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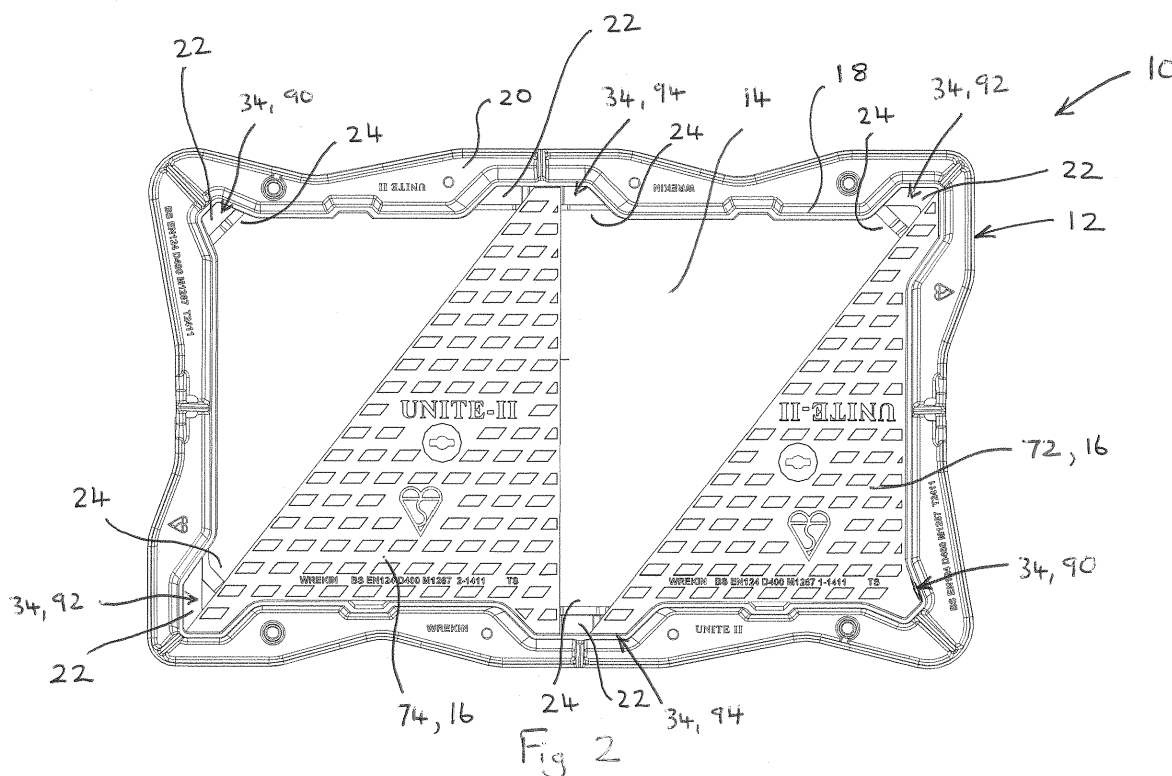
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(54) **Ground surface access assemblies**

(57) A ground surface access assembly (10) includes a frame (12) defining an opening (14) in which covers (16) are receivable. The frame (12) includes a wall member (18) which extends around the opening (14). A support flange (20) extends from an in use lower part of the wall member (18). The frame (12) includes a

plurality of cover support surfaces (22) on which the covers (16) are mountable in use. The wall member (18) defines pocket spaces (24) which extend outwardly from the opening (14). The cover support surfaces (22) are located in the pocket spaces (24).



Description

[0001] The present invention relates to ground surface access assemblies.

[0002] Conventionally, ground surface access assemblies comprise a frame defining an opening and a cover mountable to the frame in the opening which is openable to permit access to underground services. Such assemblies must conform to regulatory standards when used in trafficked situations. The regulatory standards, such as European Standard EN 124, specify a testing regime primarily based around compression testing through a load plate. The highest specification products are now usually formed of ductile iron because of its superior strength to weight ratio and non-catastrophic failure mode.

[0003] In practice, it has been found that products which meet the regulatory standards can fail, for example, in unusually intense trafficking situations. Investigations have shown that, in such situations, it is more often installation failure which occurs rather than product failure. In installation failure, the access assembly remains intact and functional, but the surround material (which could comprise underlying foundation material, bedding material, haunching material, sub base material, road base material and surfacing material) degrades and breaks up, so that the access assembly becomes loose and can be dislodged. This can present a hazard to road users and must be remedied without delay.

[0004] The use of ductile iron has in fact increased the occurrence of installation failure rather than product failure in such situations because ductile iron is resiliently deformable under load, whereas grey iron does not substantially deform under load but fails catastrophically, thus transferring less movement under load to the surround material until failure occurs.

[0005] In this specification, the terms inner, outer, inwardly and outwardly, when used in relation to the frame, are used with respect to the opening, which is inward of the frame, and the terms upward and downward are used in relation to the in use orientation of a ground surface access assembly, in which downward means down into the ground.

[0006] According to a first aspect of the present invention, there is provided a ground surface access assembly, the assembly including a frame defining an opening in which a cover is receivable, the frame including a wall member which extends around the opening, a support flange extending from an in use lower part of the wall member, the frame including a plurality of cover support surfaces on which one or more covers are mountable in use, the wall member defining pocket spaces which extend outwardly from the opening, the cover support surfaces being located in the pocket spaces.

[0007] Possibly, the support flange is substantially planar. Possibly, each cover support surface is substantially planar, and may be substantially parallel with the support flange.

[0008] Possibly, an outer part of the support flange extends outwardly from an in use lower part of the wall member. Possibly, an inner part of the support flange extends inwardly beneath the wall member towards the opening.

[0009] Possibly, each cover support surface, when viewed in plan or from the side in section, is spaced outwardly from an innermost edge of the support flange. Possibly each cover support surface is located in an area between 10% and 50% of the local width of the support flange.

[0010] Possibly, the frame includes a plurality of cover supports, each of which may comprise a support member, which may extend across one of the pocket spaces between pocket defining parts of the wall member. Each cover support surface may comprise an upper surface of one of the support members.

[0011] Possibly, the frame includes a plurality of pocket base walls, each of which may extend across an in use lower part of one of the pocket spaces between pocket defining parts of the wall member. The pocket base walls may comprise the inner part of the support flange.

[0012] Possibly, the or each or some of the cover supports include a support structure. Possibly, each support structure is in the form of a box with one open side. Possibly, the box has at least five sides and one open side. Possibly, the five sides are solid. Possibly the open side is inwardly directed. Possibly, each support structure includes pocket defining parts of the wall member, the respective support member and the respective pocket base wall. Possibly, the respective support member forms a top wall of the support structure. Possibly, each support structure includes at least three pocket defining parts of the wall member.

[0013] Possibly, each cover support includes a strengthening fillet, which may extend between the wall member and the outer part of the support flange.

[0014] Each cover support member may be spaced upwardly in use from the respective pocket base wall of the pocket space.

[0015] One or some or each cover support(s) may include a reinforcement arrangement, which may include a cover support reinforcement member, which may extend between the cover support member and the respective pocket base wall. Each reinforcement member may extend substantially vertically in use.

[0016] The cover support reinforcement arrangement may comprise an I-beam arrangement, in which the respective pocket base wall and cover support member form I-beam flanges and the respective cover support reinforcement member forms an I-beam web between the flanges.

[0017] Possibly, an inner edge of the pocket base wall projects further into the opening than an inner edge of the cover support member.

[0018] Possibly, the pocket base wall is recessed into the pocket space, to permit stacking.

[0019] Possibly, the reinforcement member extends

between an inner part, possibly the inner edge, of the pocket base wall and an inner part, possibly the inner edge, of the cover support member, and may extend outwardly to the respective pocket defining part of the wall member.

[0020] Possibly, the reinforcement member includes an end face facing the opening, which may slope for at least a relatively greater part downwardly and inwardly from the cover support member to the pocket base wall. Possibly, the slope angle of the greater part to the plane of the support flange could be at least 65° and may be no more than 85°, more desirably could be at least 70° and may be no more than 80°.

[0021] One or the or each cover support may include a plurality of spaced reinforcement members, and may include a pair of spaced reinforcement members.

[0022] Possibly, the or each or one cover support includes one or more restraining formations, each of which in use restrains horizontal movement of a cover mounted thereon.

[0023] Possibly, the assembly includes at least one pair of covers. Each cover may be substantially triangular in plan shape. Each cover may include three mountings, each of which is located at or towards a corner of the cover. Possibly, each mounting includes a mounting projection which extends outwardly and in an assembled condition may be receivable within one of the pocket spaces of the frame.

[0024] Each cover member may include a reinforcement arrangement, which may include a first reinforcement formation and/or a second reinforcement formation. The covers of the pair may be different, and may include a first cover and a second cover. The first cover may include both the first and second reinforcement formation. The second cover may include only the first reinforcement formation. The first reinforcement formation may include an L-shaped, gusseted reinforcement member. The second reinforcement formation may include a pair of gusseted reinforcement members.

[0025] Each cover may include a plurality of restraining surfaces, which may be substantially near vertical in use. Each of the restraining surfaces may, in use in an assembled condition, be abutable against the or one of the restraining formations of the frame.

[0026] Possibly, the covers and the frame are formed by moulding, and may be formed of metal by casting, and may be formed of ductile iron. Possibly, the frame has a depth of at least 100mm, and may have a depth of no more than 200mm.

[0027] According to a second aspect of the present invention, there is provided a method of supporting a ground surface access assembly cover member in a hole in a ground surface, the method including providing a ground surface access assembly, the assembly including a frame defining an opening in which the cover is receivable, the frame including a wall member which extends around the opening, a support flange extending from an in use lower part of the wall member, the frame including

a plurality of cover support surfaces on which one or more covers are mountable in use, the wall member defining pocket spaces which extend outwardly from the opening, at least one cover support surface being located in each pocket space.

[0028] Possibly, the ground surface access assembly includes any of the features described in any of the preceding statements. Possibly, the method includes any of the steps described in any of the preceding statements.

[0029] Embodiments of the present invention will now be described, by way of example only, and with reference to the accompanying drawings, in which:-

Fig. 1 is a perspective view of a ground surface access assembly;

Fig. 2 is a plan view of the assembly, with two covers removed;

Fig. 3 is a plan view from above of the assembly, showing a frame only with all of the covers removed;

Fig. 4 is a perspective view of the assembly, again showing the frame only with all of the covers removed;

Fig. 5 is a plan view from below of the assembly, with all of the covers in an assembled condition;

Fig. 6 is a perspective view from below of one of the covers;

Fig. 7 is a perspective view from below of another of the covers;

Fig. 8 is a perspective view of part of the assembly, showing a first corner cover support;

Fig. 9 is a perspective view of part of the assembly, showing a second corner cover support;

Fig. 10 is a perspective view of the second corner cover support with one cover in the assembled condition;

Fig. 11 is a perspective view of part of the assembly, showing a side cover support;

Fig. 12 is a perspective view of the side cover support with one cover in the assembled condition;

Fig. 13 is a perspective view of the side cover support with two covers in the assembled condition;

Fig. 14 is a perspective view of the side cover support with two covers in the assembled condition, one of the covers being different and in a different position to that shown in Fig. 13;

Fig. 15 is a side sectional view through the first corner cover support as indicated by the section line XV-XV in Fig. 3;

Fig. 16 is a side sectional view through the second corner cover support as indicated by the section line XVI-XVI in Fig. 3;

Fig. 17 is a side sectional view through the side cover support as indicated by the cranked section line XVII-XVII in Fig. 3;

Fig. 18 is a perspective view of a frame of a second ground surface access assembly according to the invention;

Fig. 19 is a perspective view from below of a cover

of the second ground surface access assembly;

Fig. 20 is a perspective view from below of another cover of the second ground surface access assembly;

Fig. 21 is a perspective view of a side cover support of the second ground surface access assembly with two covers in the assembled condition, similar to the view of Fig. 14;

Fig. 22 is a perspective view from below of the side cover support of Fig. 21 with three covers in the assembled condition; and

Fig. 23 is a perspective view from below of a corner cover support of the second ground surface access assembly with two covers in the assembled condition.

[0030] Figs. 1 to 17 show a ground surface access assembly 10, the assembly 10 including a frame 12 defining an opening 14 in which covers 16 are receivable. The frame 12 includes a wall member 18 which extends around the opening 14. A support flange 20 extends from an in use lower part of the wall member 18. The frame 12 includes a plurality of cover support surfaces 22 on which the covers 16 are mountable in use. The wall member 18 defines pocket spaces 24 which extend outwardly from the opening 14. The cover support surfaces 22 are located in the pocket spaces 24.

[0031] The location of the cover support surfaces 22 in the pocket spaces 24 ensures that the clear open area of the opening 14 is maximised in size to facilitate access therethrough.

[0032] The support flange 20 is substantially planar. An outer part 26 of the support flange 20 extends outwardly from an in use lower part of the wall member 18. An inner part 28 of the support flange 20 extends inwardly beneath the wall member 18 towards the opening 14. A plurality of spaced strengthening fillets 86 extend between the wall member 18 and the outer part 26 of the support flange 20. The underside of the support flange 20 is provided with gripping formations 89 in the form of pyramidal or conical protrusions which in use grip into the surround material.

[0033] In one example, the frame 12 could have a depth excluding gripping formations of at least 100mm, and could have a depth of no more than 200mm. Such depth frames are typically specified for heavy duty trafficking applications to meet for example, the regulatory requirements of EN 124 D400.

[0034] Each cover support surface 22 is substantially planar and is substantially parallel with the support flange 20. Each cover support surface 22, when viewed in plan or from the side in section as shown in Figs. 15 to 17, is spaced outwardly from an innermost edge 29 of the support flange 20. Each cover support surface 22 is located in an area 32 between 10% and 50% of the local width 30 of the support flange 20 from the innermost edge 29.

[0035] In the example shown, the frame 12 includes six cover supports 34, each of which comprises a support

member 36, which extends across one of the pocket spaces 24 between pocket defining parts 38 of the wall member 18. Each cover support surface 22 comprises an upper surface of one of the support members 36.

[0036] Each of the cover supports 34 includes a pocket base wall 40, which defines an in use lower part of the respective pocket space 24 between the pocket defining parts 38 of the wall member 18. In this embodiment, the pocket base walls 40 comprise the inner part 28 of the support flange 20. and are coplanar with the support flange 20.

[0037] Each cover support 34 includes a support structure 23. Each support structure 23 is in the form of a box with at least five substantially solid sides and one inwardly directed open side. Each support structure 23 includes the pocket defining parts 38 of the wall member, the respective support member 36 and the respective pocket base wall 40. The respective support member 36 forms a top wall of the support structure 23. Each support structure 23 includes at least three pocket defining parts 38 of the wall member.

[0038] The support structures 23 could include one corner support structure 23A at each corner of the frame 12. The corner support structures 23A have six solid sides. In the case of a rectangular frame as shown in Fig. 4, the support structures 23 could include one side support structure 23B in each of the longer sides. The side support structures 23B have five solid sides.

[0039] The box-like support structures 23 are themselves inherently rigid and stable, being integrally formed by casting and are relatively strong and resistant to torsion forces. In use, the box-like support structures 23 provide stiffening to the frame 12 when the frame 12 is under load, increasing its strength under load and increasing its resistance to torsion forces. The frame 12 of the invention can be thought of as a plurality of L-section members connected together at the corners and along the longer sides by the box-like support structures 23. The applicant has found that the support structures 23 significantly increase the strength and resistance to torsion of the frame 12.

[0040] Each cover support 34 includes one of the strengthening fillets 86.

[0041] Each cover support member 36 is spaced upwardly in use from the respective pocket base wall 40 of the respective pocket space 24.

[0042] Each cover support 34 includes a reinforcement arrangement 41, which includes a substantially planar cover support reinforcement member 42, which extends substantially vertically in use between the cover support member 36 and the respective pocket base wall 40.

[0043] The cover support reinforcement arrangement 41 comprises an I-beam arrangement, in which the respective pocket base wall 40 and cover support member 36 form I-beam flanges and the respective cover support reinforcement member 42 forms an I-beam web between the flanges.

[0044] The I-beam cover support reinforcement ar-

rangement 41 further stiffens the support structures 23, which in use reduces movement under load of the frame which can result in damage to the surround material.

[0045] As shown most clearly in Figs 15 to 17, an inner edge 44 of the pocket base wall 40 projects further into the opening 14 than an inner edge 46 of the cover support member 36.

[0046] The cover support reinforcement member 42 extends between the inner edge 44 of the pocket base wall 40 and the inner edge 46 of the cover support member 36, and extends outwardly to the respective pocket defining part 38 of the wall member 18.

[0047] The cover support reinforcement member 42 includes an end face 48 facing the opening 14, which slopes from the cover support member 36 firstly for a relatively small radiused portion downwardly and outwardly (relative to the opening 14) and then for a relatively greater part downwardly and inwardly to the inner edge 44 of the pocket base wall 40. In one example, the included slope angle 50 of the downwardly and inwardly sloping greater part of the end face 48 to the plane of the support flange 20 could be at least 65° and no more than 85°, and more desirably could be at least 70° and no more than 80°.

[0048] The feature that the cover support surface 22 is spaced outwardly from the innermost edge of the pocket base wall 40 means that in use, when load is applied to the covers 16, the load is transmitted more centrally and thus more evenly across the width of the support flange 20 than in conventional arrangements. This helps reduce rotational flexing and twisting of the support flange 20 which can cause installation failure.

[0049] Although the features of the I-beam cover support reinforcement arrangement 41 and the outward spacing of the cover support surface 22 could be provided separately, the applicants have found that this combination of features has a significant and unexpected beneficial effect in reducing installation failure in unusually intense trafficking situations.

[0050] The cover supports 34 are of three different types, a first corner cover support 90, which in the assembled condition receives one of the mountings 62 of the first cover 72; a second corner cover support 92, which in the assembled condition receives one of the mountings 62 of the first cover 72 and also one of the mountings 62 of the second cover 74; and a side cover support 94, which in the assembled condition receives one of the mountings 62 of the first cover 72, one of the mountings 62 of one of the second covers 74 and one of the mountings 62 of the other of the second covers 74.

[0051] Figs. 15, 16 and 17 are side sectional views through the cover supports 34, as indicated by the respective section lines XV-XV, XVI-XVI, XVII-XVII in Fig. 3, which run through the respective cover support reinforcement member 42 and the respective strengthening fillet 86, normal to an inner edge 46 of the cover support member 36.

[0052] Figs. 8 and 15 show the first corner cover sup-

port 90, which includes a first corner cover support surface 100 located in the area 32 which has an inner boundary at a first horizontal distance 47 from an inner edge 44 of the pocket base wall 40 and an outer boundary at a second horizontal distance 37 from the inner edge 44 of the pocket base wall 40, the dimensions being taken along the respective section line, ie thorough the respective fillet 86 and normal to the inner edge 46 of the cover support member 36. In one example of the first corner cover support 90, the first horizontal distance 47 could be substantially 12% of the maximum local width 30 of the support flange 20 from the innermost edge 29, and the second horizontal distance 37 could be substantially 30% of the maximum local width 30 of the support flange 20 from the innermost edge 29. The slope angle 50 could be substantially 75°.

[0053] Figs. 9 and 16 show the second corner cover support 92, which includes a second corner cover support surface 102 located in the area 32 which has an inner boundary at the first horizontal distance 47 from the inner edge 44 of the pocket base wall 40 and an outer boundary at the second horizontal distance 37 from the inner edge 44 of the pocket base wall 40. In one example of the second corner cover support 92, the first horizontal distance 47 could be substantially 35% of the maximum local width 30 of the support flange 20 from the innermost edge 29, and the second horizontal distance 37 could be substantially 60% of the maximum local width 30 of the support flange 20 from the innermost edge 29. The slope angle 50 in this example could be substantially 71°.

[0054] Figs. 10 and 17 show the side cover support 94, which includes a side cover support surface 104 located in the area 32 which has an inner boundary at a first horizontal distance 47 from the inner edge 44 of the pocket base wall 40 and an outer boundary at a second horizontal distance 37 from the inner edge 44 of the pocket base wall 40. In one example of the side cover support 94, the first horizontal distance 47 could be substantially 12% of the maximum local width 30 of the support flange 20 from the innermost edge 29, and the second horizontal distance 37 could be substantially 42% of the maximum local width 30 of the support flange 20 from the innermost edge 29. The slope angle 50 in this example could be substantially 79°.

[0055] The cover support reinforcement arrangement 41 of the side cover support 94 includes two spaced cover support reinforcement members 42, which provide stiffening over the relatively longer length of the side cover support 94.

[0056] As shown in Figs 15 to 17, in comparison with the first corner and the side cover supports 90, 94, the second corner cover support 92 is somewhat different in cross section, in that the second corner cover support surface 104 is distanced relatively further from the opening 14, and the cover support member 36 includes a step 96 and an inner surface 98 which is lower than the second corner cover support surface 104.

[0057] In the second corner cover support 92, the load

bearing second corner cover support surface 102 is shifted even more towards the centre of the local width 30 of the support flange 20. The applicants have found that load transmission is unevenly distributed over the supports 34, and that the second corner cover support 92 is subjected to a relatively higher load proportion than the other supports 90, 94. The second corner cover support 92 hence requires a more central load distribution to ensure even transmission of the loading forces to the surround material in an installed condition.

[0058] In the example shown, the assembly 10 includes two pairs of covers 16. Each cover 16 is substantially triangular in plan shape, and includes three mountings 62 which are located at or towards the corners of the respective cover 16. Each mounting 62 includes a mounting projection 64 which extends outwardly (relative to the respective cover itself) and in an assembled condition is receivable within one of the pocket spaces 24 of the frame 12 on one of the cover support surfaces 22.

[0059] The covers 16 and the frame 12 could be formed of ductile iron by casting.

[0060] The covers 16 of the pair are different, and include a first cover 72 and a second cover 74. The first and second covers 72, 74 are different in plan size and shape, and the assembly 10 is arranged so that they are not interchangeable in position in the frame 12. The assembly is arranged so that the second covers 74 are located side by side in the middle of the frame 12 and the first covers 72 are spaced from each other, one at each end of the frame 12. The arrangement of the covers 16 and the frame 12 is not symmetrical about a line, but is rotationally symmetrical about the centre point of the assembly 10.

[0061] Each cover 16 includes a reinforcement arrangement 66, which includes a first reinforcement formation 68 and/or a second reinforcement formation 70.

[0062] The first cover 72 includes both the first and second reinforcement formations 68, 70. The second cover 74 includes only the first reinforcement formation 68. The first reinforcement formation 68 includes an L-shaped reinforcement member 76 with strengthening gussets or fillets 77. The second reinforcement formation 70 includes a pair of reinforcement members 78 with strengthening gussets or fillets 79. In each case, the first reinforcement formation 68 extends along the long or hypotenuse side of the respective cover 16. The second reinforcement formation 70 extends along the side of the second cover 74 which extends across the centre of the opening 14. The gusseted reinforcement formations 68, 70 provide strong, stiff yet relatively light composite strengthening formations.

[0063] Each cover support 34 includes one or more restraining formations 52, which in use restrain horizontal movement of the covers mounted thereon.

[0064] The restraining formations 52 include first restraining formations 54, each of which includes an upwardly projecting nib 56. The nibs 56 are arranged in spaced pairs projecting upwardly from each side cover

support surface 104, each nib 56 extending across the width of the respective side cover support surface 104.

[0065] The restraining formations 52 include second restraining formations 58, which include cover abutment surfaces 60, which in use are substantially near vertical, and are located below the level of the cover support surfaces 22.

[0066] Each cover 16 includes a plurality of cover restraining surfaces 80, which are substantially near vertical in use. The cover restraining surfaces 80 include first or upper restraining surfaces 82, which, in use in an assembled condition, are abutable against the first or upper restraining formations 54 of the frame 12.

[0067] Referring to Figs. 11 to 14, it will be noted that the three covers 72, 74, 74 locate on the side cover support surface 104 with a nib 56 located between each cover 72, 74, 74. In use, as the covers 72, 74, 74 move in the frame 12, the first restraining surfaces 82 abut against the nibs 56 which restrain the covers 72, 74, 74 from moving horizontally along the length of the frame 12.

[0068] Referring to Figs. 6 to 14, the cover restraining surfaces 80 include second or lower cover restraining surfaces 84, which, in use in an assembled condition, are abutable against the second or lower restraining formations 58 of the frame 12. The abutment of the second cover restraining surfaces 84 against the second restraining formations 58 restrains the covers 72, 74 from lateral movement across the width of the frame 12.

[0069] The applicants have found that certain exceptional intense trafficking situations can impose demands on ground surface access assembly installations which are unforeseen and go beyond the demands of regulatory standards. An example of such an exceptional intense trafficking situation is a junction in a bus lane operating continuously for 24 hours per day. Such situations demand close attention to detail to identify and overcome problems, and apparently what would otherwise appear to be relatively minor details can assume an unforeseen importance.

[0070] There is thus provided a ground surface access assembly 10 which provides a number of advantages over conventional arrangements. The cover support surfaces are located in pocket spaces extending outwardly from the opening to maximise the clear open area of the opening. The cover support surfaces, when viewed in plan or from the side in section, are spaced outwardly from an innermost edge of the support flange, so that loading forces are transmitted more evenly through the support flange to the surround material, reducing rotational flexing and twisting of the frame wall members and damage to the surround material.

[0071] The cover supports 34 include box-like support structures 23, which are rigid and stable and increase the strength of the frame and its resistance to torsion forces. The use of such box-like structures is generally avoided in casting processes as each structure requires a core to be provided which increases complexity in the manufacturing process and therefore cost. However, the

applicant has surprisingly found that the box-like support structures provide a significant increase in strength and rigidity which outweighs the disadvantage of increased manufacturing complexity.

[0072] The cover support members and support structures are supported and stiffened by vertical reinforcement members, which extend between the cover support members and the pocket base walls. This provides an I-beam arrangement which results in a stronger, stiffer frame, which further reduces movement of the frame under load.

[0073] The restraining formations of the frame and the restraining surfaces of the covers help restrain horizontal movement of the covers. In intense trafficking situations, such movement can cause damage both to the assembly and the installation.

[0074] As mentioned previously, the use of ductile iron in such situations has increased the occurrence of installation failure as the mode of failure. For example, movement of the frame under load can cause damage to surround material. Movement of the frame at the surface allows water ingress, causing problems in freeze-thaw weather cycles. Conventional ways to reduce the risk of installation failure in high intensity traffic applications include increasing the thickness of sections to strengthen and stiffen the sections, but this increases the weight and cost of the product. The applicant has found that by utilising the features described above, the access assembly of the present invention provides a product with improved strength and stiffness which reduces the risk of installation failure without substantially increasing material usage or product unit cost.

[0075] Figs. 18 to 22 show another embodiment of the invention, many features of which are similar to those already described in relation to the embodiment of Figs. 1 to 17. Therefore, for the sake of brevity, the following embodiment will only be described in so far as it differs from the embodiment already described. Where features are the same or similar, the same reference numerals have been used and the features will not be described again.

[0076] Figs. 18 to 22 show a second ground surface access assembly 110 including a frame 112, first covers 172 and second covers 174. The first and second covers 172, 174 are arranged in two pairs, each pair comprising one of each of the first and second covers 172, 174, the pairs being arranged side by side in the frame 112 in the assembled condition.

[0077] As shown in Fig. 18, the frame 112 includes a pair of side cover supports 94, one on each of the long sides of the frame 112. Each side cover support 94 includes a support structure 23 similar to that of the previous embodiment and a pair of spaced cover support reinforcement members 42.

[0078] The frame 112 includes four corner supports 90, 92, each of which includes a support structure 23 similar to that of the previous embodiment. In this embodiment, the corner supports 90, 92 do not have cover

support reinforcement members. This is because the applicant has found that the box-like structures 23 at the corners have sufficiently inherently high rigidity and strength with a relatively smaller open side width so that the cover support reinforcement members are not required.

[0079] In this embodiment, the pocket base wall 40 of each of the cover supports 34 is recessed upwardly into the pocket space 24 above the plane of the support flange 26 to define a lower pocket recess 106. The wall member 18 tapers inwardly upwardly so that when one frame 112 (or one ground surface access assembly 110) is stacked on top of another, the uppermost part of the wall member 18 of the lower frame 112 is received within the opening 14 and the lower pocket recesses 106 defined by the upper frame 112 to provide a stable stacking arrangement.

[0080] The applicant has found the recessed pocket base walls 40 have no effect on the performance and durability of installations using the ground surface access assemblies of this embodiment. This is because, in use, the surround material simply fills the lower pocket recesses 106. In practice, even if it does not, imposed forces on the assembly are transmitted via the wall member 18 and the support flange 26 to the surround material.

[0081] In this embodiment, the frame 112 includes a plurality of restraining formations 52 including lower formations in the form of projections 158 which extend inwardly from the cover support members 36 of the side cover supports 94 and the second corner cover supports 92, and upper formations in the form of projections 154 which extend inwardly from the wall member 18 above the side cover supports 94.

[0082] The covers 172, 174, include upper restraining surfaces 182 which in the assembled condition can abut against the upper formations 154. The covers 172, 174 include lower restraining surfaces 184 which in the assembled condition can abut against the lower formations 158. The abutment of the cover restraining surfaces 182, 184 against the upper formations 154 and the lower formations 158 restrains lateral horizontal sliding movement of the covers 172, 174 relative to each other and the frame 112. In comparison with the nibs 56 of the previous embodiment, the restraining formations 154, 158 have a greater extent of depth so are less likely to jump or slide out of engagement.

[0083] Figs. 21 to 23 show the engagement and abutment of the restraining surfaces 80 and the restraining formations 154, 158. As will be seen from Figs. 22 and 23, in the assembled condition the lower restraining formations 158 are engaged with and interlock within recesses defined by the lower restraining surfaces 184.

[0084] Various other modifications could be made without departing from the scope of the invention. The assembly, the covers and the frame and the features thereof could be of any suitable size, shape and number, and could be formed of any suitable material. For example, the frame could define a substantially square open-

ing in which one pair of covers 72, 74 is locatable. In other examples, the frame could define an elongate rectangular opening in which three or more pairs of covers are locatable.

[0085] The assembly could include any one or combination of the features described.

[0086] Any of the features or steps of any of the embodiments shown or described could be combined in any suitable way, within the scope of the overall disclosure of this document.

Claims

1. A ground surface access assembly (10, 110), **characterised in that** the assembly includes a frame (12, 112) defining an opening (14) in which a cover (16) is receivable, the frame including a wall member (18) which extends around the opening, a support flange (20) extending from an in use lower part of the wall member, the frame including a plurality of cover support surfaces (22) on which one or more covers are mountable in use, the wall member defining pocket spaces (24) which extend outwardly from the opening, the cover support surfaces being located in the pocket spaces.
2. A ground surface access assembly according to claim 1, in which each cover support surface, when viewed in plan or from the side in section, is spaced outwardly from an innermost edge of the support flange.
3. A ground surface access assembly according to claims 1 or 2, in which the frame includes a plurality of cover supports (34), each of which comprises a support member (36), which extends across one of the pocket spaces between pocket defining parts (38) of the wall member, each cover support surface comprising an upper surface of one of the support members.
4. A ground surface access assembly according to claim 3, in which the or each or some of the cover supports include a support structure (23), which is in the form of a box with one inwardly directed open side.
5. A ground surface access assembly according to claim 4, in which the box has at least five sides and the one open side.
6. A ground surface access assembly according to claims 4 or 5, in which each support structure includes the pocket defining parts of the wall member, the respective support member which forms a top wall of the support structure, and a respective base wall (40) of the pocket space which extends across an in use lower part of the respective pocket space between the pocket defining parts of the wall member.
7. A ground surface access assembly according to claim 6, in which an inner edge (44) of the pocket base wall projects further into the opening than an inner edge (46) of the cover support member.
8. A ground surface access assembly according to claims 6 or 7, in which one or some or each cover support(s) include(s) a reinforcement arrangement (41), which includes a cover support reinforcement member (42), which extends between the cover support member and the respective pocket base wall, so that the cover support reinforcement arrangement comprises an I-beam arrangement, in which the respective pocket base wall and cover support member form I-beam flanges and the respective cover support reinforcement member forms an I-beam web between the flanges.
9. A ground surface access assembly according to claim 8, in which the reinforcement member extends between an inner part of the pocket base wall and an inner part of the cover support member.
10. A ground surface access assembly according to claims 8 or 9, in which one or the or each cover support includes a plurality of spaced reinforcement members.
11. A ground surface access assembly according to claim 3 or any claim dependent thereon, in which the or each or one cover support includes one or more restraining formations (52), each of which in use restrains horizontal movement of a cover mounted thereon.
12. A ground surface access assembly according to any of the preceding claims, in which the assembly includes at least one pair of covers, each cover is substantially triangular in plan shape, and includes three mountings (62), each of which is located at or towards a corner of the cover, each mounting including a mounting projection (64) which extends outwardly and in an assembled condition is receivable within one of the pocket spaces of the frame.
13. A ground surface access assembly according to claim 12 when dependent on claim 11, in which each cover includes a plurality of restraining surfaces (80), each of which is, in use in an assembled condition, abutable against the or one of the restraining formations of the frame.
14. A method of supporting a ground surface access assembly cover, **characterised in that** the method in-

cludes providing a ground surface access assembly (10, 110), the assembly including a frame (12, 112) defining an opening (14) in which a cover (16) is receivable, the frame including a wall member (18) which extends around the opening, a support flange (20) extending from an in use lower part of the wall member, the frame including a plurality of cover support surfaces (22) on which one or more covers are mountable in use, the wall member defining pocket spaces (24) which extend outwardly from the opening, the cover support surfaces being located in the pocket spaces.

15. A method according to claim 14, in which the ground surface access assembly includes any of the features defined in any of claims 1 to 13.

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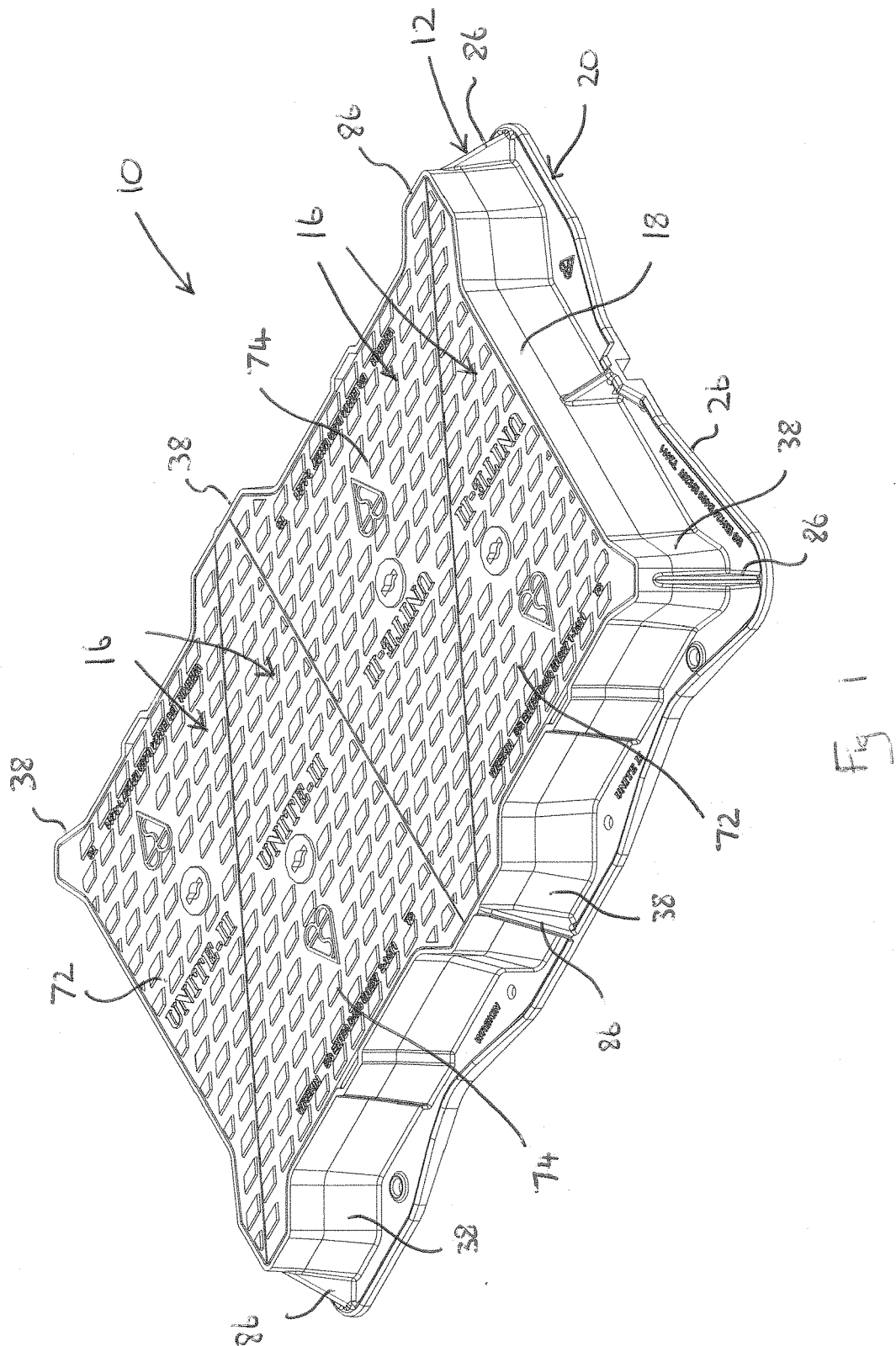
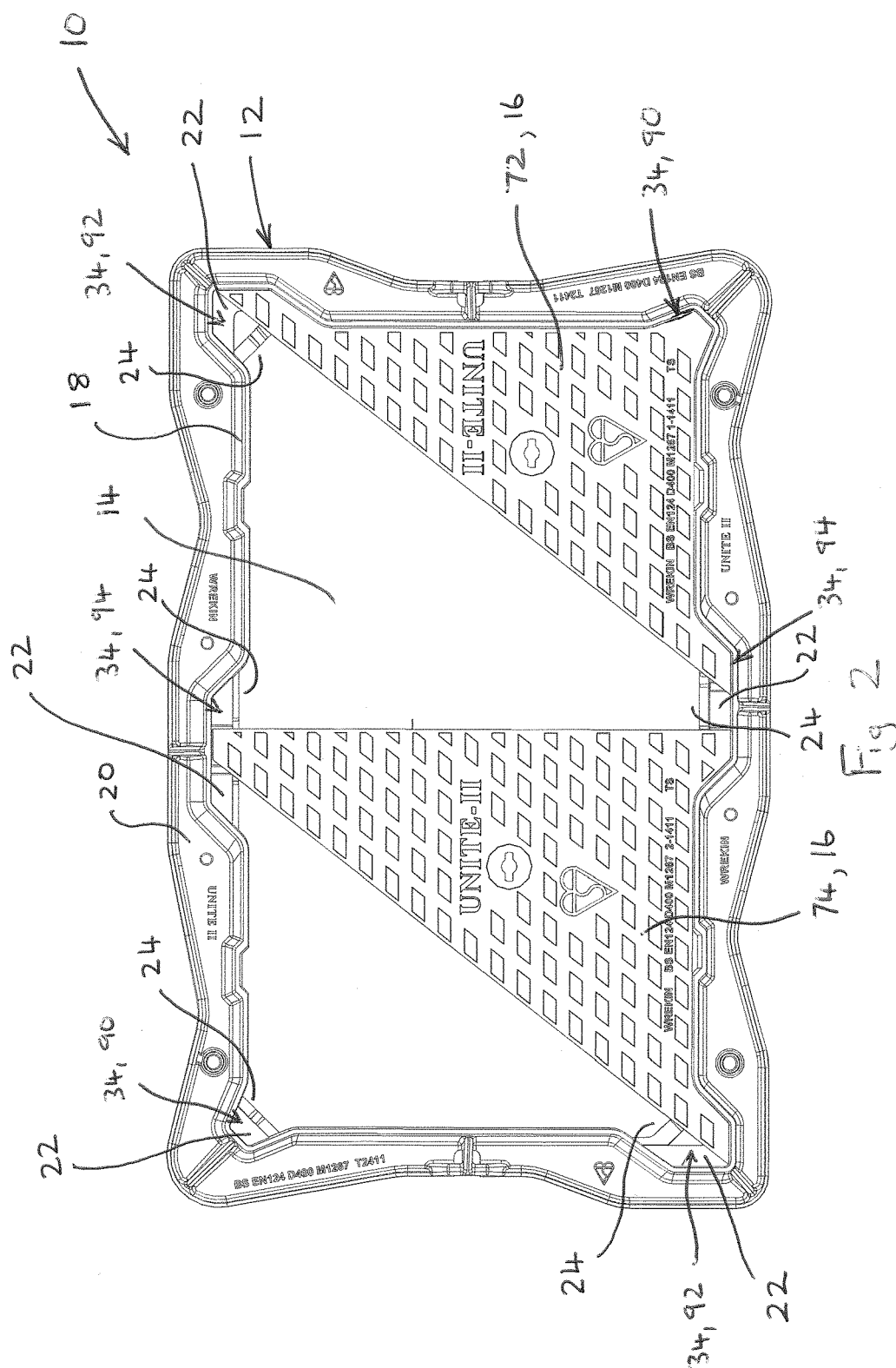
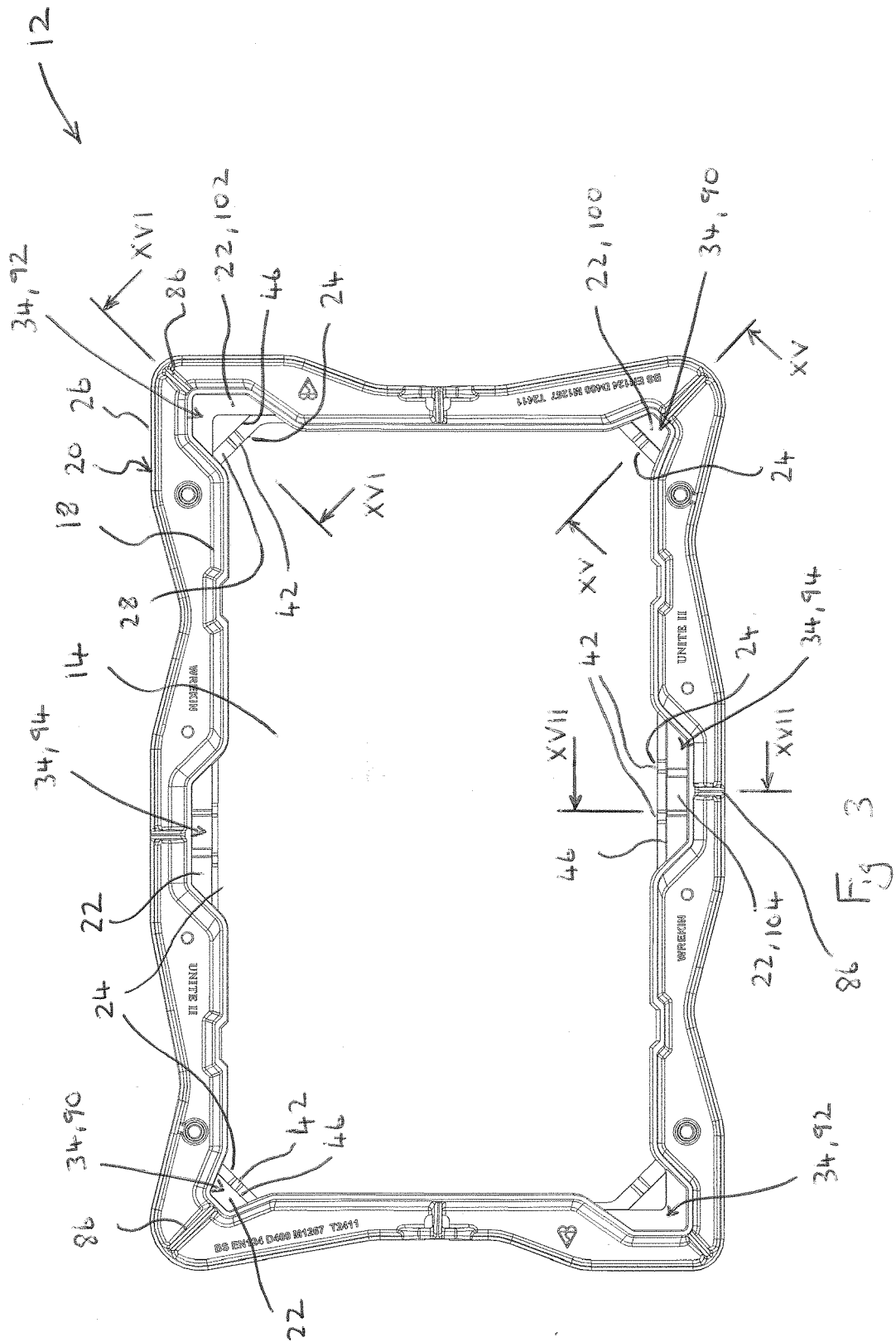
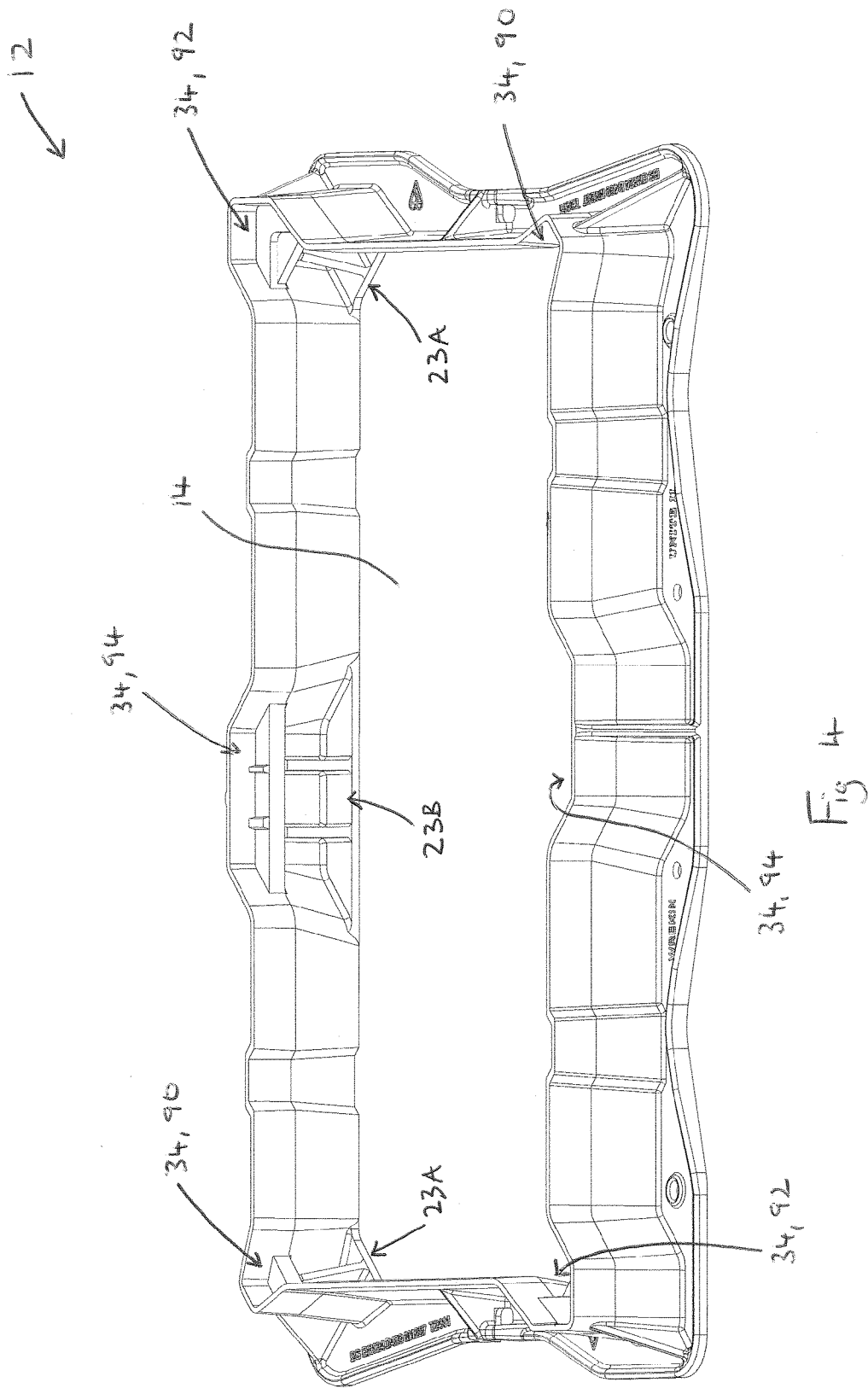


Fig. 1







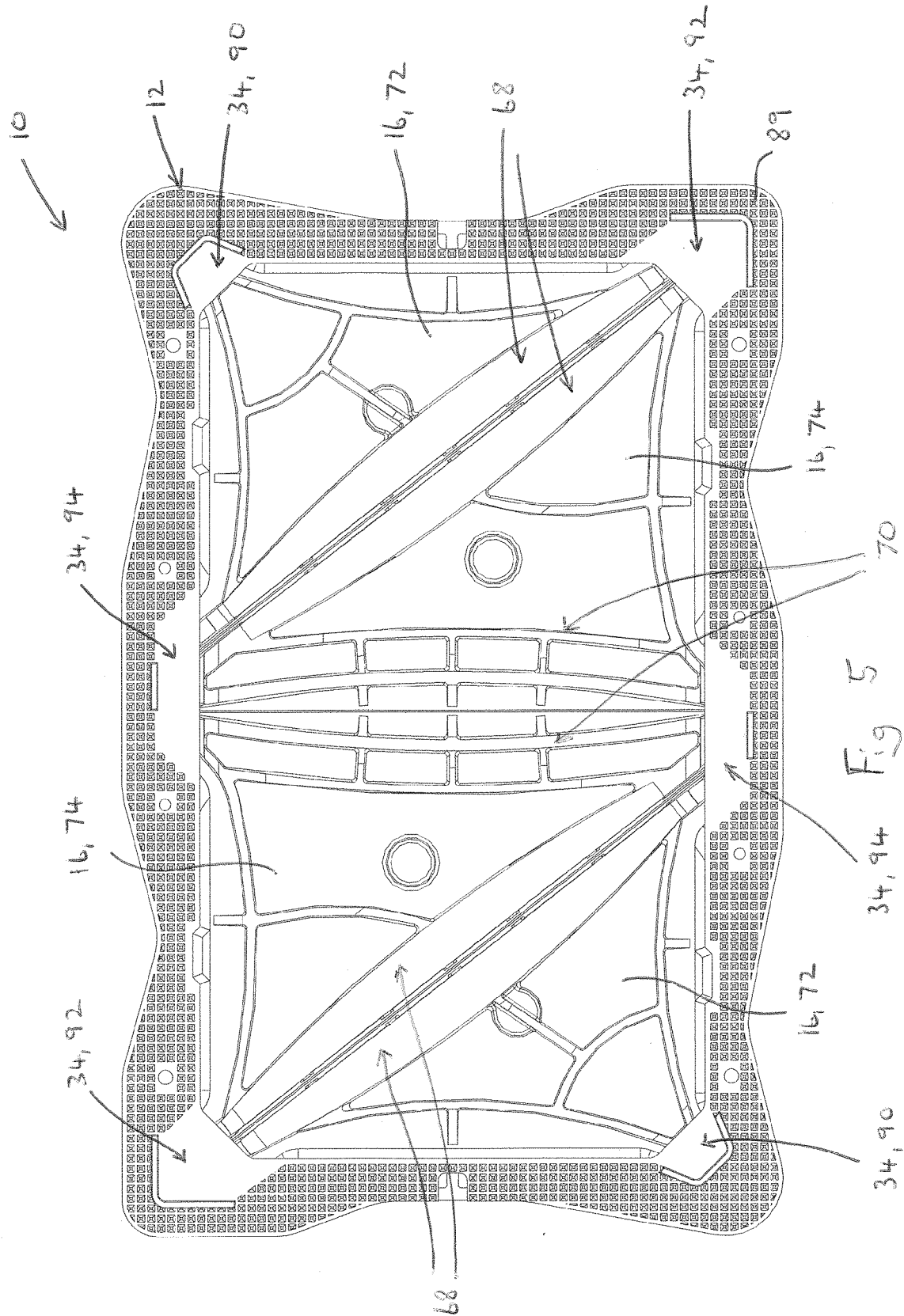
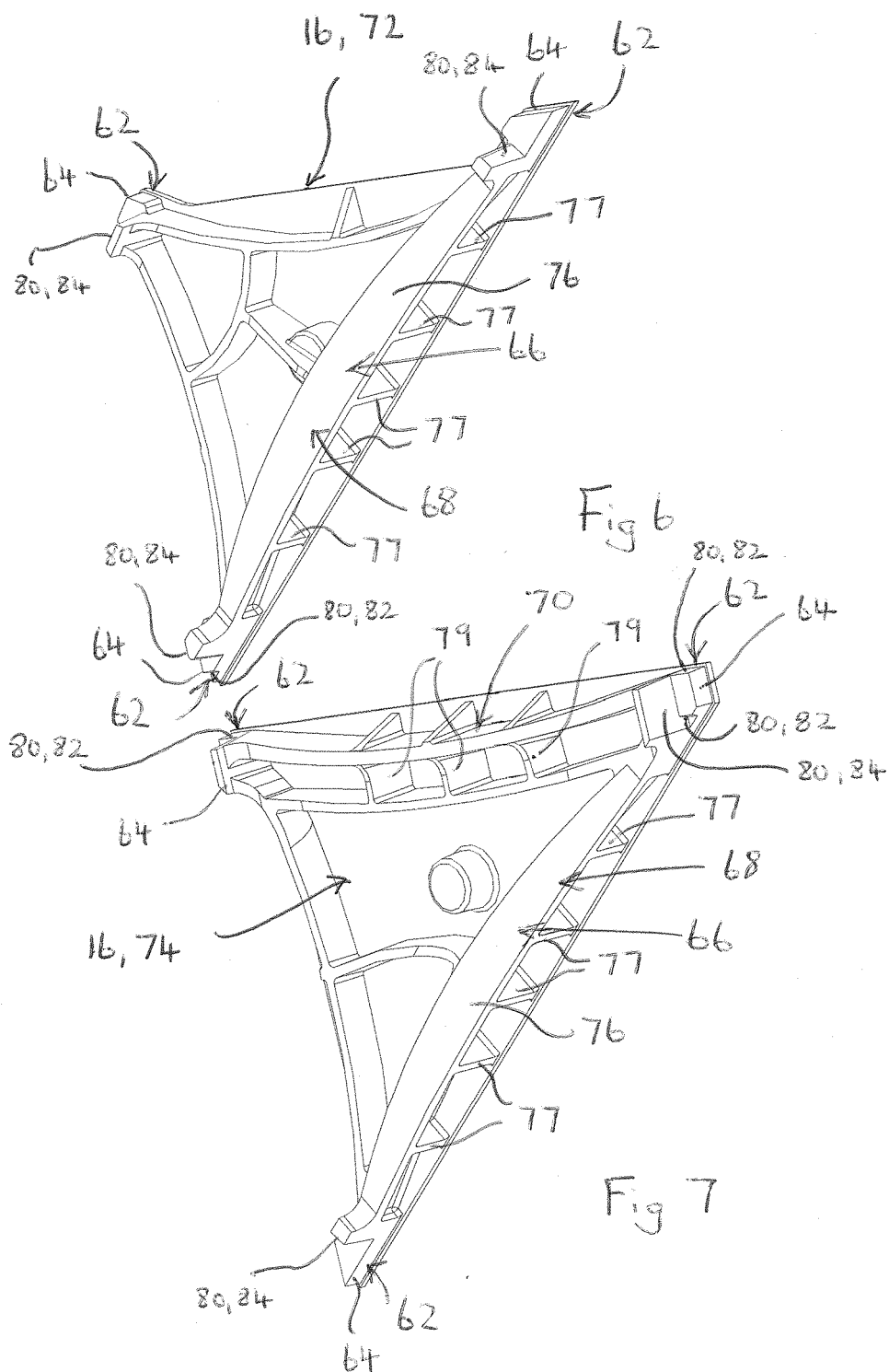
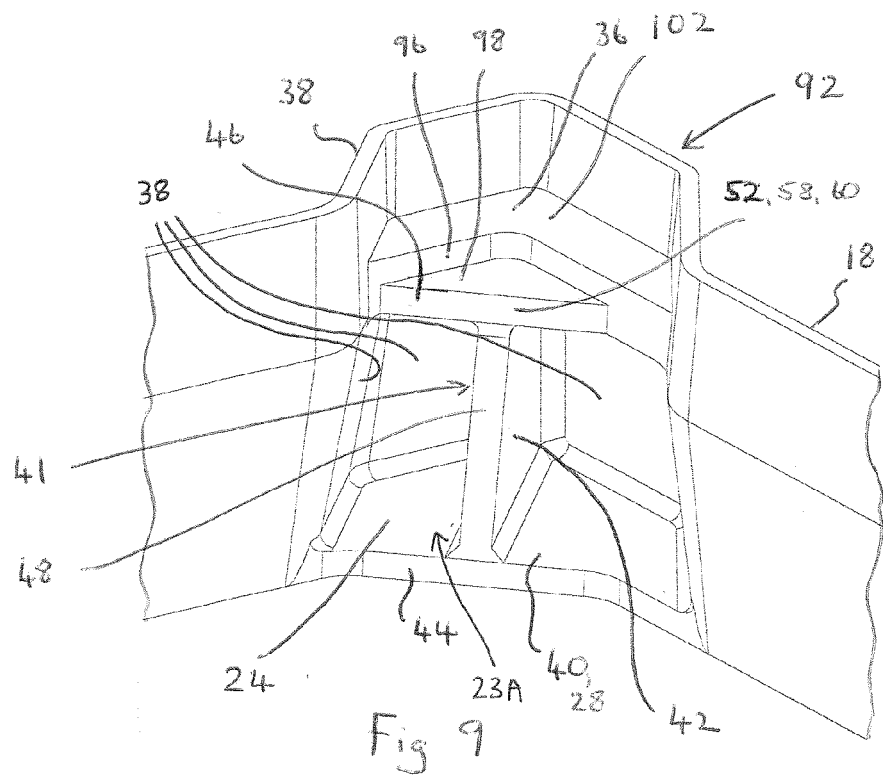
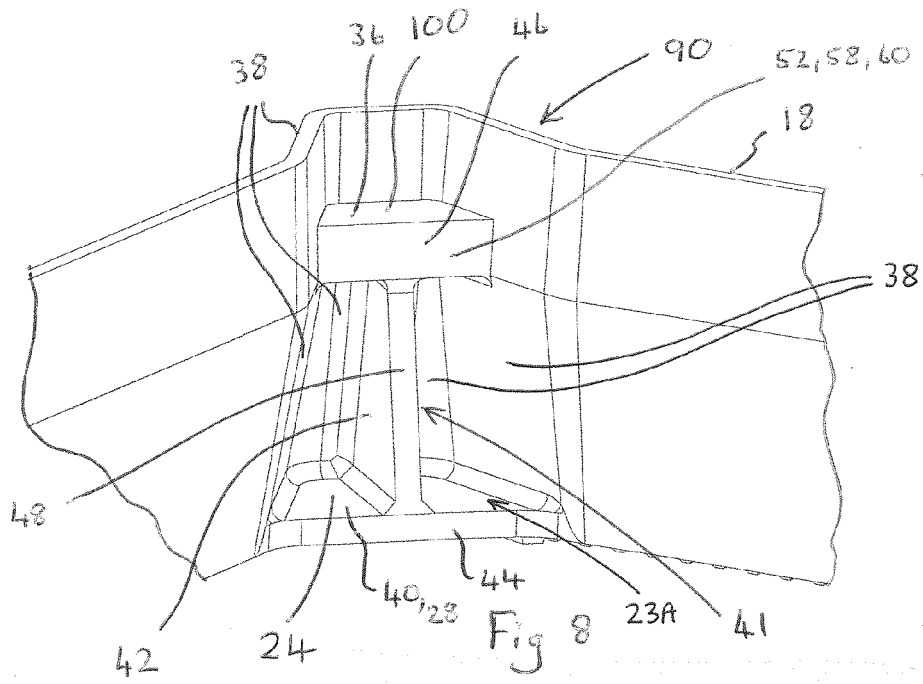


Fig 5





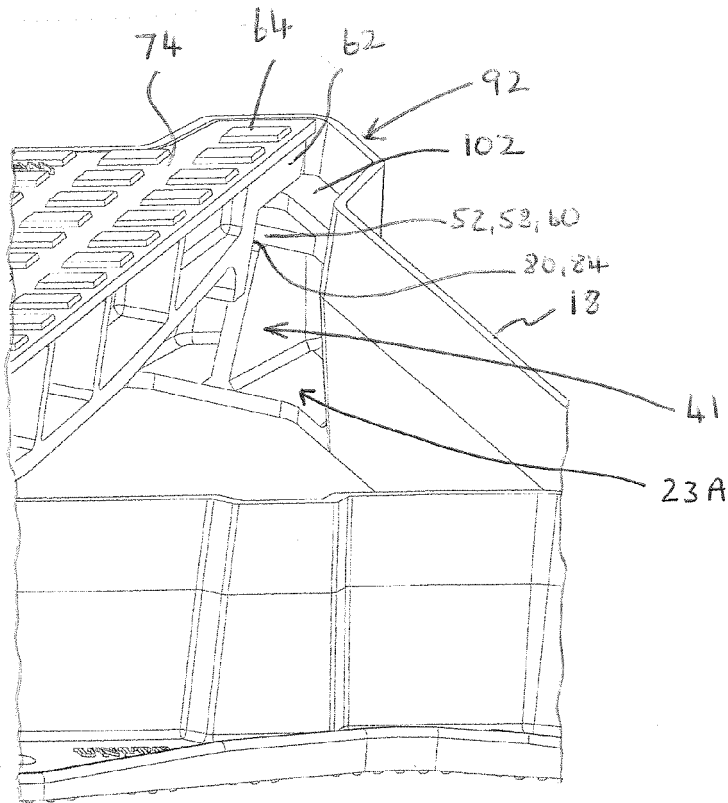


Fig 10

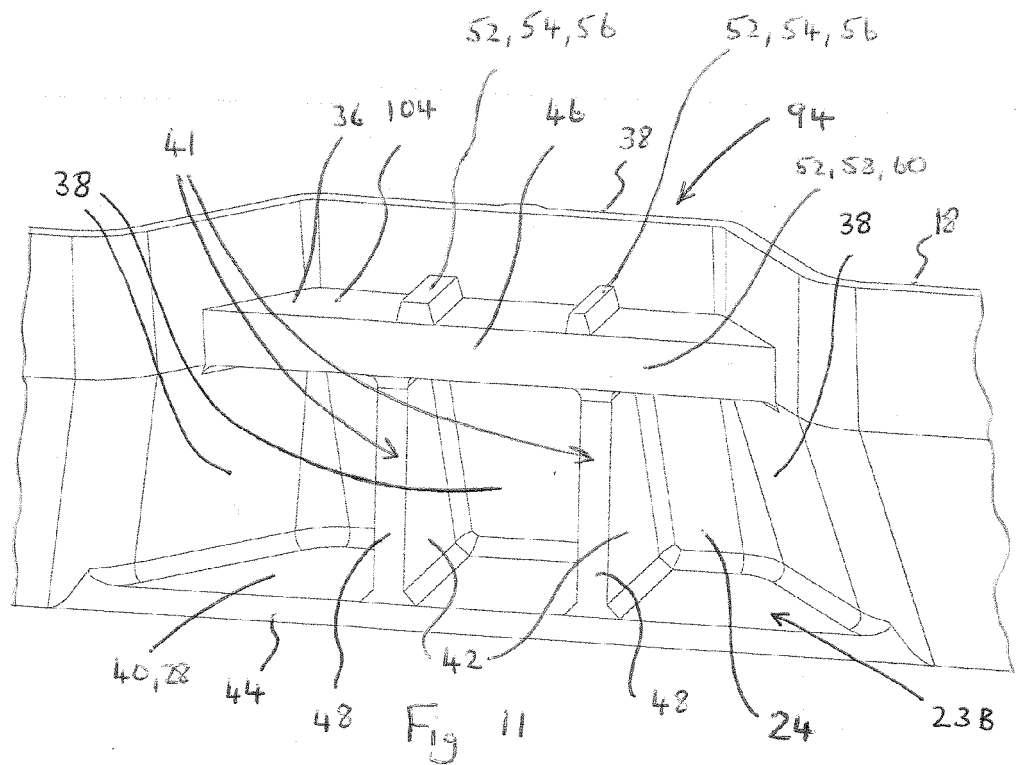
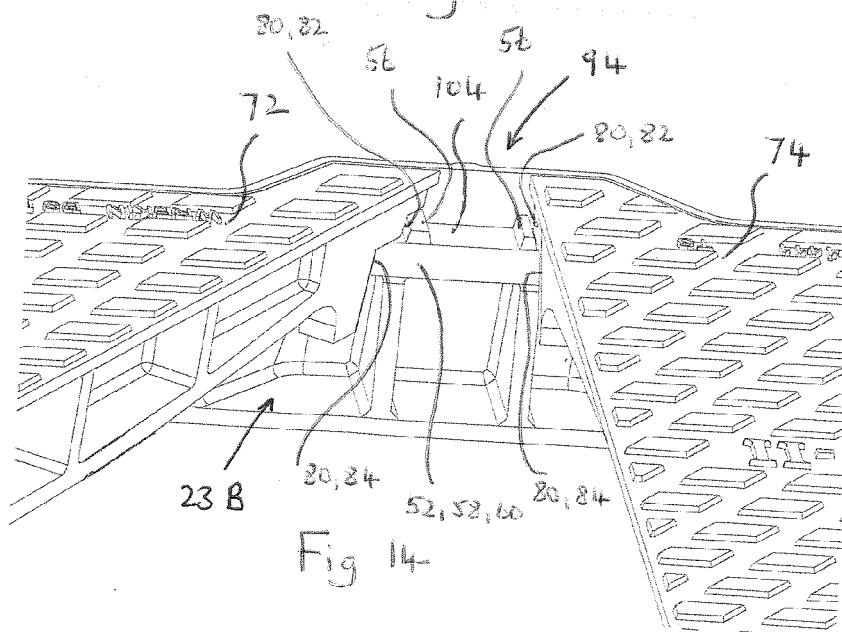
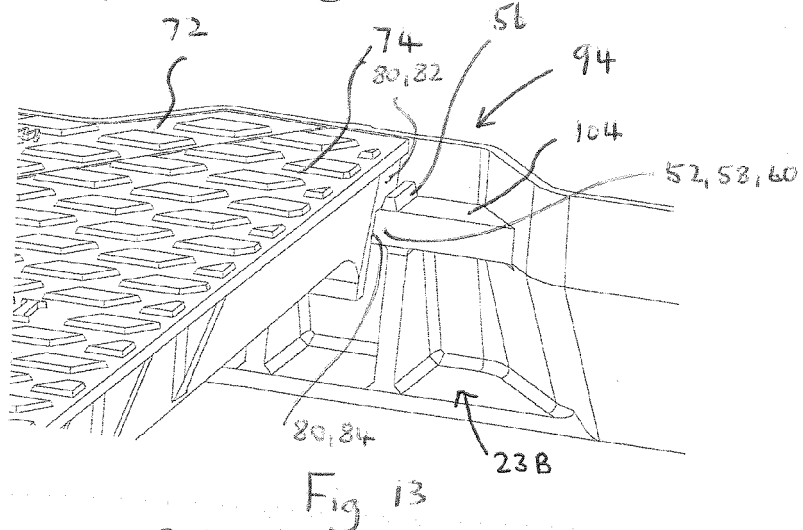
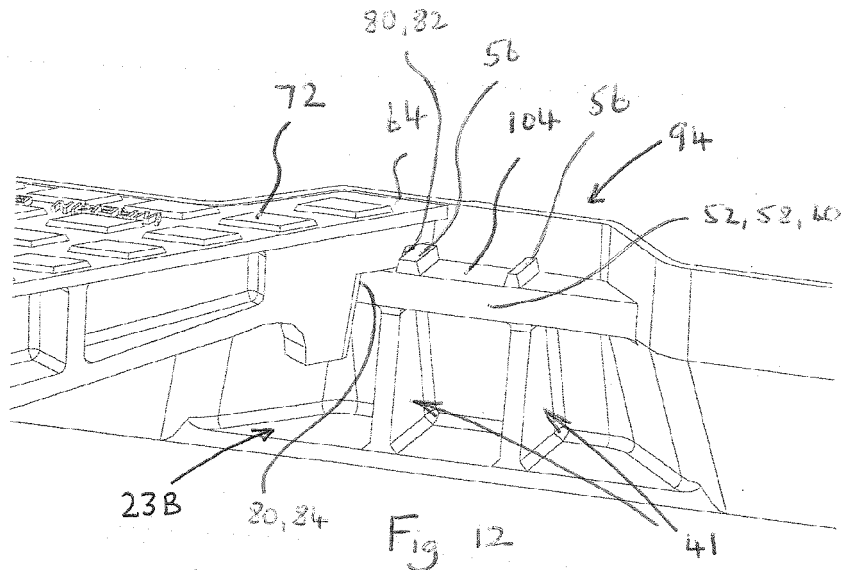
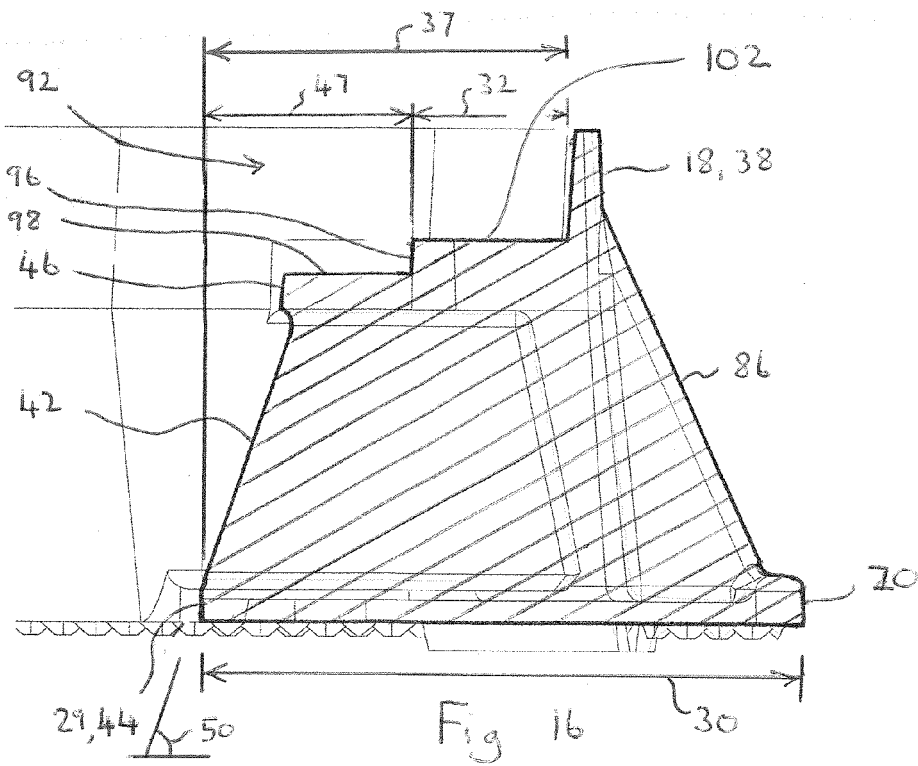
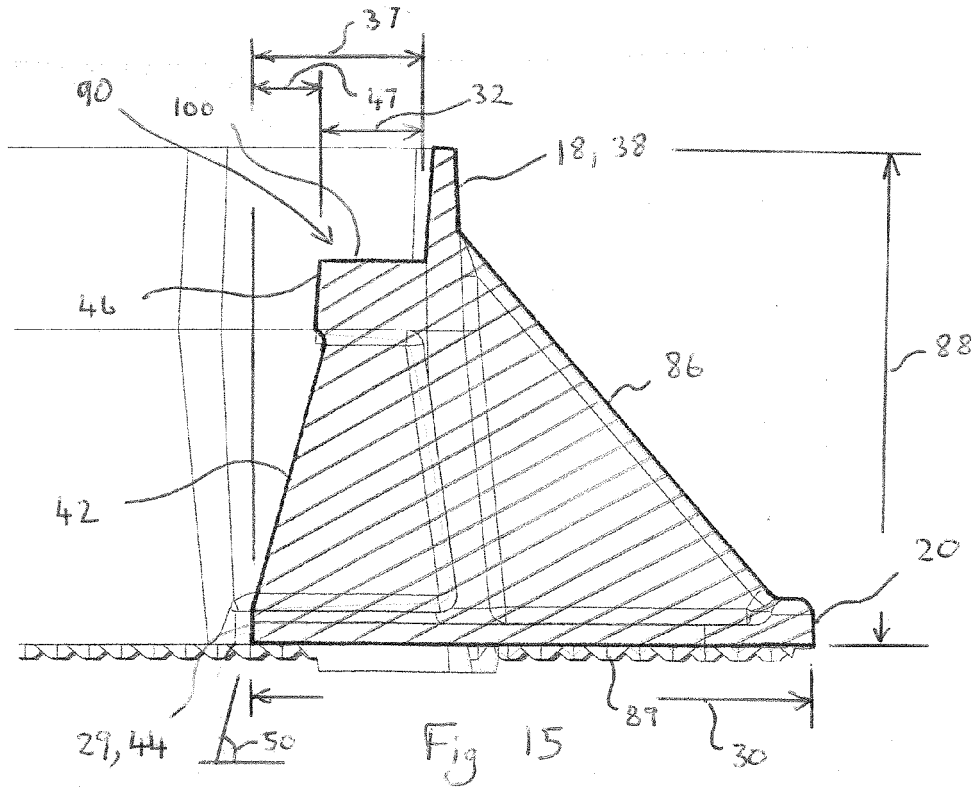
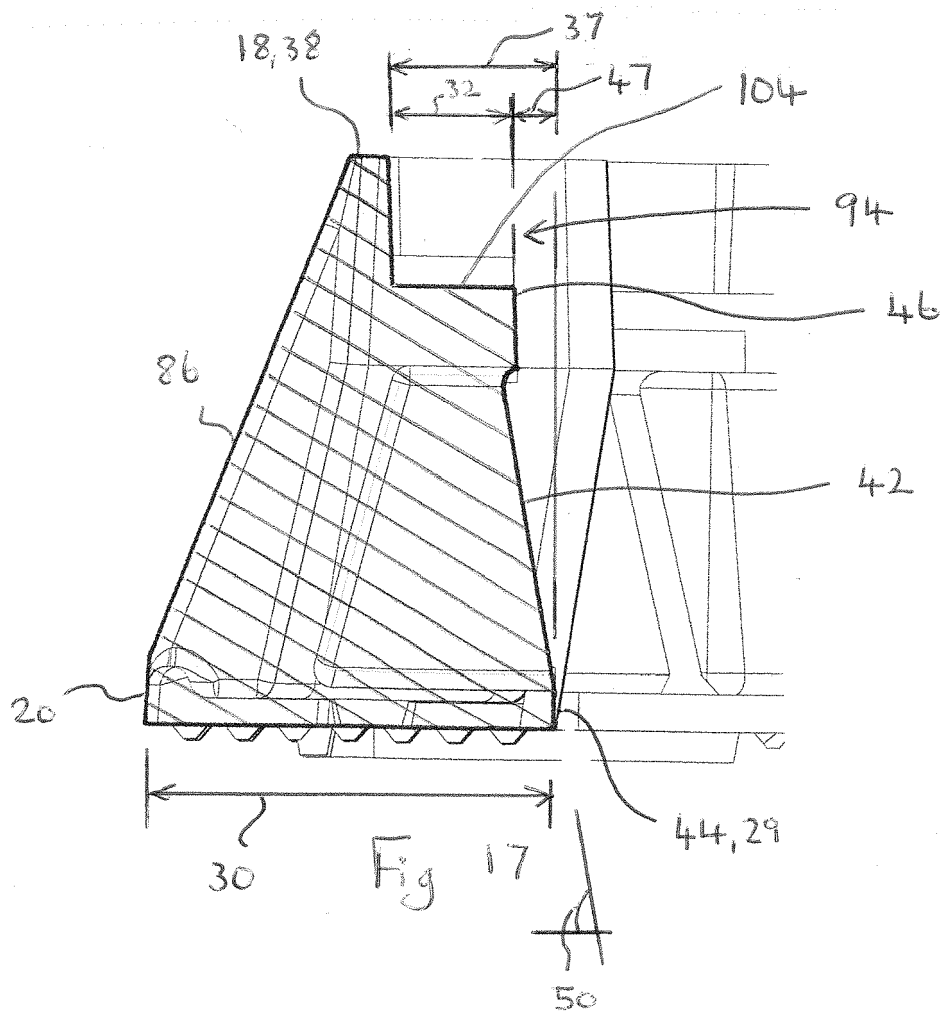


Fig 11







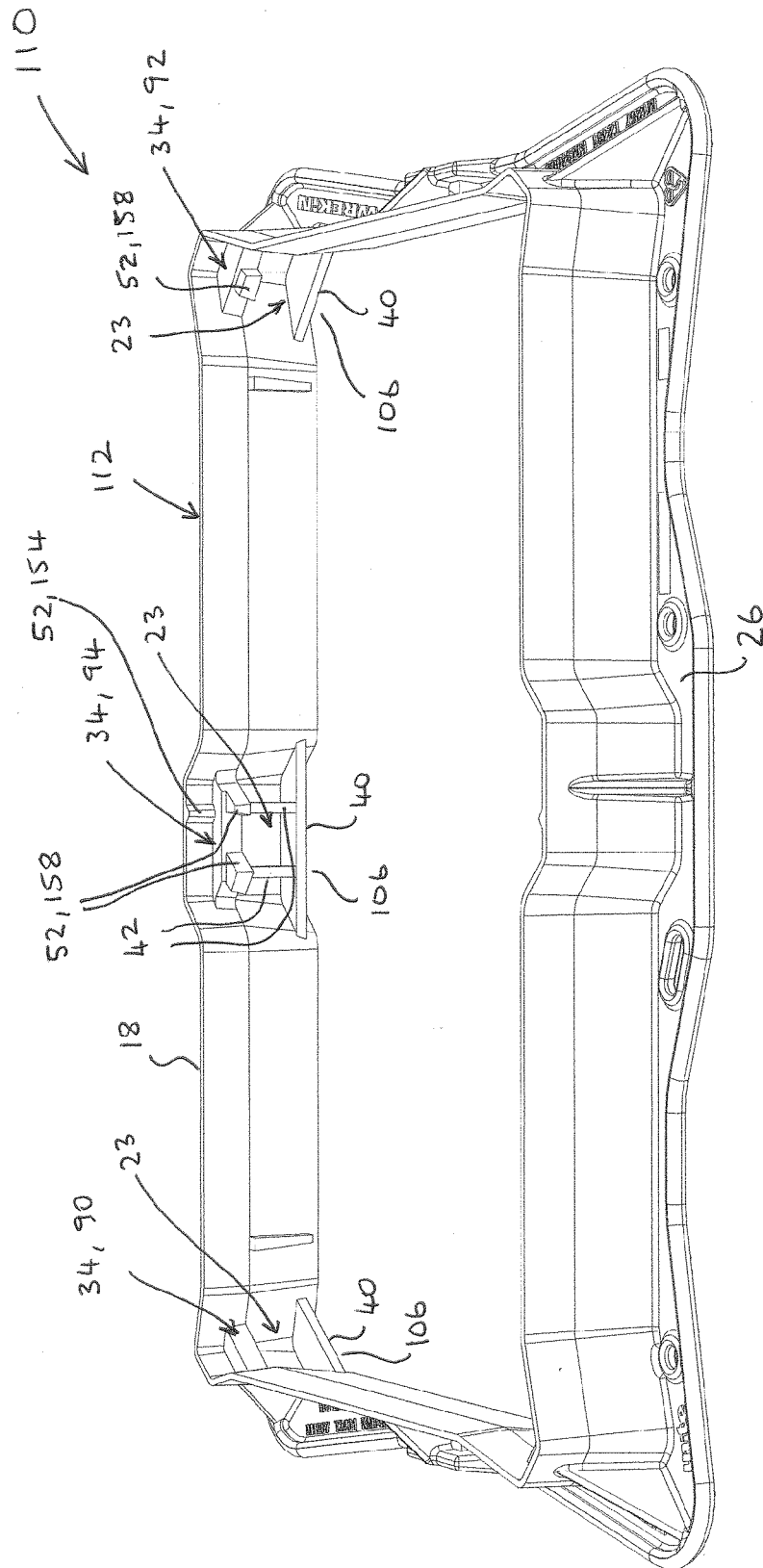
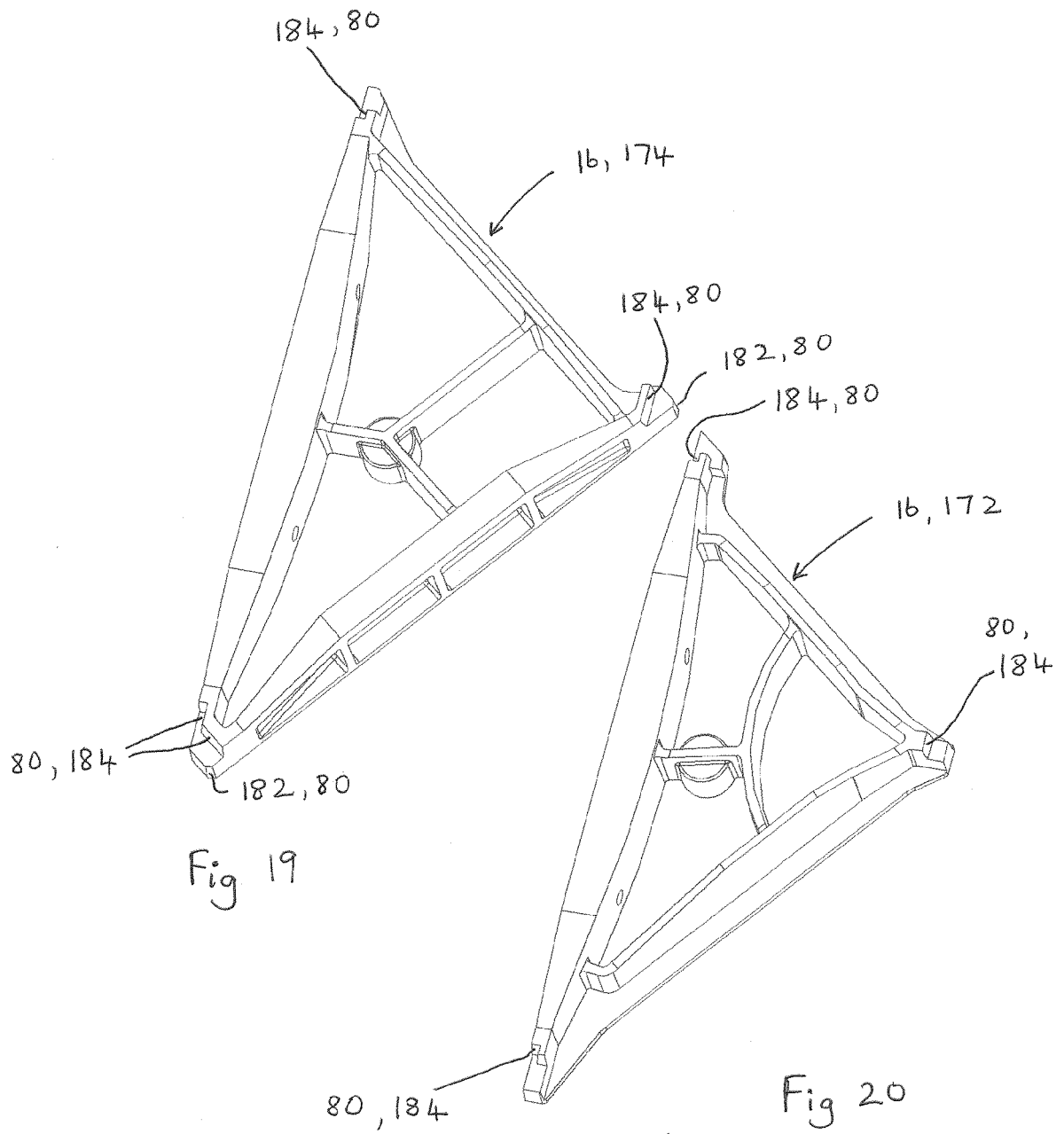


Fig 18



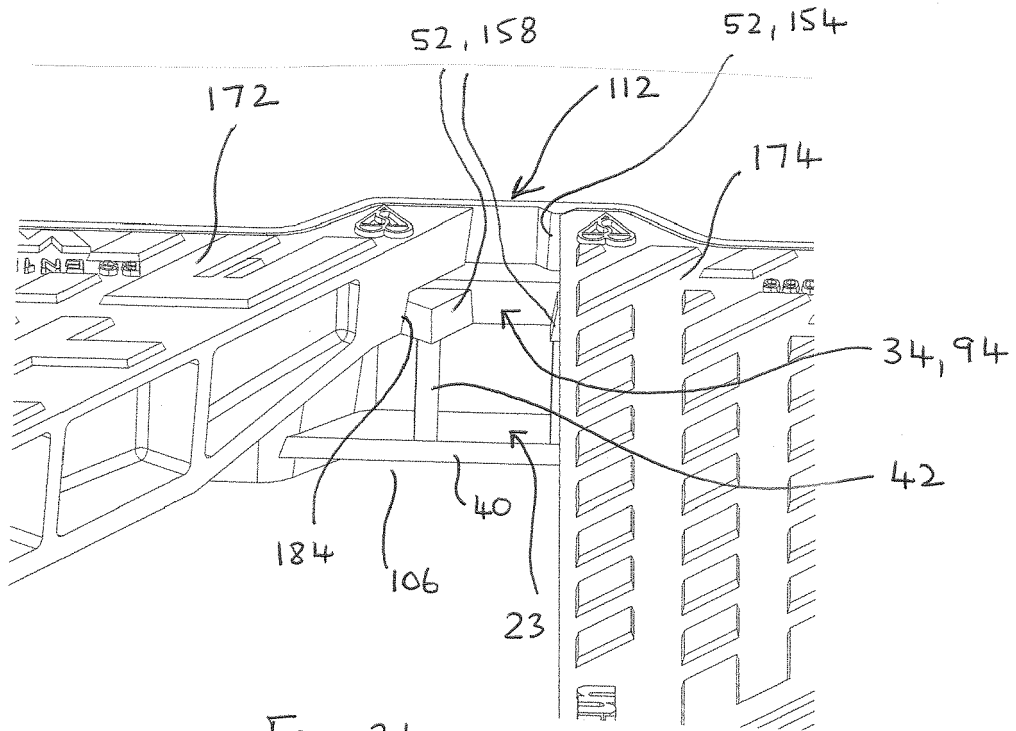


Fig 21

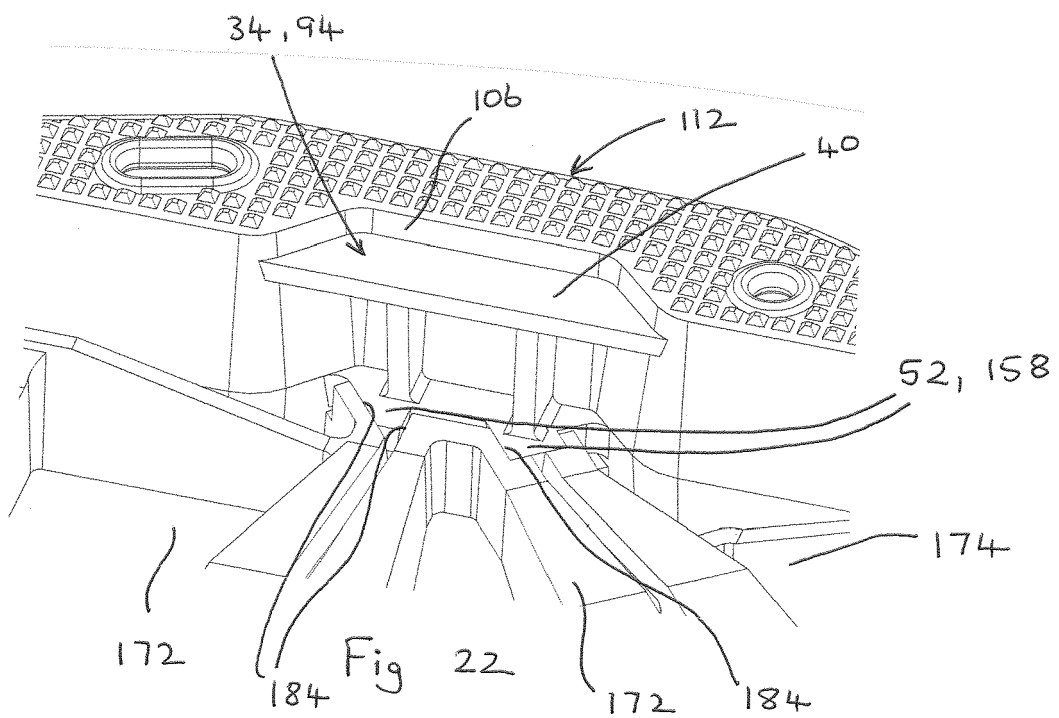
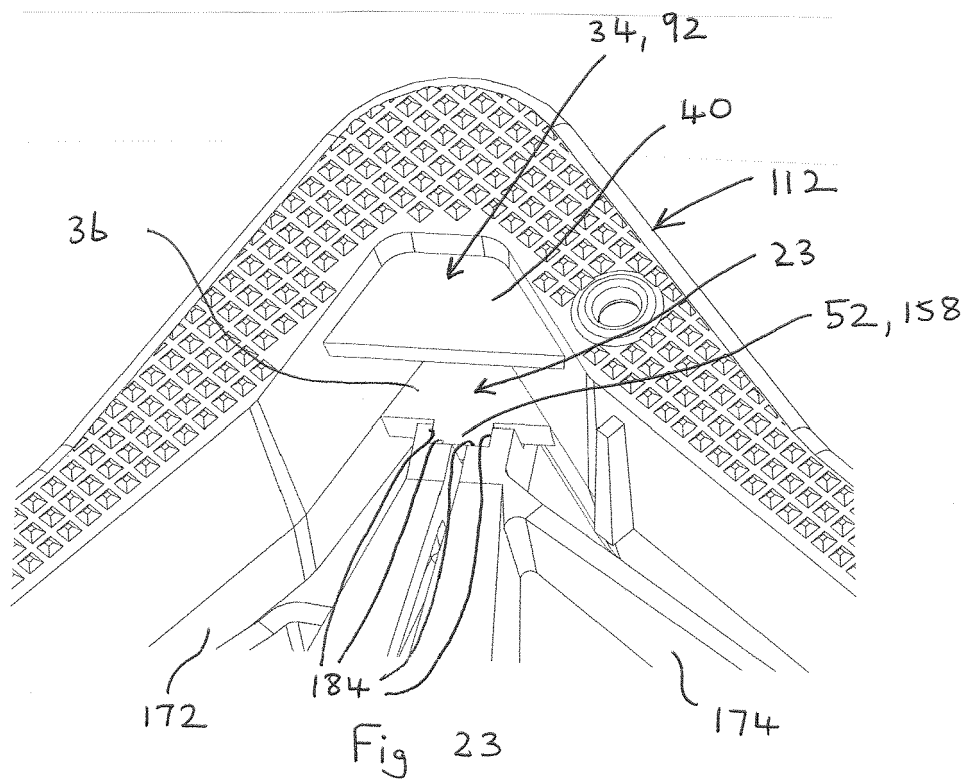


Fig 22





EUROPEAN SEARCH REPORT

Application Number
EP 14 16 5510

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			TECHNICAL FIELDS SEARCHED (IPC)
			E02D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 11 August 2014	Examiner Friedrich, Albert
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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The members are as contained in the European Patent Office EDP file on
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11-08-2014

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82