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(54) APPARATUS

(57) An apparatus (1) for forming a joint in a concrete floor on an upper floor of a building, the apparatus comprising:
an elongate divider plate (2) for dividing first and second volumes of concrete in use on first and second sides of the apparatus (1); and
an elongate top section (3A, 3B or 3C) co-operable with the divider plate (2) to extend a height of the divider plate (2) in use;
wherein the divider plate (2) has a bottom region which comprises one or more indentations for engaging an undulating surface.

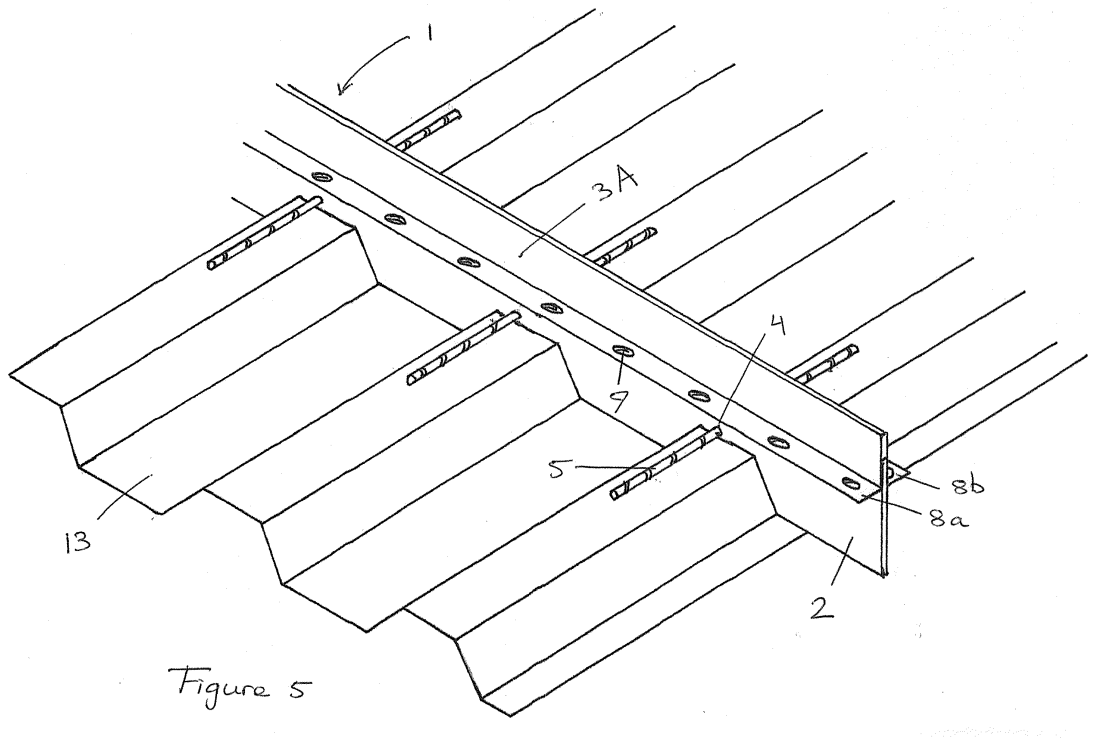

Figure 5

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Description

Field of the invention

[0001] The present invention relates to an apparatus for forming a joint in a concrete floor on an upper floor of a building, and a method for forming a joint in a concrete floor on an upper floor of a building.

Background to the invention

[0002] Upper floors in buildings with a steel frame can be constructed by placing sheets across the steel beams and pouring concrete on top of the sheets. The sheets are generally either thin gauge corrugated steel sheets or precast concrete sheets (also known as hollowcore concrete planks). It is not usually possible to pour a whole concrete floor in one day, making it necessary to stop the concrete part way along the floor being cast. At present, it is common to use a simple piece of timber across the top of the corrugated steel or concrete sheet to stop the concrete, and to then remove the timber the next day before pouring the rest of the floor. In the case of corrugated steel sheets, further pieces of shaped wood (or rigid foam) are often used to plug the troughs in the corrugated profile, or the concrete is simply allowed to pour through until it stops of its own accord with the under spill being removed later, once set.

[0003] When casting concrete floors on the ground, known as the subbase, concrete floor slabs are generally cast on top of a slip membrane to allow free movement. These concrete floor slabs are generally cast as adjoining slab panels where each slab panel is cast inside a formwork, which defines a space in which to cast the concrete. The formwork may be removable, which means it is removed after the concrete has cured, or it may be leave-in-place formwork, which forms part of the resulting concrete structure. After casting, such concrete slabs display drying shrinkage, which generally results in the opening of the joints between the slab panels, due to each concrete slab panel shrinking away from the joint; a joint used to accommodate such shrinking, or contraction, is known as a "contraction joint". Another type of joint can be adapted to also accommodate thermal expansion of a slab panel, and is known as an "expansion joint".

[0004] In the case of casting concrete on an upper deck surface (i.e. on an upper floor of a building), the surface on which the concrete is being cast will be adapted such that the concrete will grip the entire surface. Corrugated steel sheets are undulating and often contain additional ridges to help the concrete to grip. Precast concrete sheets generally have a very rough and/or undulating upper surface for the concrete to grip. Because of this, the concrete will be held in place across the entire sheet. When the concrete sets, the concrete floor as a whole will therefore develop very small cracks throughout, rather than contract as a concrete slab on a slip membrane on the subbase would. Casting concrete on an upper deck surface therefore needs to meet very different requirements from casting concrete on the subbase. On an upper deck surface, it is important to lock or tie an entire floor together, while avoiding any major cracks running through the floor.

[0005] It is an aim of the present invention to provide an apparatus for forming a joint between concrete floor sections on an upper deck surface, embodiments of which can enhance the ease of casting the concrete floor and the performance characteristics of the resulting concrete floor.

Statements of the invention

[0006] According to a first aspect of the present invention there is provided an apparatus for forming a joint in a concrete floor, the apparatus comprising:

an elongate divider plate for dividing first and second volumes of concrete in use on first and second sides of the apparatus; and
an elongate top section co-operable with the divider plate to extend a height of the divider plate in use;
wherein the divider plate has a bottom region which comprises one or more indentations for engaging an undulating surface.

[0007] The term "elongate" as used in the context of the invention, for example in the context of the divider plate and the top section, means that the relevant component has an elongate shape. Suitably, the longitudinal axis of the elongate component is, in use, positioned parallel or substantially parallel to the longitudinal axis of the apparatus.

[0008] The apparatus provides a leave-in-place system which allows a concrete floor to be poured without the need to use and remove timber partitions. The adjustability of the height of the apparatus allows it to suit a range of concrete floor heights.

[0009] The divider plate can be conventional in construction, for example as in EP 1389648 or similar.

[0010] In an embodiment, the divider plate is an elongate flat section of material.

[0011] Optionally, the divider plate may be non-deformable. This means that the material from which the divider plate is made is not compressible by the concrete once the concrete has been cast on one or both sides of the divider plate. Optionally, the divider plate may be rigid. Advantageously, the divider plate may be formed from a metal such as, for example, steel. This can result in a divider plate of high mechanical strength, capable of withstanding the forces acting upon it during the casting of concrete.

[0012] Suitably, the divider plate may comprise a longitudinal fold at the top and/or the bottom of the divider plate. Such a fold can, for example, be a longitudinal L-fold, a longitudinal J-fold, a longitudinal V-fold or a Dutch fold (where the divider plate is completely folded back on

itself). Such a fold can strengthen the divider plate.

[0013] In an embodiment, the elongate top section is formed from a single elongate section of material. Advantageously, the top section may be formed from a metal such as, for example, steel. Optionally, the top section may be unitary.

[0014] In an embodiment, the top section is formed from a single sheet of metal by rolling and/or folding.

[0015] In an embodiment, the top section is formed as an elongate extrusion. Advantageously, the elongate extrusion may have a substantially constant cross-section along its length.

[0016] The top section may comprise an elongate side wall which, in use, sits parallel (or substantially parallel) and adjacent to a first side of the divider plate. The top section may also comprise a flange, extending from the side wall sitting parallel (or substantially parallel) and adjacent to the first side of the divider plate in use, for example resulting in a top section with a substantially L-shaped cross-section. In use, the flange may extend into the area where concrete is poured. The flange can therefore engage with the concrete, helping to lock the apparatus in position. Advantageously, the flange may comprise a plurality of holes. Such holes allow the flange to become more strongly embedded in the concrete during casting and curing.

[0017] In an embodiment, the top section comprises an elongate concrete-engagement member which extends into the region where, in use, concrete is poured. Advantageously, the elongate concrete-engagement member may comprise a plurality of holes. Such holes allow the elongate concrete-engagement member to become more strongly embedded in the concrete during casting and curing.

[0018] In an embodiment, the top section comprises a top strip and two side walls defining a socket between them. One or each of the two side walls may also have a flange which extends from the side wall and which, in use, extends into the area where concrete is poured, to engage with the concrete in use, as described above.

[0019] In use, the divider plate and top section may be combined to form the apparatus for forming a joint in a concrete floor.

[0020] Advantageously, the apparatus may be suitable for forming a joint in a concrete floor on an upper floor of a building. It is envisaged that in use, the joint may be positioned on a sheet, such as a thin gauge corrugated steel sheet or a precast concrete sheet, which lies across the steel beams in a steel frame building. The surface of such a sheet positioned on an upper floor is known as an upper deck surface.

[0021] Preferably, the apparatus may be for forming a tied joint. A tied joint is intended to tie together the concrete on each side of the joint.

[0022] The divider plate has a top region. The top section has at least one bottom region. When combined, the bottom region of the top section may preferably overlap, at least partially, with the top region of the divider plate.

[0023] In an embodiment, the divider plate is arranged to be securable to the upper deck surface. Preferably, the top section may be arranged to be movable relative to the divider plate.

[0024] In use, the top section can be moved up and down relative to the divider plate, which allows the height of the apparatus above the upper deck surface to be adjusted. The apparatus therefore allows a range of different formwork heights to be achieved, which can be continuously variable, by using a single size of divider plate instead of requiring a large number of different sizes of divider plates. Therefore the apparatus can enhance the ease with which concrete floors can be produced, particularly on upper floors of buildings, can enhance the performance characteristics of the resulting concrete floors, and can eliminate the need to trim off concrete spillage, which can save time and reduce waste management costs on site.

[0025] In an embodiment, the top section is connectable to the top region of the divider plate. Suitably, the top section may be connectable along the top region of the divider plate. Optionally, at least one of the divider plate and the top section may comprise members adapted to engage with the other, to hold the top section in place along the top region of the divider plate.

[0026] As mentioned above, the top section may comprise a top strip and two side walls defining a socket between them. Advantageously, the side walls may function as biasing means which can hold the top section in place relative to the divider plate.

[0027] In an embodiment, the top section comprises a socket and the socket can be placed over the divider plate to variable distance, which means that the divider plate is insertable into the socket to variable depth. Optionally, the distance to which the socket is placed over the divider plate may be adjusted in a stepwise manner. Alternatively, the distance to which the socket is placed over the divider plate may be adjusted in a continuous manner.

[0028] In an embodiment, the top section comprises members adapted to engage with the divider plate. In an embodiment, the divider plate comprises members adapted to engage with the top section. The top section can, for example, be held in position by friction.

[0029] In an embodiment, the divider plate and the top section comprise interengaging members arranged to hold the top section in place along the top region of the divider plate. The interengaging members may, for example, comprise surface profiling and/or serrations.

[0030] In an embodiment, the top section is arranged to be held in position along the top region of the divider plate by means of fastening means, such as for example self-tapping (self-fastening) screws or nuts and bolts.

[0031] The divider plate has a bottom region which comprises one or more indentations for engaging an undulating surface.

[0032] Preferably, the shape of the bottom region of the divider plate is such that, in use, it can engage with

the corrugations of a corrugated steel sheet. The parts of the divider plate which protrude into the corrugations of the corrugated steel sheet may follow the contours of the corrugations closely, or may leave one or more gaps between the protrusions on the divider plate and the corrugations of the corrugated steel sheet. Advantageously, the shape of the bottom region of the divider plate is such that, in use, it can mate with the corrugations of a corrugated steel sheet.

[0033] The divider plate has a bottom edge, which bounds the bottom region of the divider plate. Preferably, the shape of the bottom region of the divider plate is such that, in use, the bottom edge of the divider plate can engage with or mate with the corrugations of a corrugated steel sheet. Optionally, the pattern formed when the bottom edge of the divider plate and the corrugated steel sheet abut may contain one or more gaps in between the divider plate and the corrugated steel sheet.

[0034] In an embodiment, the divider plate is connectable to the upper deck surface in use. The divider plate may, for example, be connected to the upper deck surface by means of one or more brackets. The brackets may, for example, be connected to the divider plate and the upper deck surface by means of self-tapping screws.

[0035] As mentioned above, the divider plate may be arranged to be securable to the upper deck surface. Optionally, the divider plate may comprise a longitudinal fold at the bottom of the divider plate. Optionally, the divider plate may comprise one or more folded-over tabs at the bottom of the divider plate. Such a fold or such tabs may allow the divider plate to be connected to the upper deck surface by means of, for example, self-tapping screws.

[0036] In an embodiment, the apparatus comprises one or more brackets which, in use, secure the divider plate to the subbase.

[0037] Securing the apparatus to the upper deck surface can make the apparatus easier to operate, since it allows the concrete to be cast without the risk of the apparatus shifting in position (in a substantially horizontal direction) under the influence of the concrete thrust. This can enhance the ease with which concrete floor slabs can be produced.

[0038] In an embodiment, the apparatus according to the first aspect of the invention further comprises:

> at least one aperture provided in the divider plate and/or in the top section or by a combination of the divider plate and the top section, which aperture is adapted to allow a connector to extend therethrough between the first and second sides of the apparatus.

[0039] The at least one aperture is provided in the divider plate and/or in the top section to allow a connector to extend therethrough between the first and second sides of the apparatus. The purpose of the connector is to engage with the concrete on each side of the apparatus in use. After the concrete has been cast, the connector will be embedded into the concrete on each side of the apparatus.

[0040] In an embodiment, the connector is a dowel bar. Advantageously, the dowel bar may be made of metal, such as steel. Preferably the dowel bar may have surface profiling, which can improve engagement with the concrete in use.

[0041] In an embodiment, the connector is a bar forming part of a mesh, which may be made of metal, such as steel. Such a mesh may, for example, be the type of mesh used inside reinforced concrete.

[0042] In an embodiment, the apparatus comprises at least one connector for extending through the at least one aperture. Preferably, the at least one connector may be positioned through the at least one aperture and may extend on each side of the apparatus into the region where, in use, concrete is cast.

[0043] In an embodiment, the at least one aperture is provided in the divider plate. Optionally, at least one aperture may further be provided in the top section, and/or by a combination of the divider plate and the top section.

[0044] In an embodiment, the at least one aperture is provided in the top section. Optionally, at least one aperture may further be provided in the divider plate, and/or by a combination of the divider plate and the top section.

[0045] In an embodiment, the at least one aperture is provided by a combination of the divider plate and the top section.

[0046] When at least one aperture is provided by a combination of the divider plate and the top section, advantageously the at least one aperture may be defined by the junction between the divider plate and the top section. As mentioned previously, the bottom region of the top section may overlap with the top region of the divider plate. One or more apertures may be defined when the regions do not overlap along their entire lengths. For example, the bottom region of the top section and/or the top region of the divider plate may be shaped, such as for example being castellated or undulating, so that the two regions only overlap at certain points along their lengths, defining apertures between the points of overlap. This means that apertures are created when the top section and the divider plate are combined. A connector may be placed between the top section and the divider plate such that it passes through the aperture when the two are combined. This allows a wider range of connectors to be used, such as connectors including sections that are too wide or the wrong shape to be inserted through the apertures otherwise. Where a reinforcement mesh is used inside the concrete in use, it has the advantage of allowing the reinforcement to continue across the joint.

[0047] The divider plate has a top edge, which bounds the top region of the divider plate.

[0048] The top section has at least one bottom edge, which bounds the at least one bottom region.

[0049] In an embodiment, the at least one aperture may be defined by the top edge of the divider plate and the bottom edge of the top section, for example by means of a groove in the divider plate extending from the top

edge of the divider plate, and/or a groove in the top section extending from the bottom edge of the top section.

[0050] According to a second aspect of the present invention there is provided an apparatus for forming a joint in a concrete floor, the apparatus comprising:

an elongate divider plate for dividing first and second volumes of concrete in use on first and second sides of the apparatus;
an elongate top section co-operable with the divider plate to extend a height of the divider plate in use;
at least one aperture provided in the divider plate and/or in the top section or by a combination of the divider plate and the top section, which aperture is adapted to allow a connector to extend therethrough between the first and second sides of the apparatus.

[0051] In the apparatus according to the second aspect of the invention, the divider plate, the top section and the at least one aperture can be as described above for the first aspect of the invention.

[0052] According to a third aspect of the present invention there is provided a method for forming a joint in a concrete floor, comprising the steps of:

(i) setting up the apparatus according to the first or second aspect of the invention to bound a space for casting concrete; and
(ii) casting concrete in the space.

[0053] In an embodiment, step (i) comprises the steps of:

(i-a) placing the elongate divider plate on an upper deck surface; and
(i-b) connecting the top section to the top region of the divider plate.

[0054] Where at least one aperture is provided in the divider plate and/or in the top section or by a combination of the divider plate and the top section, which aperture is adapted to allow a connector to extend therethrough between the first and second sides of the apparatus, advantageously, at least one connector may be placed in the at least one aperture provided in the divider plate and/or in the top section or by a combination of the divider plate and the top section. The connector may be placed in the aperture before step (i-a), between steps (i-a) and (i-b), between steps (i-b) and (ii), or after step (ii).

[0055] In an embodiment where at least one aperture is defined by the junction between the divider plate and the top section, as described for the first aspect of the invention above, advantageously the connector may be placed in the aperture between steps (i-a) and (i-b). For example, when producing a floor of reinforced concrete, it is possible to set up the elongate divider plate, place a mesh over the divider plate, and subsequently position the top section such that the bars of the mesh sit in the apertures defined by the junction between the divider plate and the top section. This arrangement therefore significantly improves the ease of producing a concrete floor.

[0056] Throughout this specification, unless expressly stated otherwise, the term "substantially parallel" is to be understood as being at an angle of less than 20° away from true parallel. In an embodiment, this is less than 19°, less than 18°, less than 17°, less than 16°, less than 15°, less than 14°, less than 13°, less than 12°, less than 11°, less than 10°, less than 9°, less than 8°, less than 7°, less than 6°, less than 5°, less than 4°, less than 3°, less than 2°, or less than 1° away from true parallel. Any angle away from true parallel can be to either side of true parallel.

[0057] Throughout the description and claims of this specification, the words "comprise" and "contain" and variations of the words, for example "comprising" and "comprises", mean "including but not limited to", and do not exclude other moieties, additives, components, integers or steps. Moreover the singular encompasses the plural unless the context otherwise requires: in particular, where the indefinite article is used, the specification is to be understood as contemplating plurality as well as singularity, unless the context requires otherwise.

[0058] Preferred features of each aspect of the invention may be as described in connection with any of the other aspects. Other features of the invention will become apparent from the following examples. Generally speaking the invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims and drawings). Thus features, integers, characteristics, compounds, chemical moieties or groups described in conjunction with a particular aspect, embodiment or example of the invention are to be understood to be applicable to any other aspect, embodiment or example described herein unless incompatible therewith. Moreover unless stated otherwise, any feature disclosed herein may be replaced by an alternative feature serving the same or a similar purpose.

[0059] Where upper and lower limits are quoted for a property, then a range of values defined by a combination of any of the upper limits with any of the lower limits may also be implied.

Specific description

[0060] Embodiments of the present invention will now be further described with reference to the accompanying figures, of which:

Figure 1 shows a perspective view of a first embodiment of the apparatus according to the second aspect of the invention.

Figure 2 shows the embodiment of Figure 1 after concrete has been cast on one side of the apparatus.

Figure 3 shows a perspective view of a second embodiment of the apparatus according to the second aspect of the invention.

Figure 4 shows the embodiment of Figure 3 after concrete has been cast on one side of the apparatus.

Figure 5 shows a perspective view of a third embodiment of the apparatus according to the first or second aspect of the invention.

Figure 6 shows the embodiment of Figure 5 after concrete has been cast on one side of the apparatus.

Figure 7 shows a perspective view of a fourth embodiment of the apparatus according to the first or second aspect of the invention.

Figure 8 shows the embodiment of Figure 7 after concrete has been cast on one side of the apparatus.

Figure 9 shows an area cross-sectional view of the embodiment of Figure 1 or 5 perpendicular to its length.

Figure 10 shows an area cross-sectional view of the embodiment of Figure 1 or 5 perpendicular to its length, with the top section moved further down relative to the divider plate than in Figure 9.

Figure 11 shows an area cross-sectional view of the embodiment of Figure 1 or 5 perpendicular to its length after concrete has been cast on one side of the apparatus.

Figure 12 shows an area cross-sectional view of the embodiment of Figure 1 or 5 perpendicular to its length after concrete has been cast on both sides of the apparatus.

Figure 13 shows an area cross-sectional view of the embodiment of Figure 1 or 5 perpendicular to its length after concrete has been cast on both sides of the apparatus where the concrete is reinforced with a steel mesh.

Figure 14 shows an area cross-sectional view of a fifth embodiment of the apparatus according to the first or second aspect of the invention.

Figure 15 shows a side view of the embodiment of Figure 5 along its length.

[0061] As shown in Figures 1-15, the apparatus **1** broadly comprises a divider plate **2** and a top section **3A, 3B** or **3C.**

[0062] The divider plate **2** is an elongate flat section of steel.

[0063] In the embodiments shown in Figures 1, 2, 5, 6 and 9-15, the divider plate **2** comprises apertures **4** along its length at regular intervals. The apertures **4** are adapted to receive dowel bars **5**.

[0064] The dowel bars **5** are made of steel and have surface profiling to improve engagement with the concrete in use.

[0065] The top section **3A, 3B** or **3C** is an elongate section of steel. The top section is unitary.

[0066] In the embodiments shown in Figures 1-13 and 15, the top section **3A** or **3B** comprises two elongate side walls **6a, 6b** defining a socket **7** between them. Each of the two side walls has a flange **8a, 8b** which extends from the side wall and which, in use, extends into the area where concrete is poured. The flange **8a, 8b** can therefore engage with the concrete, helping to lock the apparatus **1** in position. Each flange **8a, 8b** can comprise a plurality of holes **9.** These holes **9** allow the elongate concrete-engagement member **8a, 8b** to become more strongly embedded in the concrete.

[0067] In another embodiment, shown in Figure 14, the top section **3C** comprise one elongate side wall **6,** which has a flange **8** with which extends from the side wall **6** and which, in use, extends into the area where concrete is poured. This results in a top section **3C** with a substantially L-shaped cross-section. The flange **8** comprises a plurality of holes **9,** which allow the flange **8** to become more strongly embedded in the concrete.

[0068] In the embodiments shown in Figures 3, 4, 7 and 8, apertures **10** are provided by a combination of the divider plate **2** and the top section **3B.** The bottom region of the top section **3B** overlaps with the top region of the divider plate **2.** Apertures **10** are defined since the regions do not overlap along their entire lengths. In the embodiments shown in Figures 3, 4, 7 and 8, the bottom region of the top section **3B** is castellated, so that the top section **3B** does not overlap with the entire top region of the divider plate **2;** apertures **10** are left between the points of overlap. In other words, the apertures **10** are defined by the top edge of the divider plate **2** and the bottom edge of the top section **3B,** by means of regular grooves **11** in the top section **3B** extending from the bottom edge of the top section **3B.**

[0069] This arrangement, where the apertures **10** are provided by a combination of the divider plate **2** and the top section **3B,** are especially suited for use with a mesh, such as a steel mesh **12** of the type which is commonly used inside reinforced concrete, as shown in Figures 3, 4, 7 and 8.

[0070] In the embodiments shown in Figures 5-8 and 15, the bottom region of the divider plate **2** comprises one or more indentations for engaging an undulating surface. Such a surface may, for example, be a corrugated steel sheet **13.** The shape of the bottom region of the divider plate **2** allows the bottom edge of the divider plate **2** to mate with the corrugations of the corrugated steel sheet **13.**

[0071] In use, the divider plate **2** is placed on an upper

deck surface which lies across the steel beams of a steel frame building; this surface can be formed by precast concrete sheets **14** as shown in Figures 1-4 or by corrugated steel sheets **13** as shown in Figures 5-8.

[0072] The divider plate **2** can be connected to the upper deck surface **14** or **13** by means of one or more brackets **15.** The brackets **15** can be connected to the divider plate **2** and the upper deck surface **14** or **13** by means of self-tapping screws (not shown).

[0073] Alternatively, the divider plate **2** may comprise a longitudinal fold or one or more folded-over tabs at the bottom of the divider plate (not shown) for securing the divider plate **2** to the upper deck surface **14** or **13.** Such a fold or such tabs allow the divider plate **2** to be connected to the upper deck surface **14** or **13** by means of, for example, self-tapping screws.

[0074] In use, the top section **3A, 3B** or **3C** is connected to the top region of the divider plate **2.** The top section **3A, 3B** or **3C** is moved relative to the divider plate **2** until the desired height of the apparatus above the upper deck surface **14** or **13** is achieved.

[0075] Where the top section **3A** or **3B** comprises a socket **7,** as shown in Figures 1-13, the socket **7** is placed over the divider plate **2** to the desired distance. Figure 9 shows a situation where the socket **7** has been placed over the divider plate **2,** and Figure 10 shows a situation where the top section **3A** has been moved further down relative to the divider **2** plate than in Figure 9.

[0076] The side walls **6a, 6b** surrounding the socket **7** may function as biasing means which can hold the top section **3A** or **3B** in place relative to the divider plate **2.** The top section **3A** or **3B** can also be connected to the divider plate **2** by means of self-tapping screws (not shown). Where the top section **3C** has a substantially L-shaped cross-section, as shown in Figure 14, it can be connected to the divider plate **2** by means of self-tapping screws (not shown).

[0077] The top section **3A, 3B** or **3C** may be connected to the top region of the divider plate **2** in an offset or staggered manner in the direction of the longitudinal axis of the apparatus **1,** as shown in Figure 15. This means that one divider plate **2** can be connected to two top sections **3A, 3B** or **3C** and vice versa, which can be helpful when aligning a number of divider plates and top sections end-to-end in use. Alternatively, the top section **3A, 3B** or **3C** and the divider plate **2** may be connected in such a way that their ends line up in the direction of the longitudinal axis of the apparatus **1,** to form a butt joint.

[0078] Dowel bars **5** may be used to connect the concrete on each side of the apparatus 1, and can be positioned through apertures **4** in the divider plate **2,** as shown in Figures 1, 2, 5, 6, 9-14. In use, the dowel bars **5** are placed through the apertures **4** after concrete has been cast on one side of the apparatus **1,** and are therefore help in position within apertures **4** by the concrete.

[0079] The concrete can be plain concrete or reinforced concrete. In the case of reinforced concrete, it may be reinforced with steel fibres or with a steel mesh **12.** The main purpose of the reinforcement is to provide extra tensile strength to the concrete and to control cracking within the concrete as it cures.

[0080] When the concrete is reinforced with a steel mesh **12,** the mesh may be placed between the divider plate **2** and the top section, by using a top section **3B** where apertures **10** are provided by a combination of the divider plate **2** and the top section **3B.** As shown in Figures 3, 4, 7 and 8, with this arrangement the divider plate **2** is placed on an upper deck surface, which can be formed by precast concrete sheets **14** as shown in Figures 3-4 or by corrugated steel sheets **13** as shown in Figures 7-8. The mesh **12** is then placed on top of the divider plate **2.** The top section **3B** contains regular grooves **11** extending from the bottom edge of the top section **3B,** which can be fitted over the bars in the mesh **12,** resulting in an apparatus where the bars of the mesh **12** pass through apertures **10** provided by a combination of the divider plate **2** and the top section **3B.** In such an arrangement, additional dowel bars **5** through for example the divider plate **2** may also be used (not shown).

[0081] The concrete may also be reinforced with a steel mesh **12** without the mesh passing through the apparatus **1.** Such a steel mesh **12** may be used in combination with one or more dowel bars **5** passing through the apparatus, as shown in Figure 13. It is envisaged that in use, the mesh **12** may be cut on each side of the apparatus **1.** In such cases, the mesh **12** may be attached to the dowel bars **5** for an improved connection throughout the concrete floor.

[0082] The apparatus **1** will form a tied joint within a concrete floor; it is intended to tie together the concrete on each side of the joint. This is as opposed to, for example, opening up like a "contraction joint" on a ground floor.

[0083] After the apparatus **1** has been set up as described above, the apparatus **1** will bound a space for casting concrete. Concrete is then poured into the space. Concrete is first cast on one side of the divider plate **2,** as shown in Figures 2, 4, 6, 8 and 11. Where appropriate, dowel bars **5** may then be placed through apertures **4** in for example the divider plate **2** into the concrete on the first side. Concrete is then cast on the remaining side of the apparatus **1,** as shown in Figures 12 and 13.

Claims

1. An apparatus for forming a joint in a concrete floor on an upper floor of a building, the apparatus comprising:

an elongate divider plate for dividing first and second volumes of concrete in use on first and second sides of the apparatus; and
an elongate top section co-operable with the divider plate to extend a height of the divider plate in use;

wherein the divider plate has a bottom region which comprises one or more indentations for engaging an undulating surface.

2. The apparatus of claim 1, wherein the shape of the bottom region of the divider plate is such that, in use, it can engage with the corrugations of a corrugated steel sheet.

3. The apparatus of claim 2, wherein parts of the divider plate which protrude into the corrugations of the corrugated steel sheet in use follow the contours of the corrugations closely.

4. The apparatus of claim 2 or 3, wherein parts of the divider plate which protrude into the corrugations of the corrugated steel sheet in use leave one or more gaps between the protrusions on the divider plate and the corrugations of the corrugated steel sheet.

5. The apparatus of claim 2, wherein the shape of the bottom region of the divider plate is such that, in use, it can mate with the corrugations of a corrugated steel sheet.

6. The apparatus of any one of the preceding claims, wherein the top section is arranged to be movable relative to the divider plate.

7. The apparatus of any one of the preceding claims, wherein the divider plate has a top region, and the top section is connectable to the top region of the divider plate.

8. The apparatus of any one of the preceding claims, wherein the top section comprises
an elongate side wall which, in use, sits parallel and adjacent to a first side of the divider plate, and
a flange which extends from the side wall and which, in use, extends into the area where concrete is poured.

9. The apparatus of any one of the preceding claims, wherein the top section comprises a top strip and two side walls defining a socket between them.

10. The apparatus of any one of the preceding claims, wherein the apparatus further comprises:

at least one aperture provided in the divider plate and/or in the top section or by a combination of the divider plate and the top section, which aperture is adapted to allow a connector to extend therethrough between the first and second sides of the apparatus.

11. The apparatus of claim 10, wherein at least one aperture is provided in the divider plate.

12. The apparatus of claim 10 or 11, wherein at least one aperture is defined by the junction between the divider plate and the top section.

13. The apparatus of claim 12, wherein the divider plate has a top region and the top section has at least one bottom region, which regions overlap and are shaped such that the at least one aperture is defined between points of overlap.

14. The apparatus of claim 13, wherein the divider plate has a top edge which bounds the top region of the divider plate, and the top section has at least one bottom edge which bounds the at least one bottom region, and wherein the at least one aperture is defined by the top edge of the divider plate and the bottom edge of the top section by means of a groove in the divider plate extending from the top edge of the divider plate, and/or a groove in the top section extending from the bottom edge of the top section.

15. A method for forming a joint in a concrete floor on an upper floor of a building, comprising the steps of:

(i) setting up the apparatus according any one of claims 1-14 to bound a space for casting concrete; and
(ii) casting concrete in the space.

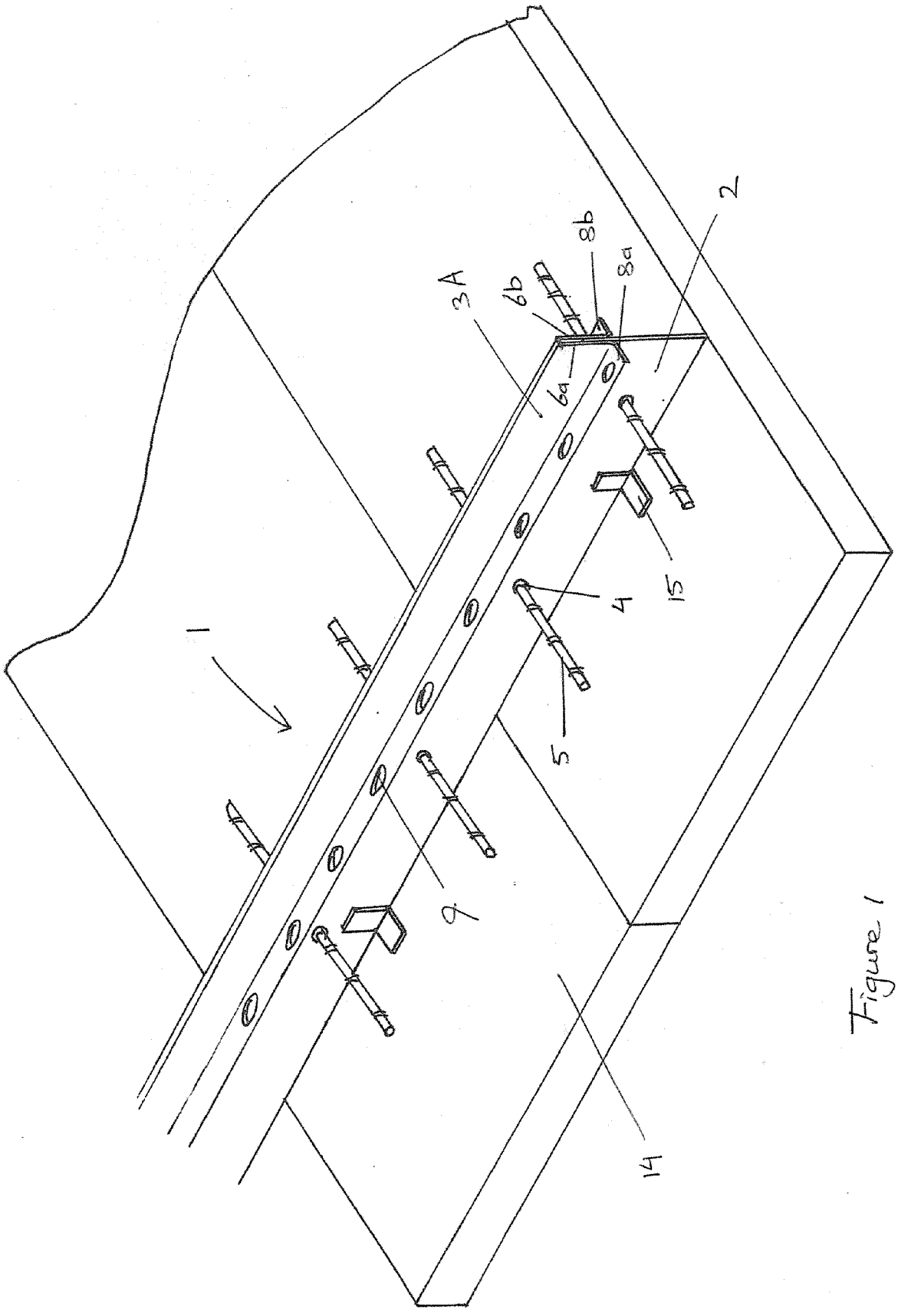


Figure 1

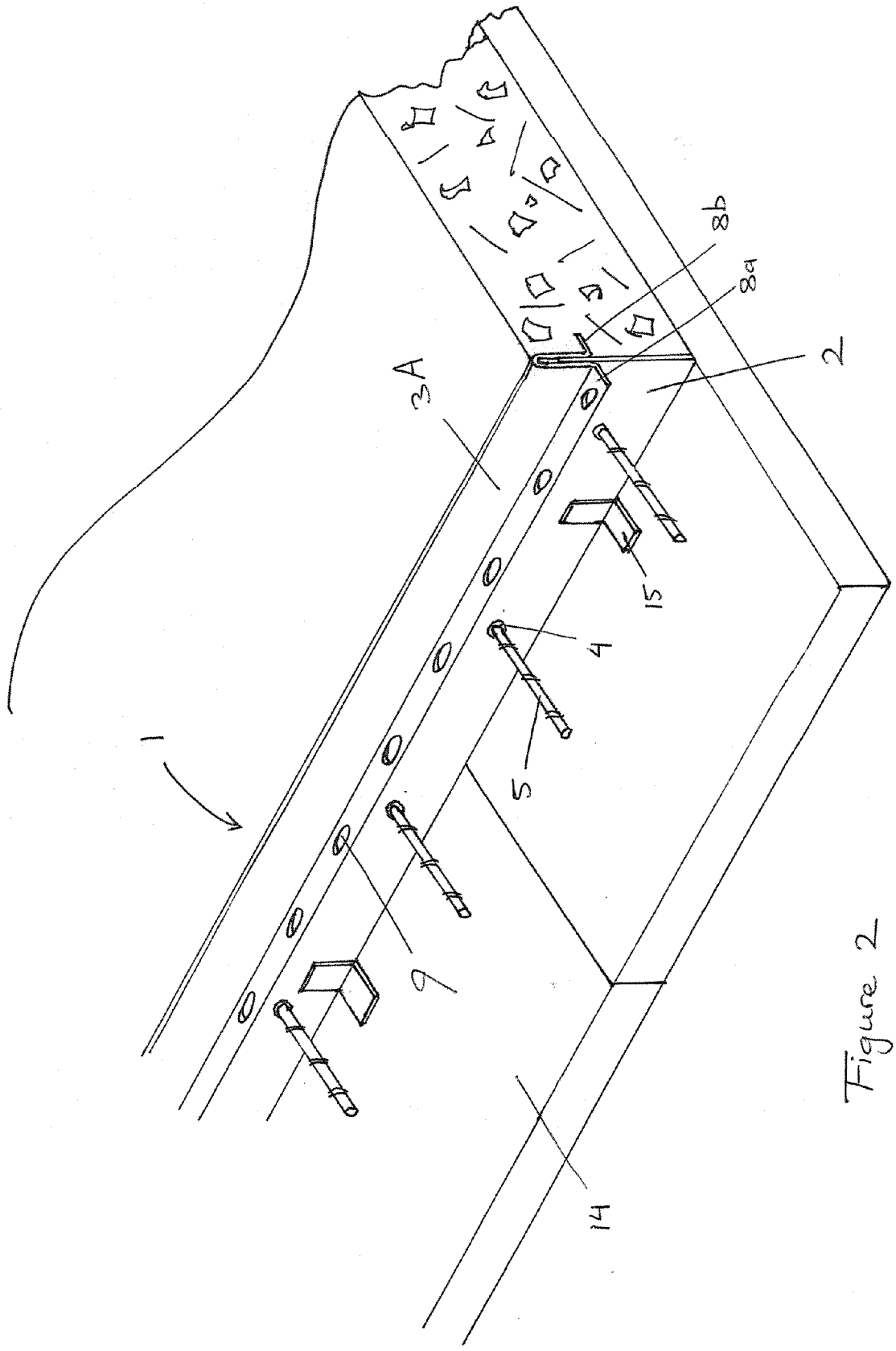


Figure 2

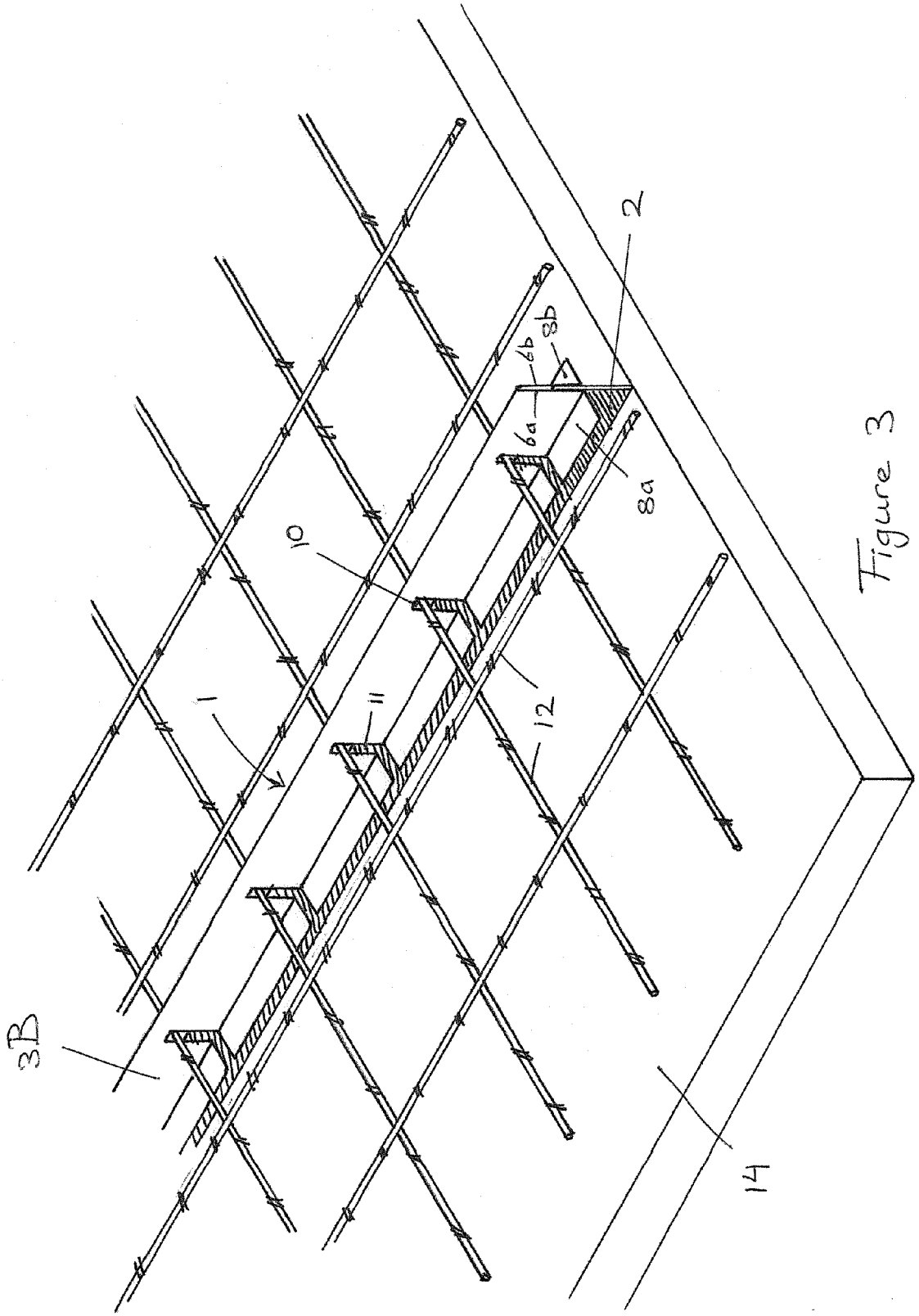


Figure 3

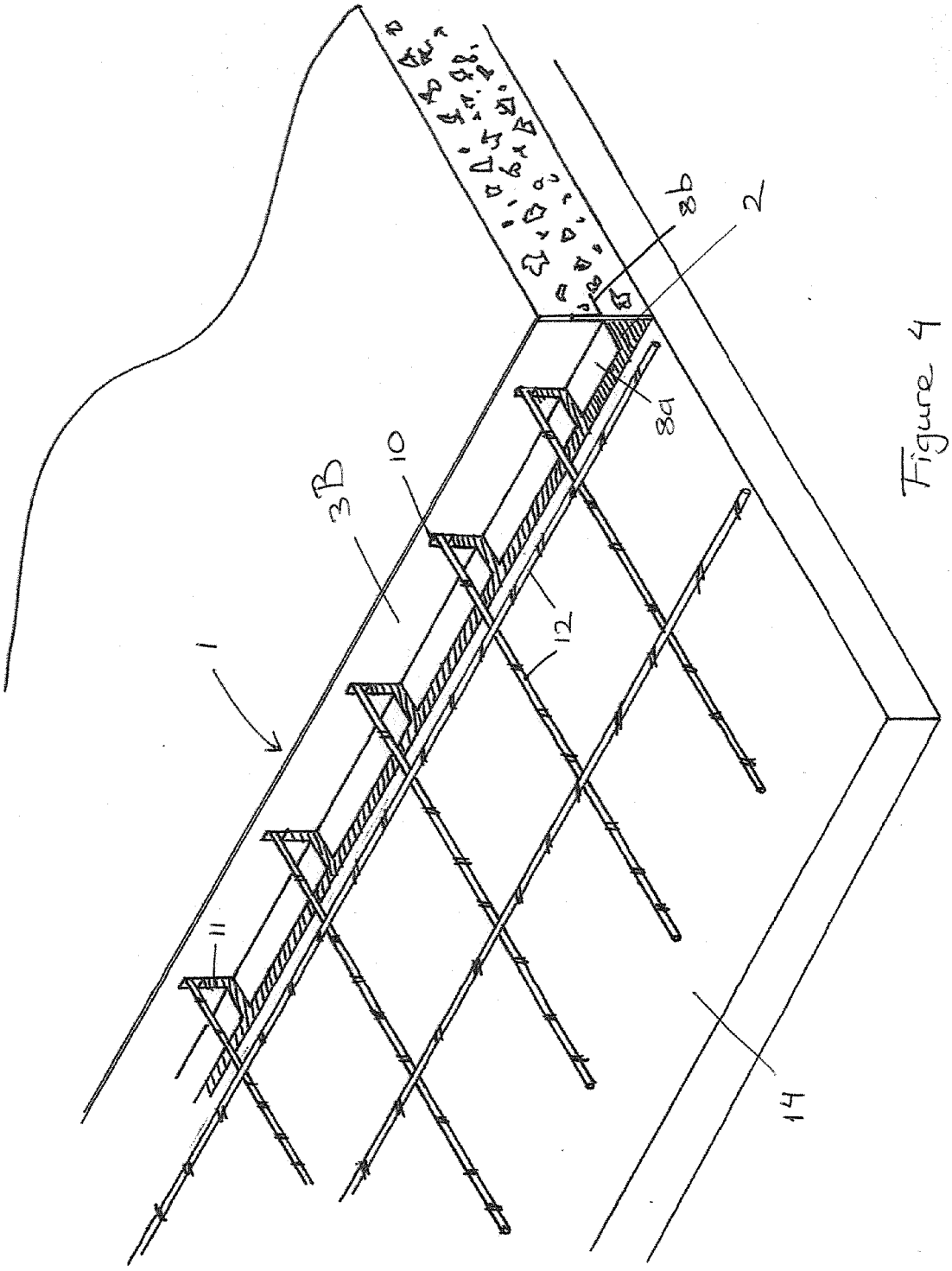


Figure 4

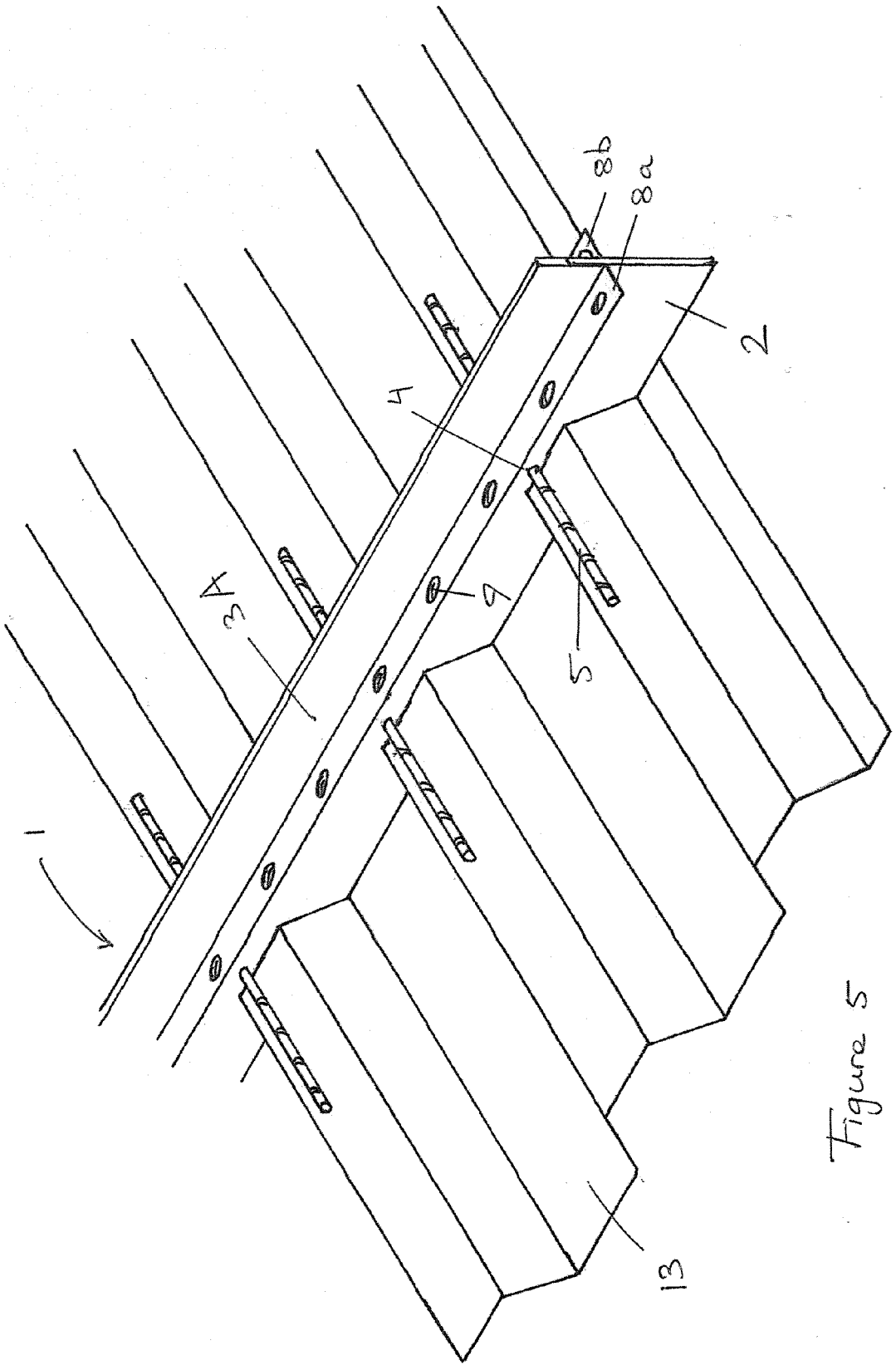
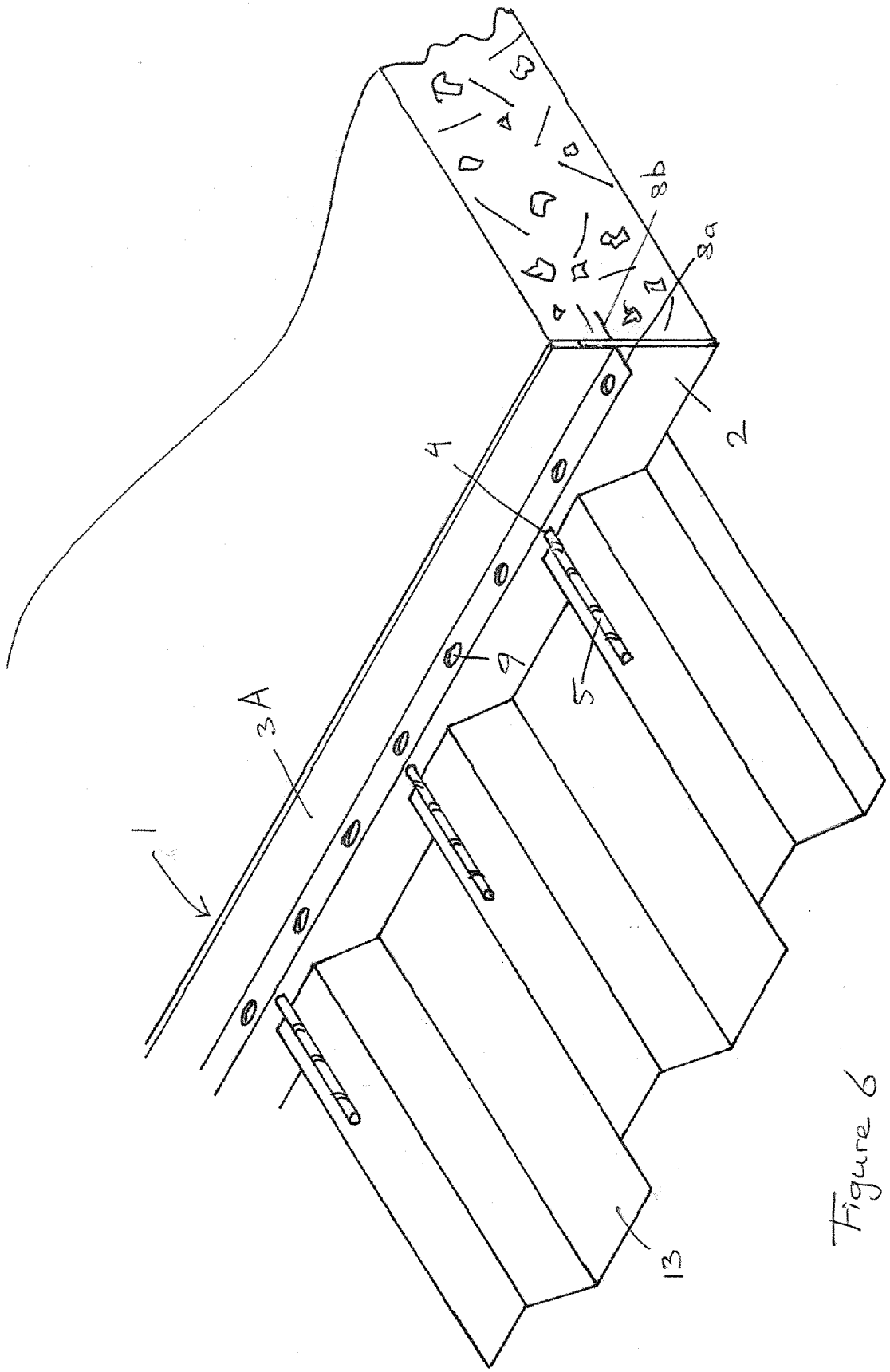


Figure 5



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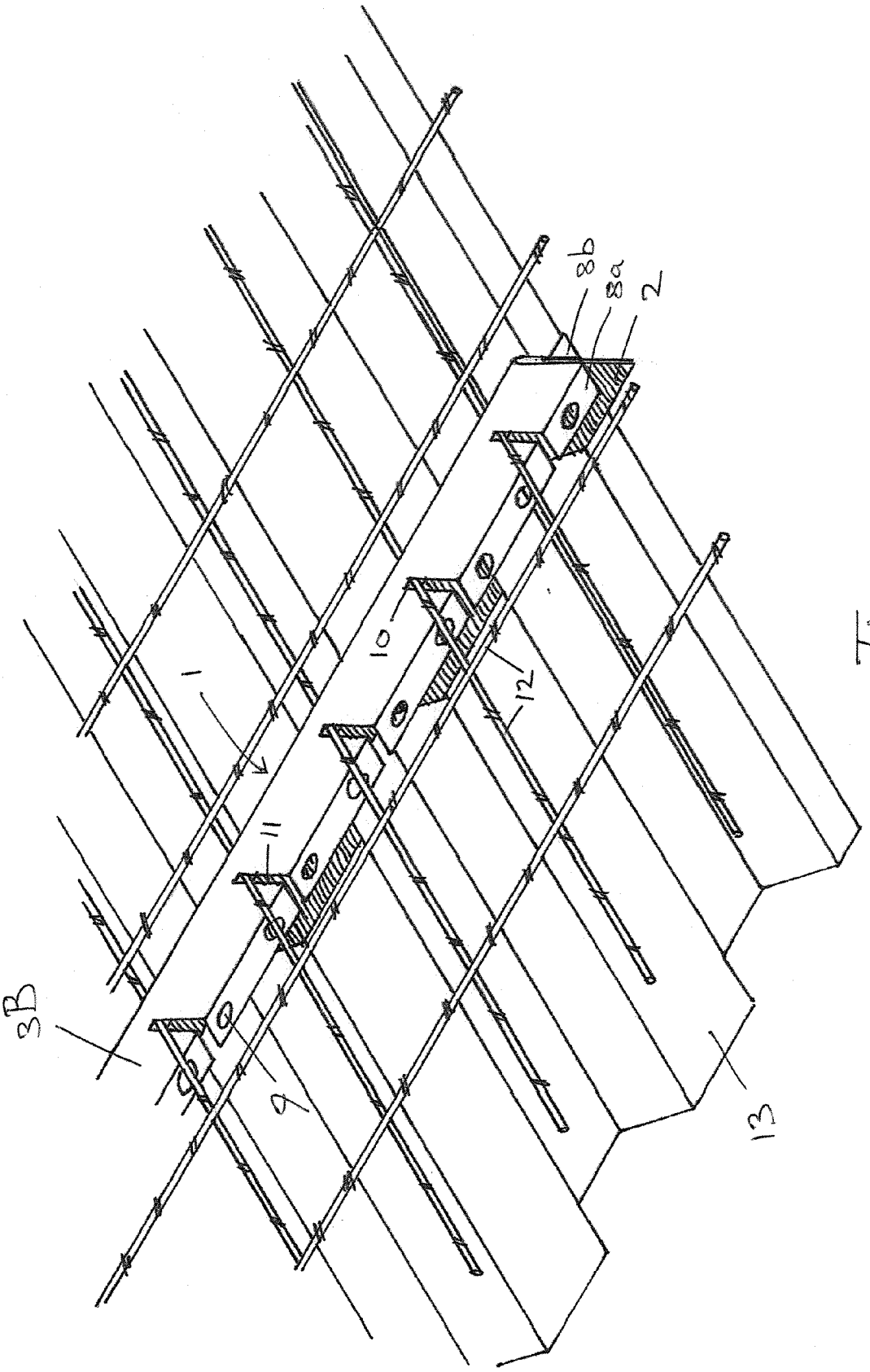

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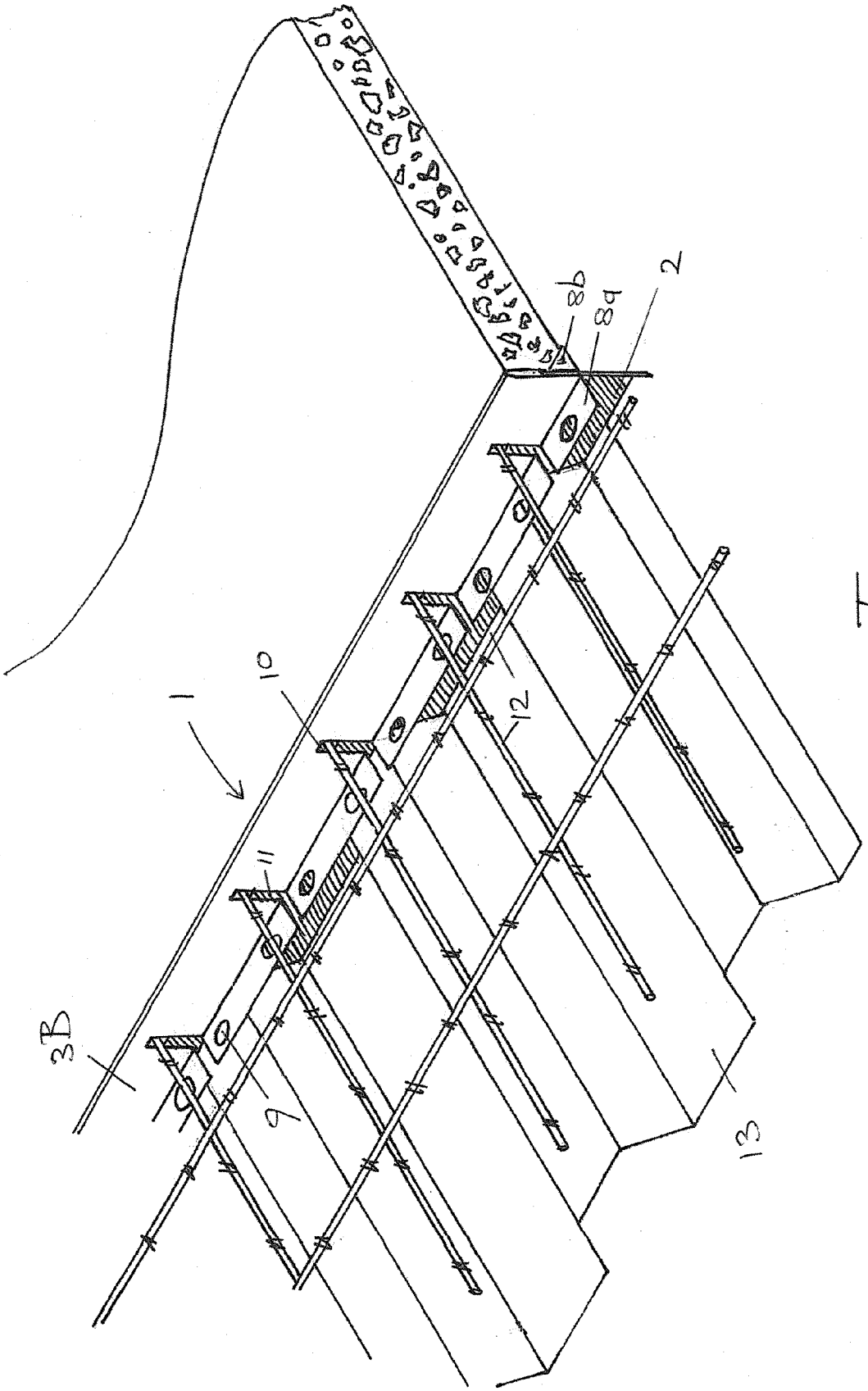

Figure 8

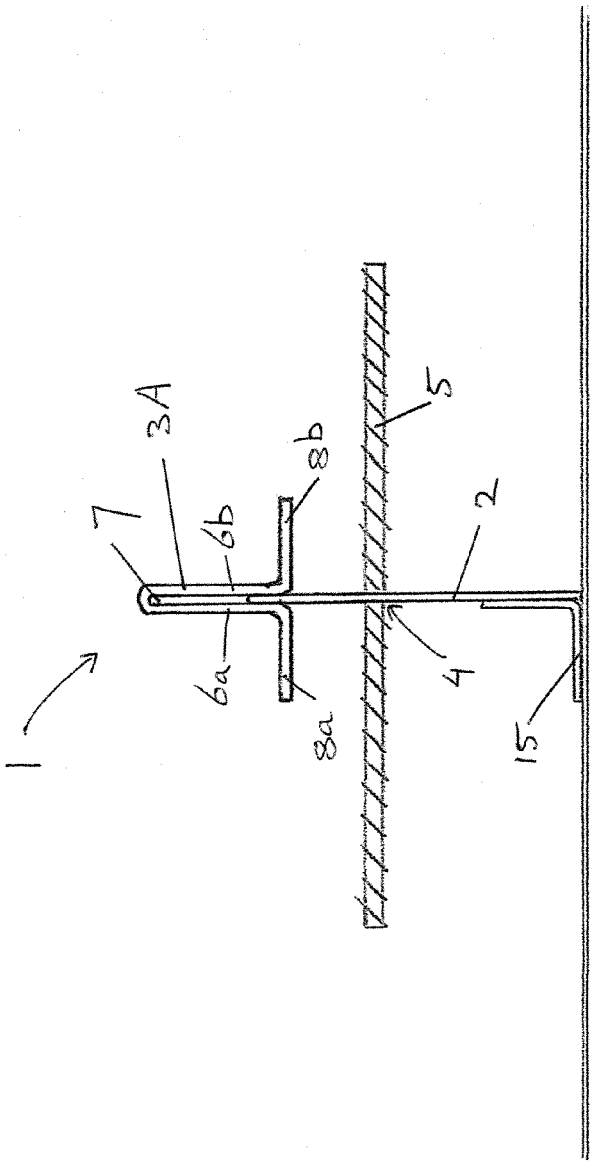

Figure 9

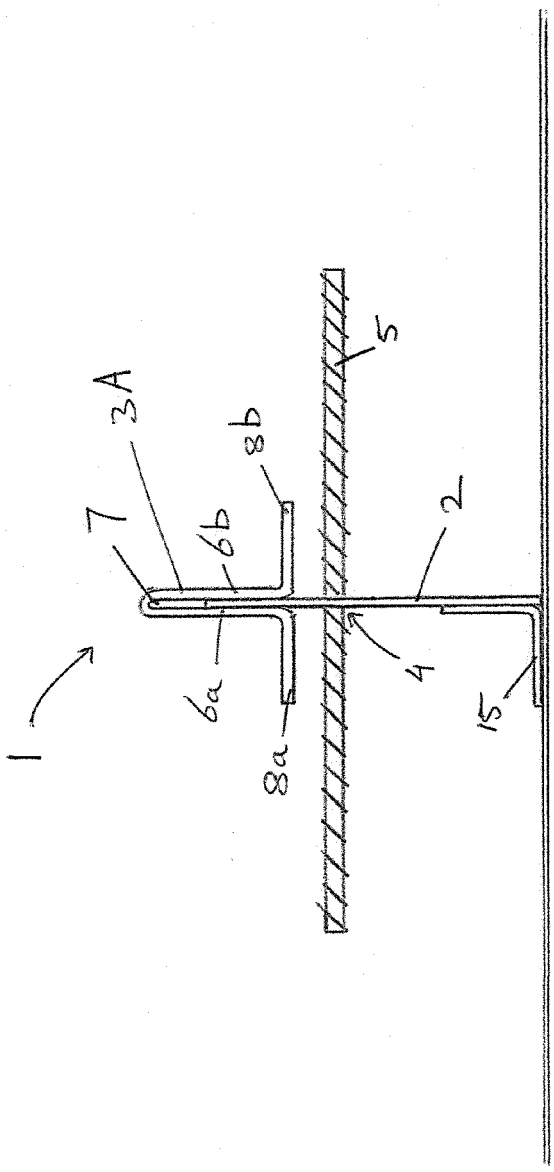

Figure 10

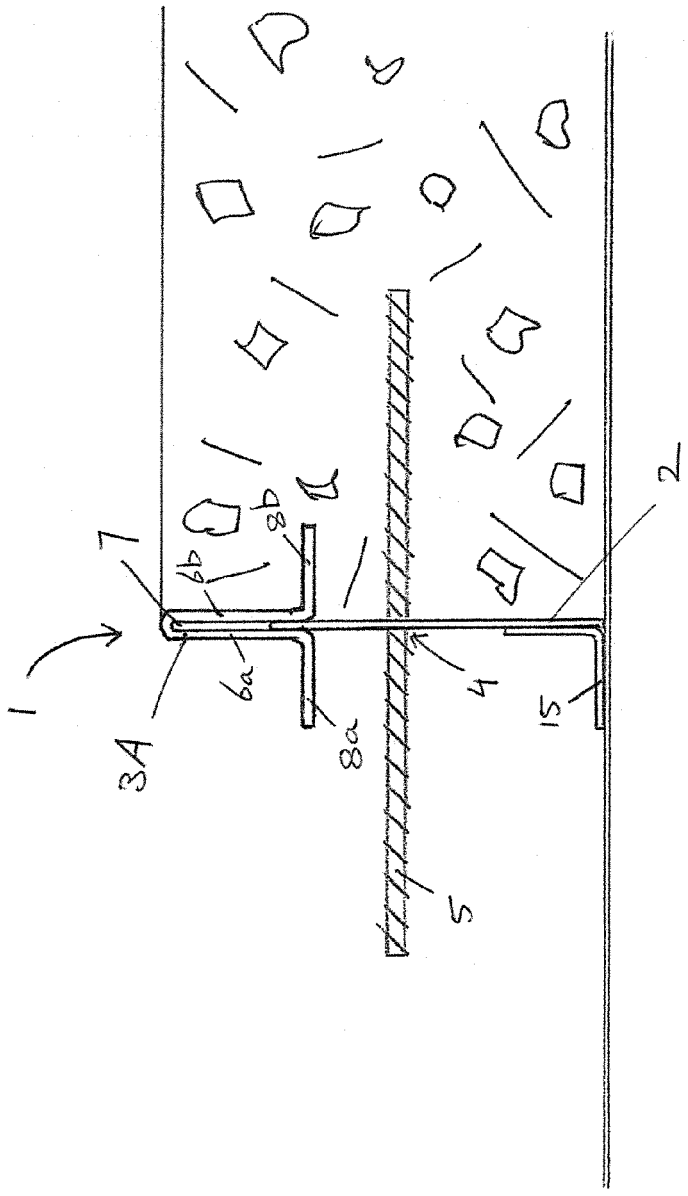

Figure 11

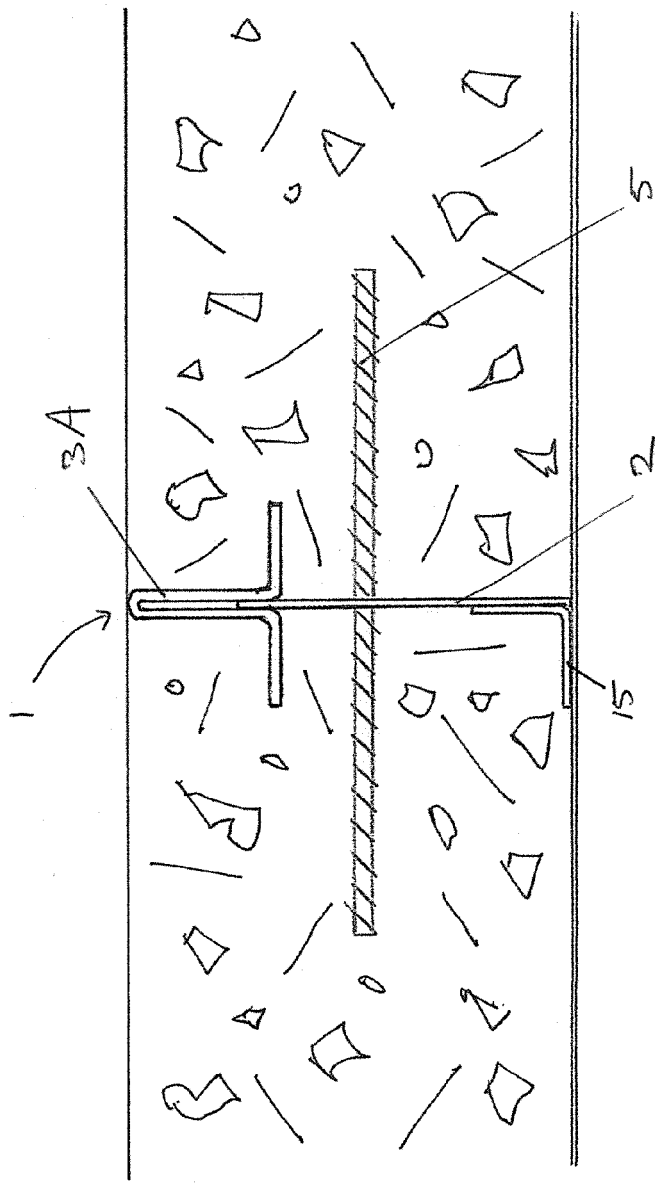

Figure 12

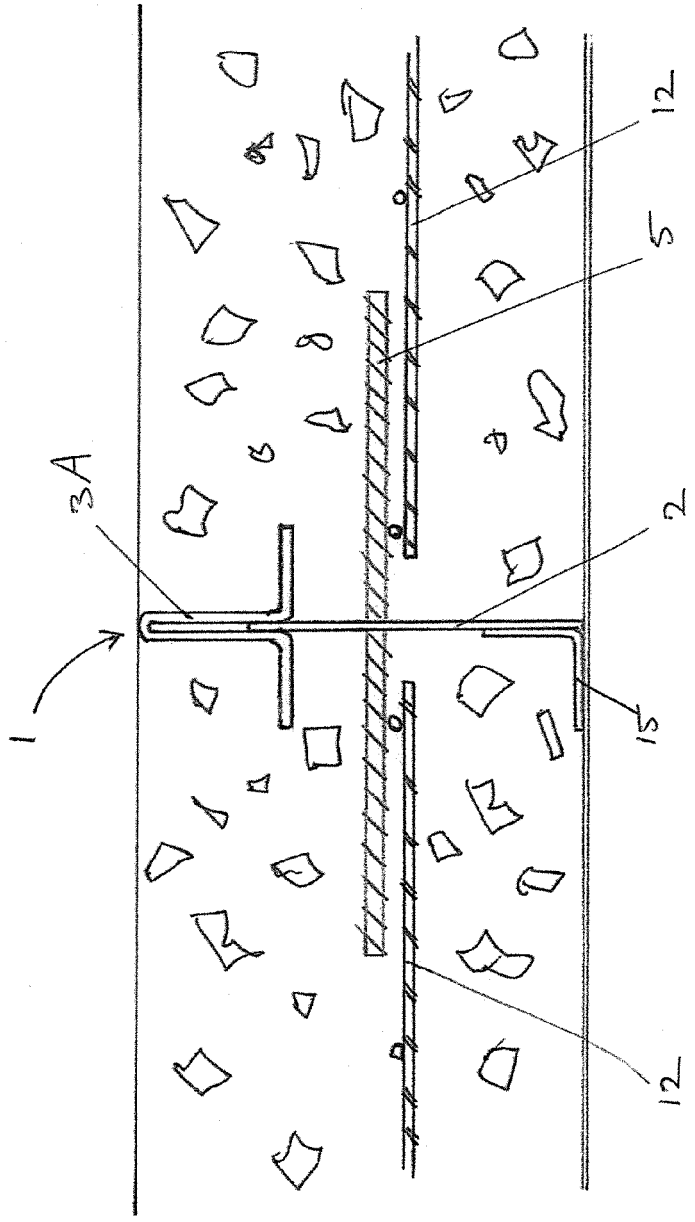

Figura 13

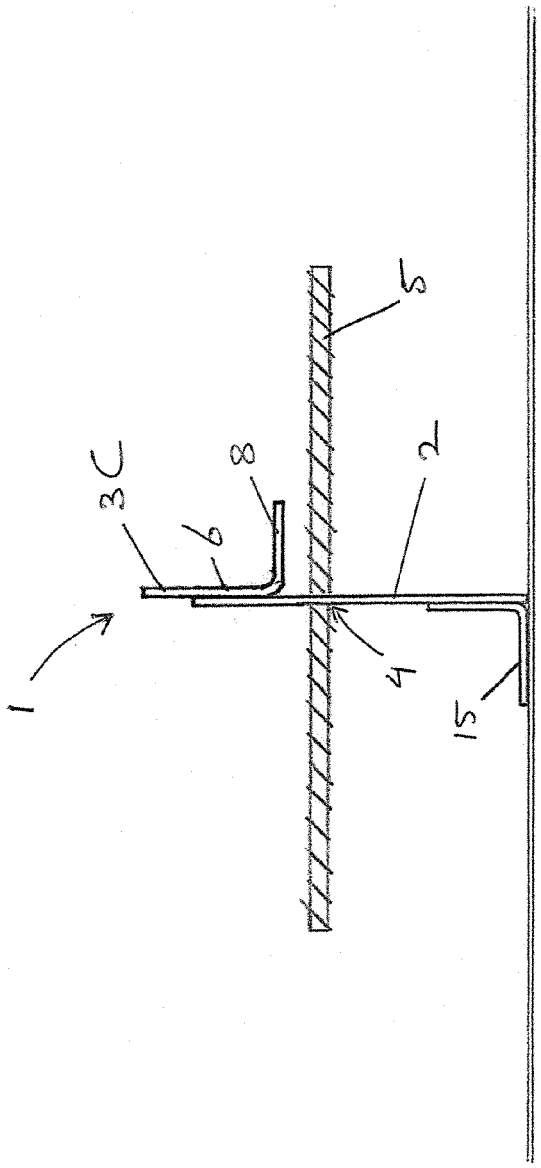

Figura 14

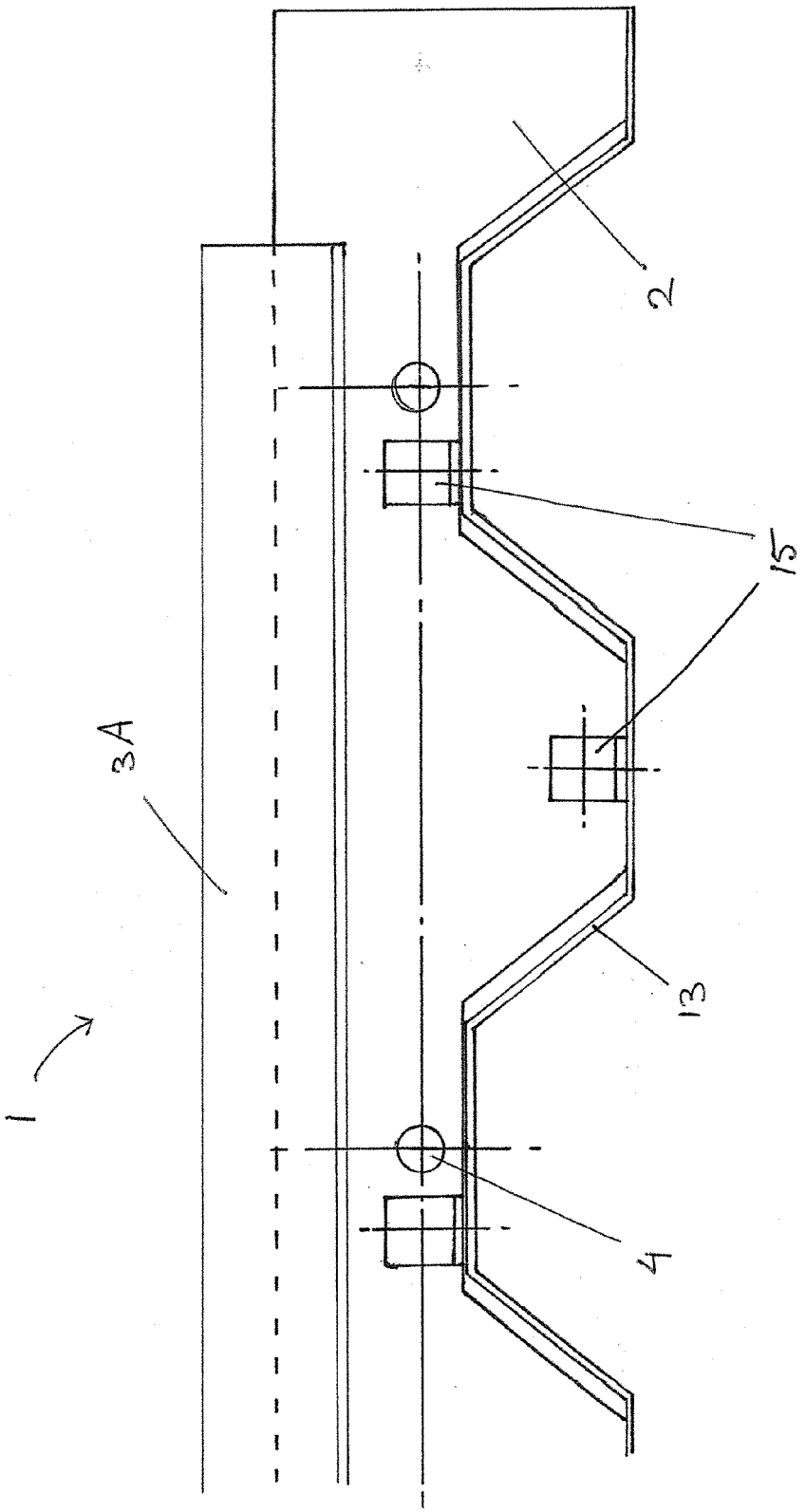

Figure 15

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EUROPEAN SEARCH REPORT

Application Number
EP 15 18 5955

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 1 826 062 A (FARMER ROSCOE D) 6 October 1931 (1931-10-06) * figures 1,2 * -----	1-5,7, 10,11,15	INV. E04B5/40 ADD.
X Y	US 2014/020320 A1 (PARKES NIGEL K [US] ET AL) 23 January 2014 (2014-01-23) * figures 1,2 * -----	1,2, 5-11,15 10-14	E01C11/02 E04B1/48 E04C5/16 E04C5/18
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E04B
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E01C
E04G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 January 2016	Petrinja, Etiel

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

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