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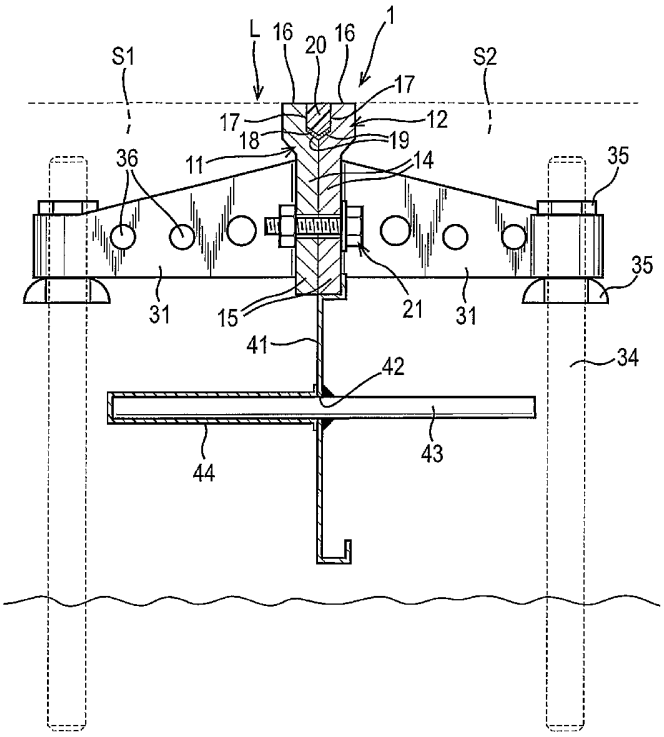
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(54) **Title:** SLAB JOINT



(57) **Abstract:** A slab joint for use between two slabs S1 & S2 of concrete set up accurately with the intended finished floor level L prior to casting of the slabs. The joint has two plates (11 & 12) rolled to a lazy Z form, having major webs (14), angled flanges (15) and parallel minor flanges (16). The two opposed lazy Z plates create a void between their minor flanges (16) which have opposing faces (17), which provides a pocket for elastomeric caulking material (20). Initially the plates are held together by plastic bolts (21) at the major flanges. Regularly spaced along the joint plates are anchorage arms (31) stamped from the major flanges and bent out sideways from them to leave apertures (32). The ends of arms (31) are provided with eyes (33) to receive height adjustment legs (34). At the bottom of one of the plates is extension plate (41) which separates the slabs. Plate (41) has apertures in which are dowel plates (43). In use, the joint is set up and concrete is poured in the adjacent slabs. The slab top L is level with the joint top. The anchorage arms hold the plates to the respective slabs on their side of the joint and the dowels are in place for resisting vertical movement of the slabs.

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SLAB JOINT

The present invention relates to a joint for concrete slabs, particularly though not exclusively for floors.

Joints are required between concrete flooring slabs, to accommodate and manage shrinkage and warping of adjacent slabs and load transfer from one slab to the next. The shrinkage and warping occurs during drying out of the slab after laying and initial setting. Load transfer occurs when for instance a fork lift truck moves from one slab to the neighbouring one.

It is known from US patent specification No. 6,354,760 – in terms of its abstract – to provide:

A load plate for transferring loads between a first cast-in-place slab and a second cast-in-place slab separated by a joint. The load plate having a substantially tapered end having substantially planar upper and lower surfaces adapted to protrude into and engage the first slab, and the load plate being adapted to transfer between the first and second slabs a load directed substantially perpendicular to the intended upper surface of the first slab. A block-out sheath embedded within the first slab could also be included. The block-out sheath could have a substantially planar top surface and a substantially planar bottom surface substantially parallel to the upper surface of the first slab. The top and bottom surfaces of the block-out sheath could each have a width, measured parallel to an intersection between the joint surface and the upper surface of the first slab, that substantially decreases away from the joint surface. The width of the block-out sheath could be substantially greater than the width of the substantially tapered end at each corresponding depth along the substantially tapered end and the block-out sheath, such that the substantially tapered end could move within the sheath in a direction parallel to the intersection between the upper surface of the first slab and the joint surface.

From European patent application No. 1,389,648 – in terms of its abstract – to provide:

Apparatus for forming the edge of a concrete floor slab, the apparatus comprises a divider plate formed with a plurality of apertures, dowels for engaging

through the apertures and sleeves for applying to the dowels, in which the divider plate is provided with means, in use, to adjust the height thereof above the ground.

Whilst the use of dowels can manage warping and accommodate load transfer between the slabs, a difficulty in practice is that the floor may be sufficiently cured for use before it has shrunk to final size. Once it is in service, typically with racking extensively installed, access for insertion of caulking material into the now open joints is awkward. The result is that the joint is not caulked. Dirt and indeed valuable lost materials can fall into the joint. The open joint can also be a hazard.

The object of the present invention is to provide an improved joint, not requiring caulking.

According to the invention there is provided a joint for concrete slabs, the joint comprising:

- two edge plates for edging two adjacent concrete slabs;
- means for anchoring the edge plates to their slabs;
- load transfer means spaced along the length of the joint for regulating the relative heights of the adjacent slabs;
- means for preliminarily holding the edge plates together, the preliminary holding means being frangible under tension applied by the anchoring means on shrinkage of the concrete slabs;
- shaping of the edge plates and/or means to space them apart whereby a channel between them is provided at their top edges, which are exposed in use; and
- caulking between the plates at their top edges.

Whilst in some embodiments the plates can be flat and held apart by an inert spacer – stopping short of the caulking at the exposed edges; preferably, the plates are upwardly divergent, i.e. flared out, towards their exposed edges to provide the channel for the caulking, with the plates initially abutting, or at least closely spaced below the channel. Conveniently the flared channel has parallel sides. For this embodiment, the plates are rolled to lazy Z form.

In the preferred embodiments, the bottom of the channel is provided with release material, whereby the caulking material does not adhere to bottom portions of the channel.

The means for preliminarily holding the plates together may take a variety of forms, conveniently it comprises frangible fasteners, such as small diameter metal fasteners or larger diameter plastics material fasteners.

The means for anchoring the plates can be arms welded or otherwise securely attached to the plates. However, in one preferred embodiment, the anchors are arms stamped from the plates, the arms having length in the length of the plates prior to stamping and being left attached to the plates at one end. Conveniently, the apertures formed by the stamping are staggered on opposite sides of the joint, to close any exit path for concrete during casting. Normally the arms will be formed at their ends with eyes for height adjustment devices.

The dowels can be provided in the height of the plates. However, since the plates are of relatively heavy material, and the dowels should be provided at a depth in the concrete to avoid them cracking out at the top (or bottom) surface of the concrete, the dowels are preferably provided in a downwards extension of one or both the plates. They can be of trapezoidal or other tapered, straight sided shape of reducing dimension away from the extension plate. Alternatively, the plates can be semicircular in plan in the concrete slab from which they are intended to withdraw to a small extent on shrinkage of the concrete.

The dowels can be welded to the extension plate and provided with sleeves. Again in one of the preferred embodiments, each dowel plate includes at least one aperture and at least one rim of the aperture and a wedge is provided for each aperture for securing the dowel plate to the extension plate, with the latter gripped between the wedge and the rim.

Each dowel plate can include at least one portion thicker than the thickness of the rest of the plate for retention of the dowel plate in the concrete slab to one side of

the joint. Similarly each sleeve can have has at least one protrusion feature for its anchoring in the other concrete slab.

The extension plate can be an integral downwards continuation of one of the edge plates. Alternatively, the extension plate is a welded-on downwards continuation of one of the edge plates. Again, the extension plate can extend from between the edge plates.

To help understanding of the invention, three specific embodiments thereof will now be described by way of example and with reference to the accompanying drawings in which Figures 1 to 4 relate to a first embodiment; Figures 5 to 7 relate to a second embodiment and Figures 8 to 10 relate to a third embodiment. The Figures are as follows:

Figure 1 is a cross-sectional end view of a joint according to the first embodiment of the invention;

Figure 2 is a plan view of the plates only of a length of the joint of Figure 1;

Figure 3 is a perspective view of the plates only of a length of the joint of Figure 1;

Figure 4 is a scrap view similar to Figure 1 of a variant with spaced lazy Z plates;

Figure 5 is a cross-sectional end view of a joint according to the second embodiment of the invention;

Figure 6 is a perspective view of the joint of the second embodiment;

Figure 7 is a perspective view of the joint of the second embodiment;

Figure 8 is a cross-sectional end view of a joint according to the third embodiment of the invention;

Figure 9 is a perspective view of the joint of the third embodiment; and

Figure 10 is a perspective view of the joint of the third embodiment.

Referring to the drawings, the joint 1 thereshown is for use between two slabs S1,S2 of concrete, shown in outline and typically 150mm deep. The joint is set up accurately with the intended finished floor level L prior to casting of the slabs. The set up being in a manner which it is believed will be familiar to the man skilled in the art and will not be described in detail.

The joint has two plates 11,12 of 50 x 6mm stainless steel. The plates are rolled to lazy Z form, with major webs 14, 120⑤ angled flanges 15 and parallel minor flanges 16. The arrangement of the two opposed lazy Z plates creates a void between their minor flanges 16. These have opposing faces 17. The width of the void, i.e. the gap between the faces 17, and its depth, i.e. the depth of the faces, are set to provide a dimensioned pocket for accepting elastomeric caulking material 20, which is chosen to stretch in use. The pocket is dimensioned to match the movement accommodation factor of the elastomeric caulking, which in turn serves to accommodate deflection of the slabs in use. Typical width and depth values for elastomeric caulking with a movement accommodation factor of 35% of caulk width and a required width to depth ratio of 2:1 are set out below for varying degrees of floor shrinkage:

Floor Shrinkage	Pocket		Caulking Movement
mm	Width mm	Depth mm	Capacity % of Width
2.5	7	4	35%
5.0	14	7	35%
10.0	29	14	35%
15.0	43	21	35%
20.0	57	29	35%

Barrier material 18, typically bond breaker tape, is laid on the opposite faces 19 of the angled flanges. The channel between the minor flanges 16 is filled with elastomeric caulking material 20, which bonds onto the faces 17.

The plates are initially held together by plastic bolts 21 at the major flanges. These bolts form no structural function and merely serve to keep the components of the joint in their design position prior to slab shrinkage.

Regularly spaced along the joint plates are provided anchorage arms 31. These are stamped from the major flanges and bent out sideways from them, leaving an aperture 32. The arms are arranged at a pitch such that the apertures alternate from

one flange to the other without coincidence that would otherwise allow flow of concrete through the joint during casting. The pitch also allows for the bolts 21. The ends of the arms are provided with eyes 33 for height adjustment legs 34, typically lengths of screwed bar carrying nuts 35 for captivating the eye on the bar and adjusting the joint to be level. For effective keying of the arms in the concrete, i.e. anchoring of the side plates 11,12, the arms can be provided with a series of punchings 36.

Welded to the bottom of one of the plates is thin extension plate 41, which separates the slabs (except beneath it where no appreciable flow of concrete is likely before the adjacent slab is poured). At regular intervals, the extension plate has apertures 42, in which are welded diametrically, circular – in plan – dowel plates 43. The plates have plastic material sleeves 44 to one side of the plate 41, so that as the slabs shrink away from each other at the fracture plane induced by the plate 41, the un-sleeved side of the dowel remains fast in its slab and the other side withdraws from its sleeve. Use of a circular dowel provides that as the joint opens, the chord of the dowel at the edge of the sleeve remains close to the dowel's diameter, at least while the slabs experience no more than expected shrinkage. The shape is well adapted also to resist relative horizontal shear along the joint.

In use, the joint is set up and concrete poured in the adjacent slabs. The slab top L is level with the joint top. The anchors hold the plates to the respective slabs on their sides of the joint and the dowels are in place for resisting relative vertical movement of the slabs. As the slabs shrink away from each other, the plates 11,12 move with them. The caulking 20 stretches, preventing a void developing between the plates a floor level L.

The invention is not intended to be restricted to the details of the above described embodiment. For instance, when the slab is predicted to exhibit large movements, two spacer plates 40 may be used to separate the plates 11,12 to widen the pocket for the elastomeric caulking material without having to use extra large lazy Z shapes. The spacer plates are both welded to one only of the lazy Z plates, with the frangible bolts passing through the Z plates between the spacer plates.

Figures 5, 6 and 7 show views of a heavy duty slab joint installed between two slab blocks 64,65, cast in place on a sub-base 63. Instead of the lazy-Z rails of the first embodiment, two flat, metallic rails 51 are provided. In practice, these are between 6 to 10mm thick and 30, 40 or 50mm deep. Elastomeric caulking 52 is provided between the rails 51 at and just below their tops. A bond breaker tape 53 is provided beneath the caulking to ensure that this does not adhere to two separators 54, which are provided to hold the rails at an initial separation, providing the channel into which the caulking is inserted. A slab division plate 55 extends down from between the separators. This plate is metallic or of plastics material, whilst the separators are of plastics material. This arrangement avoids electrical contact and possible galvanic action between the top rails 51 and their downwards extension plate 55. The rails, separators and extension plate are all held together by frangible plastics material bolds 56. The rails have anchorage loops 57 welded to them for their securement in the concrete.

Trapezoidal dowel plates 59 extend through the extension plate 55 and are held securely in position prior to casting of the concrete by wedges 60 passing through the dowels. The wedges captivate the plate 55 between themselves and downturns 61 on the dowels, thereby securing the dowels perpendicular to the extension plate. At their edges remote from the extension plate, on the wedge side of it, the dowels each have a downturn 62 for secure attachment of the dowel in the concrete 64 on this side of the plate 55. On the other side, the dowels are each provided with a plastics material sleeve 58 shaped complementarily to the dowel for ease of its withdrawal. The sleeve is provided with tabs 66 for its securement in the concrete on its side.

Turning on to Figures 8 to 10, the joint thereshown is a lighter duty joint, suitable for external use, between concrete slabs 84,85 over a sub-base 83. It has one deep side rail 71, which extends down as a slab divider/extension plate, and one shallow side rail 72. The latter can be between 2 and 6mm thick and 30, 40 or 50mm deep. The plates can be bolted together with frangible plastics material bolts or as shown are frangibly attached together by a high density foam material strip 75 bonded to the rails. The strip leaves an upper channel for an elastomeric caulking material 73, with a bond breaker tape 74 therebetween.

The rails have anchorage arms 76 pressed out leaving apertures 77 at the level of the foam strip, the apertures being staggered from one rail to the next. The arms have end formations for secure gripping of the concrete around them.

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The joint has dowel sleeves 78, dowels 79, wedges 80 and dowel downturns 81,82 arranged in like manner to those of the second embodiment. The wedges allow on site assembly and shipping of the joint in a relatively compact form.

CLAIMS:

1. A joint for concrete slabs, the joint comprising:
   - two edge plates for edging two adjacent concrete slabs;
   - means for anchoring the edge plates to their slabs;
   - load transfer means spaced along the length of the joint for regulating the relative heights of the adjacent slabs;
   - means for preliminarily holding the edge plates together, the preliminary holding means being frangible under tension applied by the anchoring means on shrinkage of the concrete slabs;
   - shaping of the edge plates and/or means to space them apart whereby a channel between them is provided at their top edges, which are exposed in use; and
   - caulking between the plates at their top edges.
2. A joint as claimed in claim 1, wherein the plates are flat rails held apart by separating means.
3. A joint as claimed in claim 1, wherein the plates are shaped to be upwardly-divergent to provide a channel between them for the caulking at their top edges.
4. A joint as claimed in claim 3, wherein the plates abut, at least on installation, below the channel.
5. A joint as claimed in claim 3 or claim 4, wherein the channel has parallel sides.
6. A joint as claimed in claim 5, wherein the plates are rolled and have a lazy Z form to provide the channel.
7. A joint as claimed in any one of claims 3 to 6, wherein a bottom of the channel is provided with release material, whereby caulking does not adhere to the bottom of the channel.
8. A joint as claimed in any one of the preceding claims, wherein the preliminary holding means comprises frangible fasteners formed from metal or plastics material.
9. A joint as claimed in any one of the preceding claims, wherein the anchoring means are arms welded or otherwise securely attached to the plates.
10. A joint as claimed in any one of claims 1 to 8, wherein the anchoring means are arms stamped from the plates, the arms having length in the length of the plates prior to stamping and being left attached to the plates at one end.

11. A joint as claimed in claim 10, wherein the apertures formed by the stamping are staggered on opposite sides of the joint.

12. A joint as claimed in any preceding claim, included height adjustment devices connected to the anchoring means.

13. A joint as claimed in any preceding claim, including an extension plate depending from the edge plates, the load transfer means being dowel plates extending through the extension plate into both concrete slabs in use.

14. A joint as claimed in claim 13, wherein the extension plate is an integral downwards continuation of one of the edge plates.

15. A joint as claimed in claim 13, wherein the extension plate is a welded-on downwards continuation of one of the edge plates.

16. A joint as claimed in claim 13, wherein the extension plate extends from between the edge plates.

17. A joint as claimed in claim 16 as appendant to claim 2, wherein the separation means is at least one spacer held secured between the edge plates by the preliminary holding means, the extension plate also being secured by the preliminary holding means.

18. A joint as claimed in any one of claims 13 to 17, wherein each dowel plate includes at least one portion thicker than the thickness of the rest of the plate for retention of the dowel plate in the concrete slab to one side of the joint.

19. A joint as claimed in any one of claims 13 to 18, wherein each dowel plate includes at least one aperture and at least one rim of the aperture and a wedge is provided for each aperture for securing the dowel plate to the extension plate, with the latter gripped between the wedge and the rim.

20. A joint as claimed in any one of claims 13 to 19, wherein at least the portion of each dowel plate extending into the other concrete slab is of reducing dimension away from the extension plate, preferably semicircular or trapezoidal in plan.

21. A joint as claimed in any one of claims 13 to 19, wherein each dowel plate is provided with a sleeve for its sliding in the concrete slab on the other side of the joint.

22. A joint as claimed in claim 20, wherein the sleeve has at least one protrusion feature for its anchoring in the other concrete slab.

23. A joint as claimed in preceding claim, wherein the caulking is formed from elastomeric material which can stretch in use.

24. A kit which comprises the components of the slab joint of any one of the preceding claims.

FIG. 1

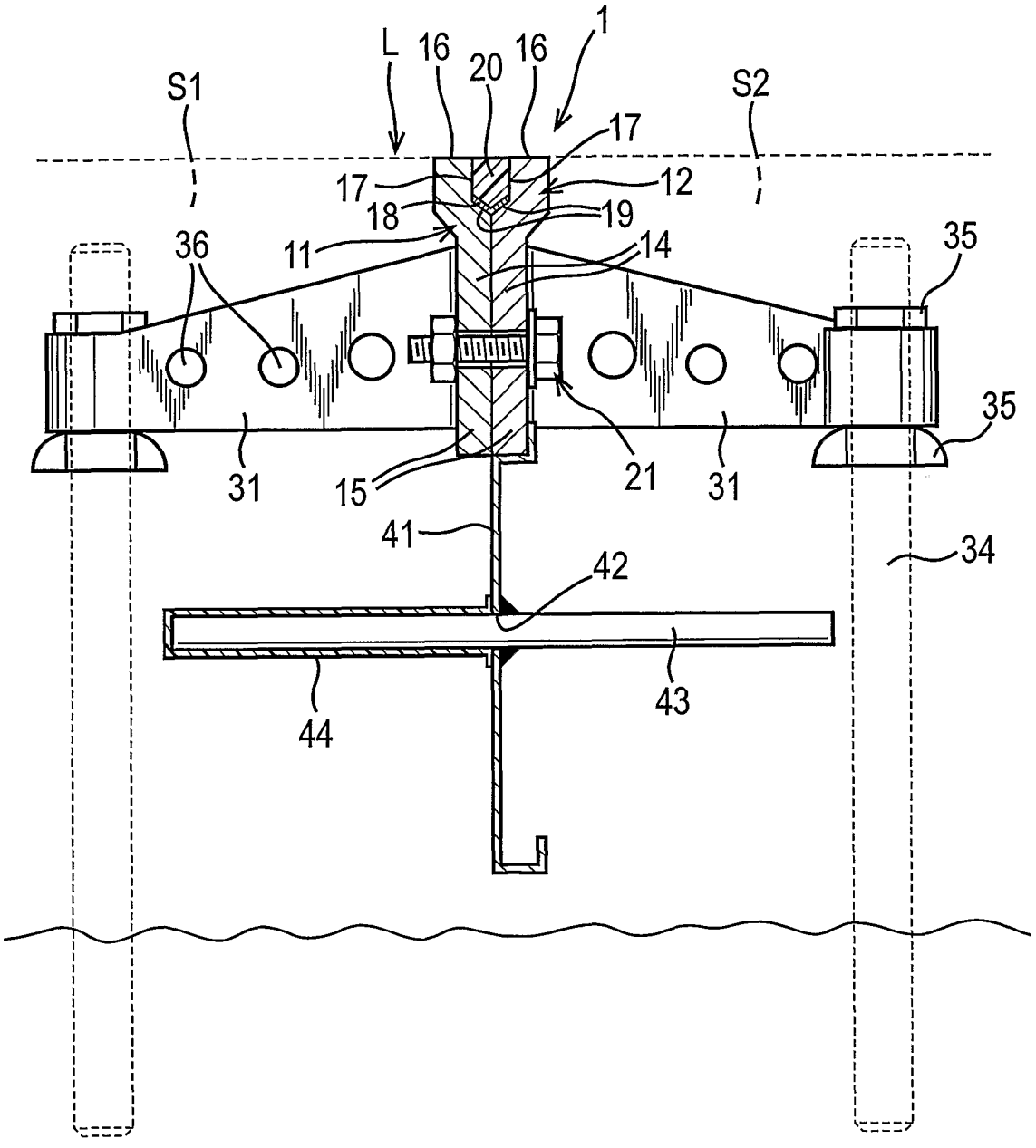

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FIG. 2

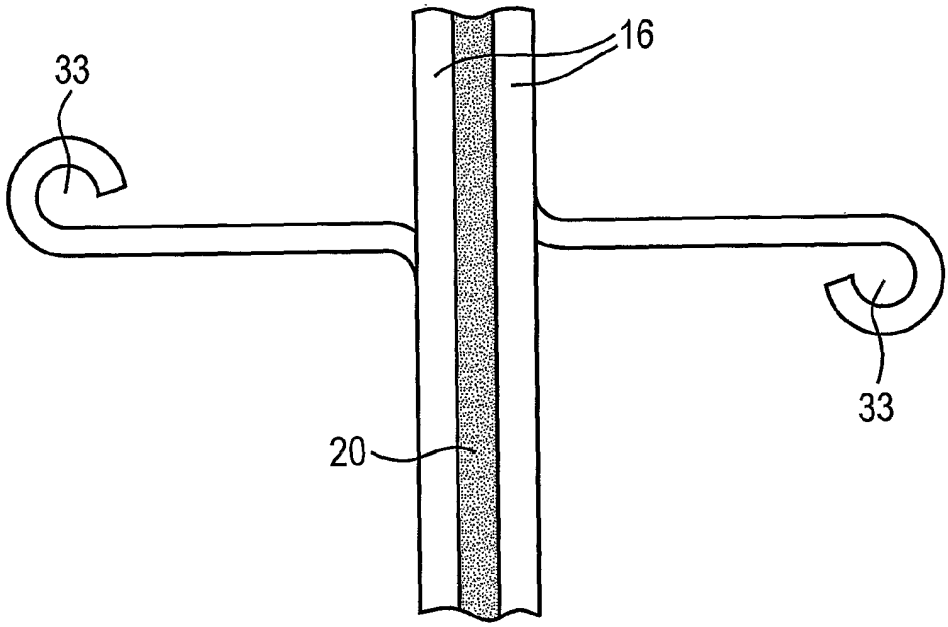


FIG. 4

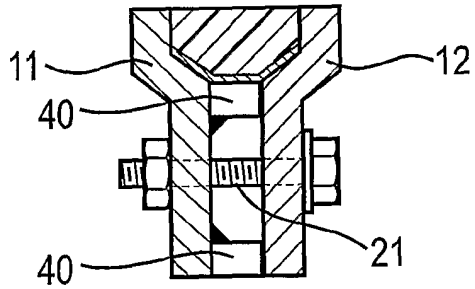


FIG. 3

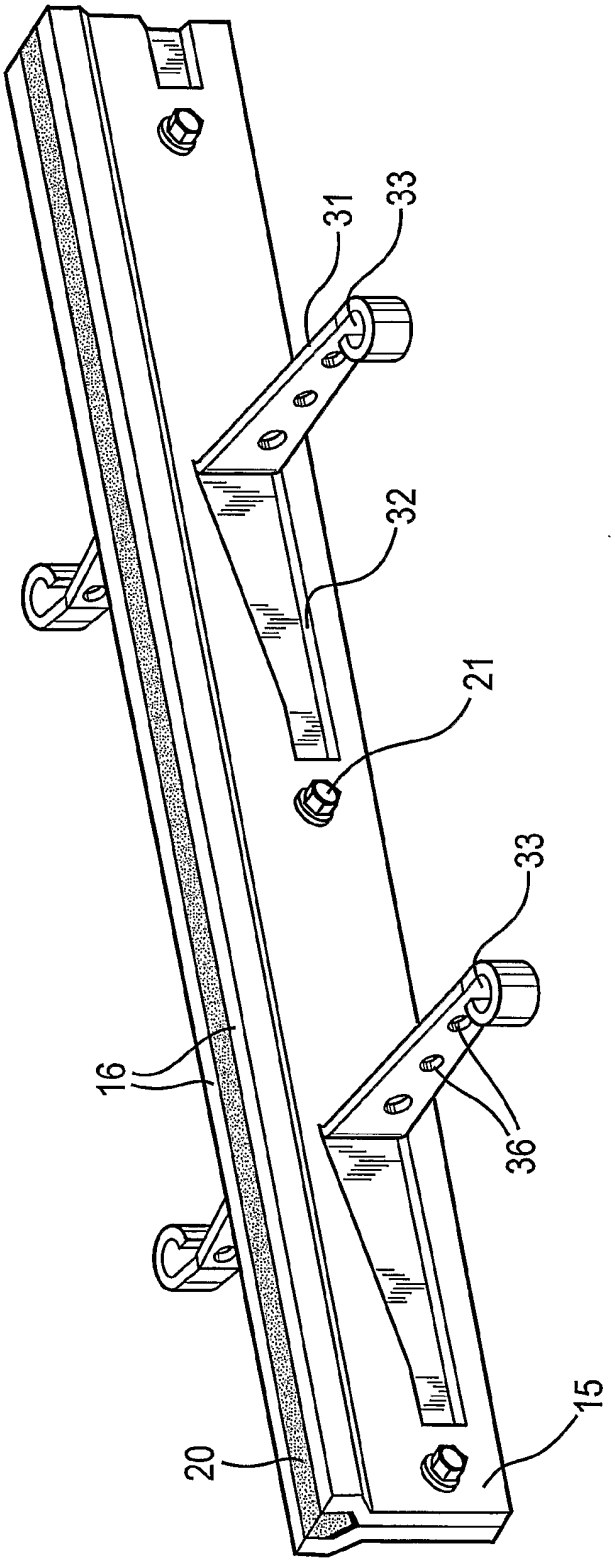


FIG. 5

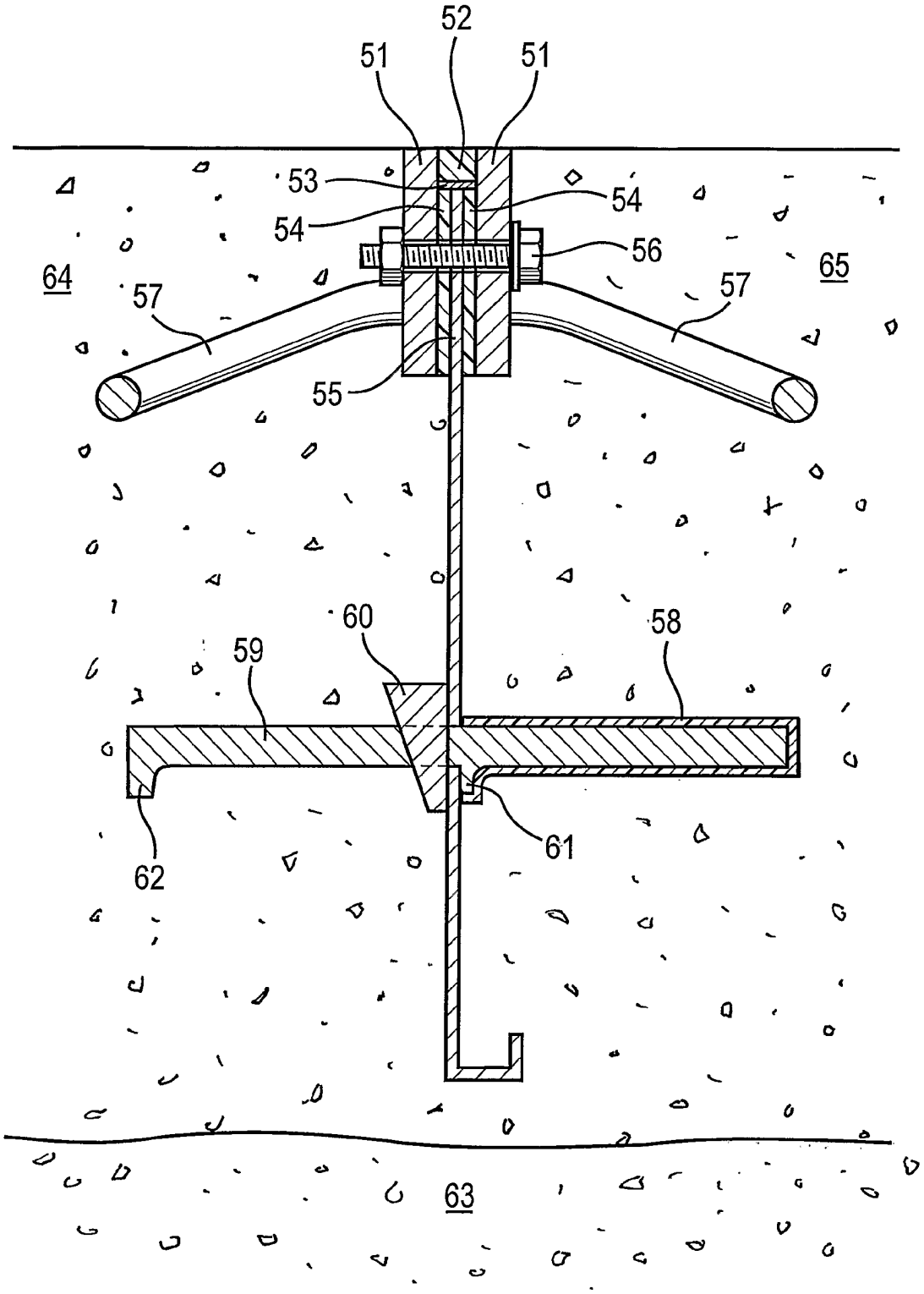


FIG. 6

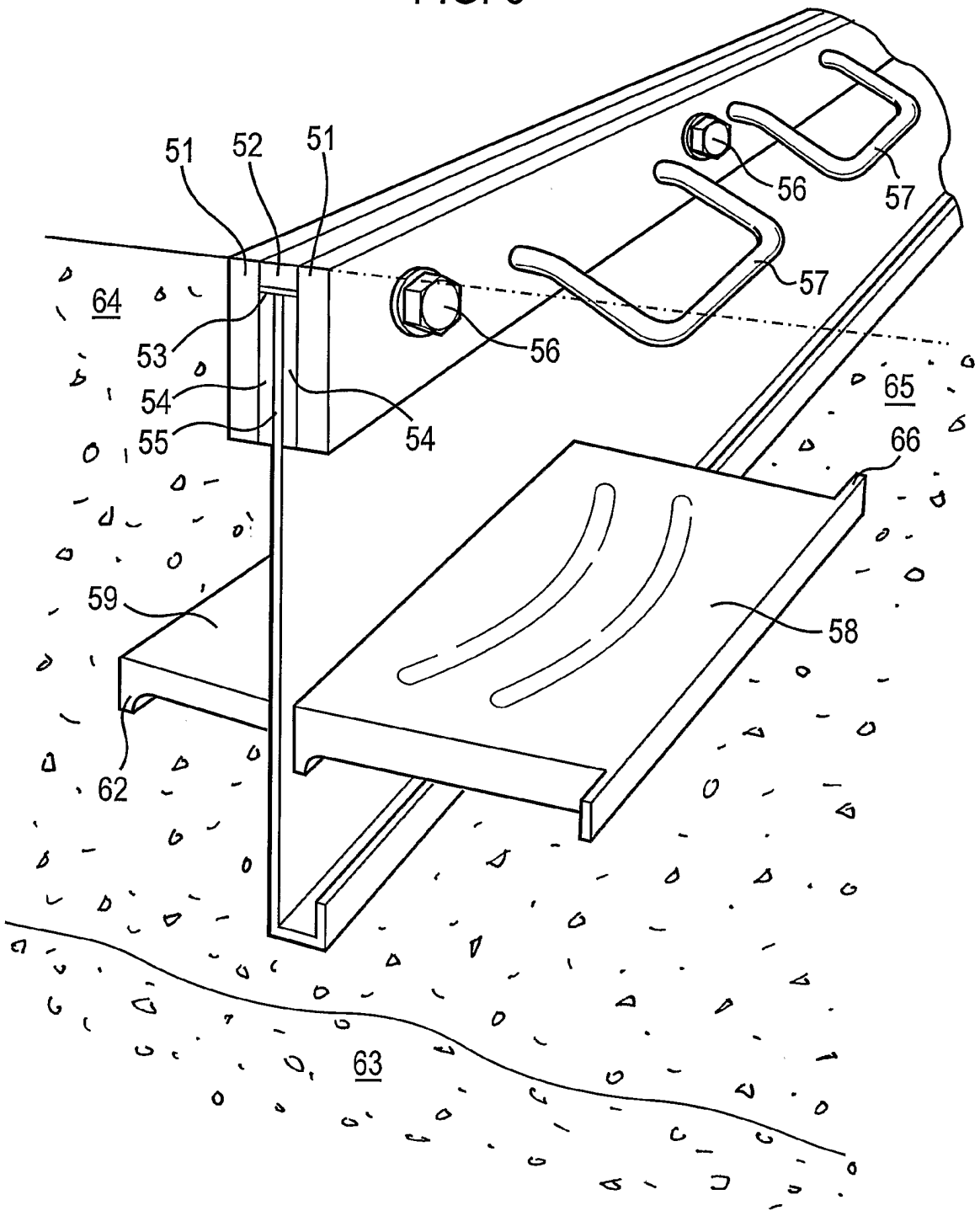


FIG. 7

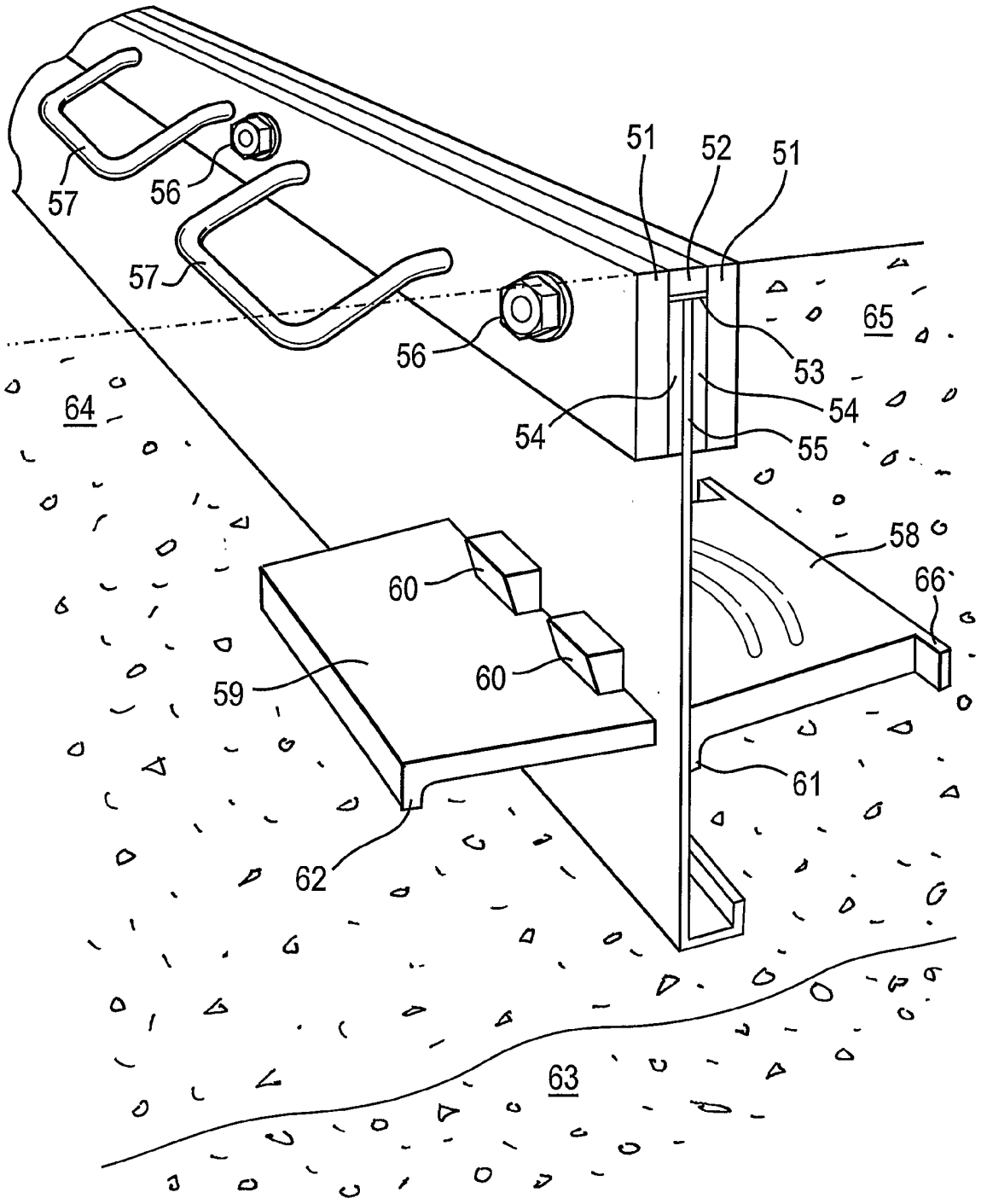


FIG. 8

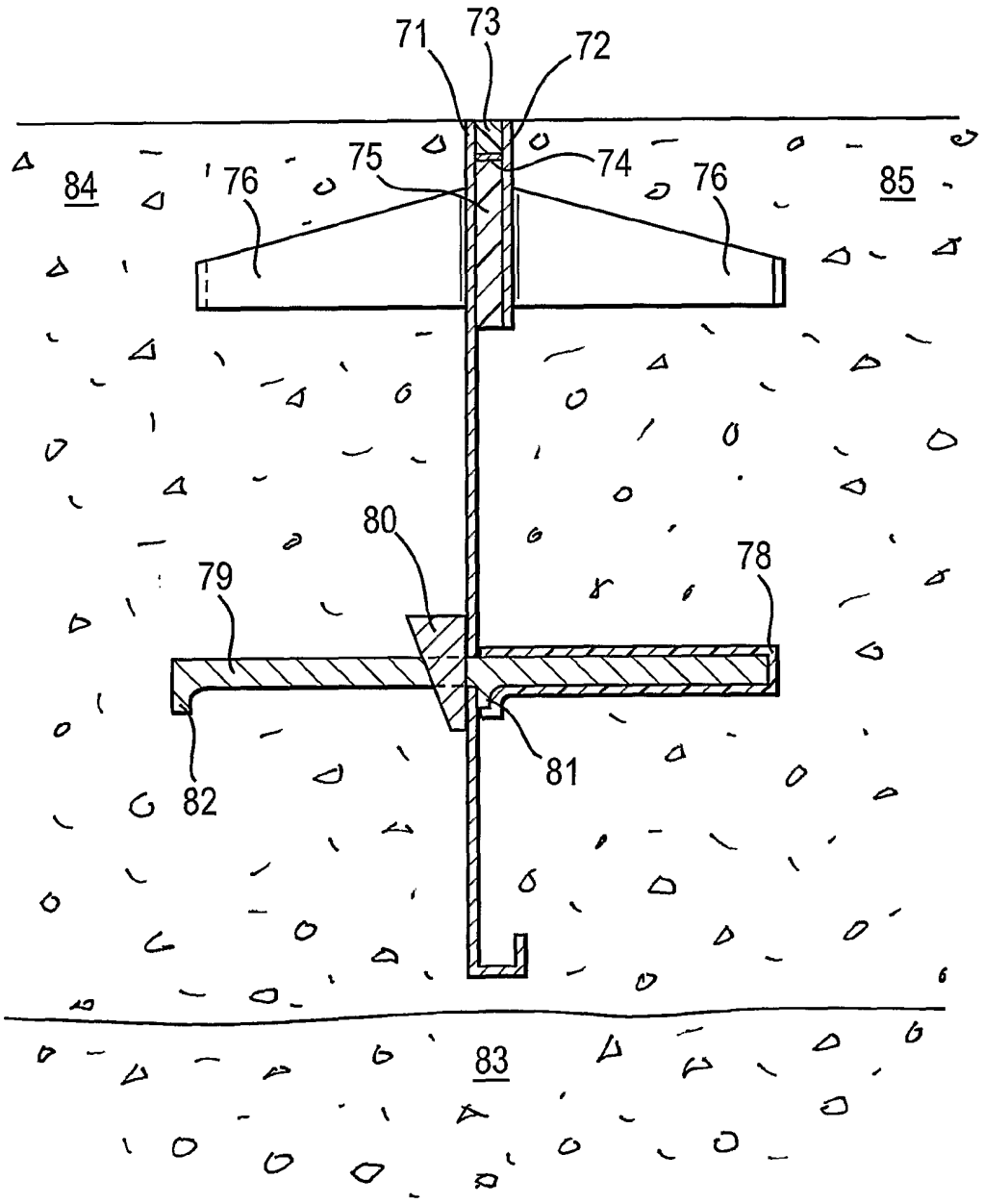


FIG. 9

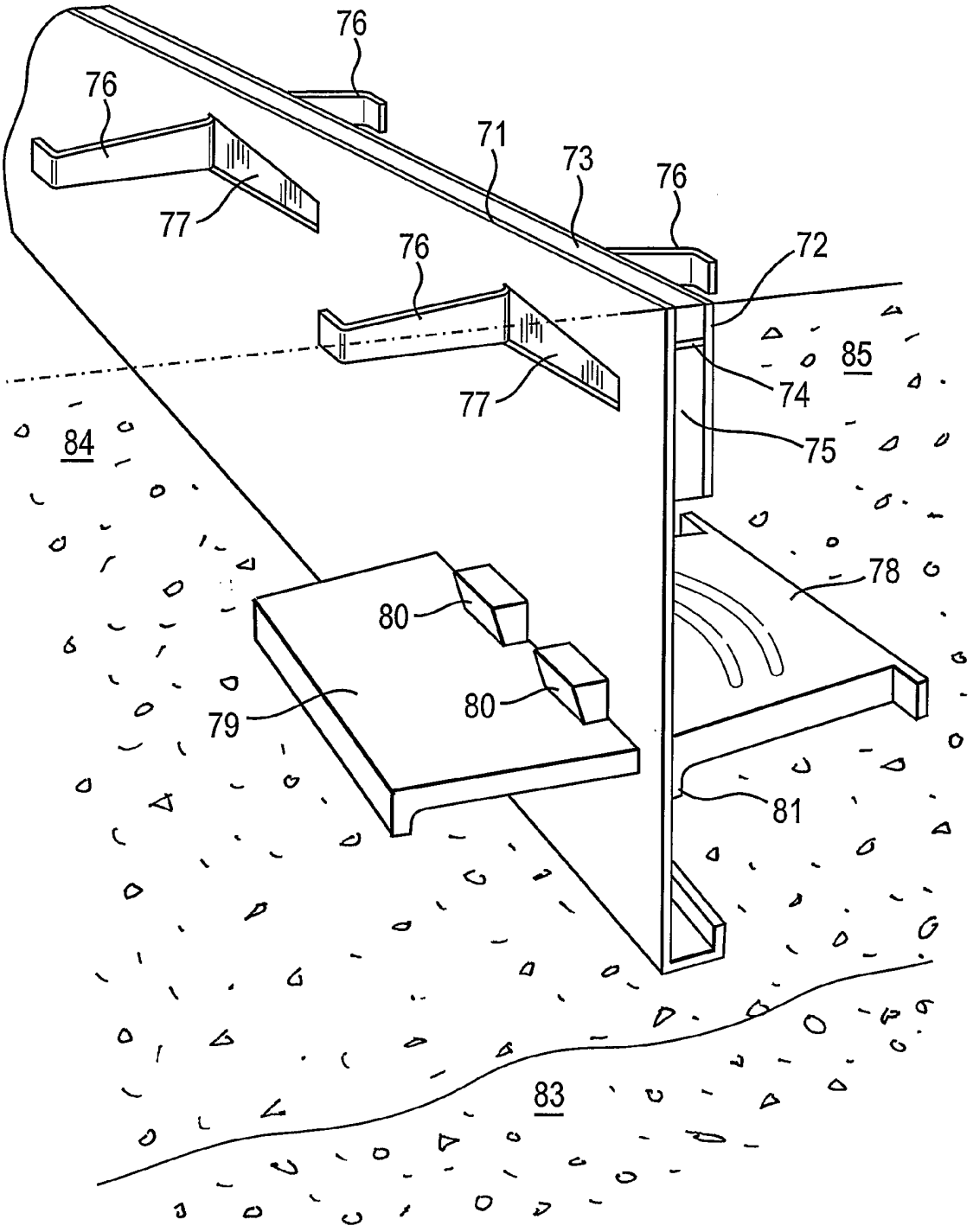
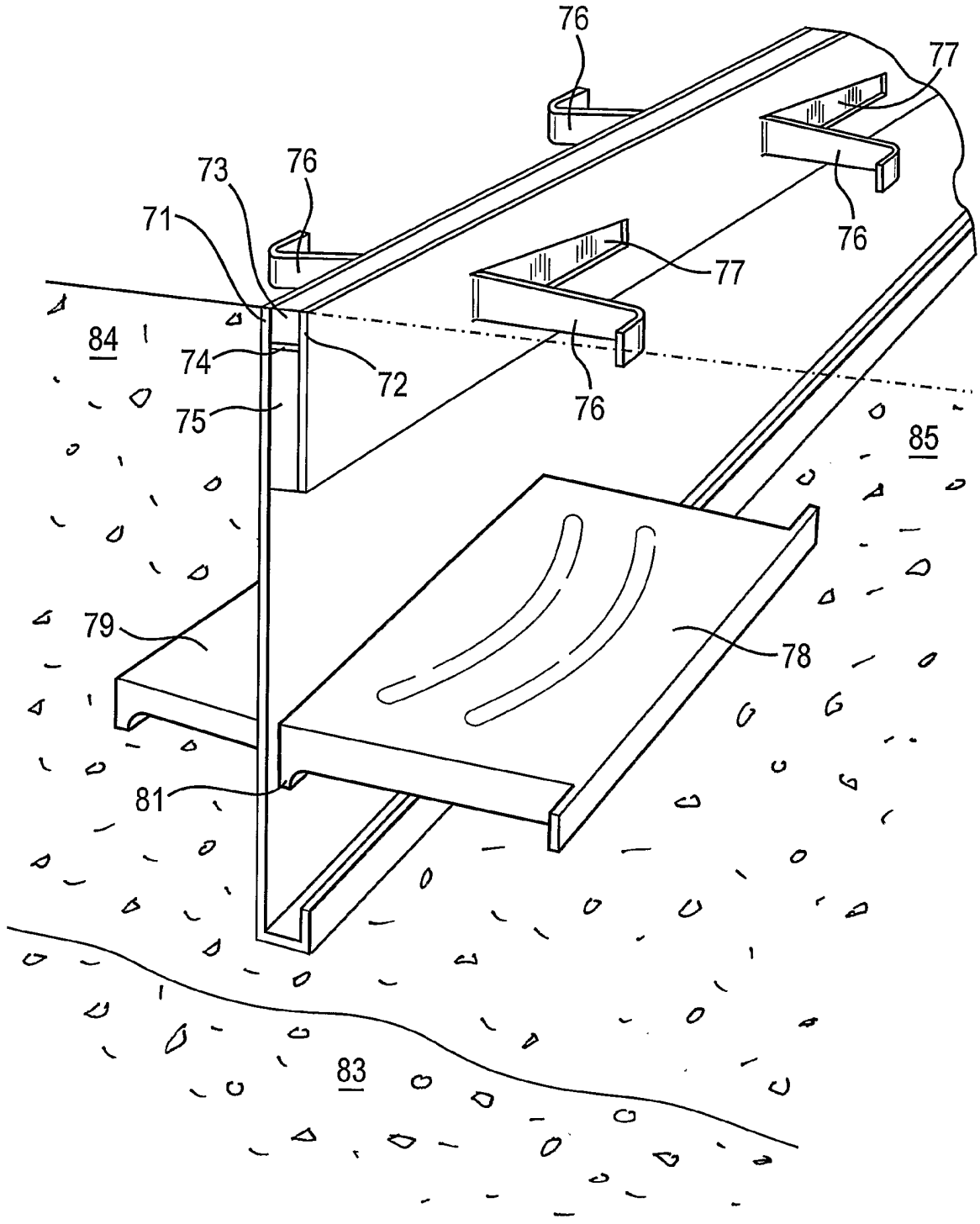


FIG. 10



INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB2005/003094

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 E01C11/12 E01C11/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 E01C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	DE 202 09 995 U1 (ED. ZUEBLIN AG) 21 November 2002 (2002-11-21) page 2, line 7 - line 27; figure 1	1,2,8,9, 12,23,24 3-7,10, 11,13-22 13,15,16
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Y A	US 3 276 335 A (MIDDLESTADT WILLIAM F) 4 October 1966 (1966-10-04) column 2, line 13 - column 3, line 25; figures 1,2	3-7 1,8

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
26 October 2005	07/11/2005

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

INTERNATIONAL Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

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