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(54) **CONCRETE SLAB EDGE RAIL**

RANDSCHIENE FÜR BETONPLATTEN

RAIL DE BORDURE POUR DALLES EN BETON

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Description

Field of the invention

[0001] The present invention relates to an apparatus for forming the edge of a concrete floor slab panel, a concrete floor slab panel comprising the apparatus, a concrete floor comprising the apparatus, a method of manufacturing a concrete floor slab panel and a method of manufacturing a concrete floor.

Background to the invention

[0002] Concrete floor slabs are generally cast as adjoining slab panels and each slab panel is cast inside a formwork; this formwork defines a space in which to cast the concrete. The formwork may be constructed from timber, steel, aluminium, plastic or the like. The formwork may be removable, which means it is removed after the concrete has cured. Alternatively, it may be leave-in-place formwork, which forms part of the resulting concrete structure, for example by providing at least part of an edge of a resulting concrete slab panel.

[0003] The formwork generally comprises one or more upright elongate divider plates, which the concrete is cast against. The divider plates ensure that the concrete is contained within the desired space. When a number of floor slab panels are cast next to one another to form a concrete floor or slab, the divider plates generally sit in between adjacent slab panels, and dowels or dowel plates, attached to the divider plates, are used to connect the slab panels together in order to transfer loads across the joint.

[0004] During the casting of a concrete floor slab panel comprising leave-in-place formwork, the formwork should be positioned in such a way that the upper edges of the formwork coincide with the finished floor level (FFL), i.e. the level of the upper surface of the finished concrete floor slab.

[0005] The slab and formwork rest on a subbase. If the subbase level (SBL) varies, the formwork will rest on the subbase's highest point. Because of this, it is common practice in casting concrete floors to allow around 15 - 25 mm for clearance. Concrete floor slab thicknesses are usually in the range of 150 to 200 mm. Formwork can be manufactured to desired thickness specifications, which is commonly done in 5 mm increments. If it is desired to cast a concrete slab with a thickness of, for example, 180 mm, formwork with a depth of 155 - 165 mm is normally used. In order to achieve the desired finished floor level (FFL), a divider plate can be suspended at the desired FFL using suspension means. Such suspension means can, for example, be a jack, or pins may be placed on both sides of the divider plate and studs, which are commonly present in an apparatus for forming the edge of a concrete floor slab, may be welded to these pins, thus suspending the divider plate at the desired FFL. In addition, wedges, adjustable feet and the like can be used to position the formwork in the desired manner against the subbase and hold it in place whilst the concrete is cast. However, in these known systems, when concrete is cast into a formwork comprising a divider plate in an elevated position, there will be a gap between the subbase and the divider plate, and some of the concrete will flow through the gap. This can negatively affect the structural soundness of the joint between neighbouring concrete slab panels, and can require rework to remove excessive spillage.

[0006] After casting, concrete slabs display normal drying shrinkage. This shrinkage may be exacerbated when the temperature of the concrete is reduced, for example in the case of floor slabs for freezer stores. The shrinkage of concrete floor slabs is a slow process: it can take up to two years for a concrete slab to stop shrinking. The shrinkage of concrete slab panels generally results in the opening of the joints between the slab panels, due to each concrete slab panel shrinking away from the joint in a direction generally perpendicular to the longitudinal axis of the joint. The type of joint which is adapted to accommodate such shrinking, or contraction, of a concrete slab panel on one or each side of the joint is known as a "contraction joint". This is as opposed to an "expansion joint", which is adapted to accommodate expansion of a concrete slab panel on one or each side of the joint where the slab panels are cast with a preset gap between them, to allow thermal expansion of the slab panel, after contraction of the slab panel due to curing has taken place.

[0007] EP 1389648 describes an apparatus for forming the edge of a concrete floor slab panel, the apparatus comprising a divider plate with a plurality of apertures, dowels for engaging through the apertures and sleeves for applying to the dowels, in which the divider plate or dowel or top strip is provided with means to adjust the height thereof above the subbase. These height adjustment means take the form of a supporting leg together with means for attaching the leg to the divider plate or dowel or top strip at a selected height. The leg is positioned alongside the divider plate or dowel or top strip, and is attached to the divider plate or dowel or top strip either *via* a separate lock means, which is passed through a vertical slot formed in the leg or the divider plate or top strip, or *via* a dowel plate. The effect of this set-up is to allow vertical movement of the joint assembly parallel to the leg, which therefore adjusts the height of the joint assembly relative to the subbase. However, when the divider plate in this apparatus is moved upwards relative to the leg, a gap is created between the subbase and the divider plate. Therefore, when concrete is cast into a formwork comprising the apparatus in its elevated position, some of the concrete will flow through the gap, which can negatively affect the structural soundness of the joint between neighbouring concrete slab panels and can require rework to remove excessive spillage. Furthermore, the lower part of the divider plate is not secured to the subbase at any point. The divider plate is only restricted

in horizontal movement perpendicular to the thrust of the concrete against the divider plate where the height adjustment leg is fitted.

[0008] FR 2964131 describes a formwork height adjusting device which comprises a support base, a divider plate, a backplate, and spaced pairs of brackets. The height of the divider plate above the support base can be adjusted by sliding it up or down relative to the backplate and the spaced pairs of brackets. This system relies on the clamping force of bolts and nuts through the spaced pairs of brackets to hold the divider plate at the correct height to achieve the required FFL. This severely limits the level of precision with which the desired FFL can be achieved, as is discussed in more detail below. In addition to this, when concrete finishing equipment (such as heavy ride-on power trowels) traverse across the top of the joint whilst the concrete is still uncured, it is probable that the joint may move vertically downwards, resulting in an FFL that is outside of the specification for the floor. Furthermore, the device in FR 2964131 contains a large number of separate components, which heightens the complexity and cost of this joint.

[0009] DE 20209468U1 describes a shuttering element for concrete floors, with formwork elements defining the edges of two adjacent concrete slabs. A blocking plate is located between the two formwork elements.

[0010] An apparatus according to the preamble of claim 1 is known from DE 202009000007U1, which describes a permanent formwork for providing edging of a floor covering. The permanent formwork has two profile elements, each provided with a support surface to hold back floor material. One of the profile elements is secured to the ground by a bracket, with a flow barrier positioned between the bracket and the profile element.

[0011] It is an aim of the present invention to provide an apparatus for forming the edge of a concrete floor slab panel, embodiments of which can enhance the ease with which formwork can be assembled, and hence with which concrete floor slabs can be produced, and which can enhance the performance characteristics of the resulting concrete floor slabs and maintain the correct and essential FFL.

Statements of the invention

[0012] According to a first aspect of the present invention there is provided an apparatus for forming an edge of a concrete floor slab panel to be laid on a subbase as defined in claim 1.

[0013] The term "elongate", as used in the context of the extension, means that the extension has an elongate shape, the longitudinal axis of which is, in use, positioned substantially parallel to the longitudinal axis of the divider plate, and hence of the apparatus.

[0014] The term "securable along the first face of the divider plate" means that elongate extension can be secured to the divider plate at two or more locations along the length of the first face of the divider plate.

[0015] In use, the extension can be moved up and down relative to the divider plate, which allows the height of the apparatus above the subbase level 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; the different formwork heights are achieved simply by adjusting the position of the elongate extension relative to the divider plate. The apparatus of the invention can therefore allow much greater flexibility than known types of formwork and can allow distributors to stock a much smaller number of divider plate variants. The production methodology can be changed from 'make to order' to 'make to stock' which allows a quicker response time to customers.

[0016] As mentioned above, it is known to suspend a divider plate at the desired finished floor level (FFL) using suspension means such as, for example, a jack. However, in these known systems, a gap is created between the subbase and the divider plate and therefore concrete can flow through the gap, which can negatively affect the structural soundness of the joint between neighbouring concrete slab panels. In the present invention, during pouring of concrete the extension would normally rest on the subbase. The apparatus of the invention therefore achieves a range of different formwork heights, which can be continuously variable, while avoiding a gap between the subbase and the divider plate which concrete can flow through.

[0017] Furthermore, the apparatus of the invention can achieve a desired finished floor level (FFL) to a high level of precision; the observed variation is in the order of mm. Known systems commonly rely on the clamping force of bolts and nuts to support the weight of the divider plate and hold it in position; in FR 2964131, for example, the divider plate is clamped in between spaced pairs of brackets which are held together with bolts and nuts. In practice, in these types of arrangements the divider plate is prone to sliding down during the finishing process, when concrete finishing equipment such as heavy ride-on power trowels traverse across the top of the joint whilst the concrete is still uncured. Hence the resulting FFL is frequently lower than intended, or varies along the length of the divider plate. The apparatus of the present invention, on the other hand, can achieve a desired finished floor level (FFL) to a much higher level of precision, i.e. accurate to within fractions of a mm.

[0018] In addition to this, the apparatus according to the first aspect of the invention can be easier to operate than existing apparatus in this field. After the divider plate has been set up by supporting (e.g. suspending) it at the desired FFL using support means (which can include suspension means such as, for example, a jack), the position of the extension relative to the divider plate can, for example, be adjusted simply by tapping the extension down to the subbase level, or if the extension is attached to the divider plate via a loose fit it can automatically drop

down to the subbase level.

[0019] Therefore the apparatus can enhance the ease with which concrete floor slab panels can be produced, can enhance the performance characteristics of the resulting concrete floor slabs, and can eliminate the need to trim off concrete spillage, which can save time and reduce waste management costs on site.

[0020] The extension is an essential element of the present invention. In addition, the extension is obviously suitable for putting the invention into effect.

[0021] In an embodiment, the elongate extension comprises at least an elongate side wall and an elongate foot.

[0022] In an embodiment, the elongate extension has a substantially L-shaped cross-section.

[0023] In an embodiment, the elongate extension further comprises an elongate return edge on the elongate foot, resulting in an elongate extension with a substantially J-shaped cross-section.

[0024] In an embodiment, the elongate extension has a substantially C-shaped cross-section.

[0025] In an embodiment, the position of the extension relative to the divider plate can be adjusted in a continuous manner. This allows the height of the formwork relative to the subbase to be adjusted to any desired height, within the range to which the extension is adjustable relative to the divider plate.

[0026] In an embodiment, the position of the extension relative to the divider plate can be adjusted in a stepwise manner. The steps can, for example, be arranged to be set at known intervals which can help in aligning different sections of formwork without the need to take measurements.

[0027] In an embodiment, at least one of the divider plate and the extension comprises members adapted to engage with the other. These members can, for example, ensure that the extension stays attached to the divider plate, ensure that the extension is held in position relative to the divider plate, and/or prevent the divider plate and extension from slipping relative to each other. In an embodiment, the divider plate comprises members adapted to engage with the extension. In an embodiment, the extension comprises members adapted to engage with the divider plate.

[0028] The extension is movable between a stowed position and the extended position and, in the stowed position, the extension cooperates with the divider plate to provide a frictional resistance to sliding extension. This stowed form can make the apparatus more convenient to store, transport and handle.

[0029] The extension is movable between the stowed position and the extended position along a movement path and the divider plate and the extension are arranged to cooperate such that the frictional resistance varies along the movement path. In an embodiment, the movement path comprises a first section of greater resistance in which extending movement of the extension under gravity is prevented and a second section of reduced resistance in which extending movement of the extension may occur under gravity. This means that while having the convenience of a stowed form, the apparatus is also easy to extend when it is set up as formwork during concrete casting: once the extension has been extended beyond a certain point relative to the divider plate it will conveniently slide down to the subbase under gravity, until it comes to rest on the subbase. In the second section, the extension may for example be attached to the divider plate via a loose fit, such that, in use, the extension can drop down to the subbase under gravity while remaining attached to the divider plate.

[0030] In an embodiment, the divider plate and the extension are arranged to cooperate such that, when the extension is in the stowed position, the extension and the divider plate are held together by friction means to resist extending movement, but if the extension is extended by a predetermined distance, the extension can, in use, drop down to the subbase under gravity while remaining attached to the divider plate. This can, for example, be achieved by having interference members, such as small embossed 'pips', which protrude from the elongate extension near the lower end of the elongate extension and interfere with the mating face of the divider plate, thus causing an interference fit when the elongate extension is in its stowed position. Once the elongate extension has been lowered sufficiently such that the interference members (e.g. the 'pips') have moved past the lower edge of the divider plate, then no interference is taking placing and the elongate extension can fall freely under gravity.

[0031] The divider plate and/or the extension contains a substantially vertical slot adapted to receive mechanical fastening means. In an embodiment, the divider plate contains a substantially vertical slot adapted to receive mechanical fastening means. In an embodiment, the elongate extension contains a substantially vertical slot adapted to receive mechanical fastening means.

[0032] The extension is arranged to be attached to the divider plate via mechanical fastening means comprising a rivet.

[0033] In an embodiment, the apparatus is arranged to be securable to the subbase. This arrangement makes 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) in the process. This can enhance the ease with which concrete floor slabs can be produced.

[0034] In an embodiment, the apparatus further comprises a pin; and a wedge; wherein, in use, the pin can be placed in the ground on the same side of the divider plate as the elongate extension, and the wedge can be placed between the pin and the elongate extension and/or the divider plate, in order to secure the apparatus to the subbase in the desired location. This arrangement allows the apparatus to resist the concrete thrust caused by concrete cast on the other side of the divider plate from the pin and wedge, which allows the concrete to be cast without the risk of the apparatus shifting in position

(in a substantially horizontal direction) in the process.

[0035] The wedge, which can be placed between the pin and the elongate extension and/or the divider plate, can be of any shape, as long as it allows the apparatus to be secured to the subbase in the desired location.

[0036] In an embodiment, the range over which the extension can be moved relative to the divider plate is a range of about 50 mm. In use, this movement would generally be in a substantially vertical direction. Since the height of a concrete floor slab is usually in the range of 150 to 200 mm, the range of movement of about 50 mm can allow the full range of common floor slab heights to be achieved with a single size of apparatus.

[0037] In an embodiment, the divider plate is 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.

[0038] In an embodiment, the extension is formed from a metal such as, for example, steel, or from plastic. In an embodiment, the extension is formed from steel.

[0039] In an embodiment, the extension is formed as an elongate extrusion. In an embodiment, the elongate extrusion has a substantially constant cross-section along its length.

[0040] In an embodiment, the extension comprises a longitudinal fold at the top edge and/or the lower edge of the extension. Such a fold can, for example, be a longitudinal L-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 extension.

[0041] The divider plate can be conventional in construction, for example as EP 1389648 or similar.

[0042] In an embodiment, the divider plate is an elongate flat section of material.

[0043] In an embodiment, the divider plate comprises a longitudinal fold at the top edge and/or the lower edge of the divider plate. Such a fold can, for example, be a longitudinal L-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.

[0044] In an embodiment, the divider plate comprises one or more apertures. In an embodiment, the apparatus further comprises one or more dowels or dowel plates for engaging through the one or more apertures. These act to connect the resulting concrete slab panels together and to provide a method of load transfer between adjacent slab panels. In an embodiment, the apertures suitable for receiving the dowels or dowel plates in the divider plate are located above the upper edge of the elongate extension when the extension is in its highest position relative to the divider plate (i.e. the extension is in its fully retracted form). In an embodiment, the extension may be castellated along its top edge such that it can accommodate the dowels.

[0045] Once cast, concrete slab panels are prone to shrinkage during curing which causes the edges of the slab panels to separate. This exposes the upper edge, or arris, of each individual slab panel to damage from loads such as from vehicles, including for example lorries or forklift trucks, passing across the joint.

[0046] The apparatus, therefore, may comprise further components, which after casting of the concrete would sit at the surface of the concrete floor. Such components include, for example, edge rails and top plates.

[0047] In an embodiment, the apparatus further comprises edge rails, which may be supported by the divider plate. In an embodiment, the apparatus comprises two such edge rails adjacent to each other. The edge rails can provide protection to the arris of the cast slab panels and improve the longevity of the slab at the joints.

[0048] The edge rails may be arranged to mate with each other along linear or non-linear edges. In an embodiment, the edge rails are arranged to mate with each other along linear edges. In an embodiment, the edge rails are arranged to mate with each other along non-linear edges.

[0049] In an embodiment, the apparatus further comprises top plates, which may be supported by the divider plate. In an embodiment, the apparatus comprises two top plates adjacent to each other, referred to as first and second top plates. The top plates can provide protection to the arris of the cast slab panels and improve the longevity of the slab at the joints.

[0050] In an embodiment, the apparatus comprises first and second top plates which are arranged to mate with one another along linear edges.

[0051] In an embodiment, the apparatus comprises first and second top plates which are arranged to mate with one another along non-linear edges, such as, for example, shown in FR 2785632.

[0052] In an embodiment, the apparatus further comprises first and second supports, the first support being attached to or attachable to the divider plate and to the first top plate, and the second support being attached to or attachable to the second top plate.

[0053] In an embodiment, the first support comprises a facing edge which faces the second support, and the edge of the first top plate is offset from the facing edge of the first support, along the direction in which the top plates can move apart, so that, when in use between two shrinking concrete slab panels, the gap which opens up between the top plates is offset from the gap which opens up between the supports and the gaps do not overlap.

[0054] In this embodiment, when the apparatus is used as a joint between concrete floor slab panels, if, as the concrete shrinks, the first and second top plates move apart in the direction perpendicular to the longitudinal axis of the joint, the elongate gap which is formed between the first and second top plates is only as deep (vertically) as the first and second top plates. This gap is offset from the gap which opens up between the supports, and which extends down to the subbase between the two shrinking concrete slab panels. The gap which opens up between the first and second top plates is offset from the gap which opens up between the supports in the same

axial plane. The two gaps do not overlap, so this joint does not contain a continuous path from the surface to the subbase. Therefore debris and vermin cannot get into the full depth shrinkage gap through the surface gap between the first and second top plates. Shrinkage gaps can commonly be filled in with a filler rod and a sealant resin. However, this is a labour intensive process, and it usually does not provide a final solution due to the long time it takes for concrete slabs to stop shrinking. The filler rod and sealant resin are usually applied before the concrete floor slabs have stopped shrinking, and as they continue to shrink the gap can reopen since the sealant is unable to stretch enough to accommodate the larger shrinkage gap. In addition to this, the sealant is costly and tends to age and requires removal before fresh sealant can be fitted. The embodiment wherein the gap which opens up between the first and second top plates does not overlap with the gap which opens up between the supports does not contain a continuous path from the surface to the subbase. This apparatus, therefore, can dispense with the need to use filler rods and/or a sealant resin.

[0055] In an embodiment, the edge rails, top plates and/or supports further comprise anchor means for embedding in the concrete. The anchor means become embedded in the concrete during curing and fix the edge rails, top plates and/or supports in position.

[0056] Some or all of these anchor means may also be welded to pins, placed on both sides of the divider plate, to suspend the divider plate at the desired finished floor level (FFL) before concrete is cast. The pins would, of course, be placed or cut off in such a way that they do not stick out above the FFL. This technique of suspending the divider plate at the desired FFL can be used as an alternative to or in combination with other support means, which can include suspension means such as, for example, a jack.

[0057] In an embodiment, the edge rails, top plates and/or supports are attached together with yieldable fixings. These fixings fail under tension as shrinking occurs during the curing process and the edge rails, top plates and/or supports of adjacent slabs are drawn apart.

[0058] In an embodiment, the yieldable fixings comprise low tensile bolts. Examples of such low tensile bolts are bolts formed from nylon, the threads of which will become stripped under shrinkage forces, or the shanks of which will fail under tension.

[0059] The apparatus according to the first aspect of the invention can be used to form, for example, prefabricated four-way intersections, three-way "T" intersections, corner units and loading dock corners.

[0060] According to a second aspect of the present invention there is provided a concrete floor slab panel comprising the apparatus according to the first aspect of the invention.

[0061] According to a third aspect of the present invention there is provided a concrete floor comprising the apparatus according to the first aspect of the invention.

[0062] According to a fourth aspect of the present invention there is provided a method of manufacturing a concrete floor slab panel, comprising the steps of

(i) setting up the apparatus according to the first aspect of the invention to form at least part of an edge of a space for casting concrete; and
(ii) casting concrete in the space.

[0063] In an embodiment, step (i) comprises supporting the apparatus using support means. In an embodiment, the support means comprise suspension means, such as e.g. a jack.

[0064] According to a fifth aspect of the present invention there is provided a method of manufacturing a concrete floor, comprising the steps of

(i) setting up the apparatus according to the first aspect of the invention to form at least part of an edge of a space for casting concrete; and
(ii) casting concrete in the space;

wherein steps (i) and (ii) are performed more than once.

[0065] In an embodiment, step (i) comprises supporting the apparatus using support means. In an embodiment, the support means comprise suspension means, such as e.g. a jack.

[0066] 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.

[0067] 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.

[0068] 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

[0069] 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 an embodiment of the apparatus of the invention, with the extension in a retracted position relative to the divider plate.

Figure 2 shows a perspective view of the embodiment in Figure 1, with the extension in a retracted position relative to the divider plate, together with suspension means in the form of a jack.

Figure 3 shows a perspective view of the embodiment in Figure 1, with the extension in an extended position relative to the divider plate, together with a jack, a pin and wedges.

Figure 4 shows an area cross-sectional view of the embodiment in Figure 1 perpendicular to its length, with the extension in a retracted position relative to the divider plate.

Figure 5 shows an area cross-sectional view of the embodiment in Figure 4, with the extension in an extended position relative to the divider plate.

Figure 6 shows a total cross-sectional view of the embodiment in Figure 1 perpendicular to its length, with the extension in an extended position relative to the divider plate, together with the subbase, a jack, two pins and wedges, before concrete has been cast.

Figure 7 shows a total cross-sectional view of the embodiment in Figure 6, after concrete has been cast on one side of the apparatus.

Figure 8 shows a total cross-sectional view of the embodiment in Figure 7, after concrete has been cast on one side of the apparatus, and the jack, two pins and wedges have been removed.

Figure 9 shows a total cross-sectional view of the embodiment in Figure 8, after concrete has been cast on both sides of the apparatus.

[0070] As shown in Figures 1 to 5, an elongate extension **2** is movably secured to one face of divider plate **1.** Divider plate **1** is an elongate flat section of material. The extension **2** is elongate and comprises an elongate side wall **2a**, an elongate foot **2b** and an elongate return edge **2c** on the elongate foot **2b,** resulting in an elongate extension **2** with a substantially J-shaped cross-section. Extension **2** has a substantially constant cross-section along its length.

[0071] The elongate extension **2** is movable relative to the divider plate **1** between a fully retracted position and a fully extended position. The extension **2** can also be moved to a position anywhere between these two extremes.

[0072] The extension **2** contains substantially vertical slots **3** at regular intervals. The slots **3** are adapted to receive rivets **4** which are also connected to the divider plate **1.**

[0073] In the embodiment shown in Figures 1 to 9, the position of the extension **2** relative to the divider plate **1** can be adjusted in a continuous manner, and the extension **2** is attached to the divider plate **1** via a loose fit. The extension **2** has a stowed position, where the extension **2** and the divider plate **1** are held together by friction means (not shown), but if the extension **2** is moved down relative to the divider plate **1** by a predetermined distance (i.e. towards a more extended form), the extension **2** can drop down to the subbase under gravity while remaining attached to the divider plate **1.**

[0074] Divider plate **1** comprises apertures **6** along its length at regular intervals. The apertures **6** are adapted to receive dowel plates **7.** On one side of the divider plate **1,** the dowel plates **7** are encased in dowel sleeves **8,** which, in use, allow movement of the concrete as it sets and shrinks.

[0075] The apparatus further comprises edge rails **5** supported by divider plate **1.** Anchor means **9** extend out from the edge rails **5** in the general direction where, in use, the concrete would be poured.

[0076] Figures 2, 3, 6 and 7 also show a jack **10,** which does not form part of the apparatus of the invention, but which can be used to suspend the divider plate **1** at the desired finished floor level (FFL) before concrete is cast. The jack **10** can, for example, have a removable threaded end which fits through apertures in the edge rails **5.** The threaded end can be secured to the edge rails **5** by securing it with a wing nut on the other side from the jack **10,** while on the side of the jack **10,** the threaded end fits inside the jack's square box section which runs up and down the threaded bar, allowing the height of the apparatus **1** relative to the subbase to be adjusted.

[0077] Figures 3, 6 and 7 also show pins **11a, 11b** and wedges **12**, which do not form part of the apparatus of the invention, but which can be used to secure the apparatus to the subbase in the desired location.

[0078] In use, as shown in Figures 6 to 9, the divider plate 1 is suspended at the desired FFL using support means, which can include suspension means such as, for example, a jack **10.** The jack **10** is secured to the subbase via a pin **11b.**

[0079] At this stage, the extension **2** can be in its stowed form. The extension **2** is then moved down relative to the divider plate **1** by a predetermined distance, past the friction means which was holding it in place (not shown); after this the extension **2** can drop down to the subbase under gravity, while remaining attached to the divider plate **1** via a loose fit.

[0080] An additional pin **11a** is then placed in the

ground on the same side of the divider plate **1** as the extension **2** and the jack **10.** Wedges **12** are placed between the pin **11a** and the extension **2** and/or the divider plate **1,** in order to secure the apparatus to the subbase in the desired location and prevent movement caused by the thrust of the concrete.

[0081] The apparatus will form at least part of an edge of a space for casting concrete. The entire edge may be formed by the apparatus, and the remaining edges may also be formed by further units of the apparatus. Once the space for casting concrete has been defined by the edges, i.e. the formwork has been set up, concrete is poured into the space.

[0082] As shown in Figures 6 to 9, concrete is first cast on the other side of the divider plate **1** from the extension **2,** the jack **10,** the pins **11a, 11b** and the wedges **12** (see Figure 7). After this concrete has set sufficiently, the jack **10,** the pins **11a, 11b** and the wedges **12** are removed (see Figure 8). The jack **10** is, for example, detached from its threaded end (which is still attached to the edge rails **5**) and the threaded end is unscrewed, while the wing nut stays in place in the concrete on the other side. After this concrete is cast on the remaining side of the apparatus (see Figure 9).

[0083] The apparatus of the invention can alleviate the need to manufacture, transport and stock a large number of different sizes of divider plates to suit all customer needs. Instead, a desired formwork height can be achieved by using a single size of divider plate, while avoiding a gap between the subbase and the divider plate which concrete can flow through. Furthermore, the apparatus of the invention can be easier to operate than existing apparatus in this field, and can achieve a desired finished floor level (FFL) to a high level of precision. Therefore the apparatus can enhance the ease with which concrete floor slab panels can be produced, and can enhance the performance characteristics of the resulting concrete floor slabs.

Claims

1. Apparatus for forming an edge of a concrete floor slab panel to be laid on a subbase, the apparatus comprising:

   a divider plate (1) for bounding a side of the slab panel, the divider plate (1) having first and second faces; and
   an elongate extension (2), securable along the first face of the divider plate (1), for sliding extension to an extended position in which the extension (2) bridges a gap between the divider plate (1) and the subbase in use, wherein the longitudinal axis of the elongate extension (2) is, in use, positioned substantially parallel to the longitudinal axis of the divider plate (2);
   wherein the apparatus contains no component which, in use, attaches directly to the second face of the divider plate (1) and which can extend beyond a lower edge of the divider plate (1) into the gap between the divider plate (1) and the subbase;
   wherein the extension (2) is movable between a stowed position and the extended position, and
   wherein the divider plate (1) and/or the extension (2) contains a substantially vertical slot (3) adapted to receive mechanical fastening means (4),
   characterized in that:

   the mechanical fastening means comprises a rivet attaching the elongate extension (2) to the divider plate (1); and
   in the stowed position, the extension (2) cooperates with the divider plate (1) to provide a frictional resistance to sliding extension, wherein the extension (2) is movable between the stowed position and the extended position along a movement path and wherein the divider plate (1) and the extension (2) are arranged to cooperate such that the frictional resistance varies along the movement path.

2. The apparatus of claim 1, wherein the elongate extension (2) comprises at least an elongate side wall (21) and an elongate foot (2b).

3. The apparatus of claim 2, wherein the elongate extension further comprises an elongate return edge (2c) on the elongate foot (2b), resulting in an elongate extension (2) with a substantially J-shaped cross-section.

4. The apparatus of any one of the preceding claims, wherein the position of the extension (2) relative to the divider plate (1) can be adjusted in a continuous manner.

5. The apparatus of any one of the preceding claims, wherein at least one of the divider plate (1) and the extension (2) comprises members adapted to engage with the other.

6. The apparatus of any one of the preceding claims, wherein the movement path comprises a first section of greater resistance in which extending movement of the extension (2) under gravity is prevented and a second section of reduced resistance in which extending movement of the extension (2) may occur under gravity.

7. The apparatus of claim 6, wherein the divider plate (1) and the extension (2) are arranged to cooperate

such that, when the extension is in the stowed position, the extension and the divider plate are held together by friction means to resist extending movement, but if the extension (2) is extended by a predetermined distance, the extension (2) can, in use, drop down to the subbase under gravity while remaining attached to the divider plate.

8. The apparatus of any one of the preceding claims, wherein the apparatus is arranged to be securable to the subbase.

9. The apparatus of claim 8, wherein the apparatus further comprises

a pin (11a,11b); and
a wedge (12);

wherein, in use, the pin (11a,11b) can be placed in the ground on the same side of the divider plate (1) as the extension (2), and the wedge (12) can be placed between the pin (11a,11b) and the extension (2) and/or the divider plate (1), in order to secure the apparatus to the subbase in the desired location.

10. A concrete floor slab panel comprising the apparatus according to any one of claims 1-9.

11. A concrete floor comprising the apparatus according to any one of claims 1-9.

12. A method of manufacturing a concrete floor slab panel, comprising the steps of

(i) setting up the apparatus according to any one of claims 1-10 to form at least part of an edge of a space for casting concrete, including suspending the divider plate at the desired finished floor level, and subsequently moving the extension along the movement path to the extended position; and
(ii) casting concrete in the space.

Patentansprüche

1. Vorrichtung zum Bilden eines Randes eines auf einem Untergrund zu verlegenden Betonbodenplattenpaneels, wobei die Vorrichtung umfasst:

eine Trennplatte (1) zum Begrenzen einer Seite des Plattenpaneels, wobei die Trennplatte (1) eine erste und eine zweite Seite aufweist, und
eine entlang der ersten Seite der Trennplatte (1) sicherbare längliche Erweiterung (2) zum gleitenden Ausfahren in eine ausgefahrene Position, in der die Erweiterung (2) in der Anwendung einen Zwischenraum zwischen der Trennplatte (1) und dem Untergrund schließt, wobei die Längsachse der länglichen Erweiterung (2) in der Anwendung im Wesentlichen parallel zur Längsachse der Trennplatte (2) positioniert ist, wobei die Vorrichtung keine Komponente enthält, die in der Anwendung unmittelbar an der zweiten Seite der Trennplatte (1) angebracht ist und sich über einen unteren Rand der Trennplatte (1) hinaus in den Zwischenraum zwischen der Trennplatte (1) und dem Untergrund erstrecken kann, und
wobei die Erweiterung (2) zwischen einer verstauten Position und der ausgefahrenen Position bewegbar ist und
wobei die Trennplatte (1) und/oder die Erweiterung (2) einen im Wesentlichen vertikalen Schlitz (3) enthält, der geeignet ist, ein mechanisches Befestigungsmittel (4) aufzunehmen,
dadurch gekennzeichnet, dass
das mechanische Befestigungsmittel eine Niete umfasst, welche die längliche Erweiterung (2) an der Trennplatte (1) befestigt, und
in der verstauten Position die Erweiterung (2) mit der Trennplatte (1) zusammenwirkt, um einen Reibungswiderstand gegen ein gleitendes Ausfahren bereitzustellen, wobei die Erweiterung (2) entlang eines Bewegungswegs zwischen der verstauten Position und der ausgefahrenen Position bewegbar ist und wobei die Trennplatte (1) und die Erweiterung (2) eingerichtet sind, um derart zusammenzuwirken, dass der Reibungswiderstand entlang des Bewegungswegs variiert.

2. Vorrichtung nach Anspruch 1, wobei die längliche Erweiterung (2) wenigstens eine längliche Seitenwand (21) und einen länglichen Fuß (2b) umfasst.

3. Vorrichtung nach Anspruch 2, wobei die längliche Erweiterung ferner einen zurückgebogenen länglichen Rand (2c) an dem länglichen Fuß (2b) umfasst, woraus sich eine längliche Erweiterung (2) mit einem im Wesentlichen J-förmigen Querschnitt ergibt.

4. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Position der Erweiterung (2) relativ zu der Trennplatte (1) stufenlos eingestellt werden kann.

5. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Trennplatte (1) und/oder die Erweiterung (2) Elemente umfasst, die geeignet sind, mit dem anderen einen Eingriff zu bilden.

6. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei der Bewegungsweg ein erstes Teilstück mit größerem Widerstand, in welchem eine schwerkraftbedingte Ausfahrbewegung der Erweite-

rung (2) verhindert wird, und ein zweites Teilstück mit verringertem Widerstand umfasst, in welchem eine schwerkraftbedingte Ausfahrbewegung der Erweiterung (2) erfolgen kann.

7. Vorrichtung nach Anspruch 6, wobei die Trennplatte (1) und die Erweiterung (2) eingerichtet sind, um derart zusammenzuwirken, dass bei in der verstauten Position befindlicher Erweiterung die Erweiterung und die Trennplatte durch Reibungsmittel zusammengehalten werden, um einer Ausfahrbewegung zu widerstehen, die Erweiterung (2) in der Anwendung jedoch im Falle eines Ausfahrens der Erweiterung (2) um eine vorab bestimmte Distanz unter Aufrechterhaltung der Verbindung zu der Trennplatte schwerkraftbedingt auf den Untergrund herabsinken kann.

8. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Vorrichtung an dem Untergrund sicherbar eingerichtet ist.

9. Vorrichtung nach Anspruch 8, wobei die Vorrichtung ferner umfasst:

einen Stift (11a,11b) und
einen Keil (12),

wobei in der Anwendung der Stift (11a, 11b) auf der gleichen Seite der Trennplatte (1) wie die Erweiterung (2) im Boden platziert werden kann und der Keil (12) zwischen dem Stift (11a, 11b) und der Erweiterung (2) und/oder der Trennplatte (1) platziert werden kann, um die Vorrichtung an der gewünschten Stelle an dem Untergrund zu sichern.

10. Betonbodenplattenpaneel, die Vorrichtung nach einem der Ansprüche 1 bis 9 umfassend.

11. Betonboden, die Vorrichtung nach einem der Ansprüche 1 bis 9 umfassend.

12. Verfahren zum Herstellen eines Betonbodenplattenpaneels, umfassend die Schritte

(i) Errichten der Vorrichtung nach einem der Ansprüche 1 bis 10, um zumindest einen Teil eines Rands eines Raumes zum Gießen von Beton zu bilden, einschließlich Einhängen der Trennplatte (1) auf der gewünschten fertigen Bodenhöhe und anschließendes Bewegen der Erweiterung entlang des Bewegungswegs in die ausgefahrene Position, und
(ii) Gießen von Beton in den Raum.

Revendications

1. Appareil permettant de former une bordure d'un panneau de dalle de sol en béton destiné à être posé sur une couche de fondation, l'appareil comprenant :

une plaque de séparation (1) permettant de délimiter un côté du panneau de dalle, la plaque de séparation (1) possédant des première et seconde faces ; et
une extension allongée (2), pouvant être fixée le long de la première face de la plaque de séparation (1), pour faire coulisser l'extension jusqu'à une position étendue dans laquelle l'extension (2) comble l'écart entre la plaque de séparation (1) et la couche de fondation lors de l'utilisation, l'axe longitudinal de l'extension allongée (2) étant, lors de l'utilisation, positionné sensiblement parallèlement à l'axe longitudinal de la plaque de séparation (2) ;
ledit appareil ne contenant aucun composant qui, lors de l'utilisation, se fixe directement sur la seconde face de la plaque de séparation (1) et qui peut s'étendre au-delà d'une bordure inférieure de la plaque de séparation (1) dans l'écart entre la plaque de séparation (1) et la couche de fondation ;
ladite extension (2) étant mobile entre une position repliée et la position étendue, et
ladite plaque de séparation (1) et/ou ladite extension (2) contenant une fente sensiblement verticale (3) conçue pour recevoir un moyen de fixation mécanique (4),
caractérisé en ce que :

le moyen de fixation mécanique comprend un rivet fixant l'extension allongée (2) à la plaque de séparation (1) ; et
dans la position repliée, l'extension (2) coopère avec la plaque de séparation (1) pour assurer une résistance par frottement permettant de faire coulisser l'extension, ladite extension (2) étant mobile entre la position repliée et la position étendue le long d'un trajet de déplacement et ladite plaque de séparation (1) et ladite extension (2) étant destinées à coopérer de sorte que la résistance par frottement varie le long du trajet de déplacement.

2. Appareil selon la revendication 1, ladite extension allongée (2) comprenant au moins une paroi latérale allongée (21) et un pied allongé (2b).

3. Appareil selon la revendication 2, ladite extension allongée comprenant en outre une bordure de retour allongée (2c) sur le pied allongé (2b), ce qui résulte en une extension allongée (2) dotée d'une section

transversale sensiblement en forme de J.

4. Appareil selon l'une quelconque des revendications précédentes, ladite position de l'extension (2) par rapport à la plaque de séparation (1) pouvant être ajustée de manière continue.

5. Appareil selon l'une quelconque des revendications précédentes, au moins un élément parmi la plaque de séparation (1) et l'extension (2) comprenant des éléments conçus pour s'engager l'un avec l'autre.

6. Appareil selon l'une quelconque des revendications précédentes, ledit trajet de déplacement comprenant une première section de plus grande résistance dans laquelle le déplacement d'extension de l'extension (2) par effet de gravité est empêché et une seconde section de résistance réduite dans laquelle le déplacement d'extension de l'extension (2) peut se produire par effet de gravité.

7. Appareil selon la revendication 6, ladite plaque de séparation (1) et ladite extension (2) étant destinées à coopérer de sorte que, lorsque l'extension se trouve dans la position repliée, l'extension et la plaque de séparation soient maintenues ensemble par un moyen par frottement pour résister au déplacement d'extension, mais si l'extension (2) est étendue d'une distance prédéfinie, l'extension (2) peut, lors de l'utilisation, descendre jusqu'à la couche de fondation par effet de gravité tout en restant fixée à la plaque de séparation.

8. Appareil selon l'une quelconque des revendications précédentes, ledit appareil étant conçu pour pouvoir être fixé à la couche de fondation.

9. Appareil selon la revendication 8, ledit appareil comprenant en outre :

une tige (11a,11b); et
une cale (12) ;

lors de l'utilisation, ladite tige (11a,11b) pouvant être placée dans le sol du même côté de la plaque de séparation (1) que l'extension (2), et ladite cale (12) pouvant être placée entre la tige (11a,11b) et l'extension (2) et/ou la plaque de séparation (1), afin de fixer l'appareil à la couche de fondation à l'emplacement souhaité.

10. Panneau de dalle de sol en béton comprenant l'appareil selon l'une quelconque des revendications 1 à 9.

11. Sol en béton comprenant l'appareil selon l'une quelconque des revendications 1 à 9.

12. Procédé de fabrication d'un panneau de dalle de sol en béton, comprenant les étapes de

(i) mise en place de l'appareil selon l'une quelconque des revendications 1 à 10 pour former au moins une partie d'une bordure d'un espace permettant de couler du béton, comprenant la suspension de la plaque de séparation au niveau de sol fini souhaité, et ensuite le déplacement de l'extension le long du chemin de déplacement jusqu'à la position étendue ; et
(ii) coulage du béton dans l'espace.

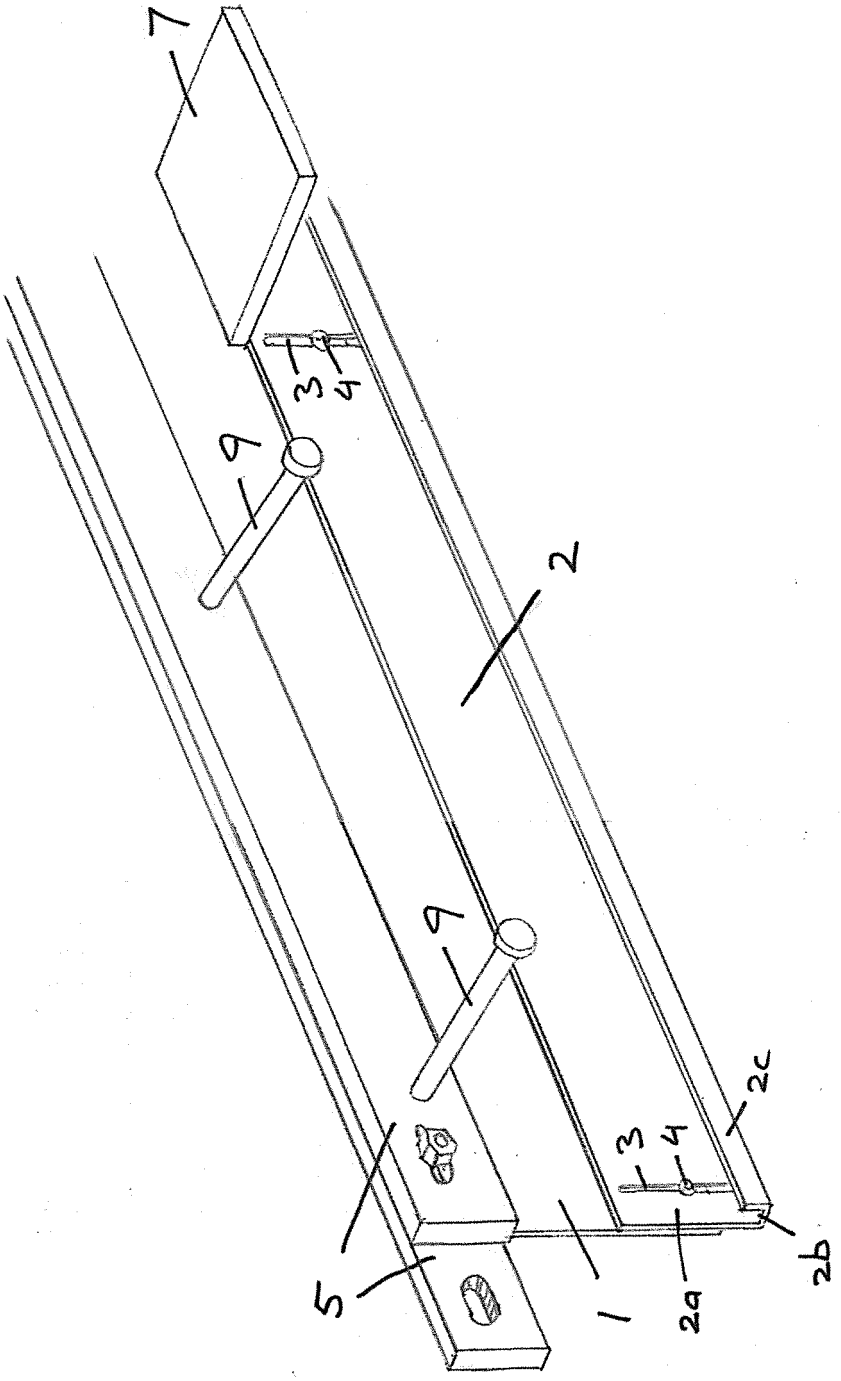

Figure 1

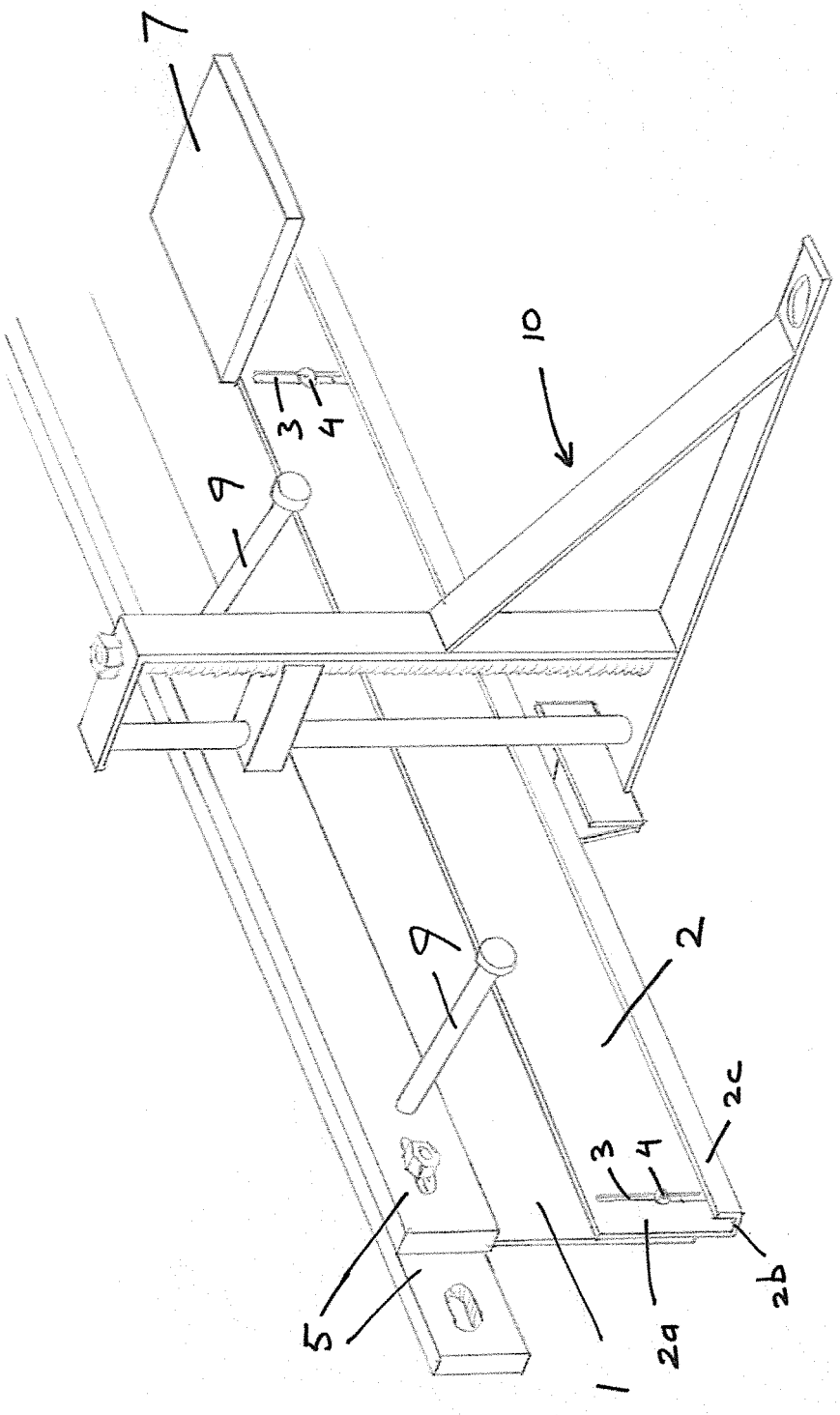

Figura 2

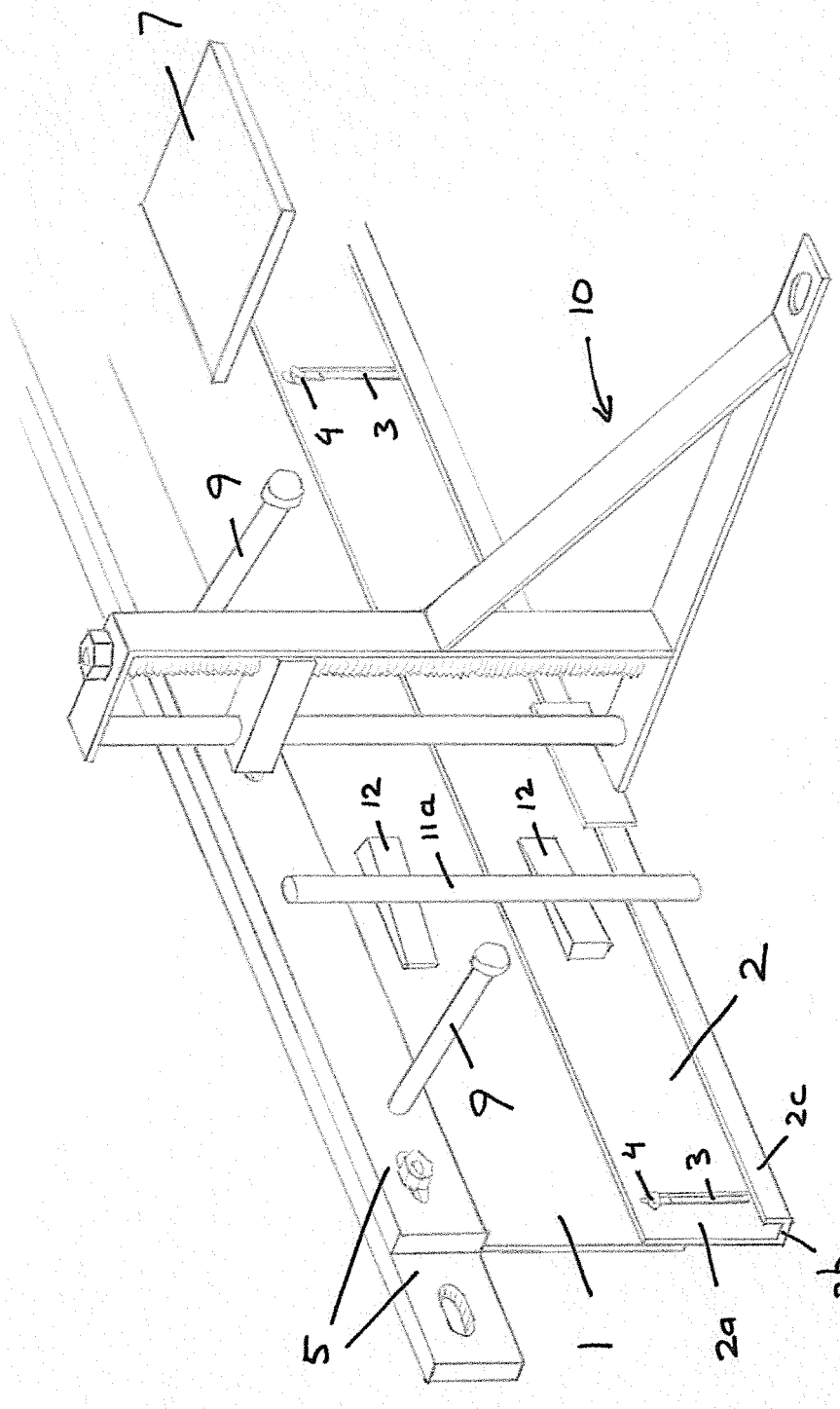

Figure 3

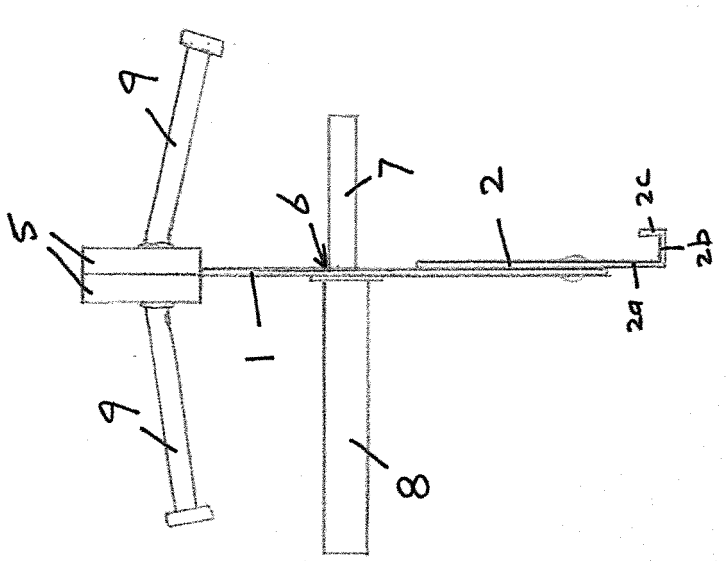

Figure 4

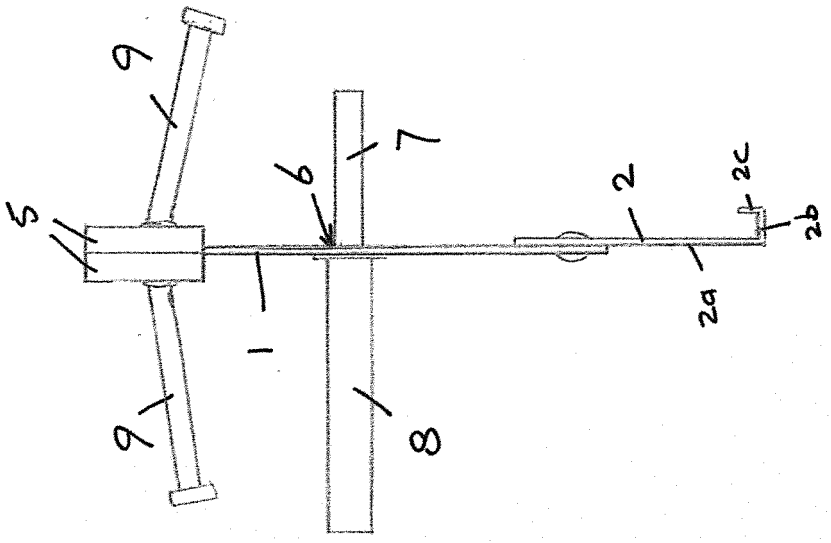

Figure 5

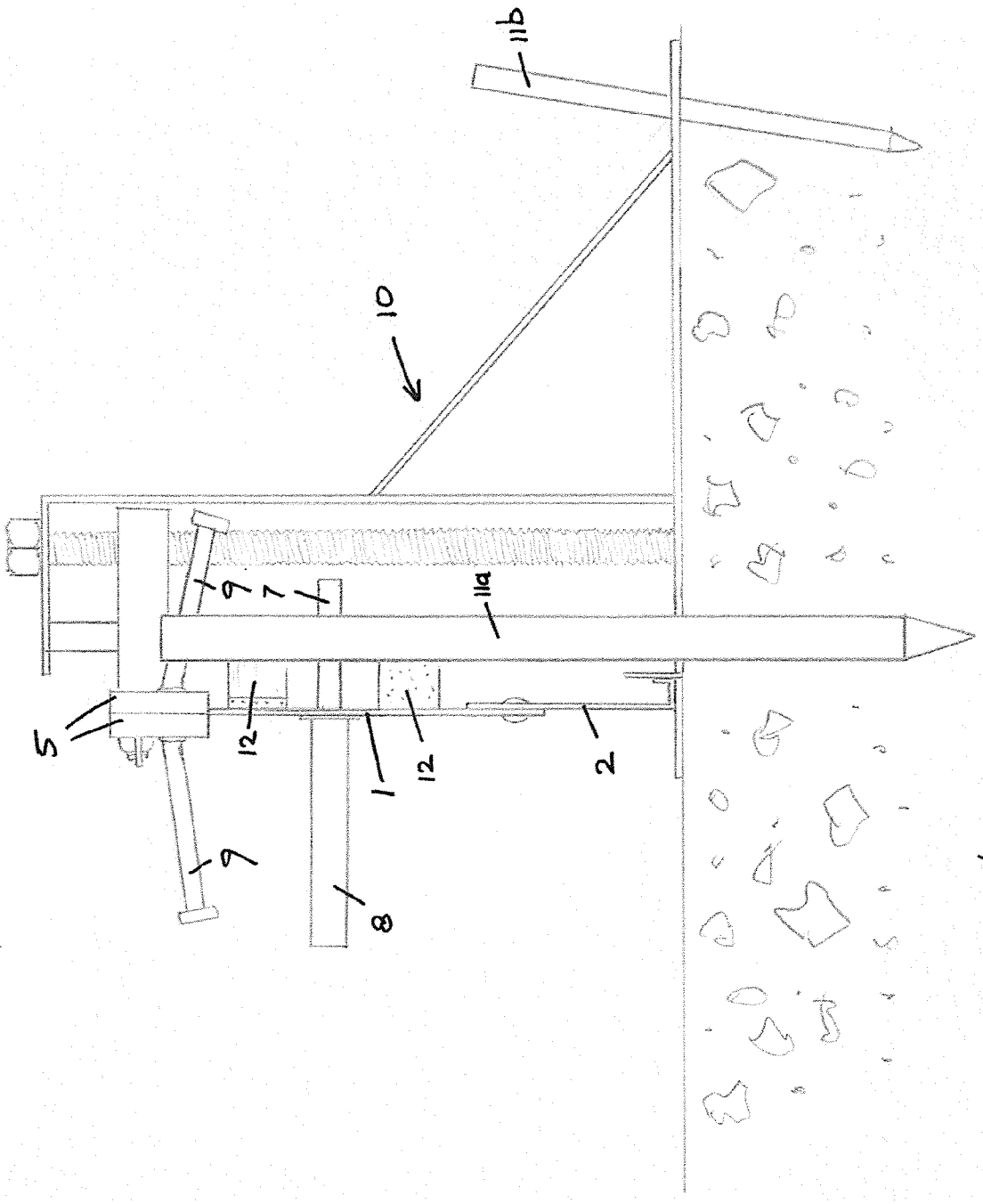

Figura 6

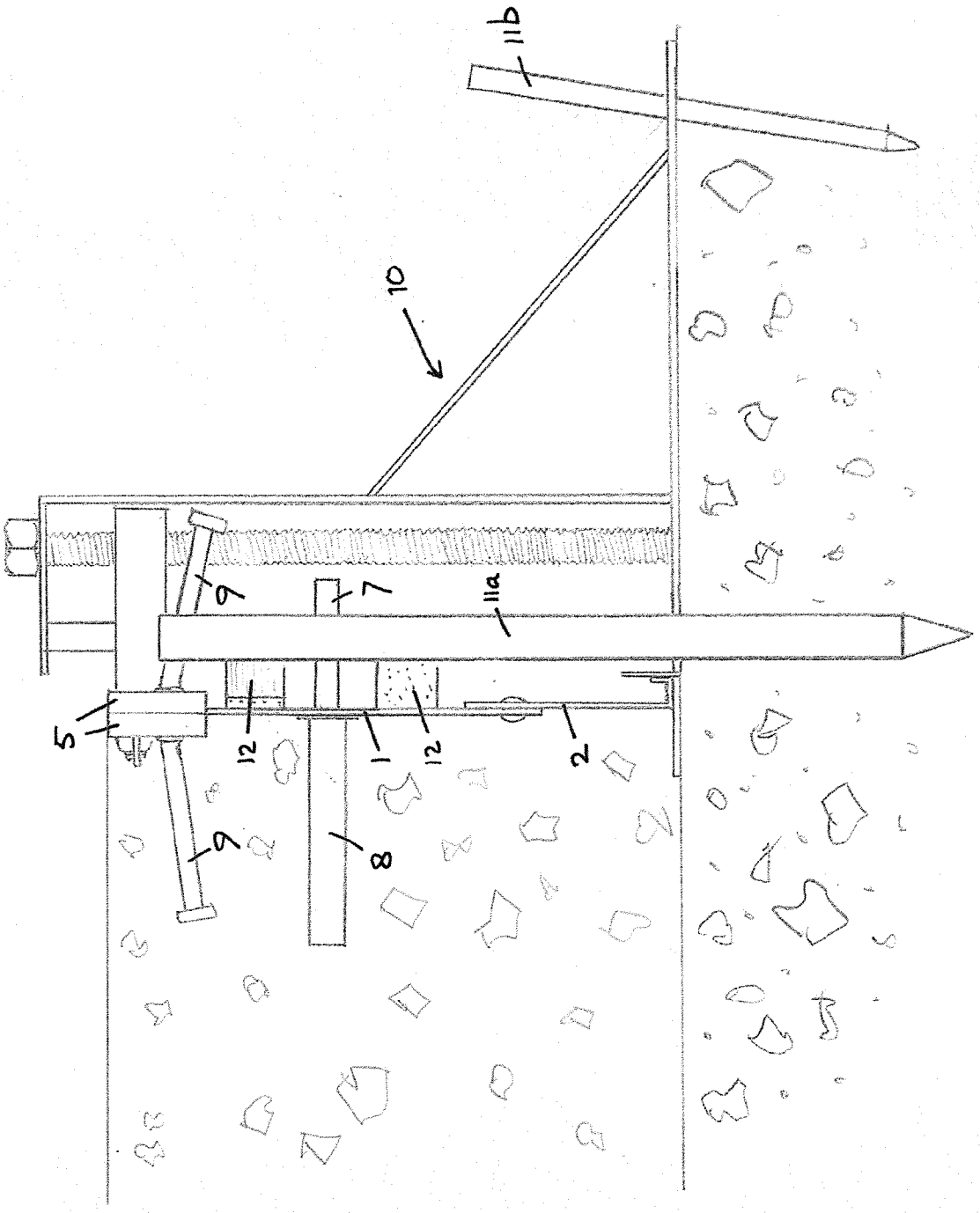

Figure 7

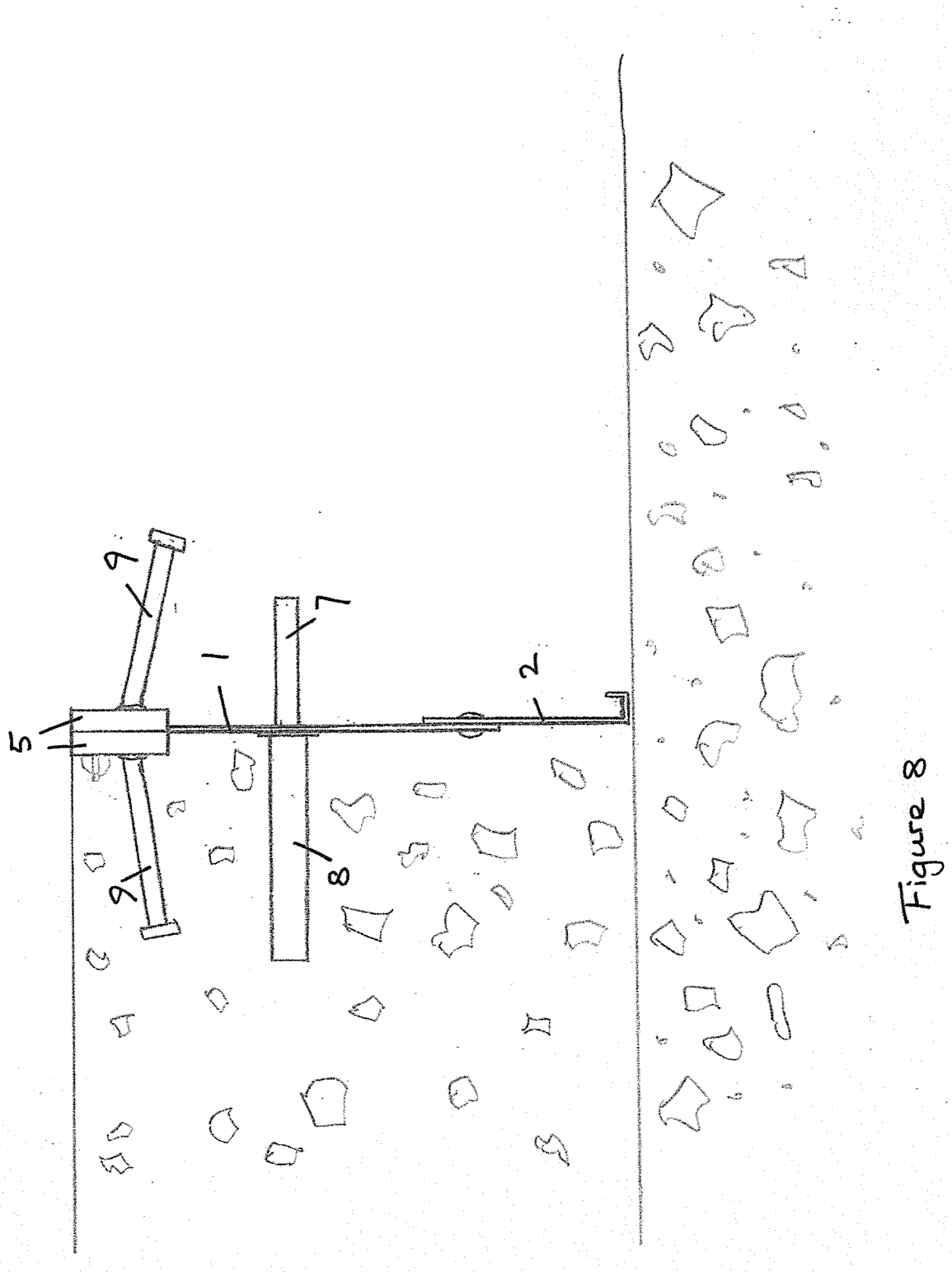

Figure 8

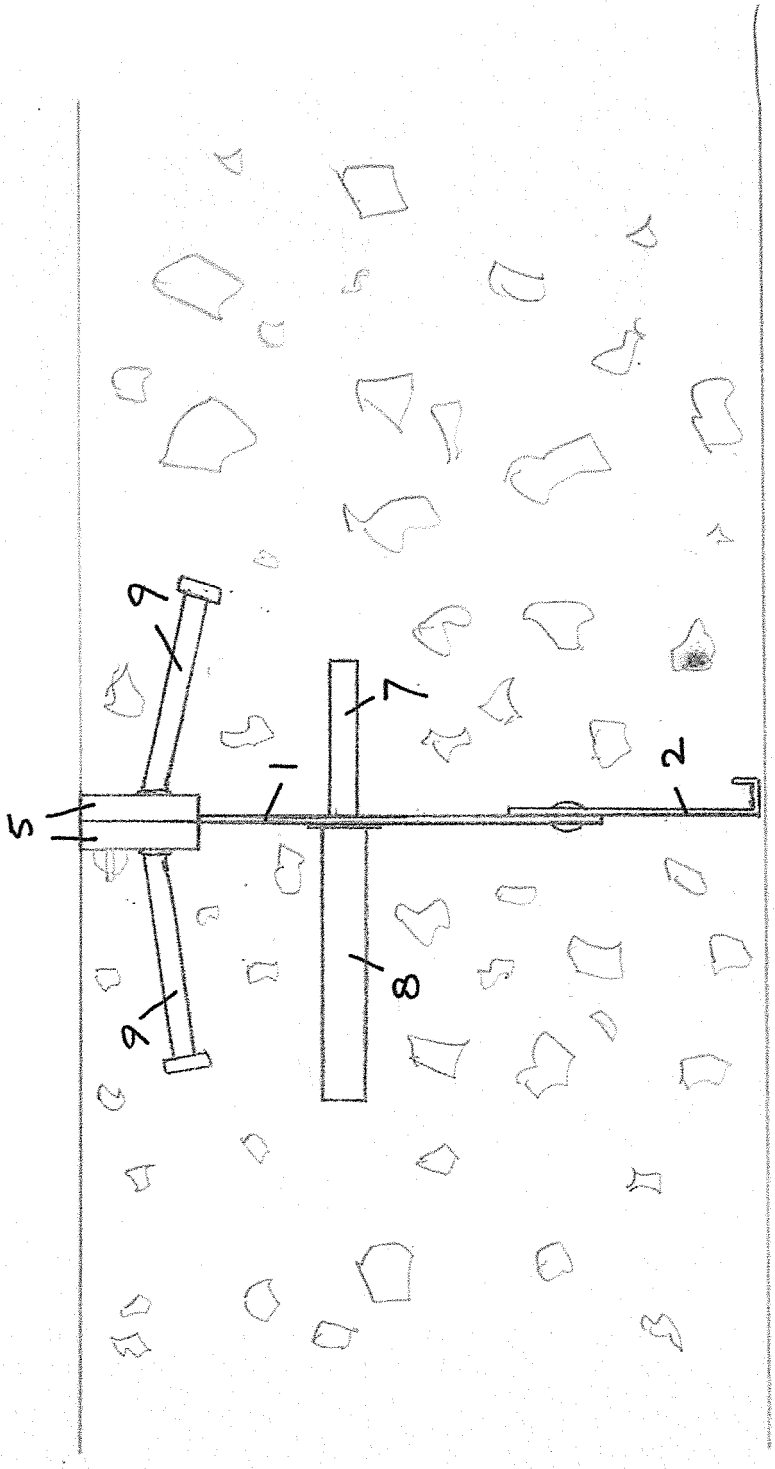

Figura 9

REFERENCES CITED IN THE DESCRIPTION

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