anspruch 12, wobei das dritte und das vierte Verbindungsteil beide mit einem elastischen Eingriffsteil** versehen sind, die angepasst sind, um ineinander einzugreifen.

14. Bauelement gemäß Anspruch 12, wobei das dritte Verbindungsteil (106) eine oder mehrere Öffnungen (142) darin umfasst, und das vierte Verbindungsteil (108) einen oder mehrere Streifen (144) umfasst, die davon zum Eingriff mit den Öffnungen (142) in dem dritten Verbindungsteil (106) vorstehen.

15. Bauelement gemäß einem der Ansprüche 11 bis 14, wobei das erste und zweite Verbindungsteil beide aus einem einzelnen Stück Material gebildet sind und wobei jedes angepasst ist, dem Umfang des Bauelements zu folgen.

16. Bauelement gemäß einem der Ansprüche 11 bis 14, wobei das Bauelement eine Vielzahl von ersten und zweiten Verbindungsteilen beinhaltet, die an jeder longitudinalen Kante jeder Platte angebracht sind.

17. Bauelement gemäß einem der Ansprüche 11 bis 16, wobei jedes der Verbindungsteile an dem Körperabschnitt (101, 201, 401) unter Verwendung eines Anbringungsverfahrens, das aus der Gruppe bestehend aus Nieten, Kleben und Heften ausgewählt ist, angebracht ist.

18. Bauelement gemäß einem der Ansprüche 11 bis 17, wobei das erste Anbringungsmittel mindestens einen Streifen (134) beinhaltet, der von dem ersten Verbindungsteil (104) vorsteht, und das zweite Anbringungsmittel mindestens eine Öffnung (132) beinhaltet, die angepasst ist, um den mindestens einen Streifen (134) eines angrenzenden Bauelements aufzunehmen.

19. Bauelement gemäß einem der Ansprüche 11 bis 17, wobei das **erste Anbringungsmittel ein erstes Befestigungselement (232)** und ein abnehmbares Befestigungsteil (234), das angepasst ist, um an dem ersten Befestigungselement (232) angebracht zu werden, beinhaltet, und wobei das zweite Anbringungsmittel ein zweites Befestigungselement (232) beinhaltet, das **angepasst ist, um ein Befestigungsteil (234) eines** angrenzenden Bauelements aufzunehmen.

20. Bauelement gemäß einem der Ansprüche 11 bis 17, wobei das erste Anbringungsmittel eine Rastung (305) beinhaltet, die von dem ersten Verbindungsteil (304) vorsteht, und das zweite Anbringungsmittel eine elastische Sperre (342) beinhaltet, die angepasst ist, um in die Rastung (305) eines angrenzenden Bauelements einzugreifen.

21. Bauelement gemäß einem, der Ansprüche 11 bis 16, wobei das erste Anbringungsmittel eine Vielzahl von Eingriffszähnen (422) beinhaltet und das zweite Anbringungsmittel eine Vielzahl von Zellen (403) beinhaltet, wobei die Zähne (422) angepasst sind, um in die Zellen (403) eines angrenzenden Bauelements eingefügt zu werden.

22. Bauelement gemäß Anspruch 21, wobei jeder Eingriffszahn (422) einen ersten Eingriffsabschnitt (422a) aufweist, der in eine erste Richtung vorsteht, und einen zweiten Eingriffsabschnitt (422b), der in eine zweite, im Wesentlichen gegenüberliegende Richtung vorsteht.

23. Bauelement gemäß einem der Ansprüche 11 bis 22, wobei jedes der zweiten Verbindungsteile (202, 302, 402) eine Verstärkungsrippe (240, 340, 440) be-

inhalte, die davon vorsteht.

24. Bauelement gemäß einem der Ansprüche 11 bis 23, wobei jedes der ersten Verbindungsteile (402) eine Verstärkungsrippe (440) umfasst, die davon vorsteht. 5
25. Bauelement gemäß einem der Ansprüche 11 bis 24, wobei der Körperabschnitt (101, 201, 401) aus einer einzelnen Lage aus extrudiertem zellulärem Material mit einer Vielzahl von Zellen (403) darin gebildet ist. 10
26. Bauelement gemäß einem der Ansprüche 11 bis 25, wobei jedes Verbindungsteil (102, 104, 106, 108) aus Walzblech gebildet ist. 15
27. Bauelement gemäß einem der Ansprüche 11 bis 25, wobei die Verbindungsteile aus einem Kunststoffmaterial gebildet sind. 20
28. Bauelement gemäß einem der Ansprüche 11 bis 25, wobei mindestens eins der Verbindungsteile integral mit dem Körperabschnitt gebildet ist. 25

#### Revendications

1. Une découpe destinée à former un élément de construction, la **découpe comprenant** :

une portion de corps allongée (10) ayant des première et deuxième extrémités et une pluralité de lignes de pliage transversales (22) qui divisent la portion de corps (10) en une pluralité de panneaux (14, 16, 18, 20), les panneaux (14, 16, 18, 20) ayant chacun des premier et deuxième bords longitudinaux ;  
un ou plusieurs premiers organes formant patte (44) s'étendant de la première extrémité de la portion de corps (10) ; et  
un ou plusieurs premiers orifices de réception de patte (42) adjacents à la deuxième extrémité de la portion de corps (10) ;

**caractérisée en ce que** chaque panneau de ladite pluralité de panneaux (14, 16, 18, 20) a au moins une deuxième patte (34) s'étendant depuis ledit premier bord longitudinal et une portion formant flasque latéral (24) adjacente audit deuxième bord longitudinal, et dans laquelle chaque portion formant flasque latéral (24) est pourvue d'au moins un deuxième orifice de réception de patte (32). 45

2. La découpe de la revendication 1, dans laquelle chaque portion formant flasque latéral (24) est séparée de son panneau respectif (14, 16, 18, 20) par une ligne de pliage (23) s'étendant de façon longitudinale, laquelle s'étend sur la longueur de la portion de

corps (10) et dans laquelle les portions formant flasques latéraux (24) sont adaptées pour être pliées de façon substantiellement perpendiculaire par rapport à leurs panneaux respectifs (14, 16, 18, 20).

3. La découpe de l'une ou l'autre revendication précédente, dans laquelle la portion de corps (10) a une portion formant flasque d'extrémité (38) adjacente à la deuxième extrémité de celle-ci, cet au moins un premier orifice (42) étant formé dans la portion formant flasque d'extrémité (38). 10

4. La découpe de n'importe quelle revendication précédente, dans laquelle la portion formant flasque d'extrémité (38) est séparée de la portion de corps par une ligne de pliage transversale (40) parmi la pluralité de lignes de pliage transversales, et dans laquelle la portion formant flasque d'extrémité (38) est adaptée pour être pliée de façon substantiellement perpendiculaire par rapport à la portion de corps (10). 15

5. La découpe de n'importe quelle revendication précédente, dans laquelle un ou plusieurs des panneaux (14, 16, 18, 20) incluent une formation de consolidation sur ceux-ci. 20

6. La découpe de n'importe quelle revendication précédente, **dans laquelle un ou plusieurs des panneaux (14, 16, 18, 20)** sont pourvus d'un troisième orifice adapté pour recevoir un moyen de renforcement. 25

7. La découpe de n'importe quelle revendication précédente, dans laquelle l'élément de construction est un bloc de construction (12). 30

8. La découpe de n'importe quelle revendication précédente, la découpe étant formée à partir de métal en feuille. 35

9. La découpe de n'importe lesquelles des revendications 1 à 7, la découpe étant formée à partir de plastique en feuille. 40

10. Un bloc de construction (12) formé à partir de la découpe selon n'importe lesquelles des revendications 1 à 9. 45

11. Un élément de construction comprenant :

une portion de corps (101, 201, 401) ayant des première et deuxième extrémités et comprenant une pluralité de panneaux formés de façon solide adaptés pour définir le périmètre de l'élément de construction, dans laquelle chaque panneau a des premier et deuxième bords longitudinaux ;

- au moins un premier organe de raccordement (104, 204, 304, 402) attaché aux panneaux de façon adjacente à leurs premiers bords longitudinaux ;  
un troisième organe de raccordement (106, 206, 306, 406) attaché à la portion de corps (101, 201, 401) de façon adjacente à la première extrémité de celle-ci,  
dans lequel le troisième organe de raccordement (106, 206, 306, 406) est adapté de façon à s'engager dans la deuxième extrémité de la portion de corps (101, 201, 401) ;  
**caractérisé en ce que** ledit élément de construction comprend de plus au moins un deuxième organe de raccordement (102, 202, 302, 402) attaché aux panneaux de façon adjacente à leurs deuxièmes bords longitudinaux ;  
dans lequel les premier et deuxième organes de raccordement sont pourvus de premier et deuxième moyens d'attache, respectivement, chacun des moyens d'attache étant adapté pour attacher l'élément de construction à un élément de construction adjacent ;  
et les premier et deuxième moyens d'attache sont formés de façon solidaire avec leurs premier et deuxième organes de raccordement respectifs.
12. L'élément de construction de la revendication 11, comprenant de plus un quatrième organe de raccordement (108, 208, 308, 408) attaché à la portion de corps (101, 201, 401) de façon adjacente à la deuxième extrémité de celle-ci, dans lequel les troisième et quatrième organes de raccordement sont adaptés de façon à pouvoir s'engager l'un dans l'autre mutuellement.
13. L'élément de construction de la revendication 12, dans lequel les troisième et quatrième organes de raccordement sont chacun pourvus d'un organe d'engagement élastique adapté pour s'engager l'un dans l'autre.
14. L'élément de construction de la revendication 12, dans lequel le troisième organe de raccordement (106) inclut un ou plusieurs orifices (142) dans celui-ci, et le quatrième organe de raccordement (108) inclut une ou plusieurs pattes (144) faisant saillie à partir de celui-ci pour s'engager dans les orifices (142) dans le troisième organe de raccordement (106).
15. L'élément de construction de n'importe lesquelles des revendications 11 à 14, dans lequel les premier et deuxième organes de raccordement sont chacun formés à partir d'une seule pièce de matériau et chacun est adapté pour correspondre au périmètre de l'élément de construction.
16. L'élément de construction de n'importe lesquelles des revendications 11 à 14, dans lequel l'élément de construction comprend une pluralité de premier et deuxième organes de raccordement attachés à chaque bord longitudinal de chaque panneau.
17. L'élément de construction de n'importe lesquelles des revendications 11 à 16, dans lequel chacun des organes de raccordement est attaché à la portion de corps (101, 201, 401) en utilisant une méthode d'attache sélectionnée dans le groupe comprenant le rivetage, le collage et le sertissage.
18. L'élément de construction de n'importe lesquelles des revendications 11 à 17, dans lequel le premier moyen d'attache comprend au moins une patte (134) faisant saillie depuis le premier organe de raccordement (104), et le deuxième moyen d'attache comprend au moins un orifice (132) adapté pour recevoir cette au moins une patte (134) d'un élément de construction adjacent.
19. L'élément de construction de n'importe lesquelles des revendications 11 à 17, dans lequel le premier moyen d'attache comprend un premier élément formant fixation (232) et un organe formant fixation détachable (234) adapté pour s'attacher au premier élément formant fixation (232), et le deuxième moyen d'attache comprend un deuxième élément formant fixation (232) adapté pour recevoir un organe formant fixation (234) d'un élément de construction adjacent.
20. L'élément de construction de n'importe lesquelles des revendications 11 à 17, dans lequel le premier moyen d'attache comprend un arrêt (305) faisant saillie depuis le premier organe de raccordement (304), et le deuxième moyen d'attache comprend un loquet élastique (342) adapté pour se mettre en prise avec l'arrêt (305) d'un élément de construction adjacent.
21. L'élément de construction de n'importe lesquelles des revendications 11 à 16, dans lequel le premier moyen d'attache comprend une pluralité de dents d'engagement (422) et le deuxième moyen d'attache comprend une pluralité de cellules (403), les dents (422) étant adaptées pour être insérées dans les cellules (403) d'un élément de construction adjacent.
22. L'élément de construction de la revendication 21, dans lequel chaque dent d'engagement (422) a une première portion d'engagement (422a) faisant saillie dans une première direction et une deuxième portion d'engagement (422b) faisant saillie dans une deuxième direction, substantiellement opposée.
23. L'élément de construction de n'importe lesquelles

des revendications 11 à 22, dans lequel chacun des deuxièmes organes de raccordement (202, 302, 402) inclut une nervure de consolidation (240, 340, 440) faisant saillie à partir de celui-ci.

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24. L'élément de construction de n'importe lesquelles des revendications 11 à 23, dans lequel chacun des premiers organes de raccordement (402) inclut une nervure de consolidation (440) faisant saillie à partir de celui-ci.

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25. L'élément de construction de n'importe lesquelles des revendications 11 à 24, dans lequel la portion de corps (101, 201, 401) est formée à partir d'une seule feuille de matière plastique cellulaire extrudée ayant une pluralité de cellules **(403) dans celle-ci.**

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26. **L'élément de construction de n'importe lesquelles des** revendications 11 à 25, dans lequel chaque organe de raccordement (102, 104, 106, 108) est formé à partir de feuille de métal.

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27. L'élément de construction de n'importe lesquelles des **revendications 11 à 25, dans lequel les organes de** raccordement sont formés à partir d'une matière plastique.

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28. L'élément de construction de n'importe lesquelles des revendications 11 à 25, dans lequel au moins un des organes de raccordement est formé de façon solidaire avec la portion de corps.

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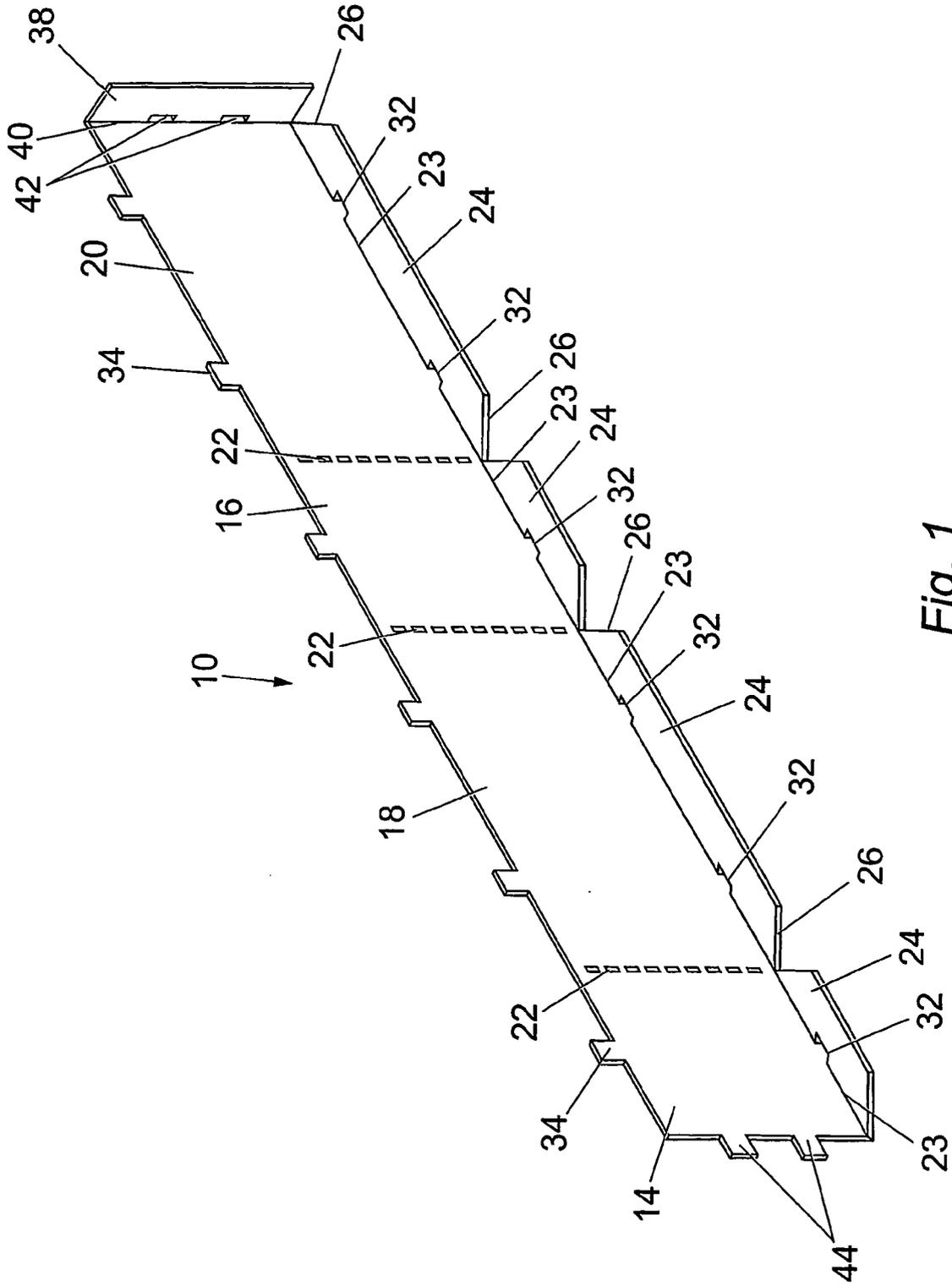
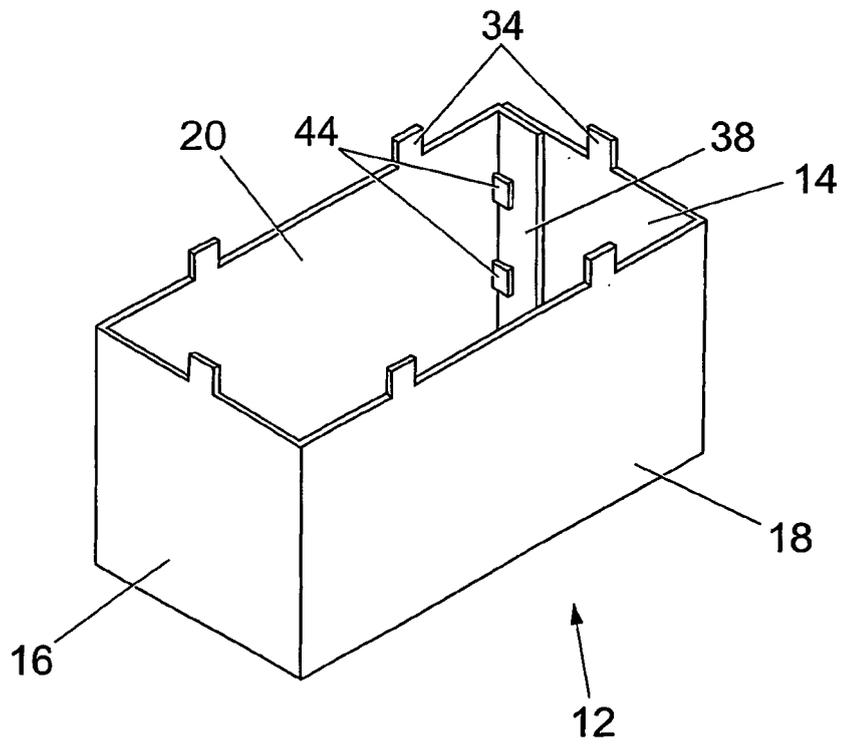
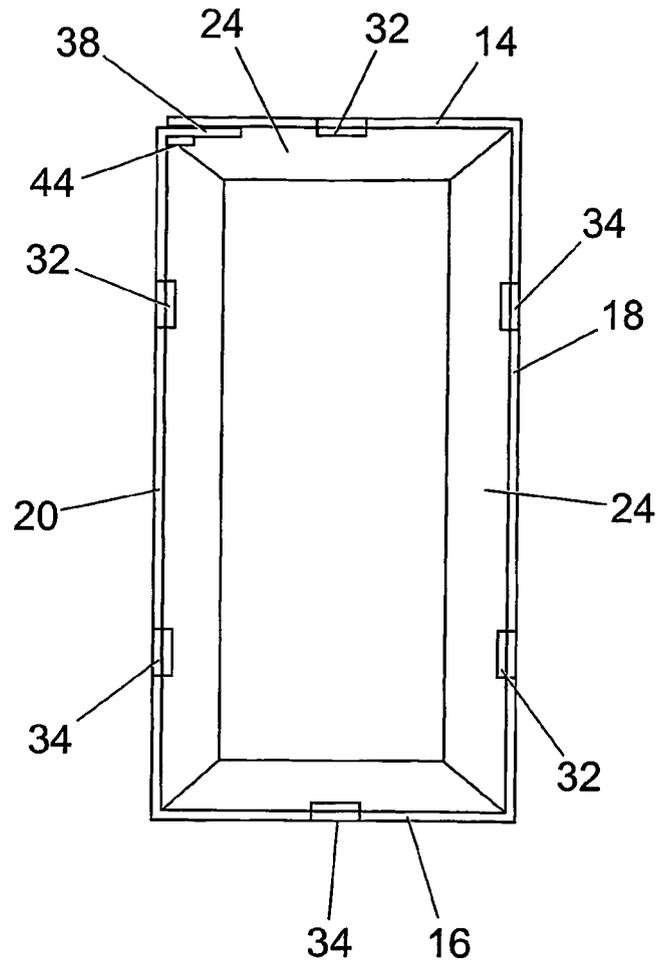


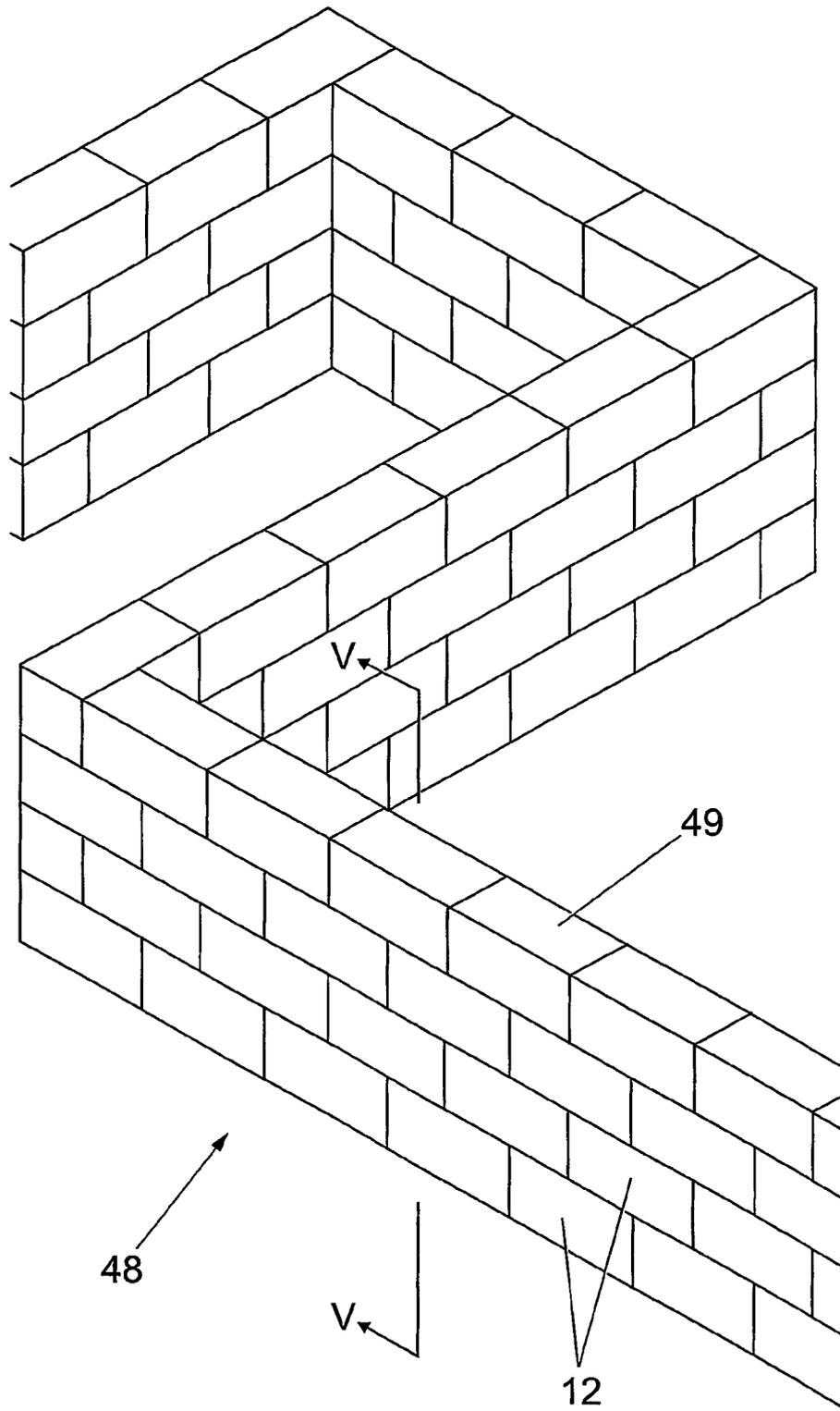
Fig. 1



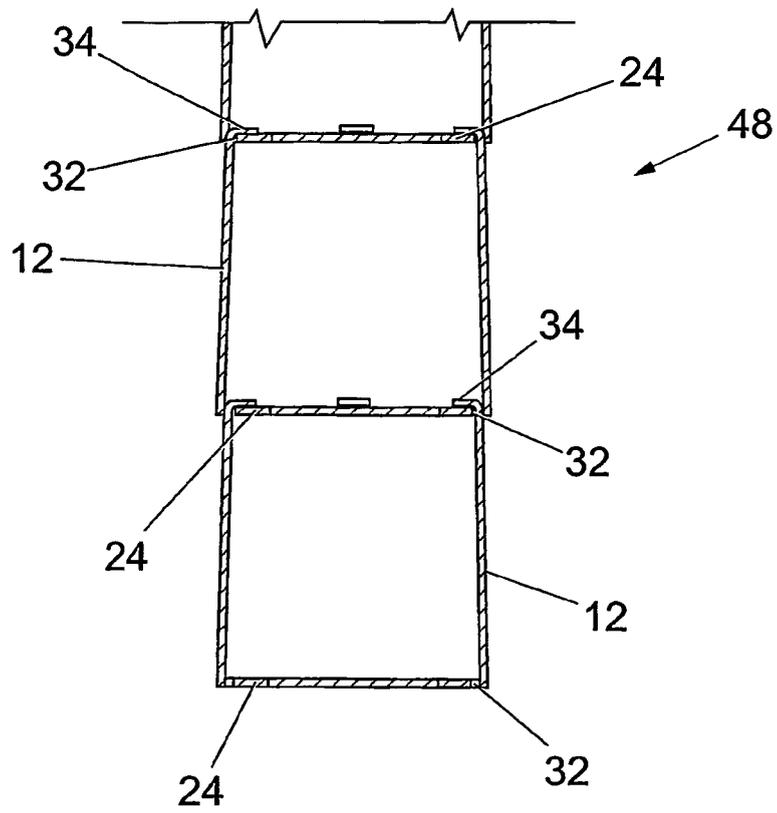
*Fig. 2*



*Fig. 3*



*Fig. 4*



*Fig. 5*

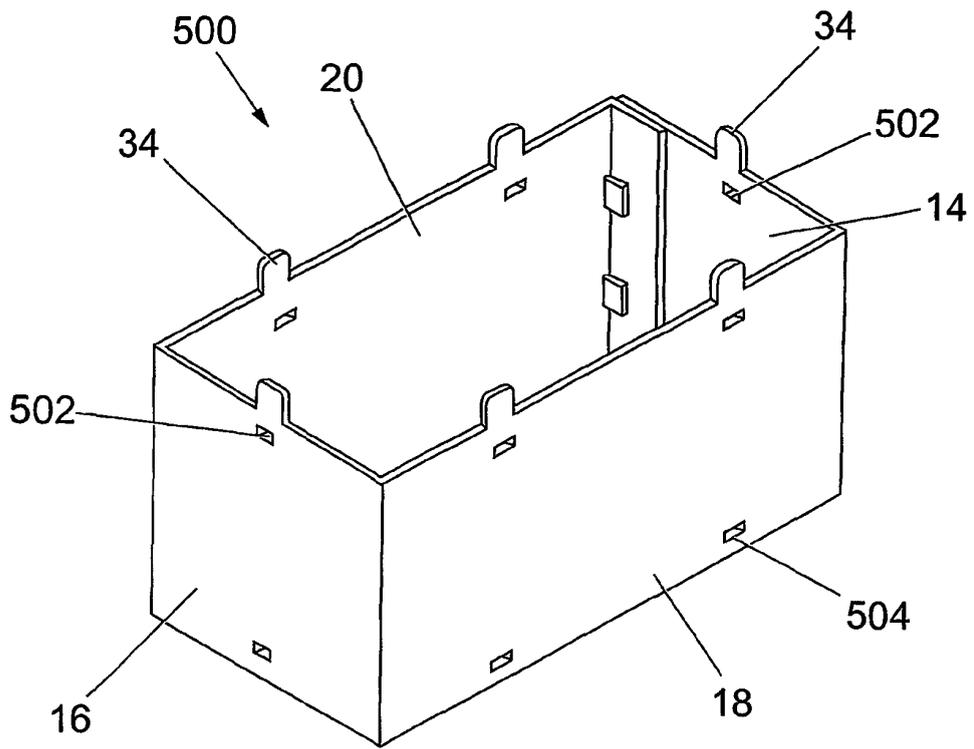


Fig. 6

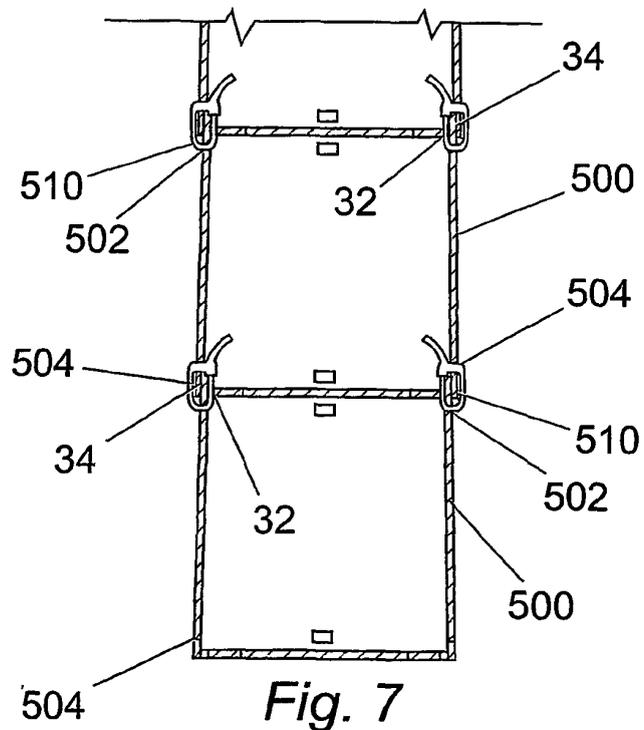
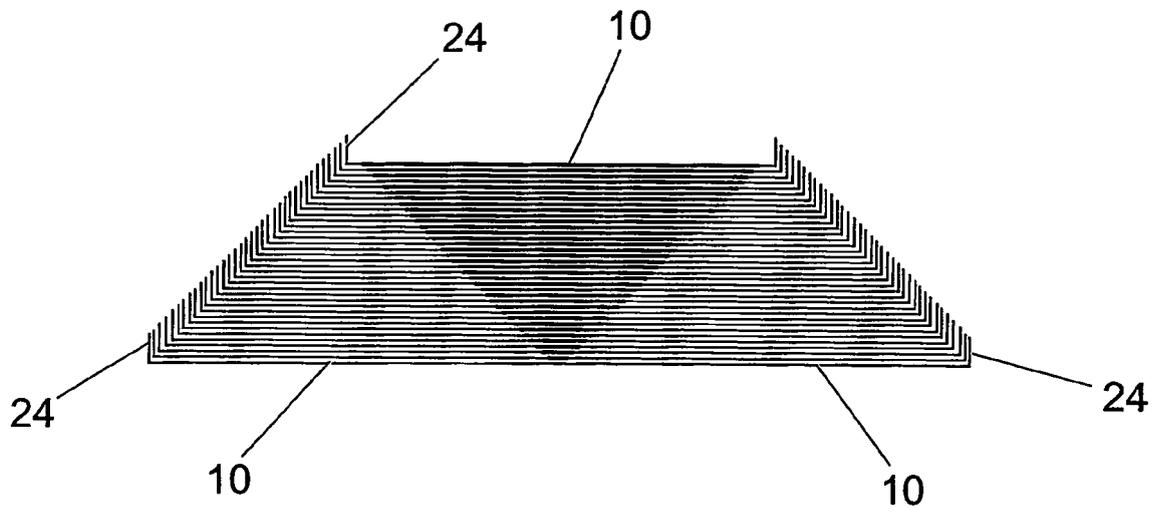
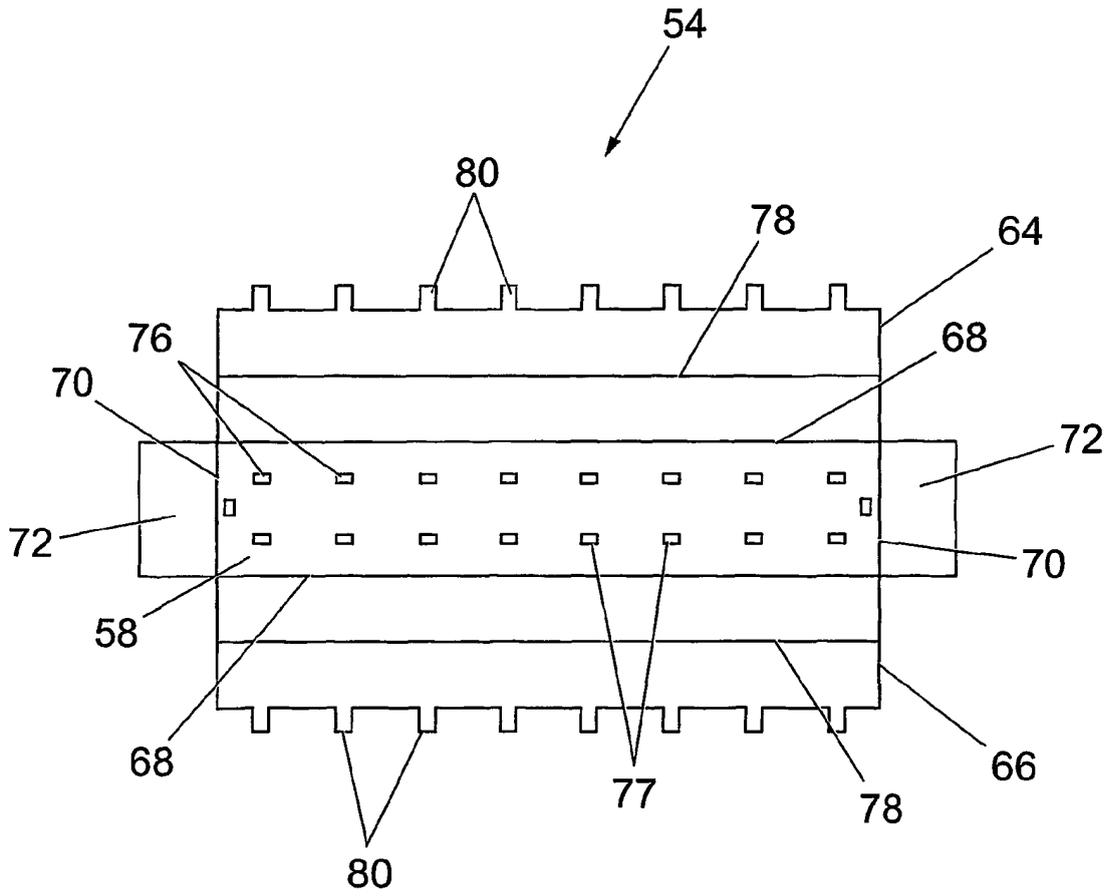


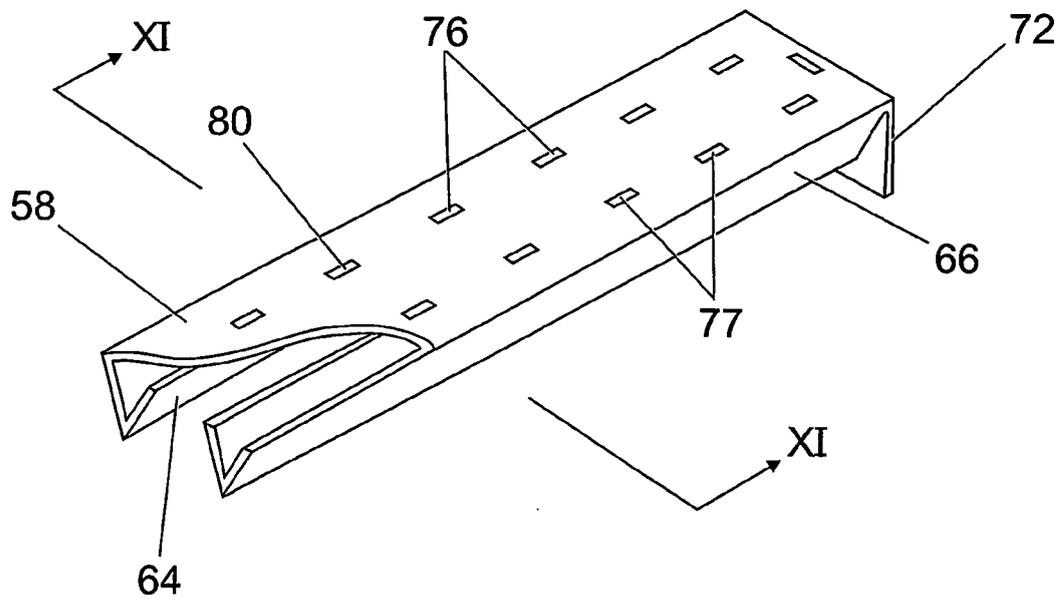
Fig. 7



*Fig. 8*



*Fig. 9*



*Fig. 10*

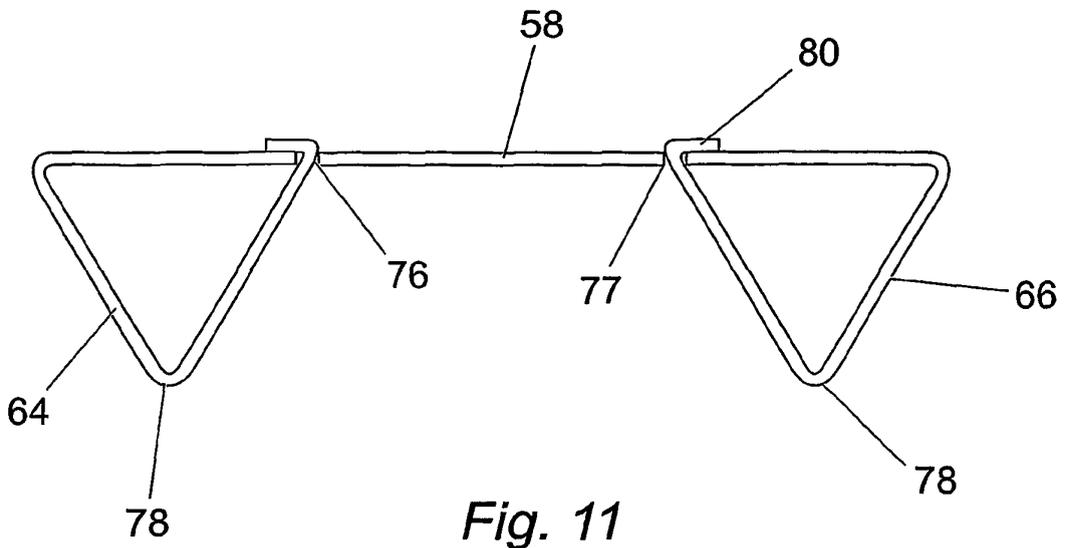
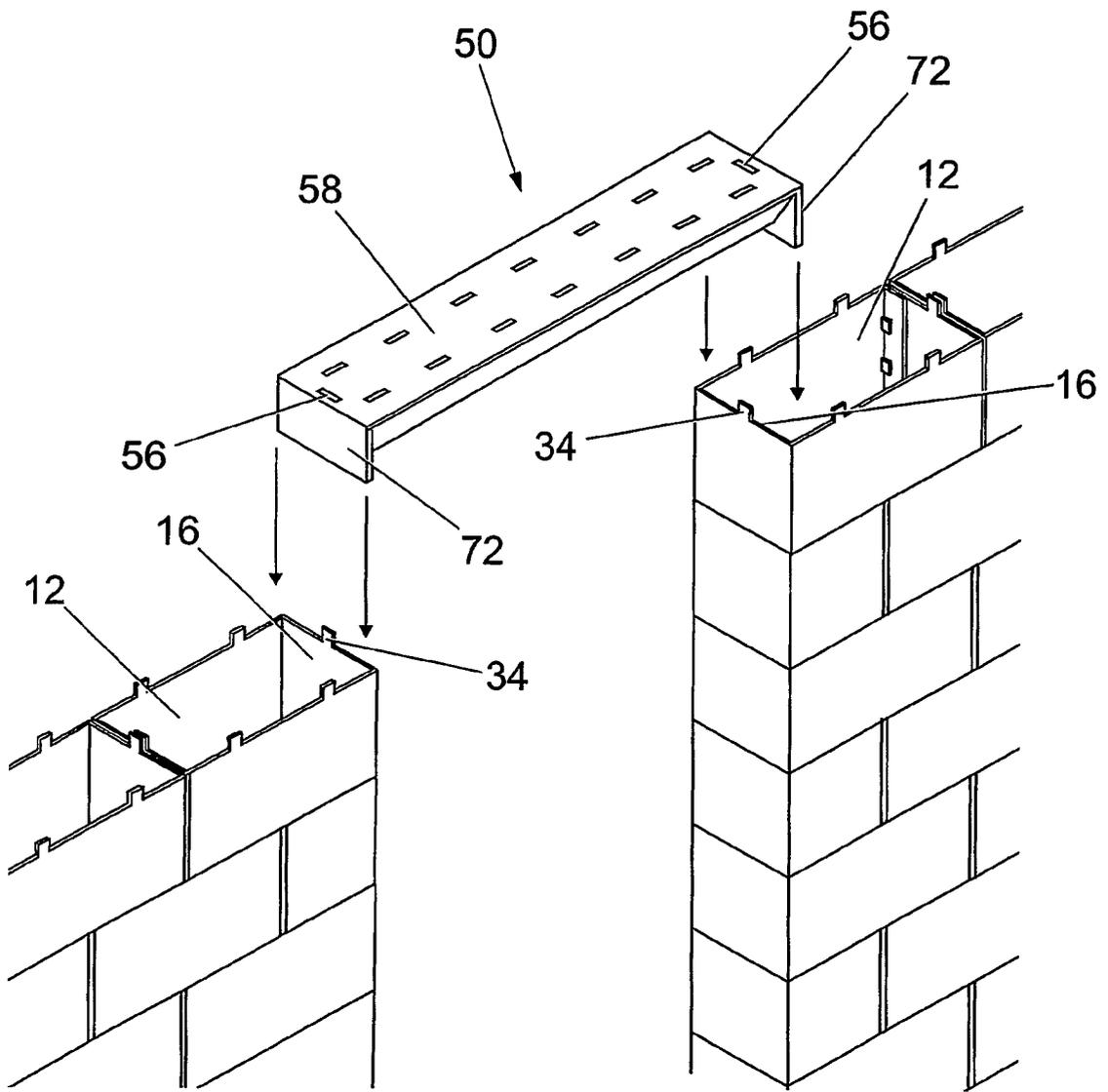
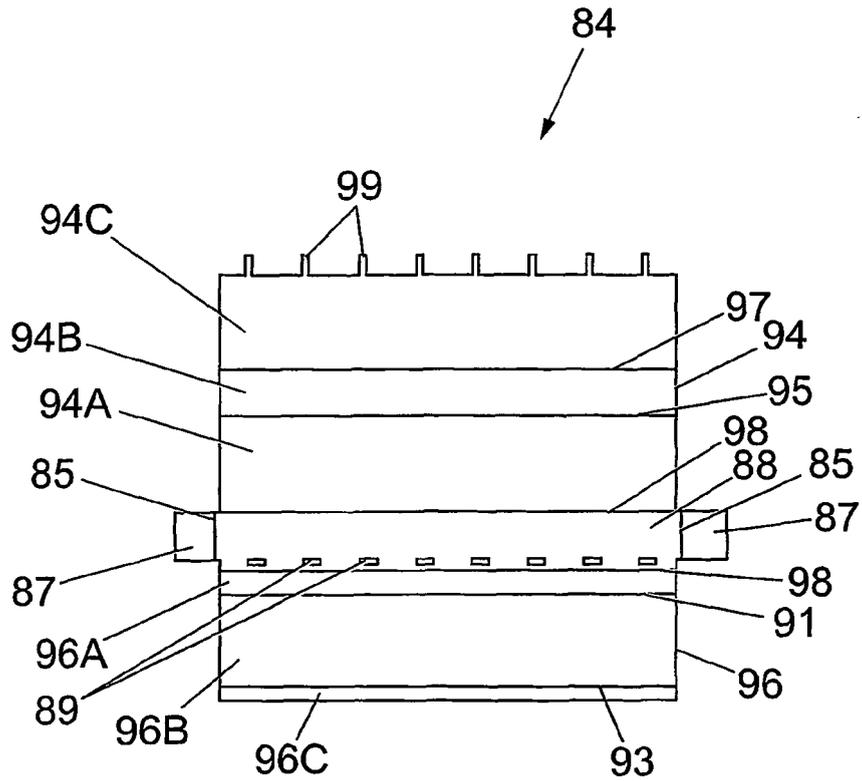


Fig. 11



*Fig. 12*



*Fig. 13*

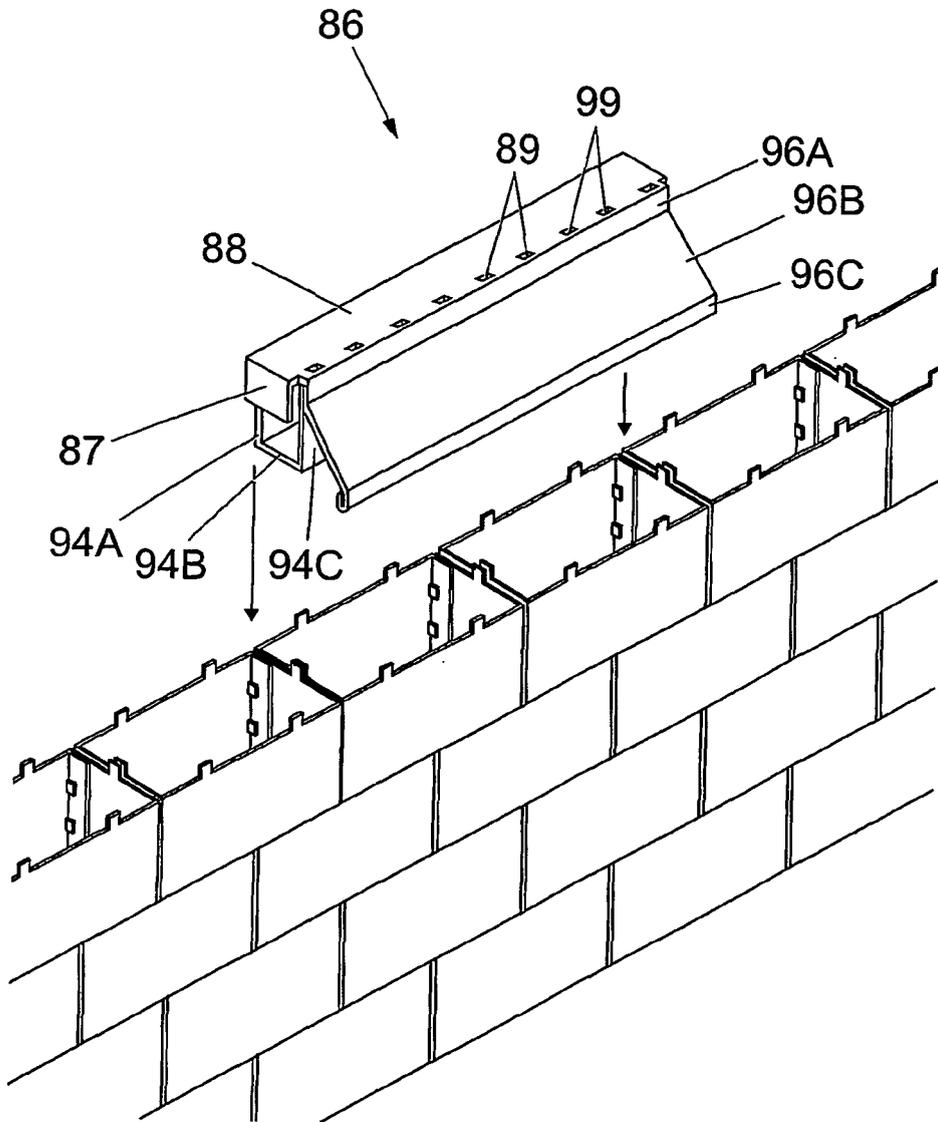
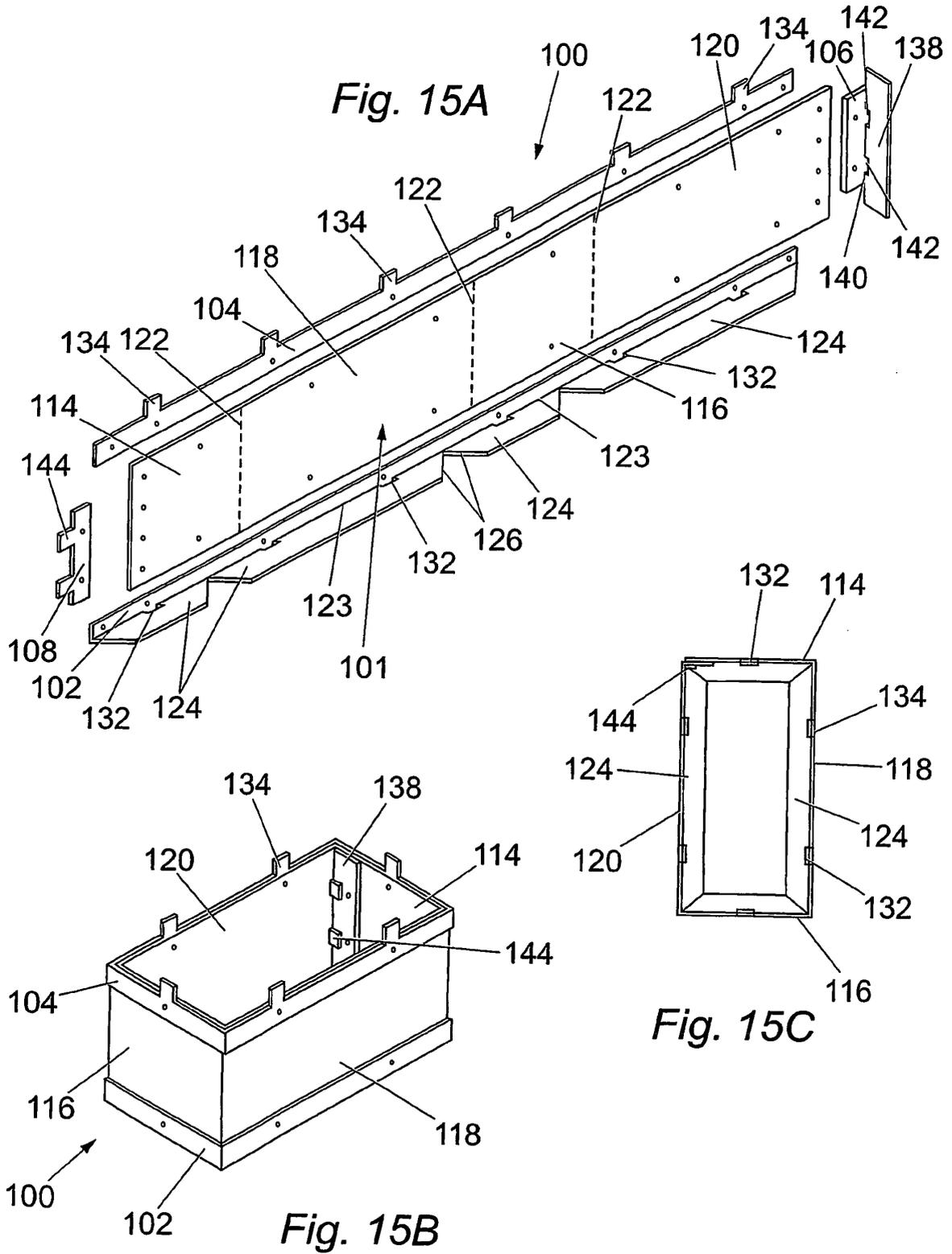
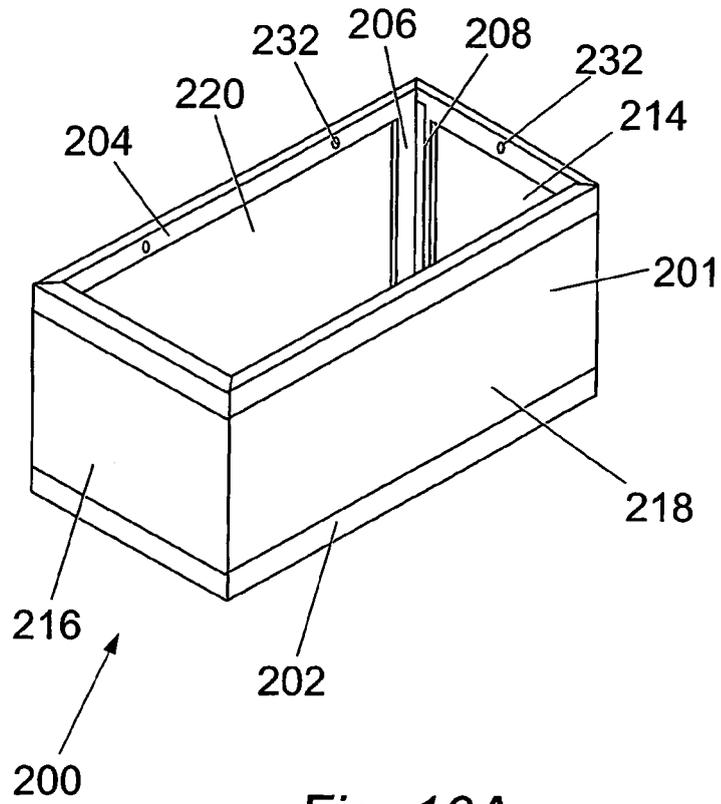
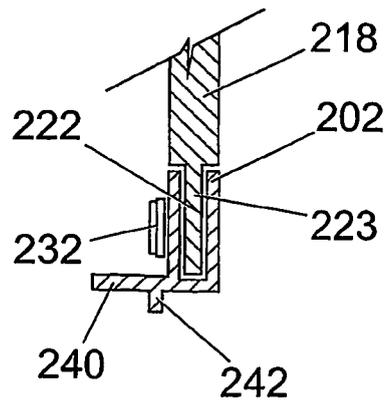


Fig. 14

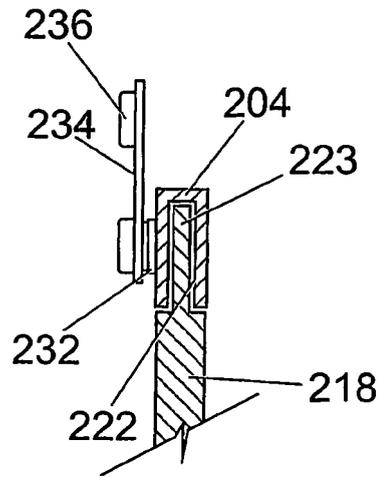




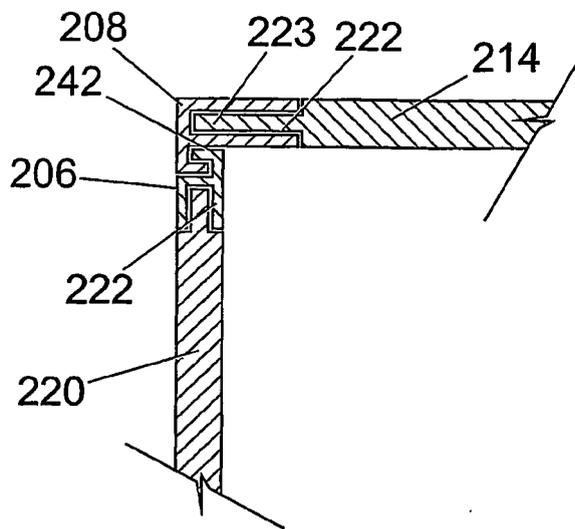
*Fig. 16A*



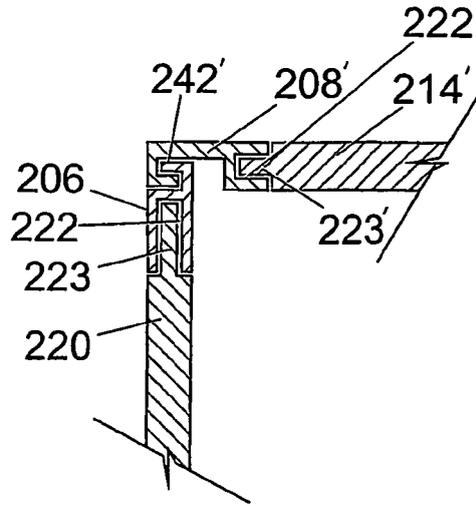
*Fig. 16B*



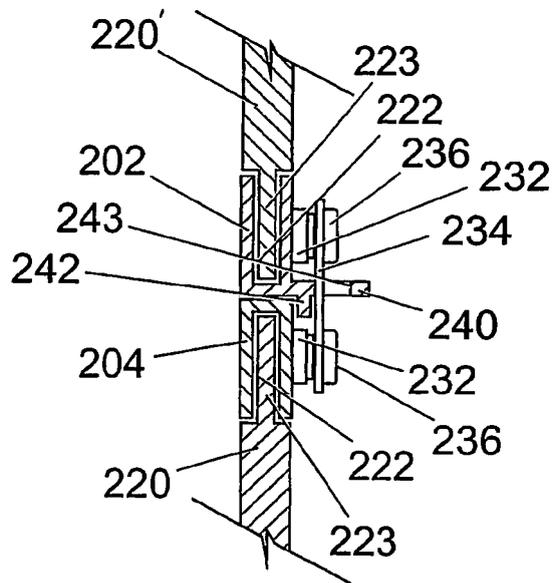
*Fig. 16C*



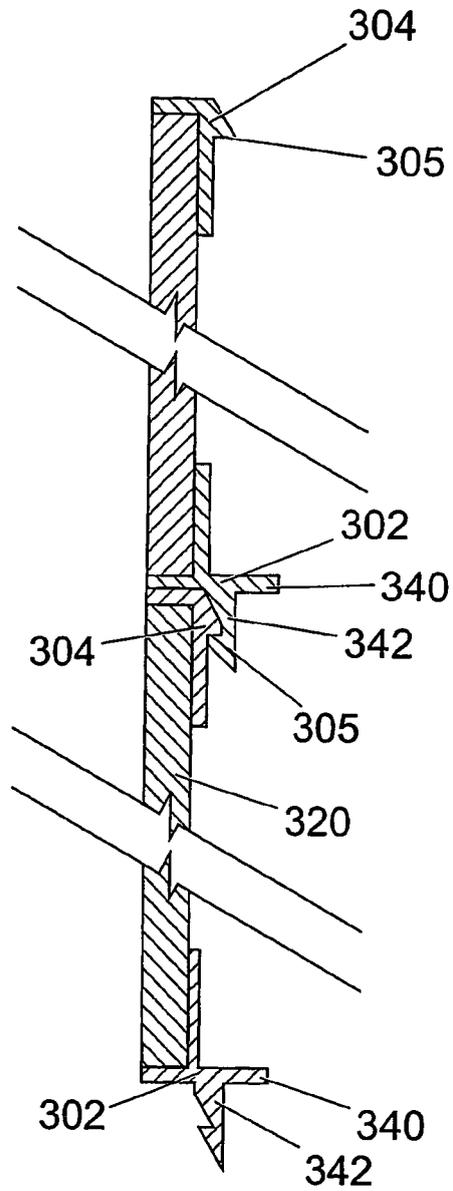
*Fig. 16D*



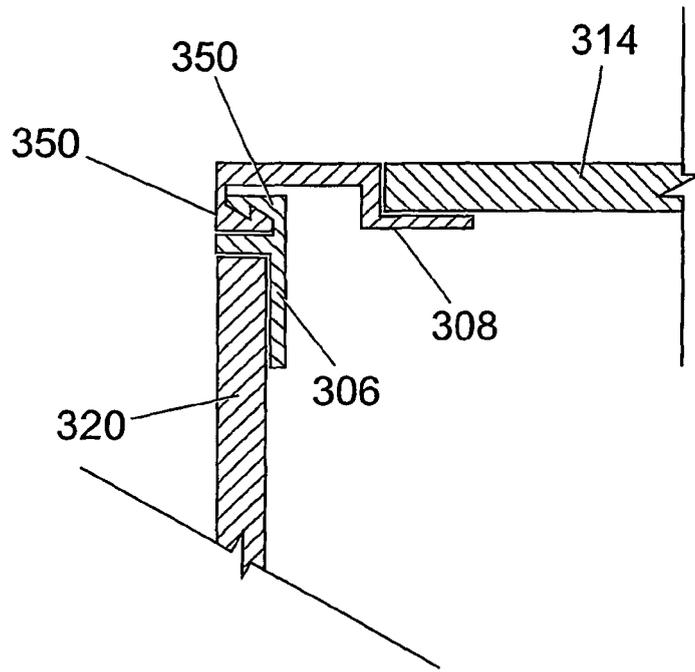
*Fig. 16E*



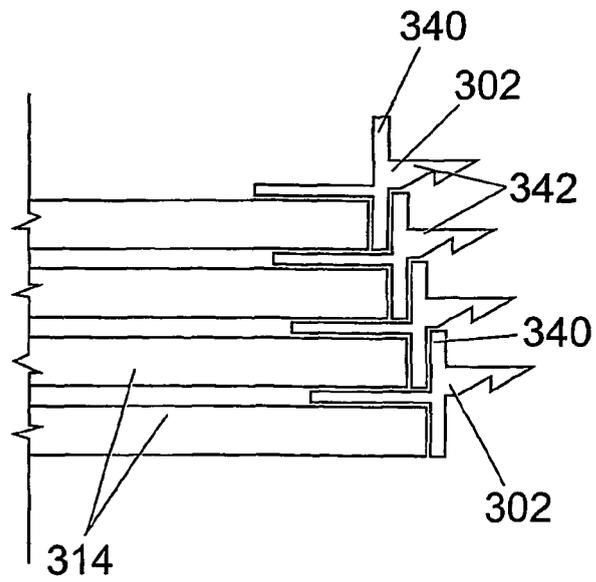
*Fig. 16F*



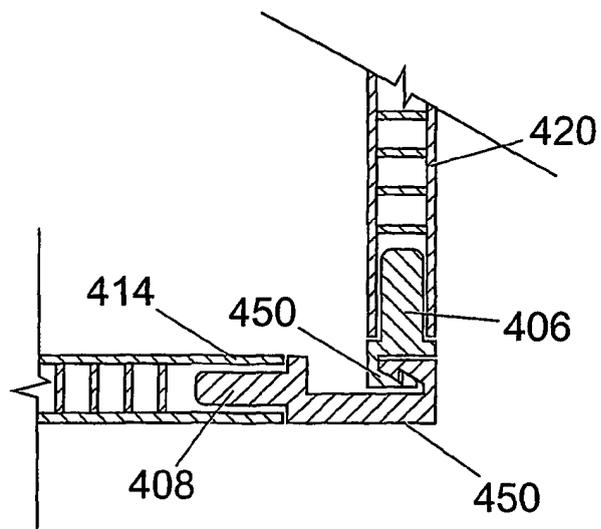
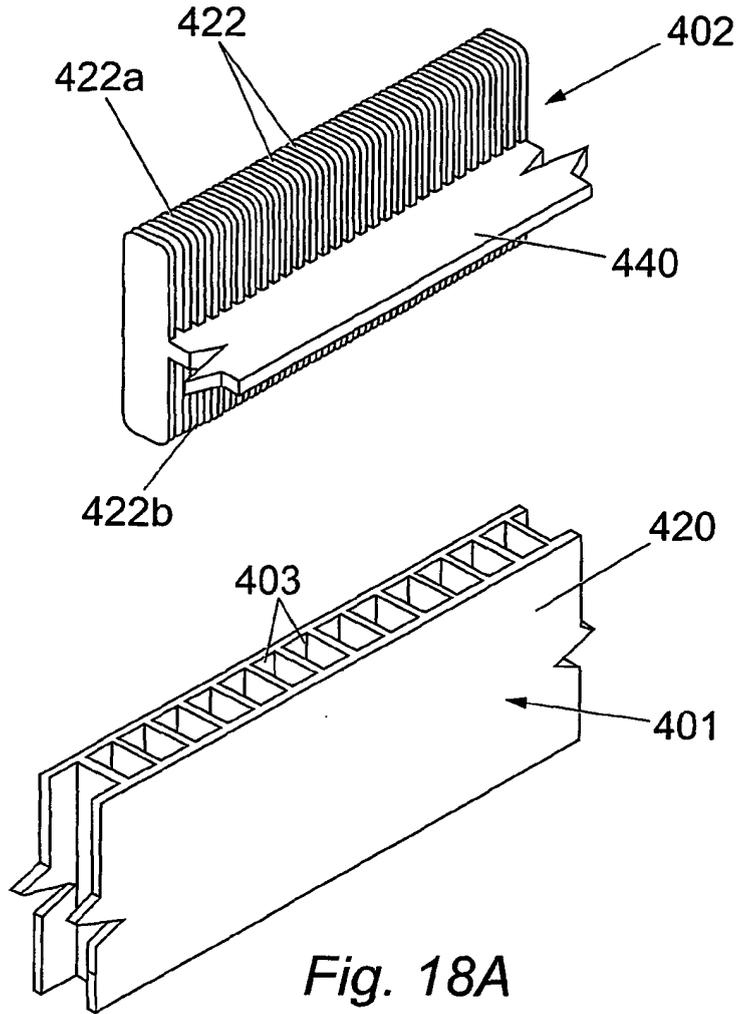
*Fig. 17A*



*Fig. 17B*



*Fig. 17C*



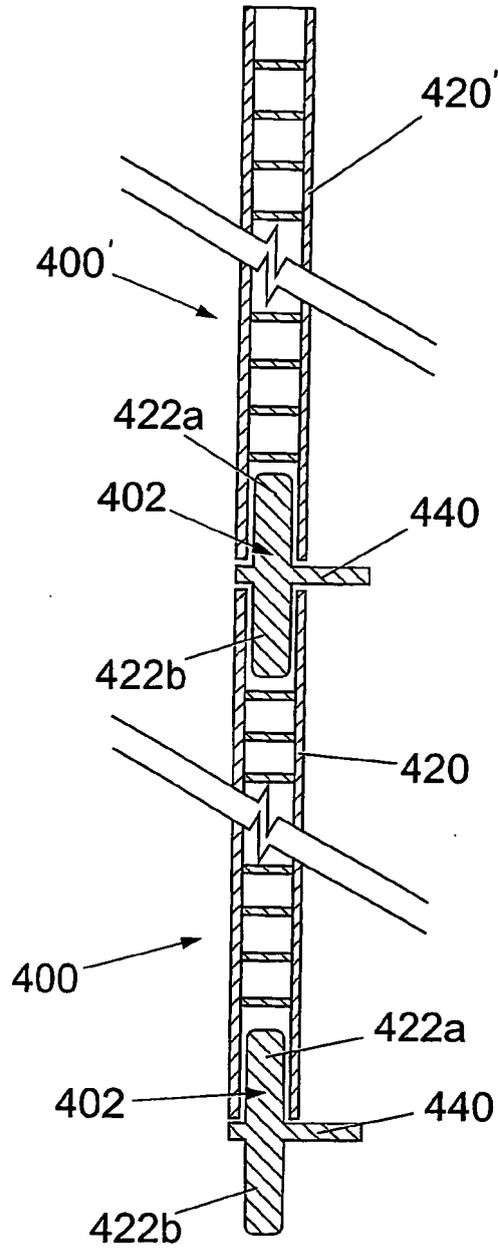


Fig. 18C

**REFERENCES CITED IN THE DESCRIPTION**

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