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Figure 1

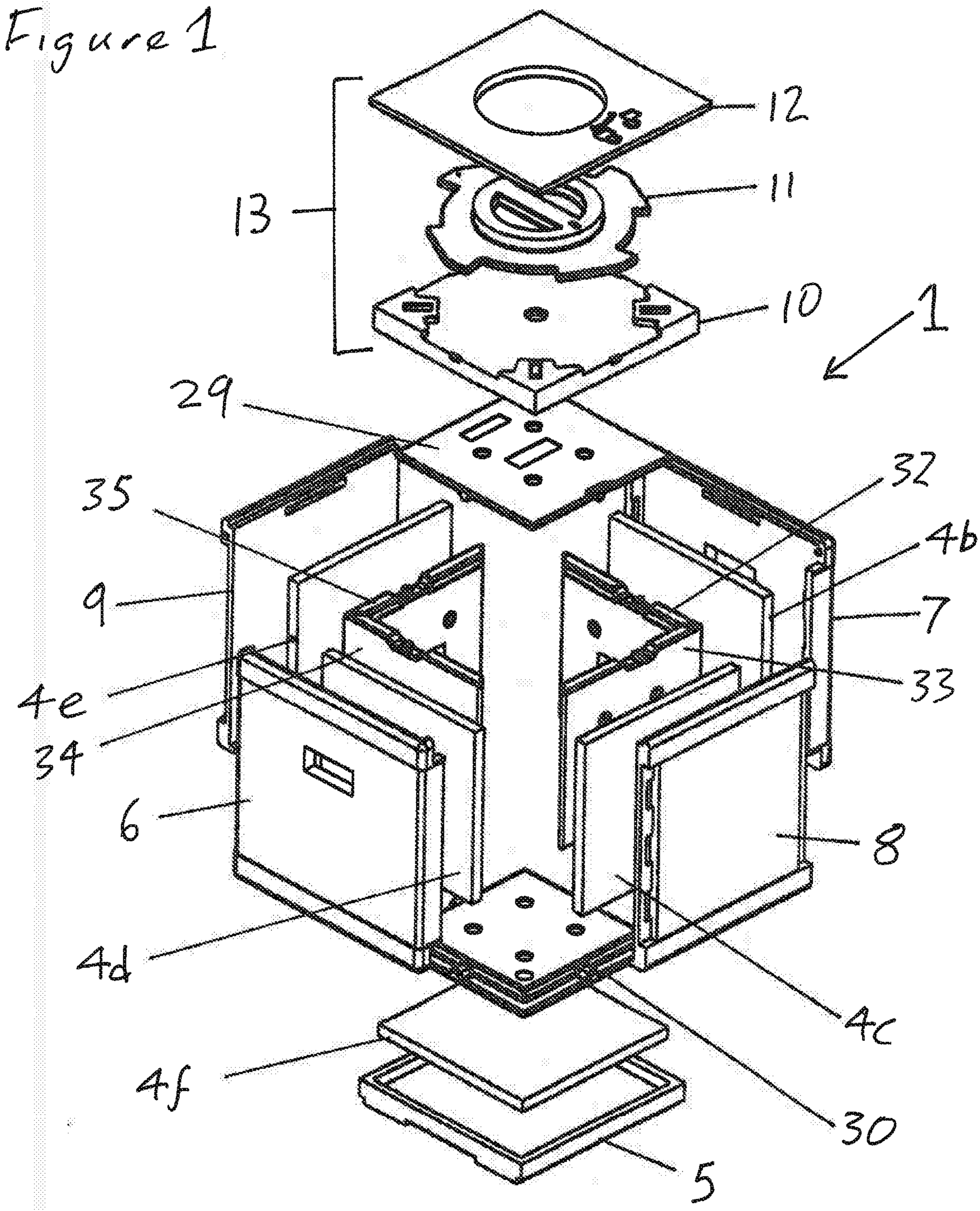


Figure 2

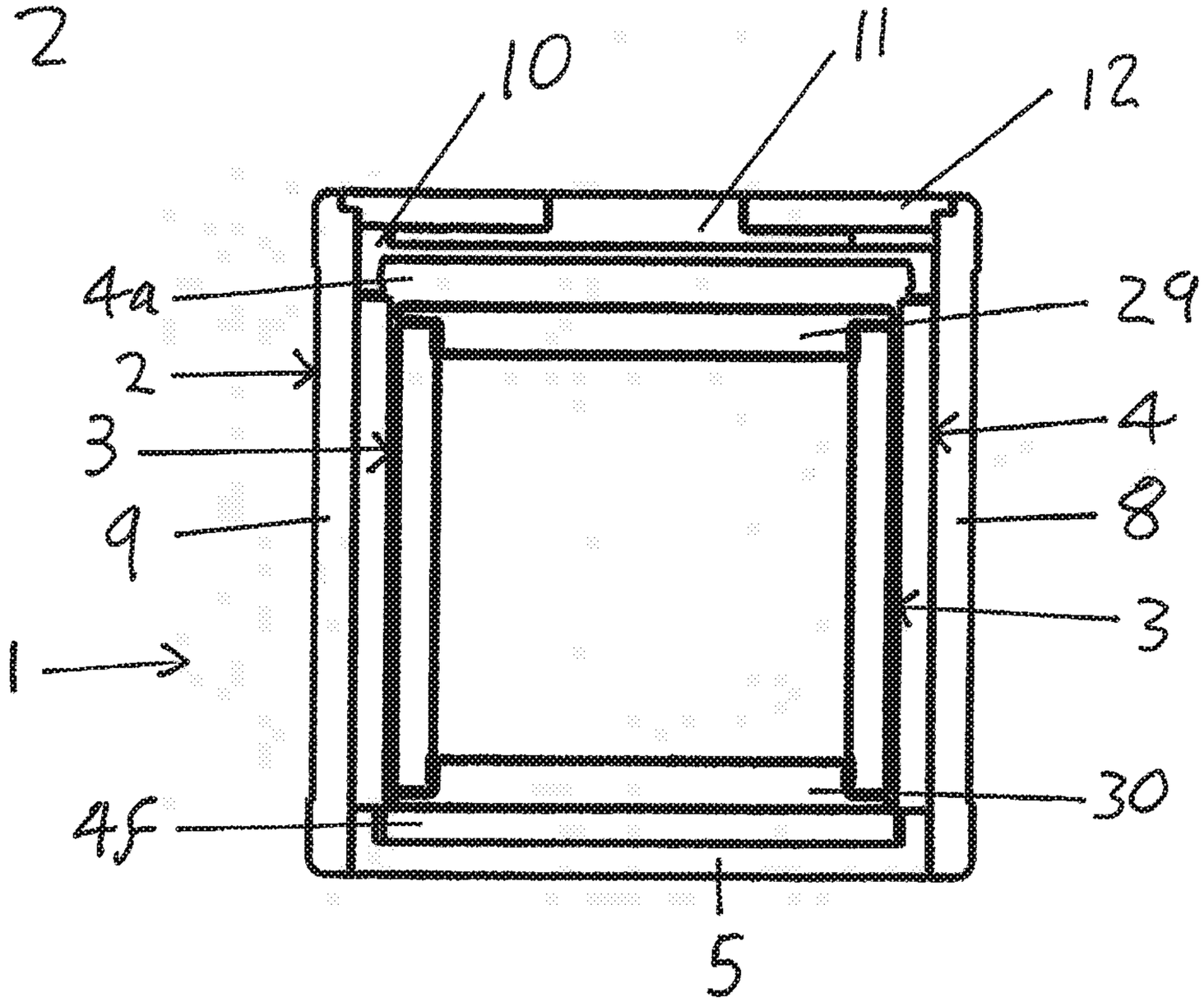


Figure 3

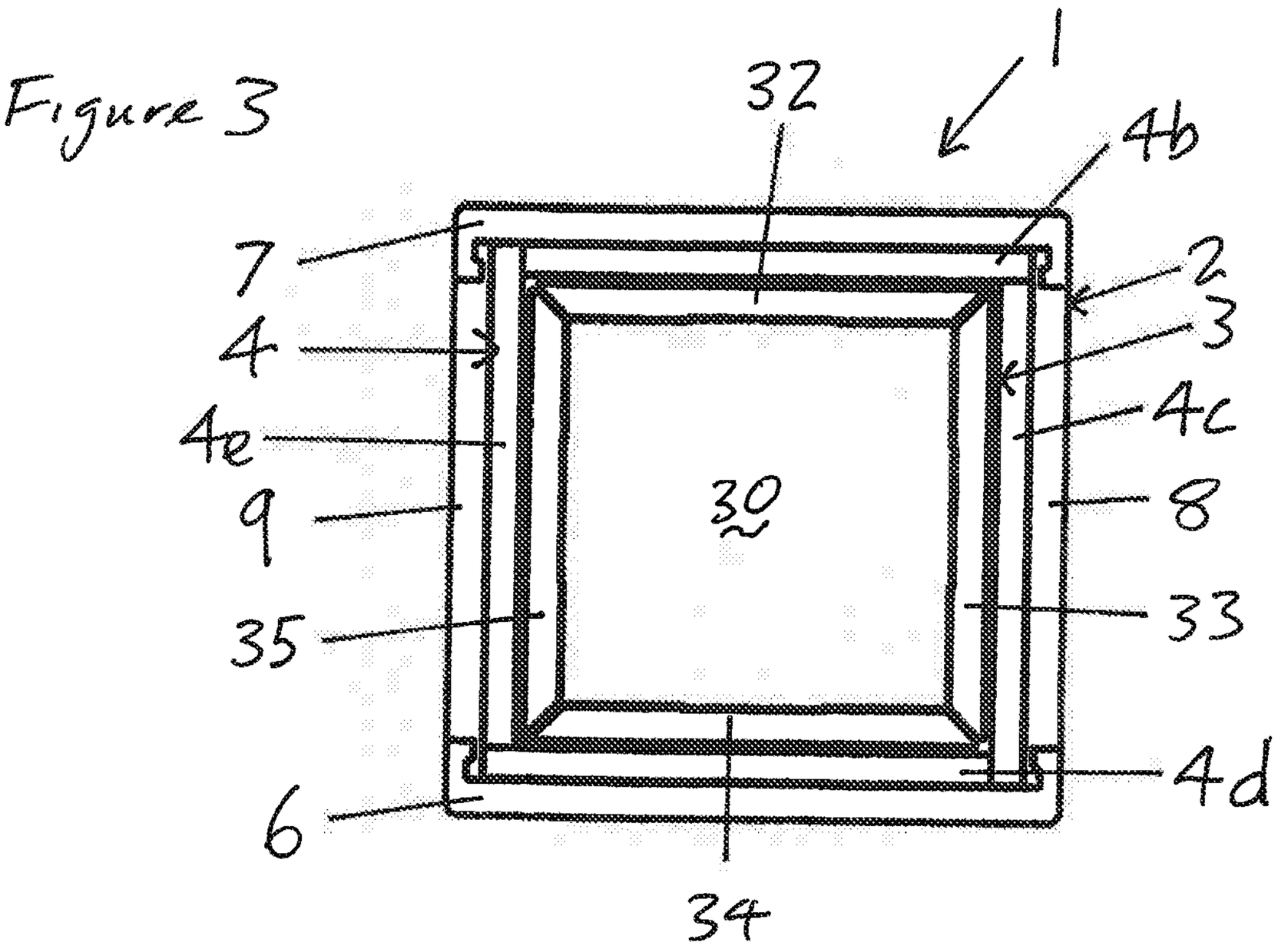
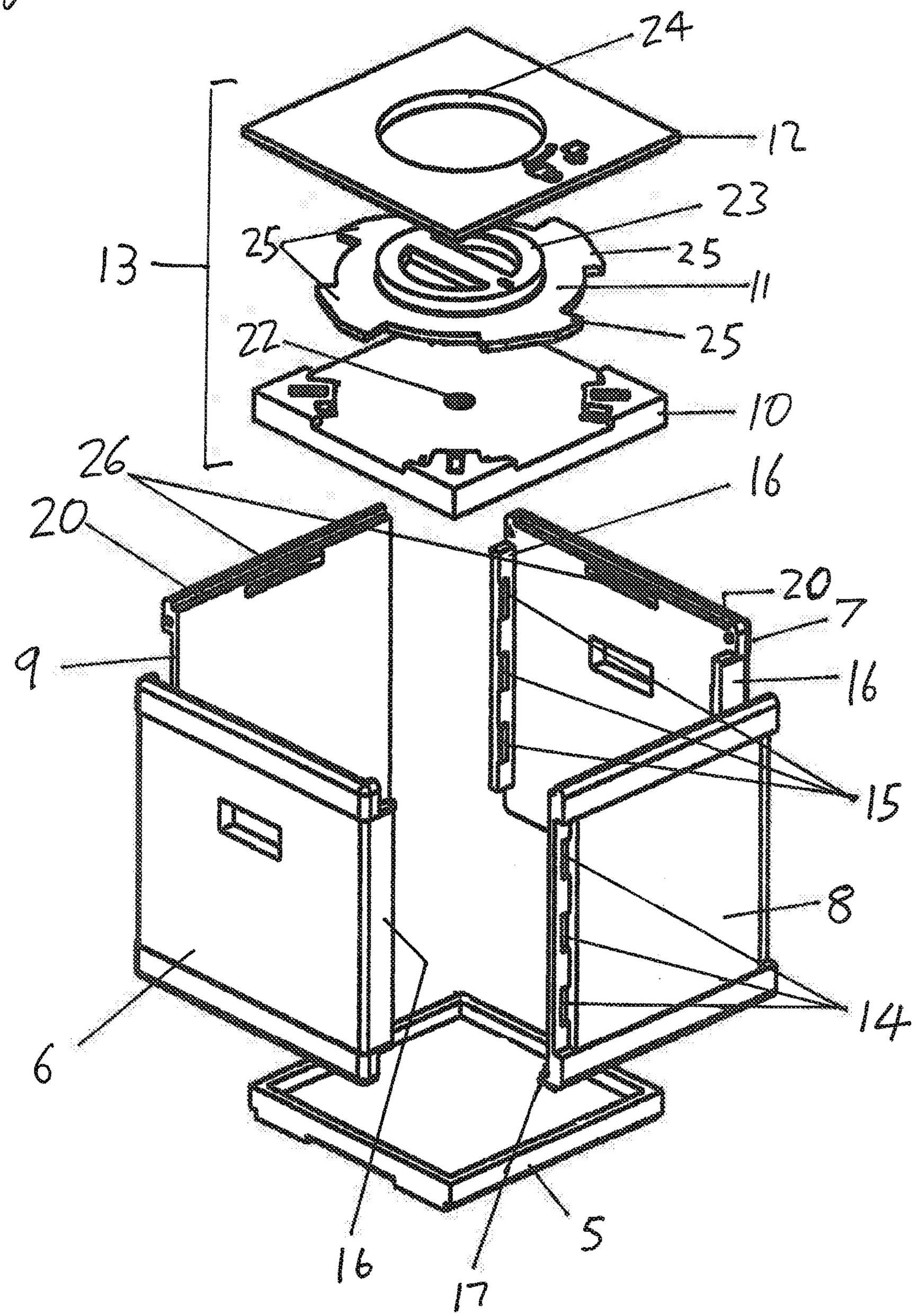


Figure 4



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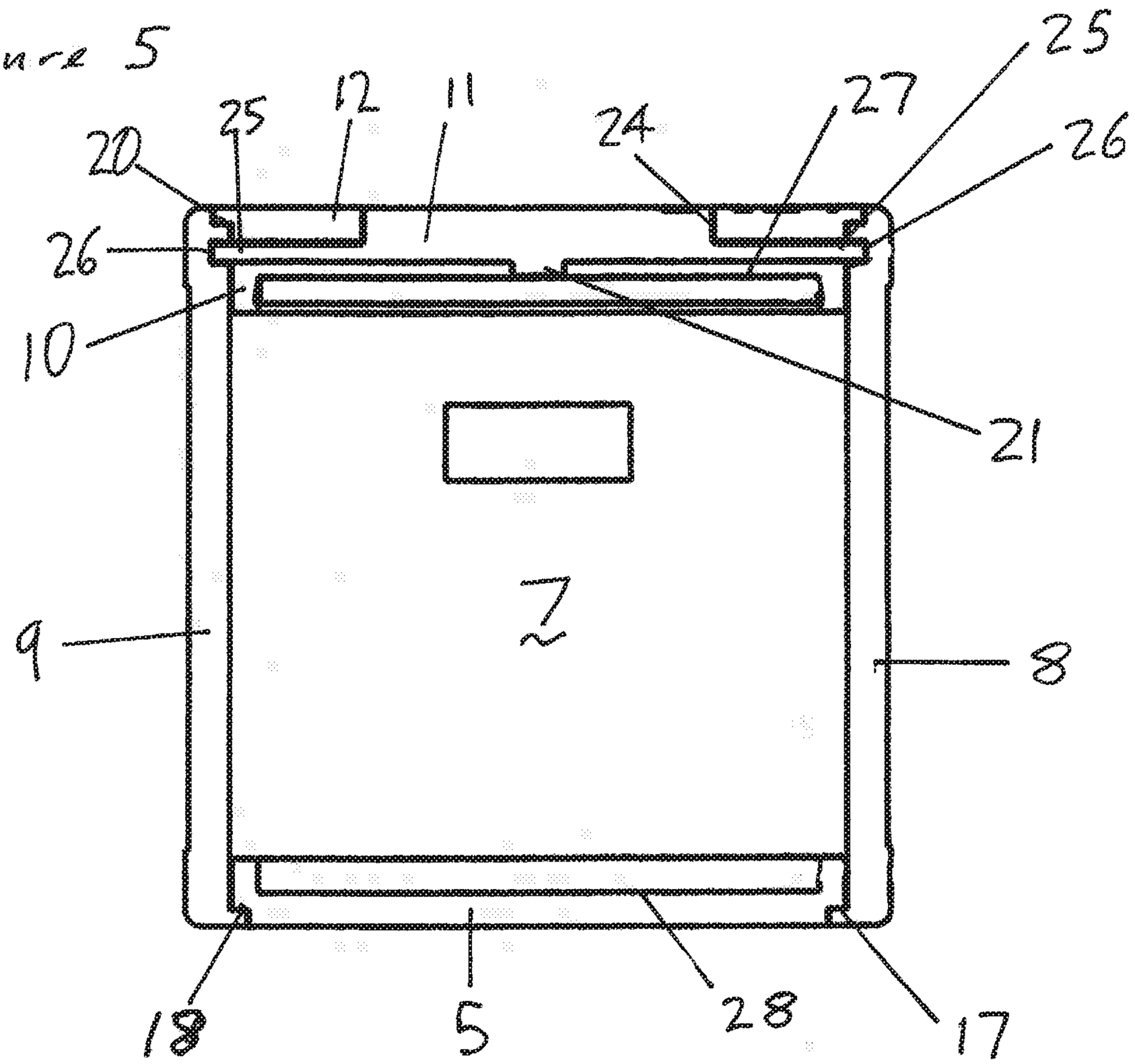

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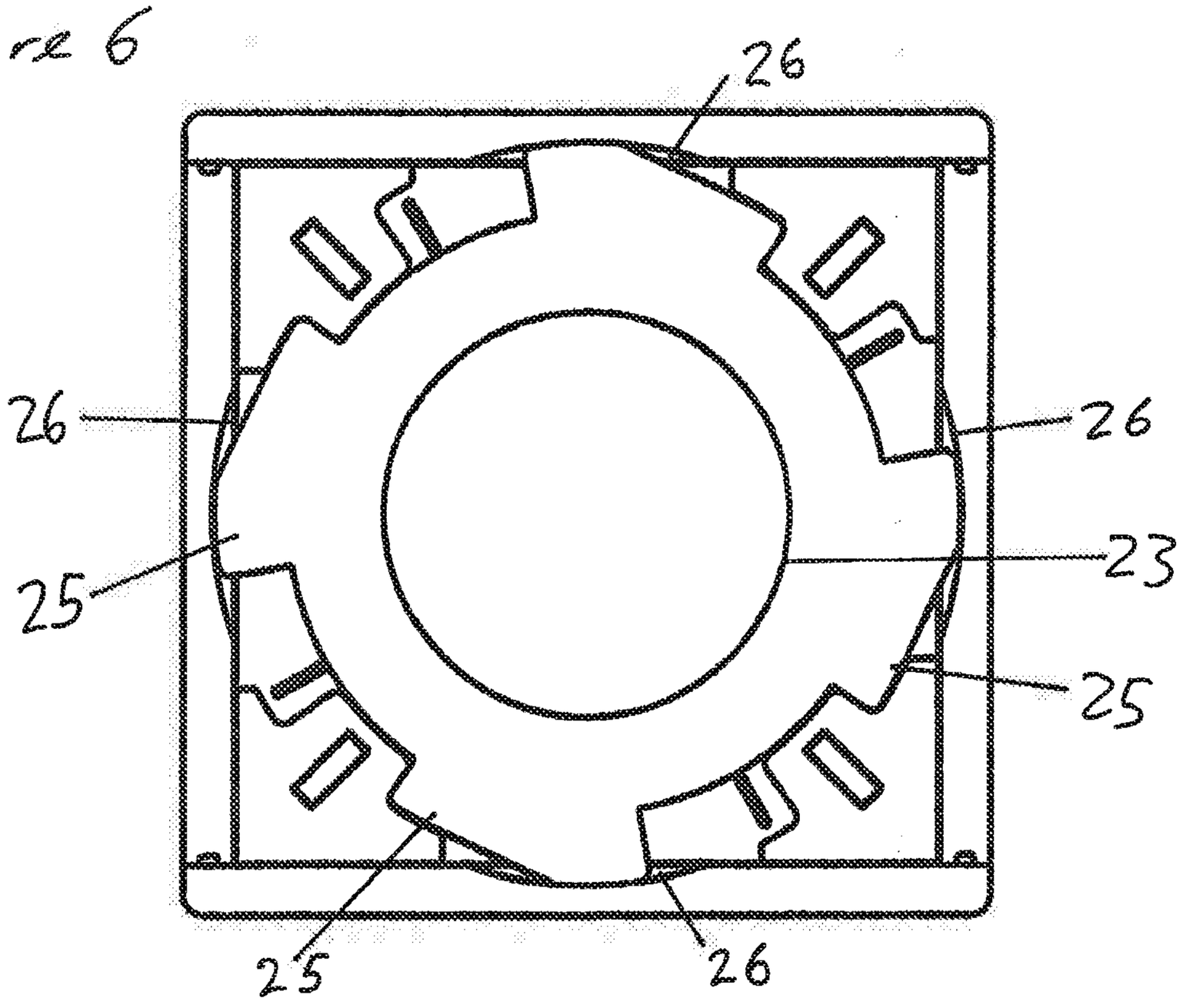

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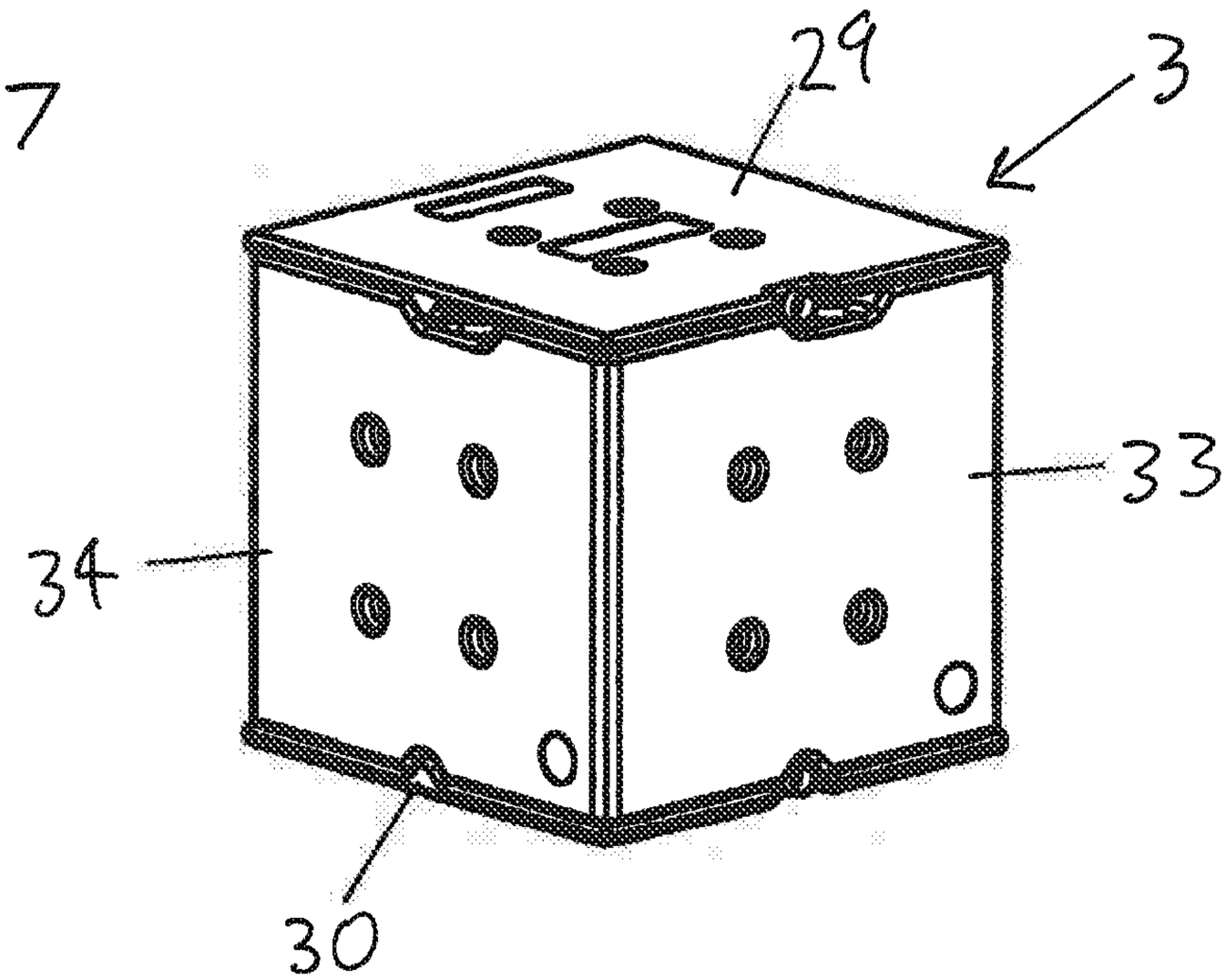

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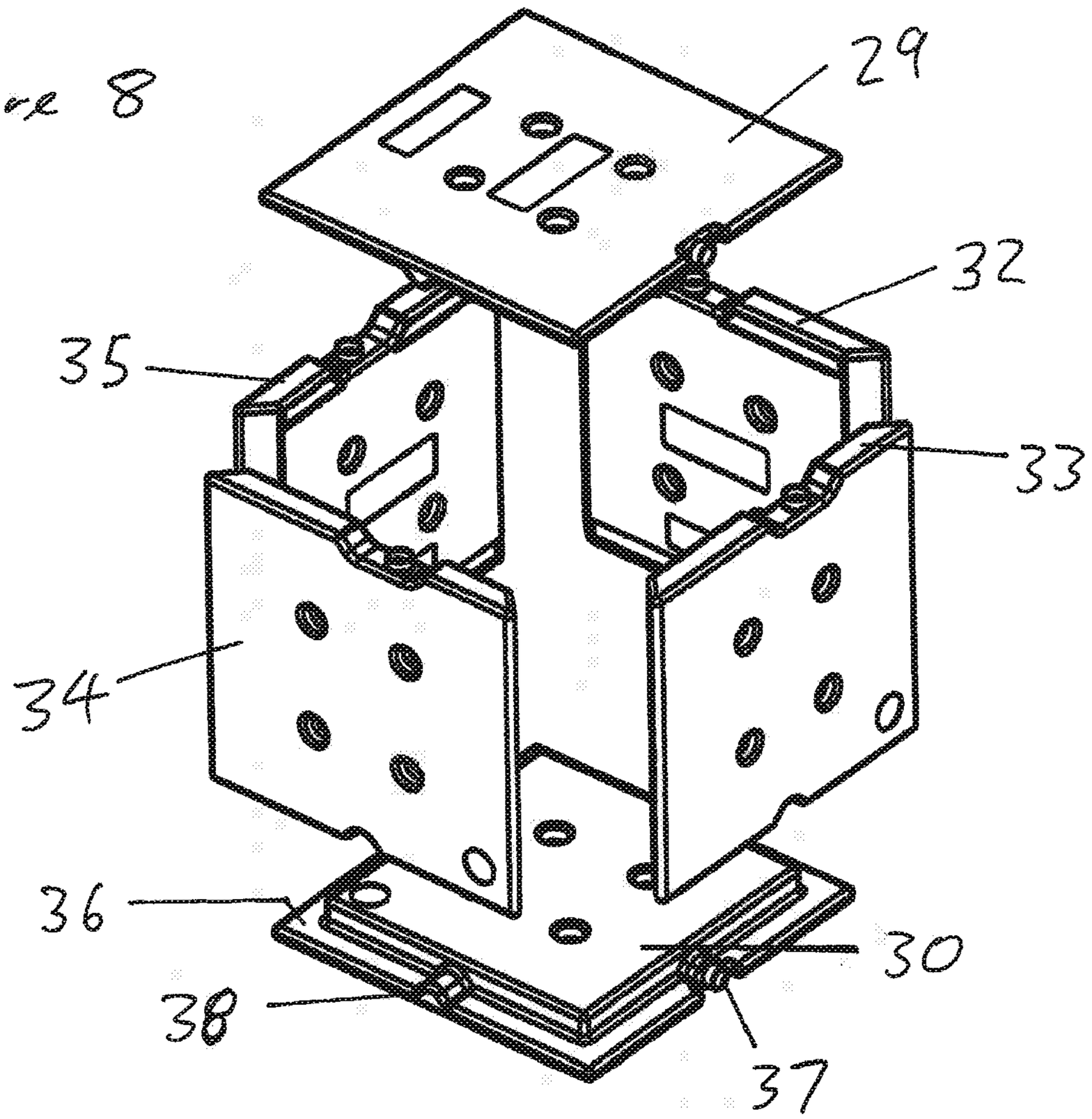

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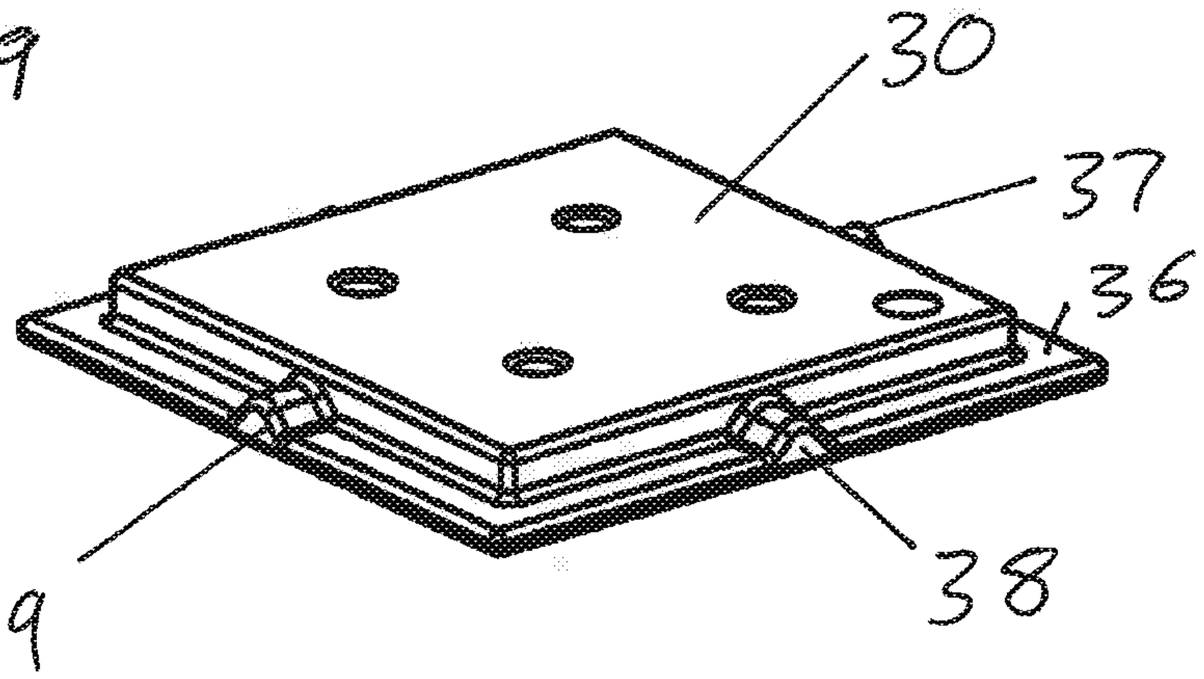

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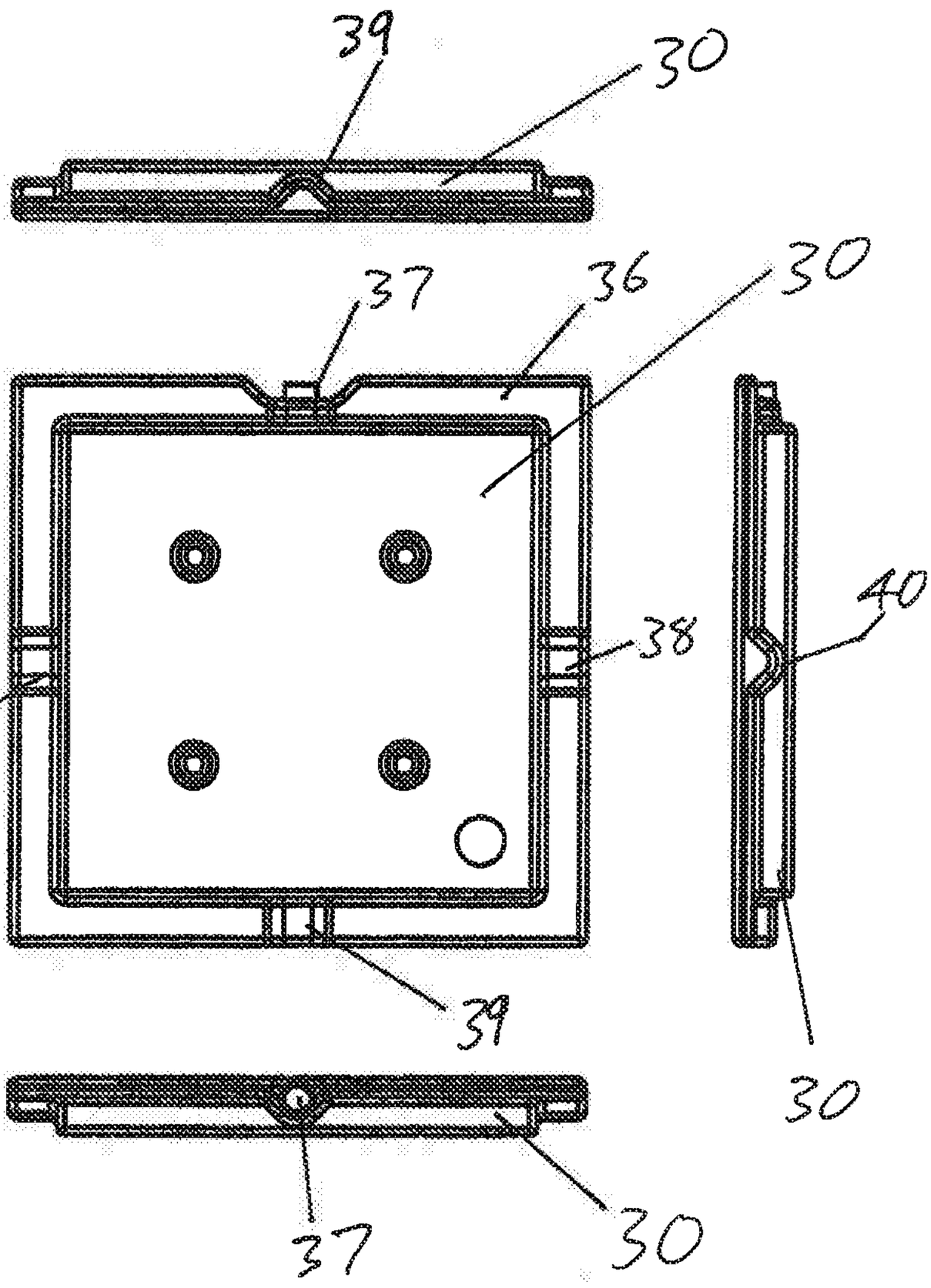

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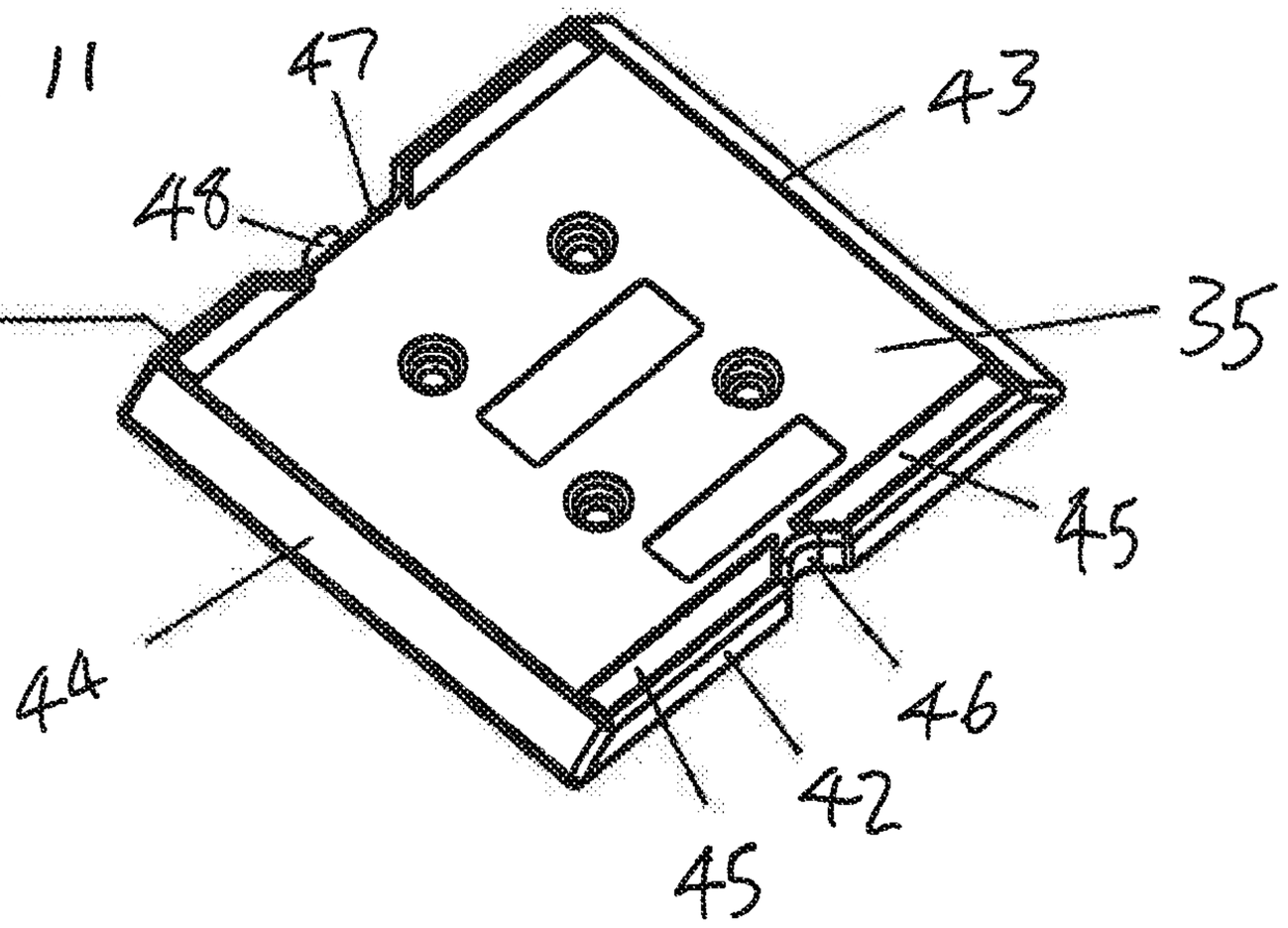

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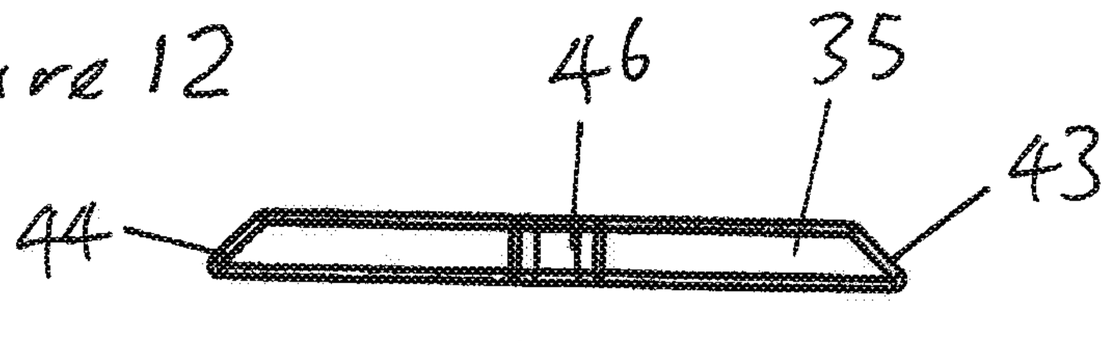

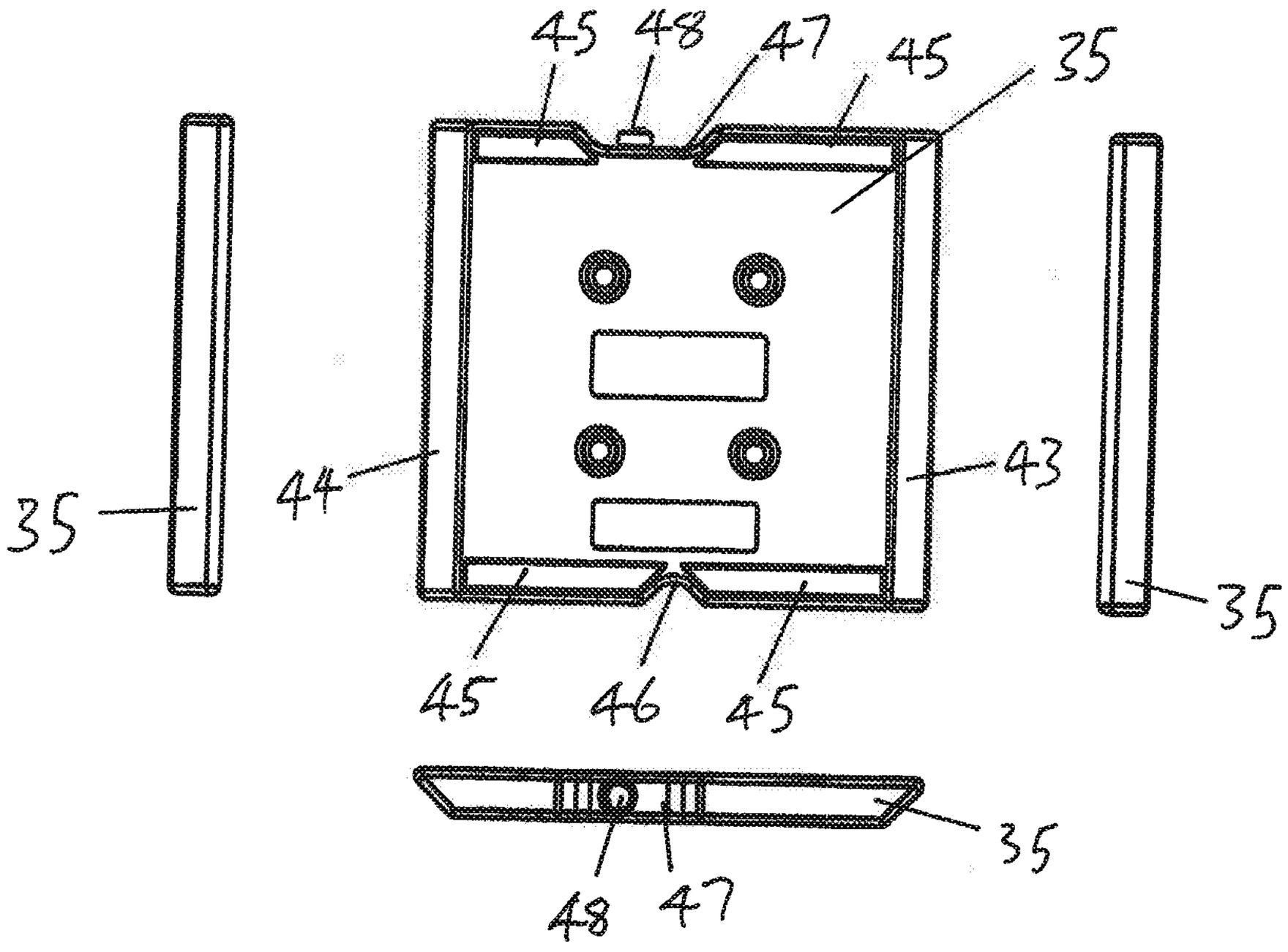

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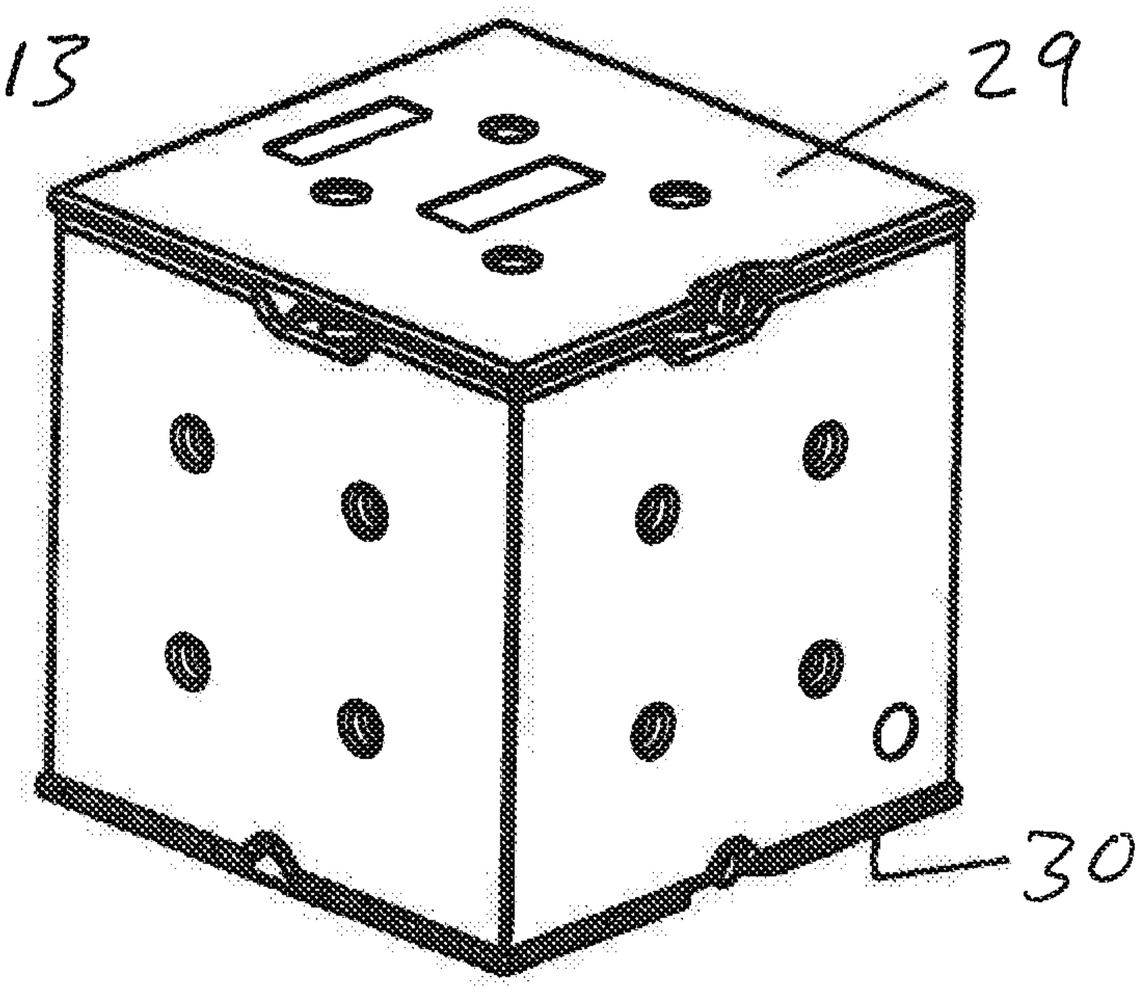

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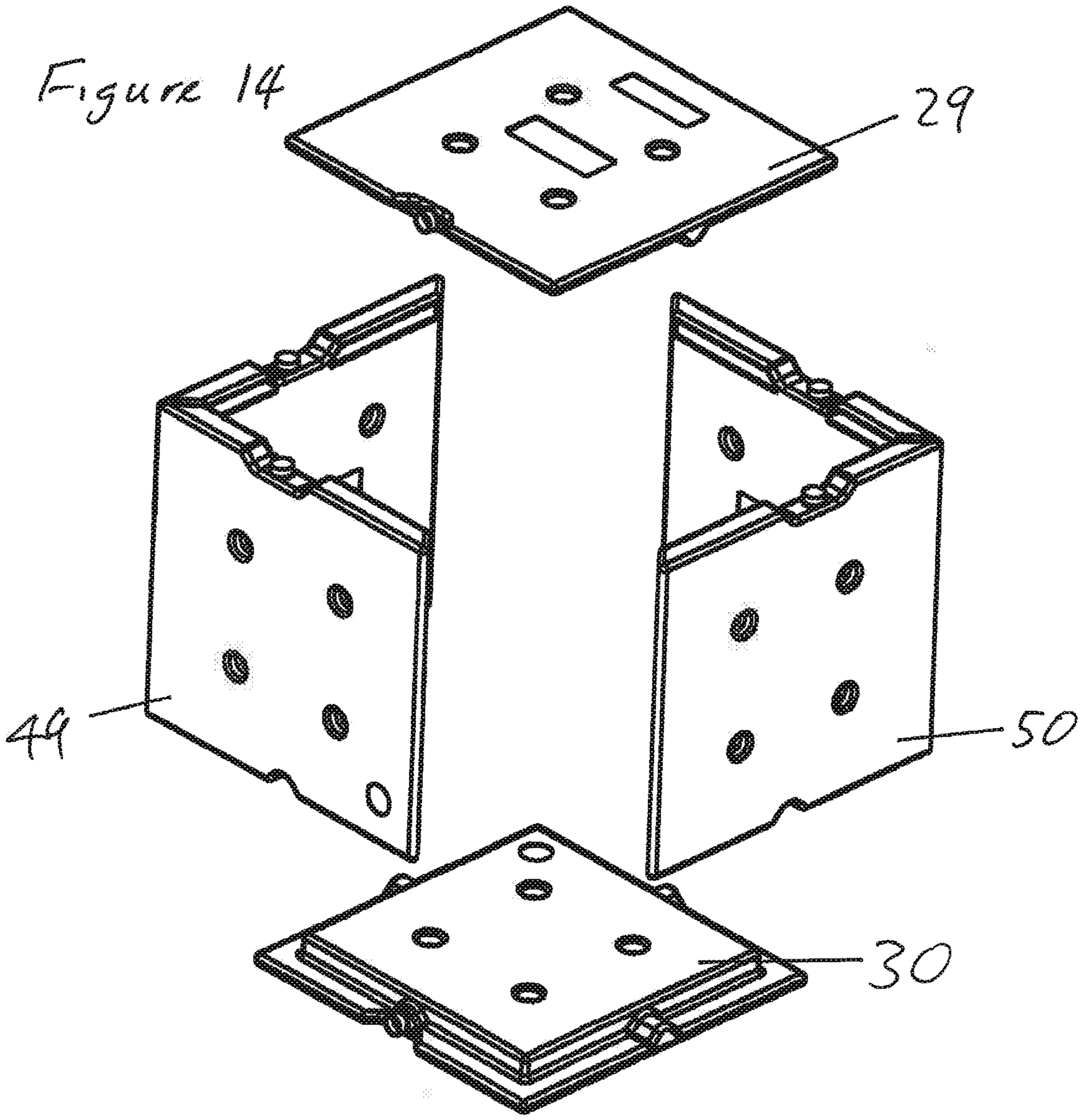

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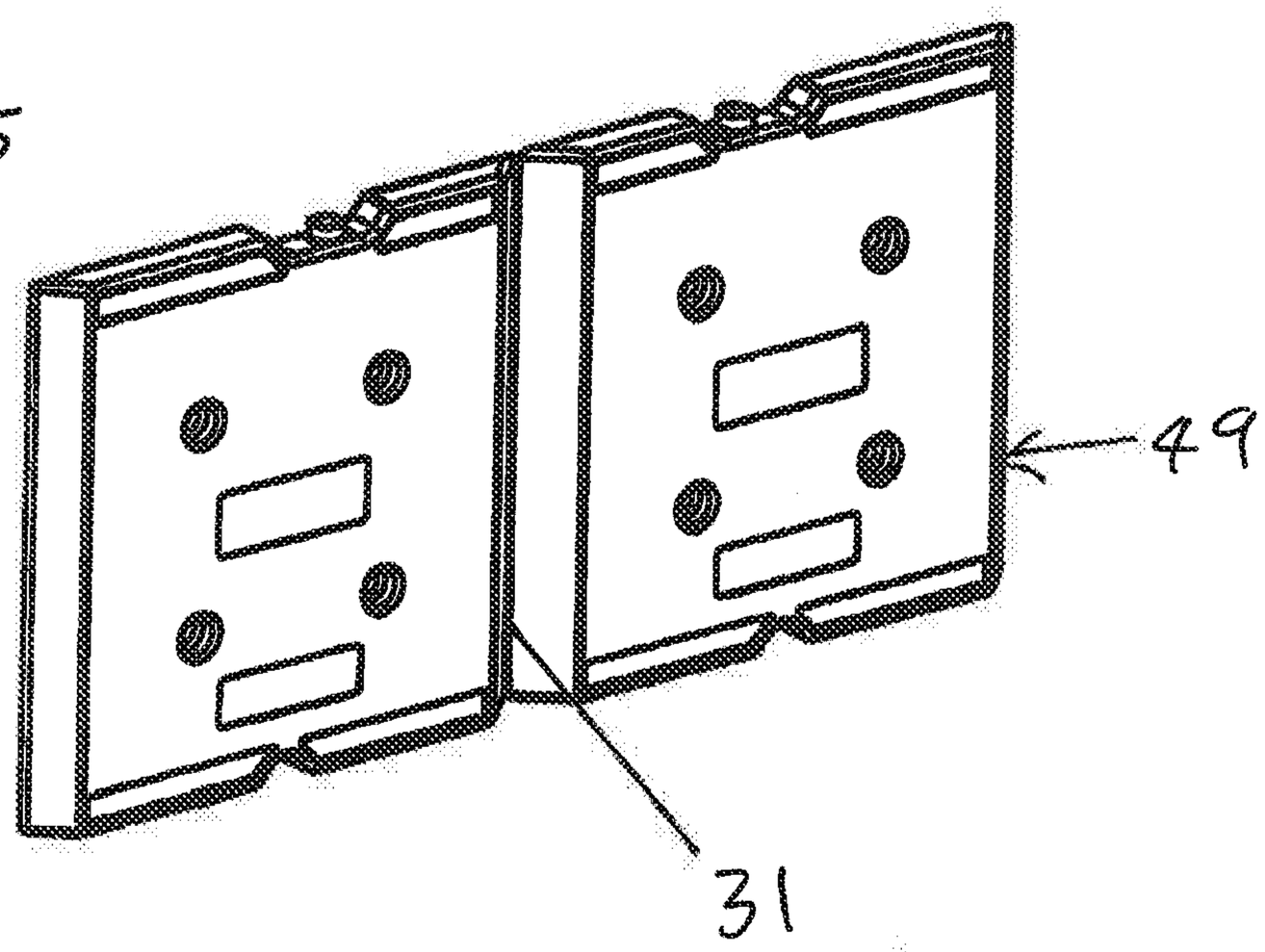

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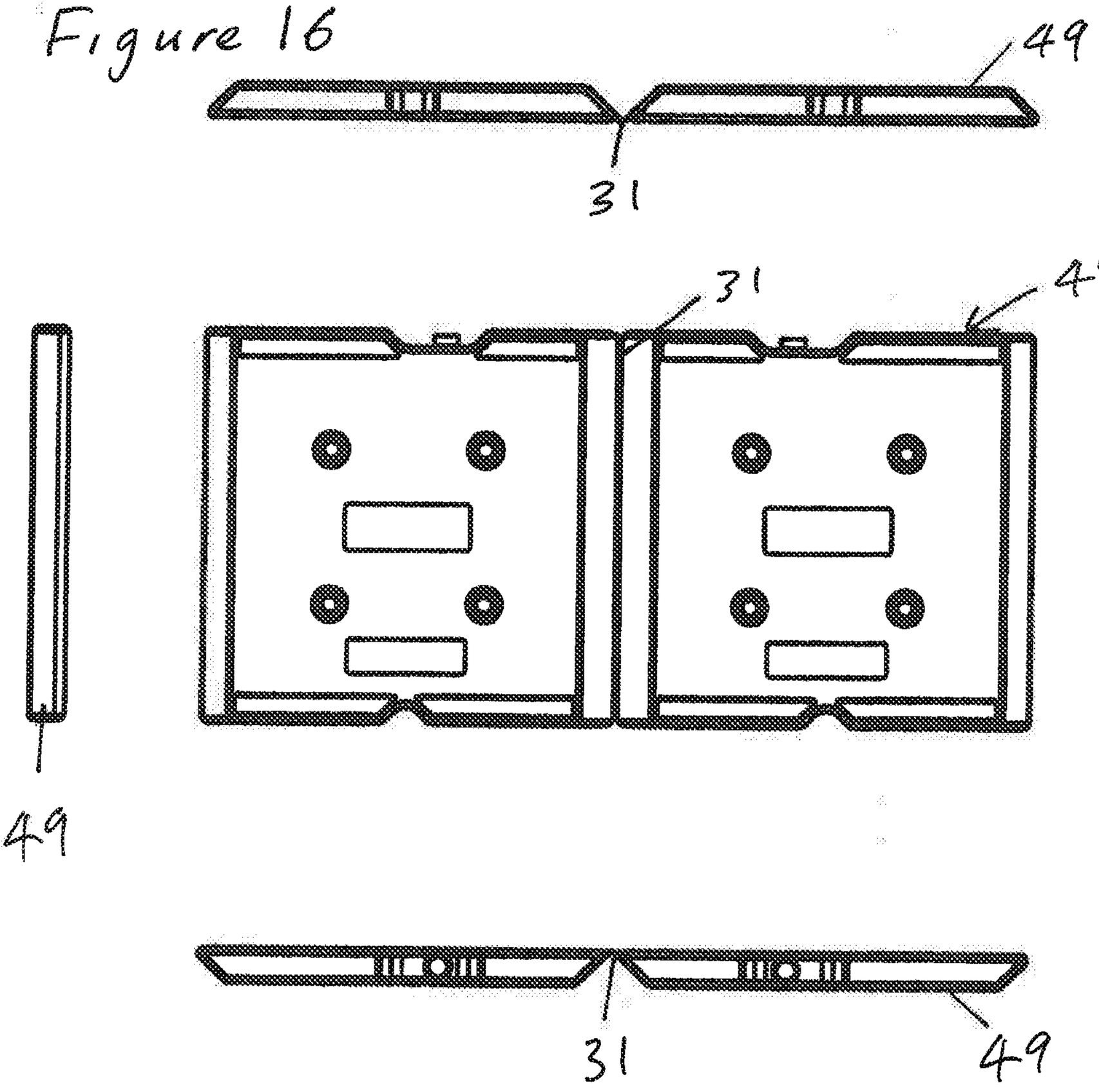

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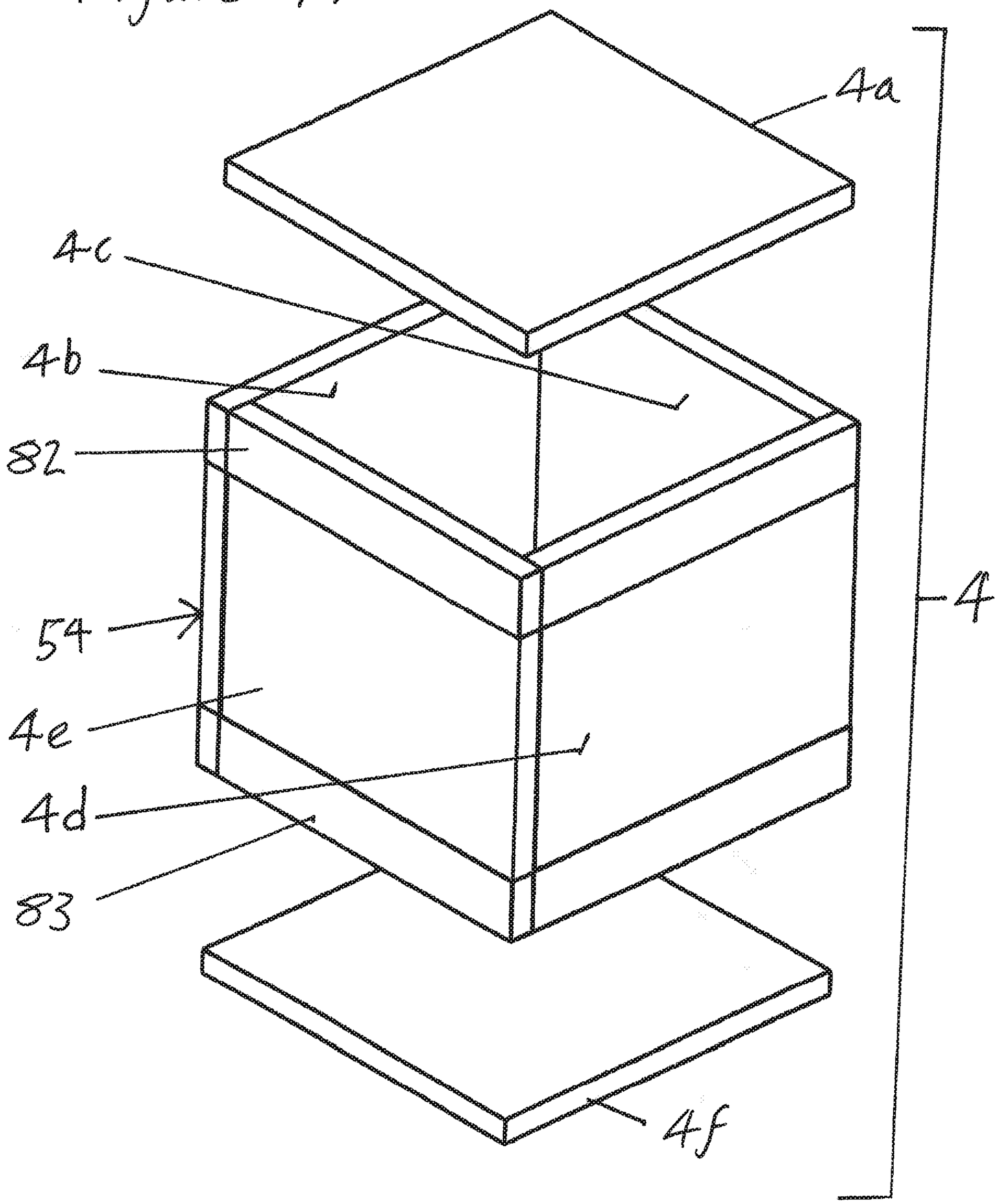

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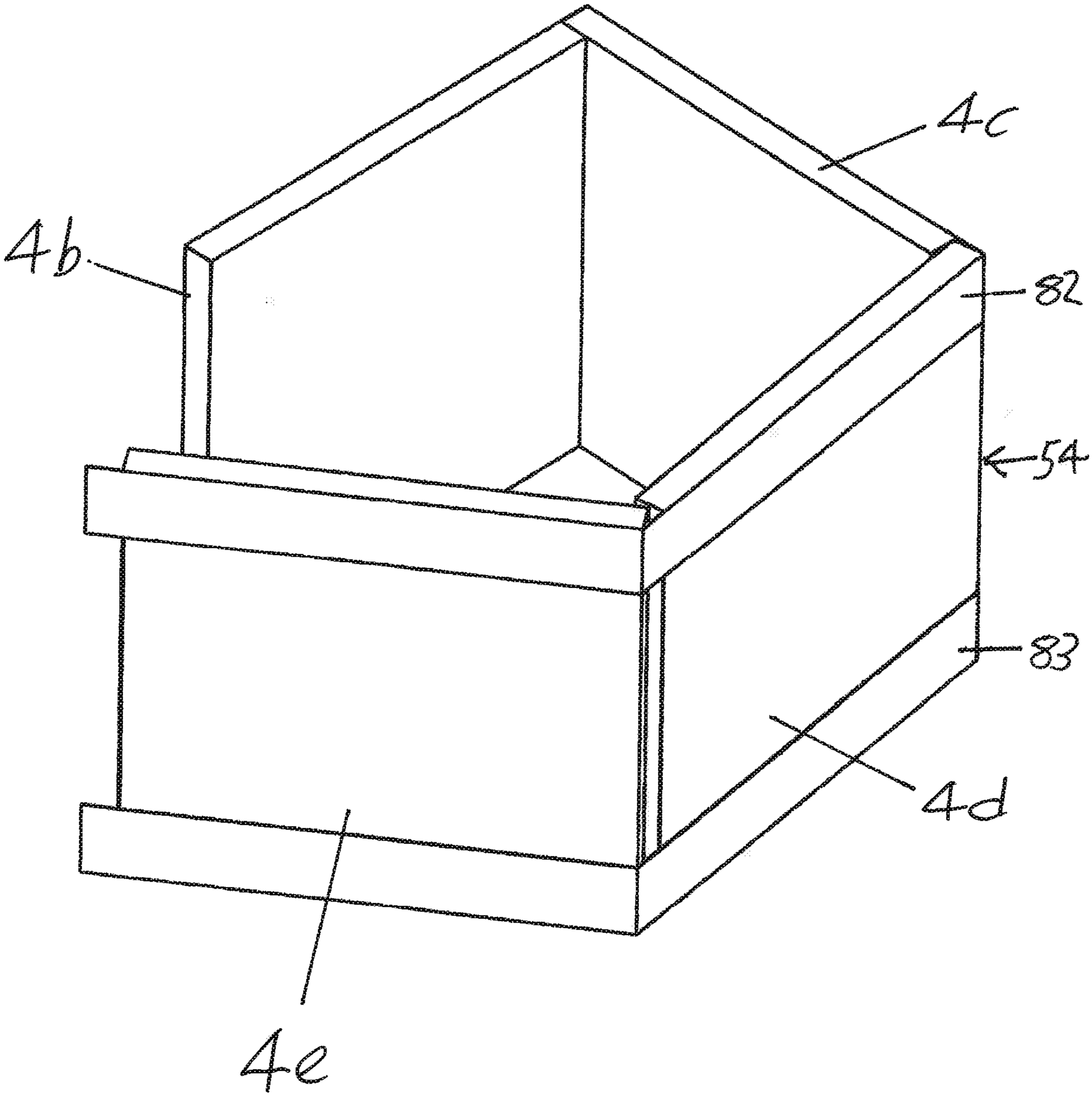

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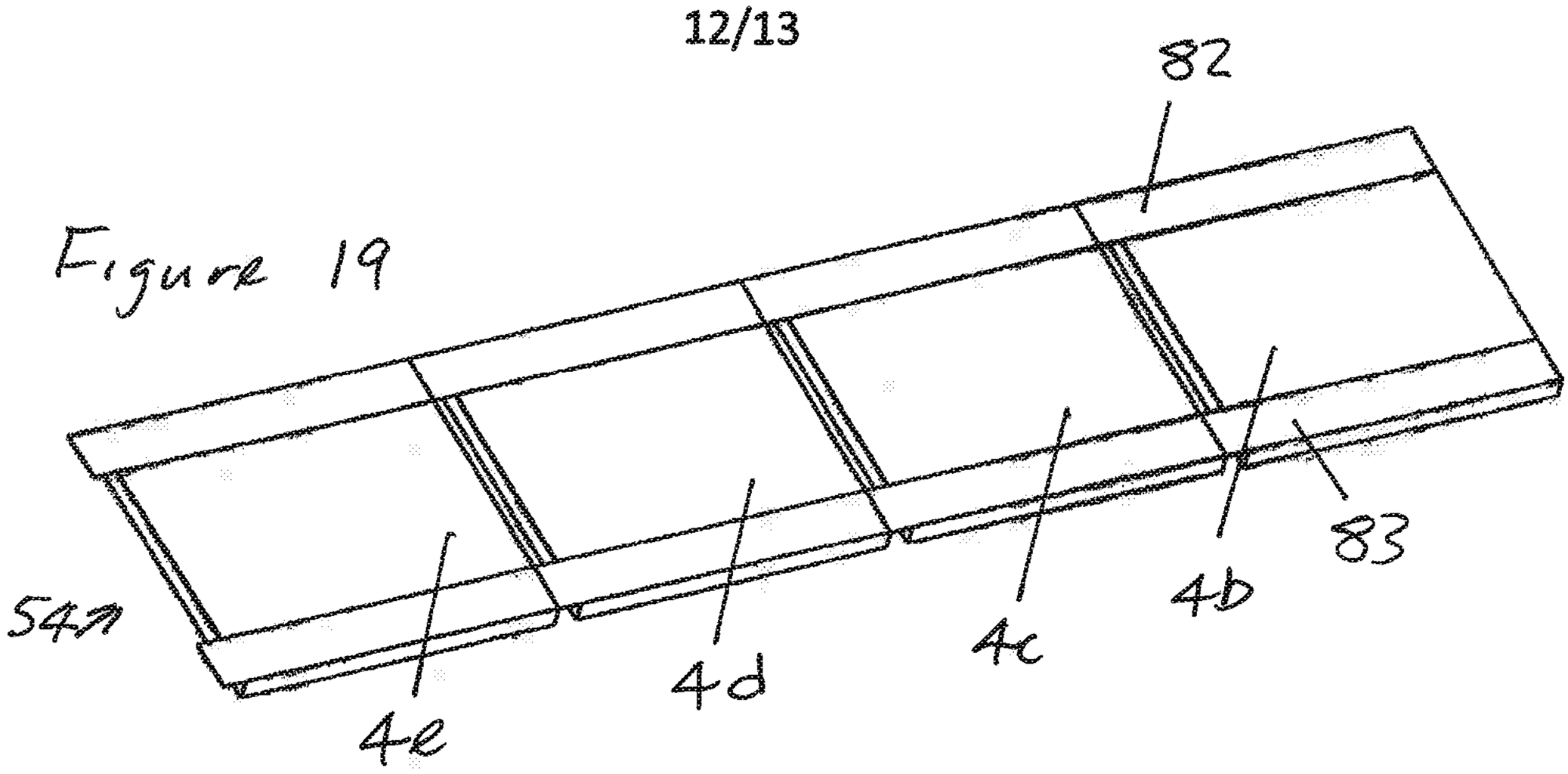
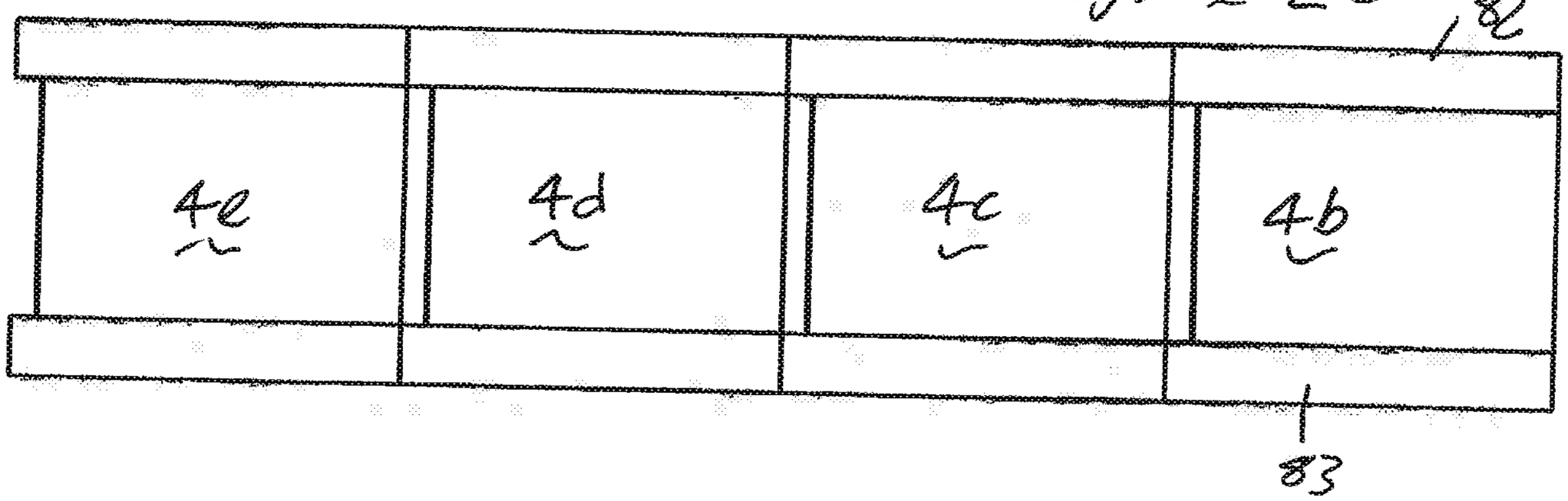


Figure 20



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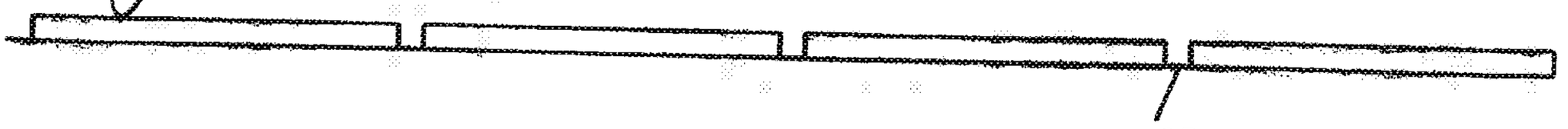


Figure 22

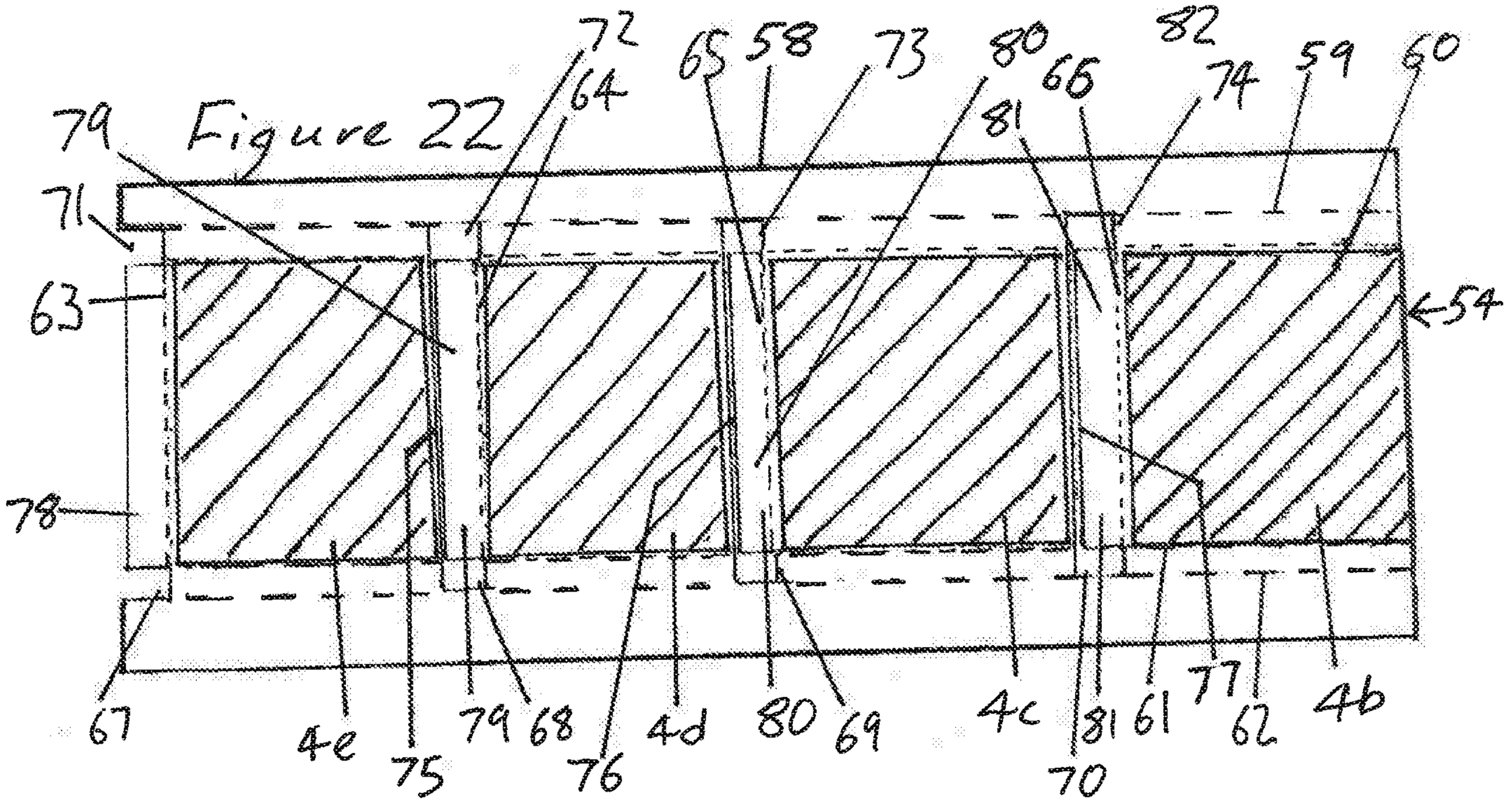


Figure 23

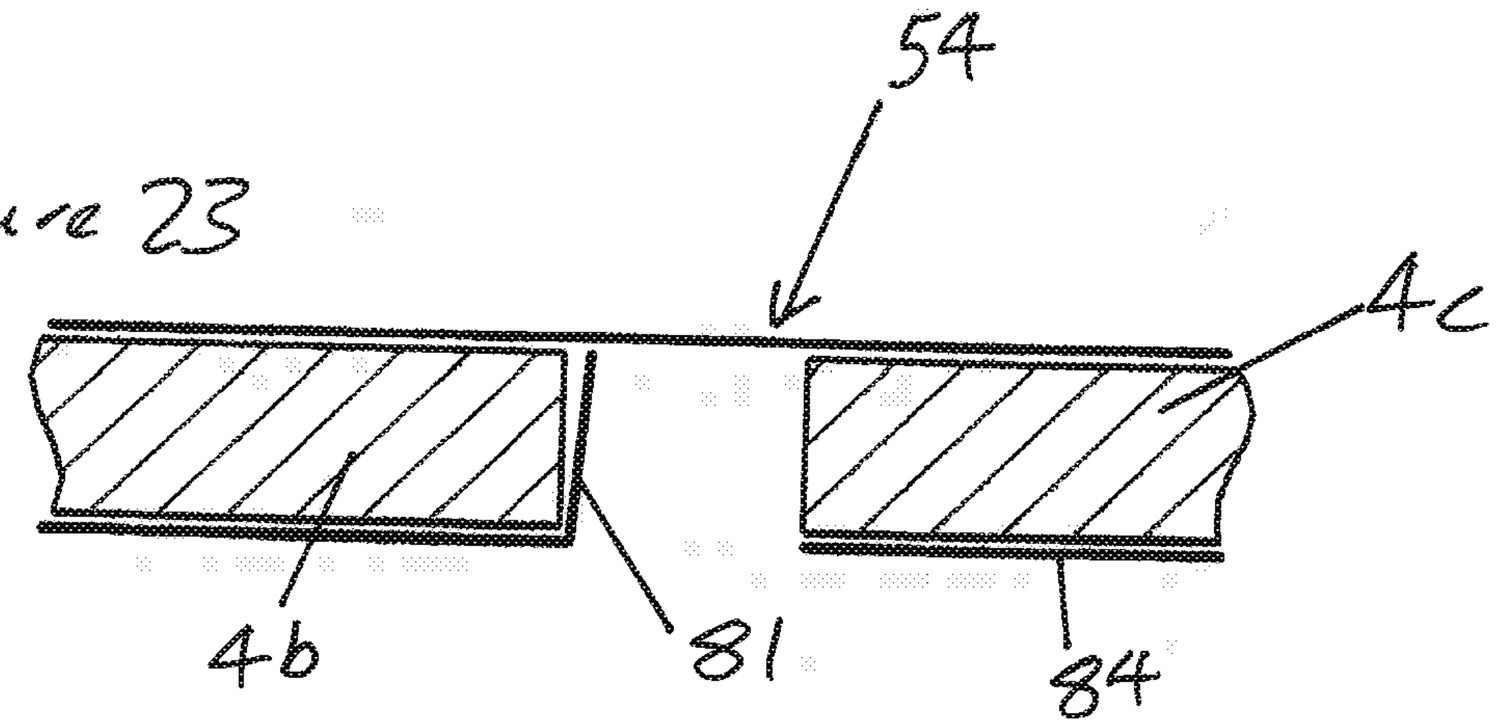


Figure 24

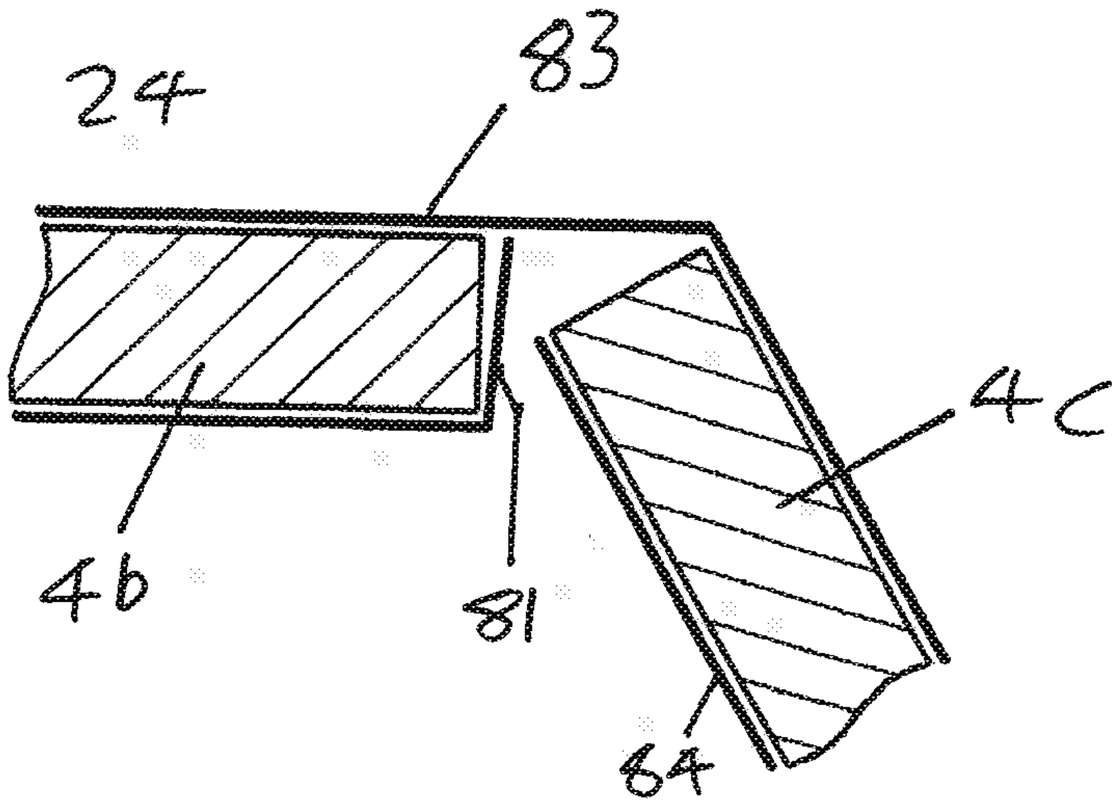
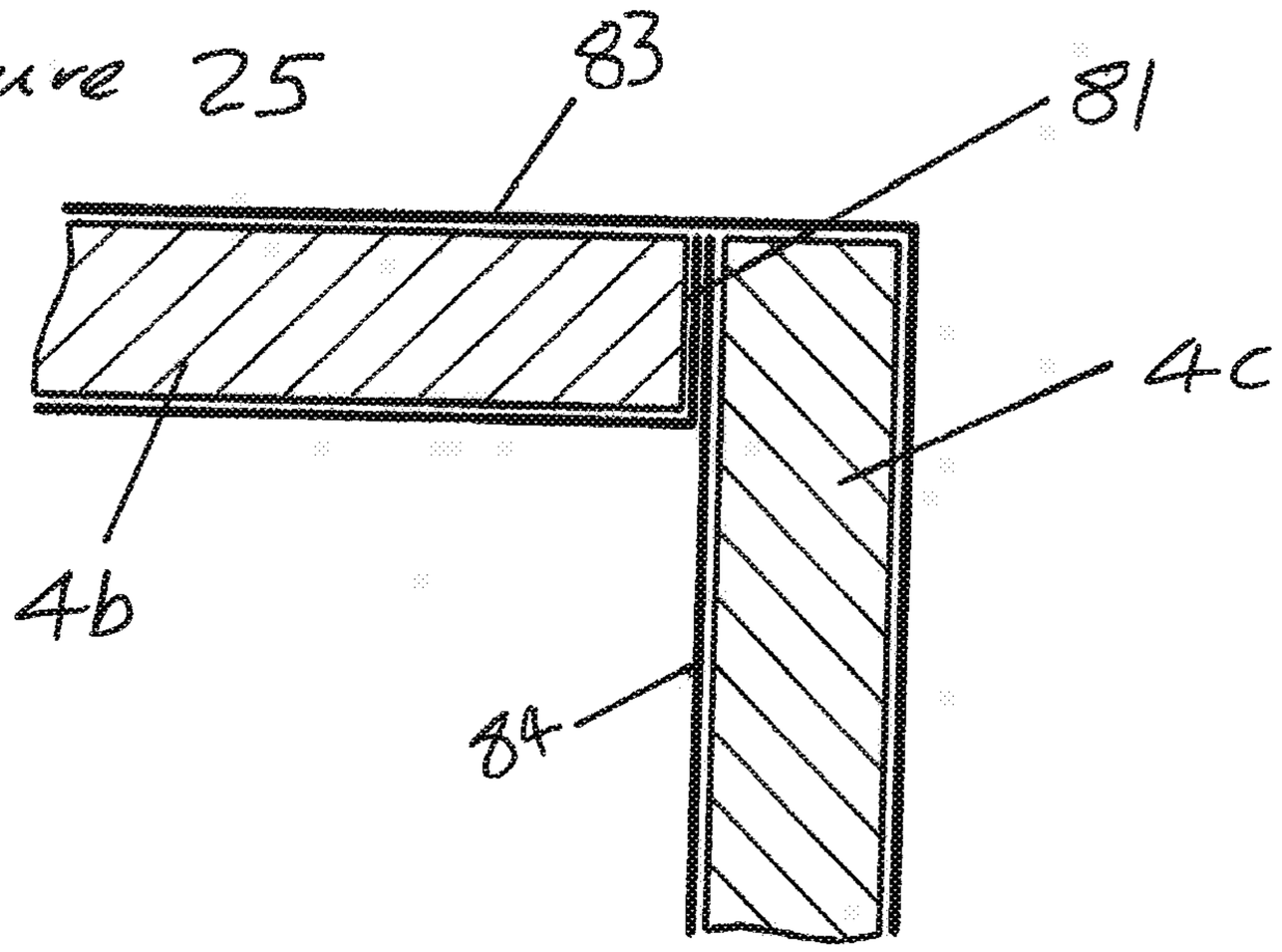


Figure 25



A Cool Pack Arrangement

The present invention relates to cool packs and particularly, but not exclusively, to a cool pack arrangement for use in a thermally insulated container. The invention has particular application for use in insulated containers, known as insulated shippers, which are used to transport products at stabilised temperatures.

It is important that some products, for example certain types of pharmaceuticals or biotech products, are maintained within a specified temperature range, typically 2° to 8°C, to prevent the product from being damaged, or its shelf-life being reduced relative to the shelf-life stated on the product. The product may be a very high value medicine or the like, which will be worthless if its temperature is not correctly controlled. This may be problematic during shipment and use of an insulated shipper will often be necessary to make shipment practicable.

Passive insulated shippers comprise an insulated container comprising an insulated outer casing which is lined with, or houses, a number of cool blocks, cool trays, gel packs, cool bricks or similar, which for the purposes of the present specification are collectively referred to as cool packs. These may be cooled until a phase change occurs in the refrigerant in the cool packs from a liquid to a solid, so that the subsequent phase change back from a solid to a liquid acts to maintain the contents of the container at a constant temperature. Examples of materials which change state from a solid to a liquid to produce a cooling effect, are paraffin wax and water-based solutions.

Although reference above and below is made only to cool packs and the requirement to maintain a product at or below a certain temperature, those packs may also be used to maintain a product above a certain temperature, for example to stop a product freezing if it is being shipped in a cold climate. Thus, although for the purposes of this specification they will be referred to only as cool packs and only the case of keeping the product cool will be discussed, it will be appreciated that the invention is equally

applicable to applications where it is desired to maintain the product above a desired temperature and the description and claims are to be interpreted so as not to preclude such an application.

Passive insulated shippers may comprise a container having three layers, an outer insulating layer, typically formed from expanded foam, an inner layer of cool packs and an intervening layer between the outer and inner layers made up of a number of vacuum insulation panels to provide enhanced insulation. The container may further comprise an outer casing to provide protection for the outer insulating layer during transportation and/or an inner lining.

A passive shipper of the type described above therefore has a large number of components which have to be initially assembled. Then, each time the container is used, at least the cool packs will normally have be removed, cooled, and then correctly reassembled in the container, possibly by staff not familiar with that particular container type.

Known containers for use as passive shippers usually have a number of cool packs, each in the form of a regular rectangular block, with six or more cool packs dispersed around a central space for the product that is to be shipped. Several, if not all of these cool packs may be identical to each other.

According to the present invention there is provided a cool pack arrangement comprising a first substantially planar cool pack having at least one edge with a first profile and a second substantially planar cool pack having at least one edge with a second profile, wherein the first and second profiles are such that when the first and second edges abut they provide a stepped path for any convection between the two edges.

The present inventors have realised that in certain applications, for example in a container such as a shipper, cool packs may not only provide a thermal mass for the

container but, if they are appropriately arranged, they may also provide a barrier to convection currents within the container. In addition, by using cool packs with appropriately profiled edges, so that when a cool pack arrangement is assembled the edges provide a stepped path for any convection between the two edges, convection currents between cool packs can be reduced and this may significantly improve the overall performance of the container.

By a “stepped path”, as used in the context of the present specification including the claims, it is meant that the path through which air must flow to get through a gap between adjacent cool packs includes an angle of approximately 90°. Such a stepped flow path significantly disrupts and reduces the flow of air especially inside a container where the flow of air is induced only by convection.

Providing a stepped profile between two edges also permits a minimum separation to be maintained between adjacent cool packs even though one of the cool packs may be imperfectly aligned with the other cool pack. For example, in the case where a first cool pack has a first profile with a step in it and the second cool pack has a second profile with a right angled edge, if the right angled edge of the second cool pack is arranged to sit in the step of the first cool pack, the second cool pack may move in a first direction parallel to the riser of the step, without increasing any separation between the riser of the step of the first cool pack and the edge of the second cool pack. Alternatively, if it moves in second direction parallel to the tread portion of the step of the first cool pack, then again any separation between the edge of the second cool pack and the tread portion of the step of the first cool pack will remain constant.

The stepped flow path may comprise a single step or it may comprise multiple steps, multiple steps further impeding the passage of convection.

In a particular advantageous embodiment of the present invention, the edge of the first cool pack has a first profile in the form of a step with a tread portion in the plane of

the first cool pack and a riser portion perpendicular to the plane of the first cool pack and wherein the second cool pack has an edge with a second profile with two surfaces at right angles to each other to permit the said two surfaces to each lie parallel to and abut a respective one of the tread portion and riser portion of the edge of the first cool pack. This permits the second cool pack to stand on the tread portion of the edge of the first cool pack so that the second cool pack extends substantially perpendicular to the plane of the first cool pack.

Preferably, where the second cool pack stands on the tread portion of the edge of the first cool pack, so that the second cool pack extends substantially perpendicular to the plane of the first cool pack, the riser portion of the edge of the first cool pack acts to at least partially restrain the second cool pack from leaning inwards over the first cool pack. In this manner, one of the cool packs may form a base portion and the other a wall portion with the base portion assisting to maintain the wall portion upright until the cool pack arrangement is fully assembled.

Preferably, the edge of the second cool pack has a square profile which will assist the cool pack stand on that edge during assembly of the cool pack arrangement as well as minimising the flow of air between the assembled edges of the first and second cool packs.

In one advantageous embodiment, the first cool pack forms a base portion with a plurality of straight edges each having a stepped profile, the arrangement comprising a plurality of second cool packs each arranged to stand upright on a respective edge of the first cool pack, thus the first cool pack and the plurality of second cool packs may form walls and a base. Where the cool packs are cooled, the stepped profile of the base portion will resist downward convection from the space defined by the cool packs and conduction through contact with the main body.

Preferably, all the second cool packs are identical to assist in assembly.

Advantageously, the first cool pack has four edges in the shape of a square or rectangle, the cool pack arrangement comprising at least four second cool packs arranged to stand on tread portions of the four edges of the first cool pack and abut each other to form a structure where the first cool pack forms a base portion with the four second cool packs upstanding from the edges thereof to form four wall portions. Preferably the side edges of each of the second cool packs is chamfered at substantially 45° so that each may abut a side edge of an adjacent cool pack, for in this manner the second cool packs may all be interchangeable and easily assembled.

The cool pack arrangement may comprise two identical first cool packs, where one of the first cool packs forms the base portion and the other forms a lid portion when inverted relative to the cool pack of the base portion, so that two first cool packs and four second cool packs may effectively form a complete six sided cool pack layer around a space for a product.

Advantageously, a top edge of each of the second cool packs, when assembled, has a profile substantially identical to the profile of its bottom edge, so that when each second cool pack abuts a respective edge of the cool pack forming the lid, the profiles of the respective adjoining edges are such that they provide a stepped path for any convection between the top edge of the second cool pack and the respective edge of the first cool pack forming the lid, thus convection is resisted along both the upper and lower edges of the cool pack arrangement. Preferably, the cool packs are substantially rigid to maintain their shape and therefore effectively seal with each other. They may be blow moulded and/or formed from high density polyethylene.

According to a second aspect of the invention, there is provided a thermally insulated container comprising a cool pack arrangement in accordance with a first aspect of the invention, wherein the container comprises four outer walls and a base formed of expanded foam in which the cool packs are accommodated. The container may comprise

a further layer of insulation panels between the cool packs and the outer insulation layer to improve thermal efficiency of the container and to provide a container with an outer insulation layer, an intermediate high insulation layer and a cool pack layer.

The invention will now be described by way of example only, with reference to the accompanying drawings, of which:

Figure 1 is a perspective exploded view of a thermally insulated shipping container with a cool pack arrangement in accordance with the present invention;

Figure 2 is a cutaway side elevation of the assembled container of Figure 1;

Figure 3 is a top view of the container of Figures 1 and 2 with the lid removed;

Figure 4 is an exploded view of the components of the outer casing of the container of Figure 1;

Figure 5 is a cutaway side elevation of the components of Figure 4 assembled;

Figure 6 is a plan view of the components of the lid portion of the casing of Figures 4 and 5 with a top cover portion removed;

Figure 7 is a perspective view of the cool pack arrangement of the container of Figure 1;

Figure 8 is a perspective exploded view of the cool packs of Figure 7;

Figure 9 is a perspective view of a top or bottom cool pack of Figure 8;

Figure 10 is a plan view, together with respective side elevations, of the cool pack of Figure 9;

Figure 11 is a perspective view of a side wall cool pack of Figure 7;

Figure 12 is plan view, together with respective side elevations, of the side wall cool pack of Figure 11;

Figure 13 is a perspective view of an alternative set of cool packs for the container of Figure 1;

Figure 14 is an exploded perspective view of the cool packs of Figure 13;

Figure 15 is a perspective view of a side wall cool pack of Figure 13;

Figure 16 is plan view, together with respective side elevations, of the side wall cool pack of Figure 15;

Figure 17 is an expanded perspective view of a top insulation panel, side wall insulation panel assembly and bottom insulation panel for the container of Figure 1;

Figure 18 shows the side wall insulation panel assembly of Figure 17 prior to insertion into the container of Figure 1;

Figure 19 is a perspective view of the side wall insulation panel assembly of Figure 18 laid out as a linear array;

Figure 20 is a plan view of the insulation panel assembly of Figure 19;

Figure 21 is a side elevation of the insulation panel assembly of Figure 20;

Figure 22 illustrates the components of the side wall insulation panel assembly of Figures 17 to 21, prior to assembly; and

Figures 23 to 25 are top views showing two side wall insulation panels of the side wall insulation panel assembly, of Figures 17 to 21, at various stages as the side wall insulation panels are folded together.

Referring to Figure 1, a thermally insulated shipping container 1 comprises a number of components which, as most clearly seen from the partially cutaway side elevation of Figure 2 and the plan view of Figure 3 (with the lid 13 removed) comprises three layers, indicated generally as a thermally insulating outer casing 2, a cool pack layer 3 comprising a cool pack arrangement in accordance with the present invention and a vacuum insulation panel layer 4 located between the two.

The components 5 to 12 of the thermally insulating outer casing 2 are disclosed and described in greater detail in and with reference to Figures 4 to 6 and the cool packs 29 to 35 forming the cool pack layer 3 are disclosed and described in greater detail in and with reference to Figures 7 to 16. The vacuum insulation panels forming the vacuum insulation panel layer 4, are located as shown in Figures 1 to 3 and comprise six panels 4a to 4f, providing additional insulation between the respective cool packs 4a to 4f and the outer insulation outer casing 3.

The four insulation panels 4b to 4e are side wall insulation panels and, although not shown in Figures 1 to 3, are assembled into insulation panel assembly as shown in and described with reference to Figures 17 to 25.

Referring now to Figure 4, the thermally insulating outer casing 2, shown in exploded view, comprises eight components each formed from expanded polypropylene (EPP) foam. The eight components comprise a base 5, a first pair of identical opposed walls 6 and 7, a second pair of identical opposed walls 8 and 9, a lid, indicated generally as 13 having an inner portion 10, a locking portion 11 and an outer portion 12.

Each of the second pairs of walls 8 and 9 have a plurality of sockets 14 moulded into both side edges of their outer faces. These engage with plugs 15 which protrude from extension portions 16 on the inward facing side edges of each of the first pairs of walls 6 and 7, only one set of which can be seen in Figure 4.

To assemble the outer casing 2, the second pair of walls 8 and 9 are positioned between respective pairs of extension portions 16 on each of the walls 6 and 7 and moved outwards until the plugs 15 on the walls 6 and 7 engage in the sockets 14 on the walls 8 and 9. Base 5 is then inserted and pushed down between the assembled walls 6 to 9 to the position shown in Figure 5, where it is retained in place by lips 17 and 18. The base locks the bottoms of the walls 6 to 9 in place by preventing walls 8 and 9 moving inwardly. The lid 13, when assembled sits between the walls 6 to 9, being retained in place by a step 20 running along the top edges of the walls 6 to 9. This similarly locks the tops of the walls 6 to 9 in place.

The lid 13, shown in Figure 4, has a locking portion 11 sandwiched between the inner portion 10 of the lid 13 and the outer portion 12 of the lid 13 which inner and outer portions 10 and 12 are fixed together to form the lid 13. The locking portion 11 is rotatably retained in place by a downwardly protruding pin 21, seen in Figure 5, engaging

in the aperture 22 in the inner portion of the lid 10 and with the upper protruding portion 23 of the locking portion 11 of the lid engaging in the aperture 24 in the outer portion of the lid 12.

The locking portion 11 has four protrusions 25, which when the locking portion 11 of the lid is rotated to a “locked” position extend beyond the four edges of the lid, engaging with respective slots 26 in the top of the walls 6 to 9, to lock the lid in place, as shown in Figures 5 and 6.

As can be seen most clearly from Figure 5, both the inner portion 10 of the lid 13 and the base 5 have recesses 27 and 28. The vacuum insulation panels 4a and 4f, forming the top and bottom of the vacuum insulation panel layer 4 of Figures 1 to 3, are accommodated in these recesses 27, 28, as shown in Figures 1 and 2. The remaining vacuum insulation panels 4b to 4e, of the outer vacuum, insulation panels 4 are then arranged as an assembly against the inner faces of the four walls 6 to 9 of the outer casing 2.

The thermally insulating outer casing 2, being formed from individually moulded walls 6 to 9 defines an inner space between the walls 6 to 9, which space has parallel vertical sides, which would not normally be possible if the four walls 6 to 9 and base 5 had been moulded as a single piece (for it would normally necessary to have tapered inner walls to permit the casing to be released from a mould tool). The advantage of having parallel inner walls is that they can correctly accommodate both standard rectangular or square vacuum insulation panels 4b to 4e of the vacuum insulation panel assembly discussed below with reference to Figures 7 to 16, keeping both the vacuum panels and cool packs tightly confined in order to minimise convection between adjacent panels or cool packs and to retain a correctly packed product in place.

If desired a stretch film wrap may be provided around three of the assembled walls and 6 to 9 of the outer casing 2, prior to the fourth wall being locked in place and

tensioning the film wrap. This may not only assist in keeping the walls of the outer container locked together, especially in the event of the container being dropped or otherwise suffering a major impact, but the wrap may also be pre-printed and thus provides an easy way of customising graphics on the container 1 for a particular customer, or enables the customer to easily apply their own graphics.

Once the outer casing 2 has been assembled, as shown in Figure 5, and the vacuum insulation panels 4b to 4e inserted, the cool packs (once cooled) of Figures 7 to 16 may be inserted therein to form the cool pack layer 3.

The cool pack layer is shown in Figure 7 as it would be arranged in the container 1 of Figure 1. As shown in Figure 8, the cool pack layer 3 comprises only two components types, comprising identical top and bottom cool packs 29 and 30, shown in greater detail in Figures 9 and 10, and four identical side wall cool packs 32 to 35, shown in greater detail in Figures 11 and 12. Each of the cool packs may be formed by standard moulding technique and filled with a water-based material or other phase change material such as paraffin wax, which can subsequently be cooled.

The top and bottom cool packs 29 and 30 will now be described in more detail with reference to Figures 9 and 10. In the following discussion the illustrated cool pack is taken to be the bottom cool pack 30, but the same features are found on the identical top cool pack 29 of Figure 8.

The bottom cool pack 30 of Figure 9 is provided with a step 36 around all four edges, with a fill point cap 37 on one of the edges. Because the cool pack 30 is relatively thin in the region below the step 36, the fill point cap 37 extends above the level of the tread portion of the step 36 and partly protrudes out of the riser portion of the step above the tread portion. In corresponding positions on each of the other three sides of the cool pack 30 there are provided blanking protrusions 38 to 40, the purpose of which is described below.

Referring now to Figures 11 and 12, there is illustrated one side wall cool pack 35, identical to each of the other side wall cool packs 32 to 34. This has flat top and bottom edges 41, 42 perpendicular to the front and rear faces of the cool pack 35 and side edges 43, 44 chamfered at 45° to abut adjacent chamfered side edges 44, 43 of adjacent cool packs, when assembled as shown in Figure 7 inside the container 1 of Figure 1.

Referring again to Figures 11 and 12, each side wall cool pack 32 to 35 has vertical notches 45 formed along the top and bottom edges of its inner face and a small recess 46 in the top or bottom edge 42 and a larger recess 47 formed in the opposite edge 41, in which the fill point cap 48 is accommodated, off-set to one side of the layer recess 47. The notches 45 assist when lifting the side wall cool packs 32 to 34 out of the container. The fill point cap 48 being off-set leaves the recess 47 clear in a midpoint, opposite to the smaller recess 46 in the opposite edge. The side wall cool packs 32 to 35 are readily distinguishable from the top and bottom cool packs 29 and 30 by their chamfered side edges 43, 44 and absence of a step 36. Therefore, when inserting a cool pack layer 3 within the assembled outer casing 2 it is to identify the top and bottom cool packs 29, 30 from the side wall cool packs 32 to 35 and first place one into the base of the outer casing 2 of the container 1 of Figure 1.

Each side wall cool pack 32 to 35, in use, may be located in any of the four side wall positions of Figure 7 and may be mounted with either of its flat edges downwards, as each side wall cool pack 32 to 35, either way up, will accommodate the fill point cap 37 of the bottom cool pack 30. This will either be accommodated in a smaller recess 46 or a larger recess 47 of the respective side wall cool pack 32 to 35.

The riser portion of the step 36 on the bottom cool pack 30, abutting the horizontal flat bottom edge of the side wall cool packs 32 to 35, resists convection of air by providing a double step for any convection currents to negotiate. This double step

feature is also present along the top edges of the side wall cool packs 32 to 35, where they engage the step 36 of the top cool pack 29 of Figure 5.

When the cool packs 29 to 34 are assembled, as shown in Figure 7, the protrusions 38 to 40 on the top and bottom cool packs 29 and 30 fit and fill the notches 46 or 47 of the side wall cool packs 32 to 35, (necessary to accommodate fill point cap 37) and restrict the convection through these notches to further prevent convection.

The step 36 on the bottom cool pack 30, being square, as opposed to chamfered, additionally assists in assembly of the side wall cool packs 32 to 35, for the step 36 acts to stop the first side wall cool pack inserted falling inwards before adjacent side wall cool pack 32 to 35 are inserted.

Referring now to Figures 13 to 16, there is shown a slightly modified set of cool packs 49, 50 for use, as the wall portion of the cool pack layer 3 of the container 1 of Figure 1. The top and bottom cool packs 29 and 30 are identical to those disclosed in Figures 7 to 9, but in this embodiment instead of there being four side wall cool packs there are instead only the two identical “double” side wall cool packs 49 and 50. Each of the two side wall cool packs 49 and 50 effectively comprises two side wall cool packs as previously described with reference to Figures 7 to 8 and 11 to 12, but which are joined by a living hinge 31. These can be formed by blow moulding in a conventional manner but with the sides of the moulds being brought together to form a living hinge 31, or the living hinge 31 can be formed by a separate subsequent step in the manufacturing process.

Referring now to Figure 17, this illustrates the components of the vacuum insulation panel layer 4.

The vacuum insulation panel layer 4 comprises a top vacuum insulation panel 4a, a bottom vacuum insulation panel 4f and a vacuum insulation panel assembly 54.

As will be described below with reference to Figures 23 to 25, with this assembly 54, the side wall vacuum insulation panels 4b to 4e may be tightly bound together when in use, as illustrated in Figure 17 and 18, without the need to tape them together. This also provides a vacuum insulation panel assembly 54 that is capable of being easily and quickly inserted into the thermally insulating outer layer 2, once this has been assembled.

The components of the vacuum insulation panel assembly 54 are shown in Figure 22, prior to assembly. These comprise the four side wall insulation panels 4b to 4e and a thin PVC sheet 58. The PVC sheet 58 is shown laid flat with the four side wall vacuum insulation panels 4b to 4e laid thereon with their outer faces uppermost. The PVC sheet is formed with four creases 59 to 62 extending parallel to the top and bottom edges of the sheet 58 and four creases 63 to 66 extending perpendicular to the top and bottom edges of the sheet 58. Each crease is formed so that it acts to fold the sheet to either side of the crease, out of the page as shown in Figure 23.

The sheet 58 has four cut out sections (although they could be formed other than by being cut) 67 to 70, formed between the parallel creases 61 and 62 and four corresponding cut out sections 71 to 74 formed between parallel creases 59 and 60. In addition, cuts 75 to 77 extend between respective pairs of cut out sections 68, 72; 69, 73; and 70, 74 to form four flaps 78 to 81 defined by the respective cuts 75 to 77 or edge of the sheet 58 and respective perpendicular creases 63 to 66. The width of each flap 78 to 81 is the same as the depth of the side wall vacuum insulation panels 4b to 4e, with the perpendicular creases 63 to 66 urging the flaps 78 to 81 vertically, out of the page as shown in Figure 22, so that they lie adjacent to a side edge of a respective vacuum insulation panel 4b to 4e.

The two parallel creases 59 and 60 are also separated by a distance equal to the width of the vacuum insulation panels 4b to 4e, with the two creases together urging the top edge portion of sheet 58 to fold through 180° and wrap over the top edge of the vacuum insulation panels, sandwiching the vacuum insulation panels therebetween.

Creases 61, 62 likewise cause the bottom edge of the sheet 58 to wrap over the bottom edges of the vacuum insulation panels 4b to 4e. Thus, the top and bottom edges of the sheet 58, as shown in Figures 17 to 20, thus now respectively form a top strip 82 and a bottom strip 83, which strips 82, 83 both extend across the outer faces of vacuum insulation panels 4b to 4e. The vacuum insulation panels can optionally then be adhered in place.

Referring now to Figure 23, this shows an edge view of a section of the vacuum insulation panel assembly 54, showing the sheet 58 and two of the vacuum insulation panels 4b and 4c. From Figure 23 it can be seen that in addition to forming top and bottom strips 82 and 83 (only 82 of which is shown) on the outward facing surfaces of vacuum insulation panels 4b to 4e, the sheet 58 also provides covering sections 84 for the inner faces of the vacuum insulation panels 4b to 4e. Respective flaps 78 to 81 form extension portions to the covering sections 84, which wrap around one edge only of the respective vacuum insulation panels 4b to 4e.

As shown in Figures 24 and 25, as adjacent vacuum insulation panels 4b, 4c are folded together, the flap 81 is sandwiched between a side edge of vacuum insulation panel 4b and the side edge of a front face of adjacent vacuum insulation panel 4c, with the top and bottom strips 82 and 83 urging the side edge of vacuum insulation panel 4c against the edge of an inner face of adjacent vacuum insulation panel 4b and maintaining them there, avoiding the need for the vacuum insulation panels 4b, 4c to be subsequently taped together. Once the vacuum insulation panel assembly 54 has been folded together, as shown in Figure 17, the PVC sheet 58 then forms a lining for the inner surfaces of the side wall vacuum insulation panels 4b to 4e. These surfaces are maintained substantially flat by one side edge of the covering section 84 and extension portion, or flaps 78 to 81 forming a right angle and with the opposite edge of each covering section 84 overlapping with and being sandwiched against the respective flap 78 to 81, as shown in Figure 23. Thus each covering section 84 effectively not only covers the inner face of each side wall vacuum insulation panel 4b to 4e, but also extends over the top and bottom edges to form

top and bottom strips 82 and 83. Thus the sheet 58 covers all exposed surfaces of the vacuum insulation panels 4b to 4e when they are assembled in the thermal insulating outer casing 2 of container 1 and protects the vacuum insulation panels 4b to 4e when the cool packs are inserted in the container 1.

One embodiment of the present invention has been described by way of example only with reference to the accompanying drawings and it will be apparent that many modifications may be made which fall within the scope of the invention as defined by the appended claims.

In addition to the features recited in the claims other potentially novel aspects are set out in the following clauses:

Clause 1. A lid for a thermally insulated container, the lid comprising a main body formed from an expanded foam and a locking member formed from an expanded foam, the main body being arranged to be received in and to close a mouth of the container and the locking member being arranged to be rotated to lock the lid in place.

Clause 2. A lid as claimed in Clause 1, wherein the main body of the lid is substantially planar and the locking member comprises at least one latch rotatably engaged in the main body of the lid and arranged to rotate about an axis substantially perpendicular to the plane of the main body, wherein in a first unlocked position the latch is housed within the main body and wherein, in a locked position, the latch extends out of the main body to engage with a wall of the container.

Clause 3. A lid as claimed in Clause 2, wherein the at least one latch is formed integrally with a pin about which the lock member rotates.

Clause 4. A lid as claimed in any preceding clause, wherein the main body of the lid forms a mouth through which the at least one latch extends when in the locked position.

Clause 5. A lid as claimed in any preceding clause, wherein the main body of the lid is rectangular and wherein the locking member comprises at least two latches which, when the locking member is in a locked position, respectively extend out of the main body midway along two opposite sides of the main body.

Clause 6. A lid as claimed in Clause 5, wherein the main body is square and the locking member has four latches which, when the locking member is in a locked position, respectively extend out of the main body midway along each of the four sides.

Clause 7. A lid as claimed in any preceding clause, wherein the locking member is arranged to rotate about a central axis in the main body of the lid.

Clause 8. A lid as claimed in any preceding clause, wherein the main body of the lid comprises a top layer and a bottom layer with the locking member sandwiched between the two layers of the main body.

Clause 9. A lid as claimed in Clause 8, wherein the top and bottom layers are fixed together, with the locking member rotatably sandwiched therebetween.

Clause 10. A lid as claimed in Clause 8 or 9, wherein the locking member has a round handle portion having a first outer diameter and the top layer of the main body has a round aperture having a second diameter of substantially the same diameter as the first diameter so that the aperture of the top layer acts to position the handle and thus the locking member and through which aperture the handle is accessible and may be rotated.

Clause 11. A lid as claimed in Clause 10, wherein the aperture in the top layer of the locking member forms a bushing for the handle to permit the handle and locking member to rotate.

Clause 12. A lid as claimed in any preceding clause, wherein the locking member is integrally formed from a single piece of foam.

Clause 13. A lid as claimed in any preceding clause, wherein the locking member is formed of expanded polypropylene.

Clause 14. A lid as claimed in any preceding clause formed entirely of expanded polypropylene.

Clause 15. A thermally insulated container comprising a lid as claimed in any preceding clause.

Clause 16. A container as claimed in Clause 15, formed of an expanded foam and having four walls formed of expanded foam which walls define a mouth of the container, wherein the mouth of the container is dimensioned to receive the lid and has a step formed in the foam of the walls around an inner edge, to retain the main body of the lid in position.

Clause 17. A container as claimed in Clause 16, wherein the walls have a plurality of slot-like recesses on their inner surface into which the latches extend when the lid is in the locked position.

Clause 18. A container as claimed in any of Clauses 15 to 17, wherein the container is a thermally insulated shipping container and comprises an outer thermally insulating layer of expanded foam, an intermediate layer of insulation panels and an inner cool pack layer.

Clause 19. A container as claimed in any one of Clauses 15 to 18, wherein the locking member of the lid has a handle and wherein the handle is flush with the top of the walls of the container.

Clause 20. A container as claimed in any one of Clause 15 to 19, wherein the outer layer of the container is formed of expanded polypropylene.

Clause 21. A thermally insulated container comprising an expanded foam layer and a further layer, internal of the expanded foam layer, formed of a plurality of cool packs or insulation panels, wherein the expanded foam layer includes a number of individual preformed sections assembled to form a main body of the container, the main body consisting of a rectangular base and four wall sections, wherein inner faces of opposed pairs of wall sections are substantially parallel to each other.

Clause 22. A container as claimed in Clause 21, wherein the expanded foam layer includes an individual base section and four individual wall sections.

Clause 23. A container as claimed in Clause 22, wherein a first side edge of one wall section has a first set of engagement means and an adjacent side edge of an adjacent wall section has a second set of engagement means arranged to cooperate with the first set of engagement means to hold the two wall sections together along their adjacent side edges.

Clause 24. A container as claimed in Clause 23, wherein the first and second sets of engagement means are arranged such that in order to assemble two adjacent wall sections together one wall section is placed approximately in the desired position relative to the other, but slightly inside of its final position and then pushed outwards to its final position to engage the two sets of engagement means.

Clause 25. A container as claimed in Clause 23, wherein appropriate sets of engagement means are located at the side edges of each of the four wall sections to hold all four wall sections together.

Clause 26. A contained as claimed in Clause 25, wherein all four wall sections are identical.

Clause 27. A container as claimed in any one of Clauses 23 to 25 , wherein a first pair of opposed wall sections each have first sets of engagement means and the second pair of opposed wall sections each have a second sets of engagement means arranged to cooperate with the first sets of engagement means in order to hold the four wall sections together in a rectangle wherein, to assemble the four wall sections, the first pair of opposed wall sections are set slightly inward of the engagement means which extend from the second pair of opposed wall sections, with the first set of opposed wall sections being arranged to engage the second set of opposed wall sections by being pushed outwards so that the first and second sets of engagement means engage each other.

Clause 28. A container as claimed in any one of Clauses 23 to 27, wherein the engagement means are integrally formed with a respective wall section.

Clause 29. A container as claimed in any one of Clauses 23 to 28, wherein the base section and wall sections are arranged such that insertion of the base section through a mouth of the container, defined by the four wall sections, to a lower position where it forms the base of the expanded foam layer of the container, locks the wall sections into position by preventing their lower edges from moving inwards.

30. A container as claimed in any one of Clauses 22 to 29, further comprising a lid section formed of expanded foam, wherein the upper edge of the wall sections define a mouth of the container and are profiled to form a step around an inner edge of the mouth, wherein the lid is dimensioned to sit within the mouth on the step and to lock the wall sections in place by preventing them from moving inwards.

Claus 31. A container as claimed in Clause 30, wherein the lid sits flush within the top edges of the wall sections and has a locking mechanism which engages with slots on the inner surface of at least some wall sections.

Clause 32. A container as claimed in any preceding clause, comprising a plurality of rectangular cool packs forming a cool pack layer to be inserted into the main body, wherein the cool packs are arranged to fit closely together and to be held in position directly or indirectly by the proximity of the wall sections of the outer expanded foam layer.

Clause 33. A container as claimed in Clause 32, further comprising a layer of rectangular vacuum insulation panels between the cool pack layer and the expanded foam layer.

Clause 34. A container as claimed in any preceding clause, wherein the expanded foam layer is expanded polypropylene.

Clause 35. A container as claimed in any preceding clause, further comprising a film wrap dimensioned to fit around the four wall sections of the container.

Clause 36. A container as claimed in Clause 35, wherein the container is arranged such that the film wrap can be placed around three assembled wall sections of the container prior to the fourth wall section being put in place and tensioning the film wrap.

Claims

1. A cool pack arrangement comprising a substantially planar base and/or lid cool pack having a first edge, and a substantially planar side wall cool pack having a second edge, wherein each cool pack comprises a phase change material and an outer casing containing the phase change material, and wherein the first and second edges are profiled such that when the first and second edges abut, the first and second edges provide, substantially continuously along the entire length of the abutting edges, a stepped path for any air flow between the two edges, which stepped path includes an angle of approximately 90 degrees.

2. A cool pack arrangement as claimed in Claim 1 wherein the stepped path comprises a single step.

3. A cool pack arrangement as claimed in Claim 1 wherein the stepped path comprises multiple steps.

4. A cool pack arrangement as claimed in Claim 1, 2 or 3 wherein the first edge of the base and/or lid cool pack has a first profile in the form of a step with a tread portion in the plane of the base and/or lid cool pack and a riser portion perpendicular to the plane of the base and/or lid cool pack and wherein the side wall cool pack has an edge with a second profile with two surfaces at right angles to each other to permit the said two surfaces to each lie parallel to and abut a respective one of the tread portion and riser portion of the edge of the base and/or lid cool pack and permit the side wall cool pack to stand on the tread portion of the edge of the base and/or lid cool pack so that the side wall cool pack extends substantially perpendicular to the plane of the base and/or lid cool pack.

5. A cool pack arrangement as claimed in Claim 4, wherein when the side wall cool pack stands on the tread portion of the edge of the base and/or lid cool pack, so that the side wall cool pack extends substantially perpendicular to the plane of the base and/or lid

cool pack, the riser portion of the edge of the base and/or lid cool pack acts to at least partially restrain the side wall cool pack from leaning inwards over the base and/or lid cool pack.

6. A cool pack arrangement as claimed in any preceding claim wherein the second edge has a square profile.

7. A cool pack arrangement as claimed in any preceding claim wherein the base and/or lid cool pack forms a base portion with a plurality of straight edges each having a stepped profile, the arrangement comprising a plurality of side wall cool packs each arranged to stand upright on a respective edge of the base and/or lid cool pack.

8. A cool pack arrangement as claimed in Claim 7 wherein the side wall cool packs are all identical.

9. A cool pack arrangement as claimed in Claim 7 or 8 wherein the base and/or lid cool pack has four edges in the shape of a square or rectangle, the cool pack arrangement comprising at least four side wall cool packs arranged to stand on tread portions of the four edges of the base and/or lid cool pack and abut each other to form a shape where the base and/or lid cool pack forms a base portion with the four side wall cool packs upstanding from the edges thereof to form four wall portions.

10. A cool pack arrangement as claimed in Claim 9 wherein the four side wall cool packs are identical.

11. A cool pack arrangement as claimed in claim 9 or 10, wherein side edges of each side wall cool pack are chamfered at substantially 45 degrees so that each may abut a side edge of an adjacent side wall cool pack.

12. A cool pack arrangement as claimed in Claim 9, 10 or 11 comprising two identical base and/or lid cool packs, wherein one of the base and/or lid cool packs forms the base portion and the other forms a lid portion when inverted relative to the cool pack of the base portion.

13. A cool pack arrangement as claimed in Claim 12 wherein a top edge of each of the side wall cool packs has a profile substantially identical to the profile of its bottom edge, so that when each side wall cool pack abuts a respective edge of the cool pack forming the lid, the profiles of the respective adjoining edges are such that they provide a stepped path for any convection between the top edges of the side wall cool packs and the respective edge of the base and/or lid cool pack forming the lid.

14. A cool pack arrangement as claimed in any preceding claim wherein each cool pack is blow moulded.

15. A cool pack arrangement as claimed in any preceding claim wherein each cool pack is formed from a high density polyethylene.

16. A thermally insulated container comprising a cool pack arrangement as claimed in any preceding claim, the container comprising four outer walls and a base formed of expanded foam into which the cool packs are arranged to be inserted.

17. A container claimed in Claim 16, wherein the cool packs are arranged to be received inside of outer walls of the container and of insulation panels of the container, to provide a container with an outer insulation layer an intermediate insulation panel layer and an inner cool pack layer.