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(54) Title: FREE MOVEMENT, ARRIS PROTECTION, CONSTRUCTION JOINT

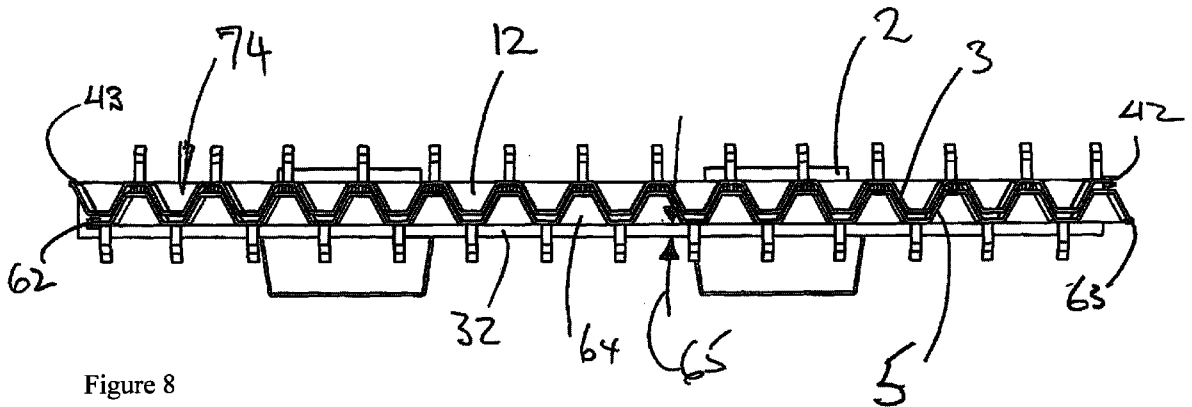


Figure 8

(57) Abstract: A free movement, arris protection, construction joint for dividing concrete during pouring of concrete slabs (71,72) on opposite sides of the joint, the joint comprising: a divider plate (1) having a top, longitudinal stiffening formation (12), the plate being for dividing the slabs through a majority of a depth of the slabs; dowels (2) crossing the divider plate for transferring load from one slab on one side of the joint to the other on the other in use; two complementarily formed, elongate wave shaped arris protection members (3,5) arranged on the top stiffening formation of the divider plate. Both arris members have: complementary wave shaped formations, and; formations (36,37;56,57) for anchoring the arris members in the slab on their respective side of the joint. One of the arris members has: a flange complementary to the divider's stiffening formation and extending transverse to its wave shaped formations, and the other of the arris members being of a height to rest on the flange of the one arris member with free edges of the arris members flush or at least grindable to be flush with finished slab level.



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FREE MOVEMENT, ARRIS PROTECTION, CONSTRUCTION JOINT

The present invention relates to a free movement, arris protection, construction joint.

5

Such a joint is disclosed in EP 2027340, whose abstract is as follows:

“A structural joint adapted to be engaged with slabs made of a moldable material comprising at least two profile elements, each adapted to be integral with one of the edges of two adjacent slabs, each profile having a substantial vertical stem adapted for extending at least partly along the edges up to a sharp edge of an upper surface of the slab, whereby that the top edge of each vertical stem of the profile elements of two adjacent slabs as seen along the line between the two adjacent slabs is composed of non-linear elements.”

10

The preferred shape of the non-linear elements is sinusoidal

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Another such joint is disclosed in EP 2729619, whose abstract is as follows:

“The present invention relates to an expansion joint to bridge an expansion gap between two parts of concrete slabs used in floor construction, especially in the manufacture of concrete floors such as for example in industrial floors. Such expansion joints are evidently required to take up the inevitable shrinkage process of the concrete and to assure that the floor elements can expand or contract such as for example occur by temperature fluctuations and resulting in a horizontal displacement of the floor panels vis-à-vis one another.”

20

This joint uses two pairs of profiles of EP 2027340, superimposed on each other with the upper and lower sinuosity not being in phase.

25

A further such joint is disclosed in our WO 2013/038123, whose abstract is as follows:

“A free movement, arris protection, construction joint (1) has a pair of arris protection members (2,3) formed complementarily from strips of sheet with a continuous trapezium wave form. A divider one (2) of the members is typically 100mm deep for a nominal 0.1m deep slab. The other one (3) is typically 50mm deep. The members are of steel plate. The wave form is comprised of flanges (4,5) extending in the length of the joint and of webs (6) angled to the flanges and the

30

length of the joint. The flanges (4,5) are spaced on opposite sides of a mid-plane (7) of the joint. The members (2,3) are bolted together with flangible nylon bolts (8), with their top (in use) edges flush. Welded to the outer ones of the flanges are L strips (9) having apertures (10) in their flats (11) extending from the flanges for anchoring the joint to its slabs. Beneath the anchor members, extending out from every other flat (5) of the deep divider one (2) of the protection members are load transfer dowels (14), with sleeves (15) on their extent across the mid-plane and beyond. In use, concrete is cast with a horizontally castellated edge, castellations at positions (16) being bounded by the divider member (2). Complementary castellations on the other side of the joint at the positions (17) interdigitate with the first castellations (16). The castellations extend to the full depth of the slabs and can be expected to have a long life.”

A further such joint is disclosed in our WO 2015/173549, whose abstract is as follows:

“The joint comprises a pair (12,14) of complementary engineering grade polymer injection mouldings. Each moulding is comprised of generally equal length oblique webs (15), set at 60 DEG to a mid-plane (16) of the assembled joint, shorter, inner webs (17) and a longer, outer webs (18). Centrally of each outer web (18) is an aperture (21) and centrally of each inner web is a pin (22) with a step (23) and a pointed head (24). The heads of one moulding clip into the apertures of the other whilst the steps determine their separation gap (25). The trapezium wave shape of the joint provides re-entrants (31) from the plane of the outer webs (18) towards that of the inner webs. Outwards of the re-entrants extend anchoring formations (33). Behind each re-entrant these formations are joined by a tab (34). Supports (41) are provided to support the repair joint off the bottom of the cavity via the tabs (34). The supports are of lazy-Z shape, with threads (42) formed at both ends. At the tabs, bolts (43) through the tab apertures (35) and secure the supports to the tabs. Further bolts (44) are engaged in the distal ends of the supports and hold the supports and the joint off the bottom of the cavity.”

30

In broad terms, the first two applications above have disclosed use of sinuous arris protection members. Our WO 2013/038123 has improved this use by providing that the concrete castellations edged by trapezium-shaped, sinuous, arris-protection members extend to the full depth of the slabs. Then in our WO 2015/173549, we

have further improved the technology by providing the arris protection members of synthetic material,

The object of the present invention is to provide a further improved arris
5 protection joint.

According to the invention there is provided a free movement, arris protection, construction joint for dividing concrete during pouring of concrete slabs on opposite sides of the joint, the joint comprising:

- 10 • a divider plate having a top, longitudinal stiffening formation, the plate being for dividing the slabs through a majority of a depth of the slabs,
- Dowels crossing the divider plate for transferring load from one slab on one side of the joint to the other on the other in use,
- Two complementarily formed, elongate wave shaped arris protection members
15 (“arris members”) arranged on the top stiffening formation of the divider plate,
 - both arris members having
 - complementary wave shaped formations and
 - formations for anchoring the arris members in the slab on their respective side of the joint,
 - 20 • one of the arris members having
 - a flange complementary to the divider’s stiffening formation and extending transverse to its wave shaped formations and
 - the other of the arris members being of a height to rest on the flange of the one arris member with free edges of the arris members flush or at least
25 grindable to be flush with finished slab level.

Whilst the stiffening formation of the divider plate can be for instance a rolled channel formed along the length of the divider at its top edge, the preferred formation is a flange, with a major part of the divider being planar and set up at least
30 substantially vertically in use, and the flange being bent at least substantially at right angles to the major part.

In the preferred embodiment, the flange of the one arris member rests on the flange of the divider plate. The flanges could be of the same width, but preferably the flange of the arris member is wider, over-hanging the divider on its side way from its flange, or other stiffening formation when it is not flanged. Conveniently the divider
5 has apertures and the flanged arris member has pips and/or clips attaching for securing the arris member to the divider.

Conveniently the dowels are plate dowels, as known in the art.

10 The shape of the wave formations is largely a matter of design. They can be sinusoidal; although we prefer to use a regular trapezium (“regular trapezoidal” in North America) shape. The peak to peak dimension of the wave shape is less than that of the width of the flange of the flanged arris member, to allow the other arris member to slide on the flange during joint opening. The mid-plane of the wave shape
15 is preferably off-set from the divider plane over the divider’s flange or at least to the one arris member’s side of the divider plate’s plane.

The flange of the one arris member may be continuous over the flange or other formation of the divider plate. However in the preferred embodiment, the flange
20 does not extend beyond its wave shaped formations on its side away from the divider plane. The flange may extend no further than the divider plane on the other side, whereby it does not extend into the slab on the other side of the divider plane. However, preferably it extends beyond the divider plate and indeed beyond the other arris member in the closed state of the joint.

25

The other arris member can be comprised simply of its wave shape and its anchoring formations. However in the preferred embodiment, we provide floors to its concavities into which concrete is poured, to reduce frictional contact between poured concrete and the flange of the flanged arris member on shrinkage opening of the joint.

30

The anchoring means can take differing shapes. Preferably they are headed, with the heads in the preferred embodiment taking the form of angled down ends.

The arris members can be arranged to abut initially, but are preferably provided with clips and or spacers for providing an equal width gap along the length of the wave forms, in case of thermal expansion exceeding concrete shrinkage.

5 To help understanding of the invention, a specific embodiment thereof will now be described by way of example and with reference to the accompanying drawings, in which:

Figure 1 is Figure 1 of EP 2027340;

Figure 2 is Figure 2 of EP 2027340

10 Figure 3 is Figure 1 of EP 2729619;

Figure 4 is Figure 2 of WO 2013/038123;

Figure 5 is Figure 6 of WO 2015/173549;

Figure 6 is Figure 7 of WO 2015/173549;

15 Figure 7 is a perspective view of a free movement, arris protection, construction joint according to the invention;

Figure 8 is a plan view of the joint of Figure 7;

Figure 9 is a scrap perspective view of a divider plate and one arris protection member of the joint of Figure 7;

20 Figure 10 is a similar scrap perspective view for another direction of the other arris member of the joint of Figure 7;

Figure 11 is a cross-sectional end view of the joint after initial pouring and curing to the green state of concrete slabs which it divides and

Figure 12 is a similar view after concrete shrinkage and opening of the joint.

25 Referring to Figures 7 to 12 of the drawings, a free movement, arris protection, construction joint has:

- a divider plate 1,
 - dowels 2 and
 - two complementarily formed, elongate wave shaped arris protection members (“arris members”) 3,5 arranged on top of the divider plate 1.
- 30

The divider plate 1 is a strip of mild steel plate with a hook-section stiffening bend 11 at its bottom and a wider, flange 12 at its top bent at right angles, to lie

horizontal when main, dividing web 14 of the plate is set up with its central plane 15 vertical. The top flange 12 has a series of punchings 16 and the main flange typically has two a pair of dowel slots 17.

5 The dowels 2 are a pair of trapezium plates 21 welded 22 at one third the dimension from the their wide end 23 to the main web. They extend through this at the slots 17 and have polymeric material sleeves 24 on their narrow sides.

10 The first arris member 3 is a moulding of glass reinforced nylon and is secured to the top flange by means of clips 31 extending through the punchings 16. It has a horizontal flange 32 abutting the top flange of the divider and concrete edging, i.e. arris, wall portions 33, 34, 35 from the flange. These are arranged in a trapezoidal wave form shown in the plan view of Figure 8 and made up of

- 15 • peak ones 33,34 of the wall portions extending parallel with the length of the joint and
- interconnecting, angled ones 35 extending at alternating 60°.

20 The wave form is continuous without gaps between adjoining wall portions 33, 34, 35. From mid-height of every other wall portions 33 extending up from the back edge of the flange 32 anchors 36 extend. For the intervening one of these flanges anchors 37 extend from the level of the flanges 32. The anchors have horizontal, in use, arms 38 with down turned ends 39, set at a downwards angle to inhibit pulling out from the surrounding concrete in use.

25 Between the angled ones 35 of the wall portions on the side of the anchors, that is on the back side, away from the flange 32, the flange is not present, whereby concrete can abut the divider flange 12 directly. On the inside of the flanges 35, clips 40 are provided for clipping to the other arris member 5. Also on the inside of the angled wall portions 35, spacers 41 are provided. A final feature of this arris member is that an end one of the wall portions has a female connection 42 for a
30 complementary opposite end male connection 43 on an opposite end, angled wall portion adjoining joint, whereby tow joints can be clipped together.

 The other arris member 5 has similar

- wall portions 53, 54, 55,
- anchors 56, 57,
- clips 60,
- spacers 61, and
- 5 • connections 62,63.

It also has a flange present only as separate sections 64 between the back sides of the wall portions 54,55, that is on the same side as the anchors 56,57.

10 When the two arris members are connected together, by the clips 40,60 and spaced by the spacers 41,61, the flange 32 of the first arris member 3 extends beyond the free edge of the flange sections 64, immediately underneath the anchors 57, by a margin 65, approximately equal to the maximum amount by which concrete slabs edged by the joint are expected to shrink away from each other.

15

In use, a number of joints are set up in line, connected together and held by conventional supports, not shown. Concrete is poured first on one side, and then on the other. Two slabs 71,72 edged by the joint are thus formed, see Figure 11. The slab 71 extends into the stiffening bend 11, sets on both sides of the dowel plates 21
20 and sets against the underside of the top flange 12 and partially over it. These features tend to cause the divider to be held more tightly to this slab than the over slab 72 when concrete shrinkage occurs. The arris member 3 is held to its side slab 71 by the anchors 36,37 and to the divider by the clips 34. Its flange 32 does extend into the slab 72, at a groove 73 formed around it, but without any feature tending to hold the
25 flange in this slab. The arris member 5 is held to its slab by the anchors 56,57.

It will be noted that fingers 74 of concrete formed against the arris member 3 as part of the slab 71 are at all times supported from below by the flange 12 of the divider plate, itself supported from below by the slab. Fingers 75 of the slab 72 have
30 the flange sections 64 beneath them. Beneath them and in intimate contact flange sections 64 beneath them. Beneath them and held in intimate contact by the clips 40,60 is the flange 32 and the divider flange 12. Thus the distal ends 76 of these fingers are well supported from below. The proximal ends 77 of the fingers are on the

other side of the divider plate, where the flange 32 is supported from below at the groove 73 by the slab 72. Thus the proximal ends 77 of the fingers 75 are also well supported from below.

- 5 When the slabs shrink apart, see Figure 12, the arris members 3,5 separate with clips 40,60 releasing. A gap 78 develops between the slab 72 and the dividing web 14. The distal and proximal ends 77,78 of the fingers 75 remain supported in the same way as flange 32 moves beneath them with the shrinkage.

CLAIMS:

1. A free movement, arris protection, construction joint for dividing concrete during pouring of concrete slabs on opposite sides of the joint, the joint comprising:
- a divider plate having a top, longitudinal stiffening formation, the plate being for dividing the slabs through a majority of a depth of the slabs,
 - dowels crossing the divider plate for transferring load from one slab on one side of the joint to the other on the other in use,
 - two complementarily formed, elongate wave shaped arris protection members (“arris members”) arranged on the top stiffening formation of the divider plate,
 - both arris members having:
 - complementary wave shaped formations, and
 - formations for anchoring the arris members in the slab on their respective side of the joint,
 - one of the arris members having:
 - a flange complementary to the divider’s stiffening formation and extending transverse to its wave shaped formations, and
 - the other of the arris members being of a height to rest on the flange of the one arris member with free edges of the arris members flush or at least grindable to be flush with finished slab level.
2. A free movement, arris protection, construction joint as claimed in claim 1, wherein the stiffening formation of the divider plate is a rolled channel formed along the length of the divider at its top edge.
3. A free movement, arris protection, construction joint as claimed in claim 1, wherein the stiffening formation is a flange, with a major part of the divider being planar and set up at least substantially vertically in use, and the flange being bent at least substantially at right angles to the major part.
4. A free movement, arris protection, construction joint as claimed in claim 3, wherein the flange of the one arris member rests on the flange of the divider plate.
5. A free movement, arris protection, construction joint as claimed in claim 4, wherein the flanges of the arris member and the divider plate are of the same width, or the flange of the arris member is wider, over-hanging the divider on its side way from its flange, or other stiffening formation when it is not flanged.

6. A free movement, arris protection, construction joint as claimed in any preceding claim, wherein the divider has apertures and the flanged arris member has pips and/or clips attached for securing the arris member to the divider.
7. A free movement, arris protection, construction joint as claimed in any preceding
5 claim, wherein the dowels are plate dowels.
8. A free movement, arris protection, construction joint as claimed in any preceding claim, wherein the shape of the wave formation is sinusoidal, or a regular trapezium/trapezoidal.
9. A free movement, arris protection, construction joint as claimed in any preceding
10 claim, wherein the peak to peak dimension of the wave shape is less than that of the width of the flange of the flanged arris member.
10. A free movement, arris protection, construction joint as claimed in any preceding claim, wherein the mid-plane of the wave shape is preferably off-set from the divider plane over the divider's flange, or at least to the one arris member's side of the divider
15 plate's plane.
11. A free movement, arris protection, construction joint as claimed in any preceding claim, wherein the flange of the one arris member may be continuous over the flange or other formation of the divider plate, or the flange does not extend beyond its wave shaped formations on its side away from the divider plane, or the flange extends
20 beyond the divider plate and indeed beyond the other arris member in the closed state of the joint.
12. A free movement, arris protection, construction joint as claimed in any preceding claim, wherein the other of the arris members includes floors to its concavities into which concrete is poured.
- 25 13. A free movement, arris protection, construction joint as claimed in any preceding claim, wherein the anchoring means are headed, and the heads are angled down ends.
14. A free movement, arris protection, construction joint as claimed in any preceding claim, wherein the arris members are arranged to abut initially.
15. A free movement, arris protection, construction joint as claimed in any preceding
30 claim, wherein the arris members are preferably provided with clips and or spacers for providing an equal width gap along the length of the wave forms.

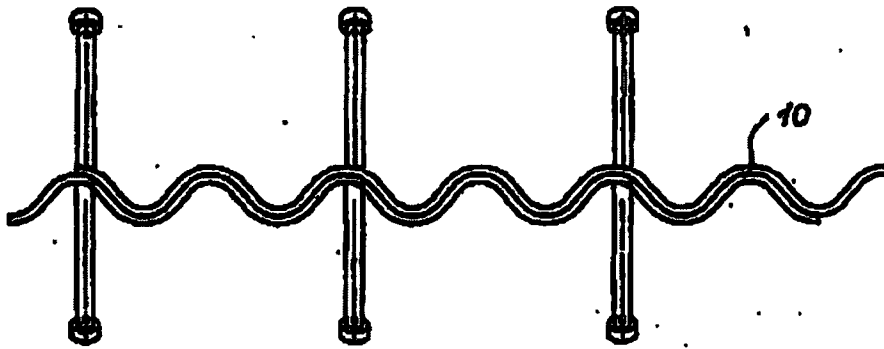


Figure 1

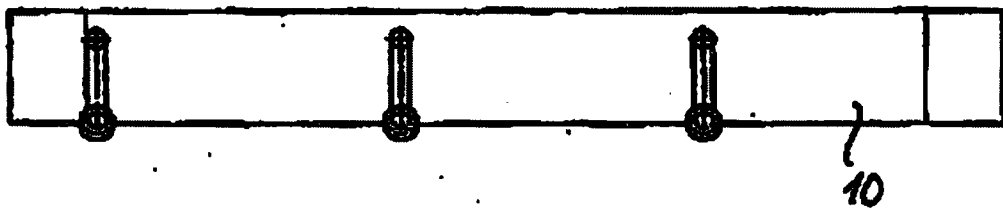


Figure 2

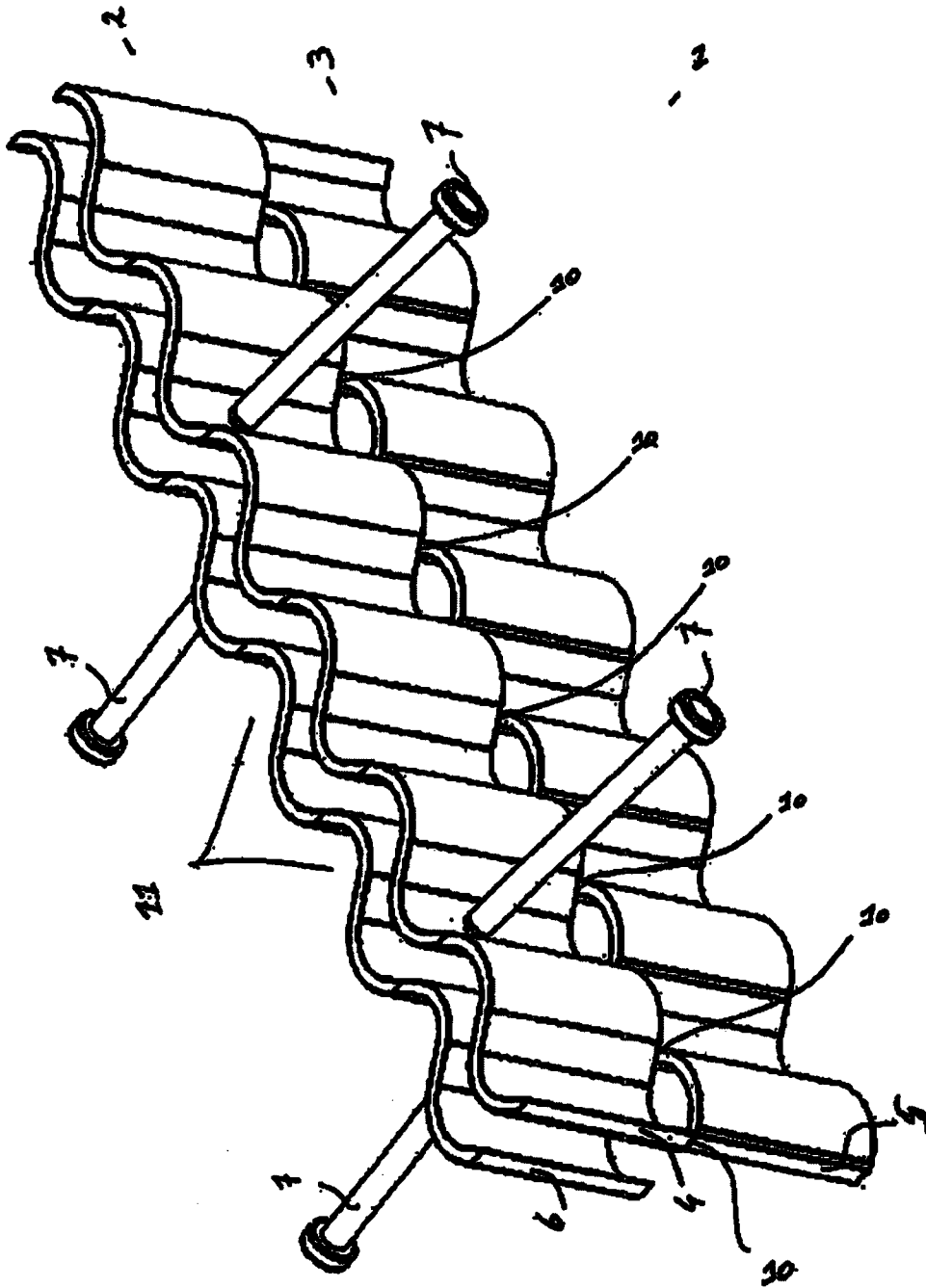


Figure 3

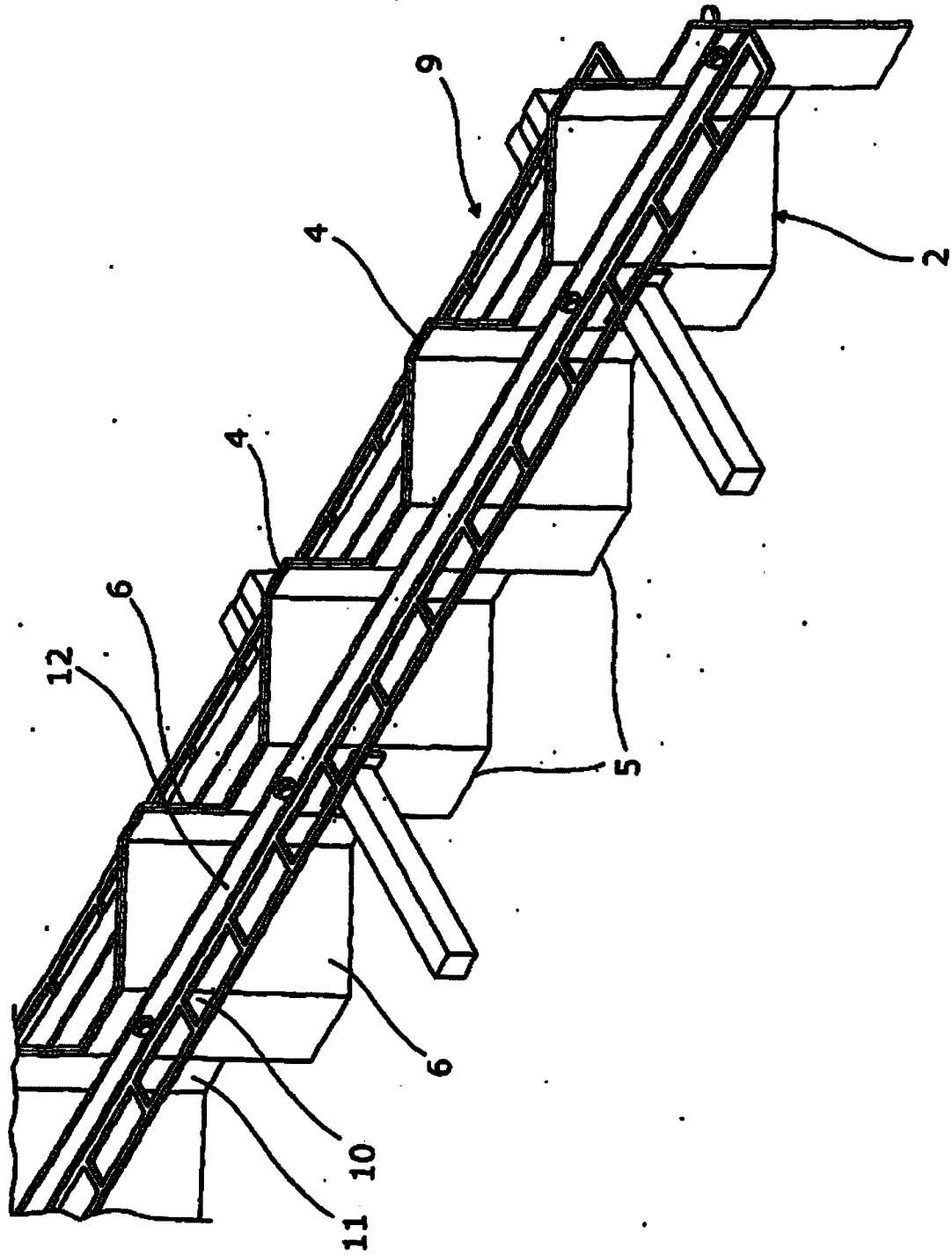


Figure 4

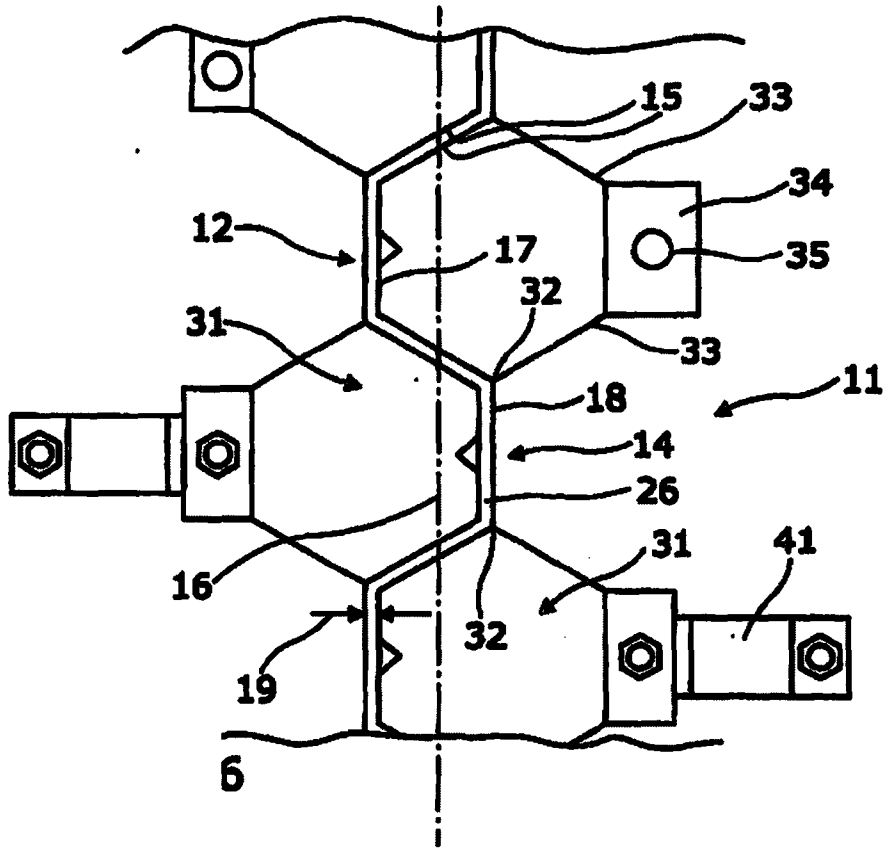


Figure 5

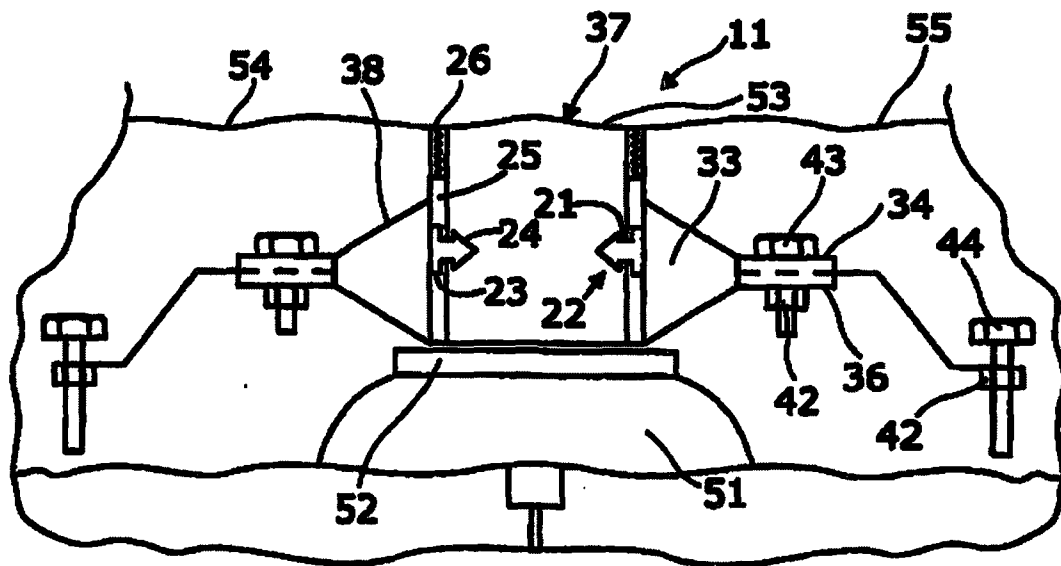


Figure 6

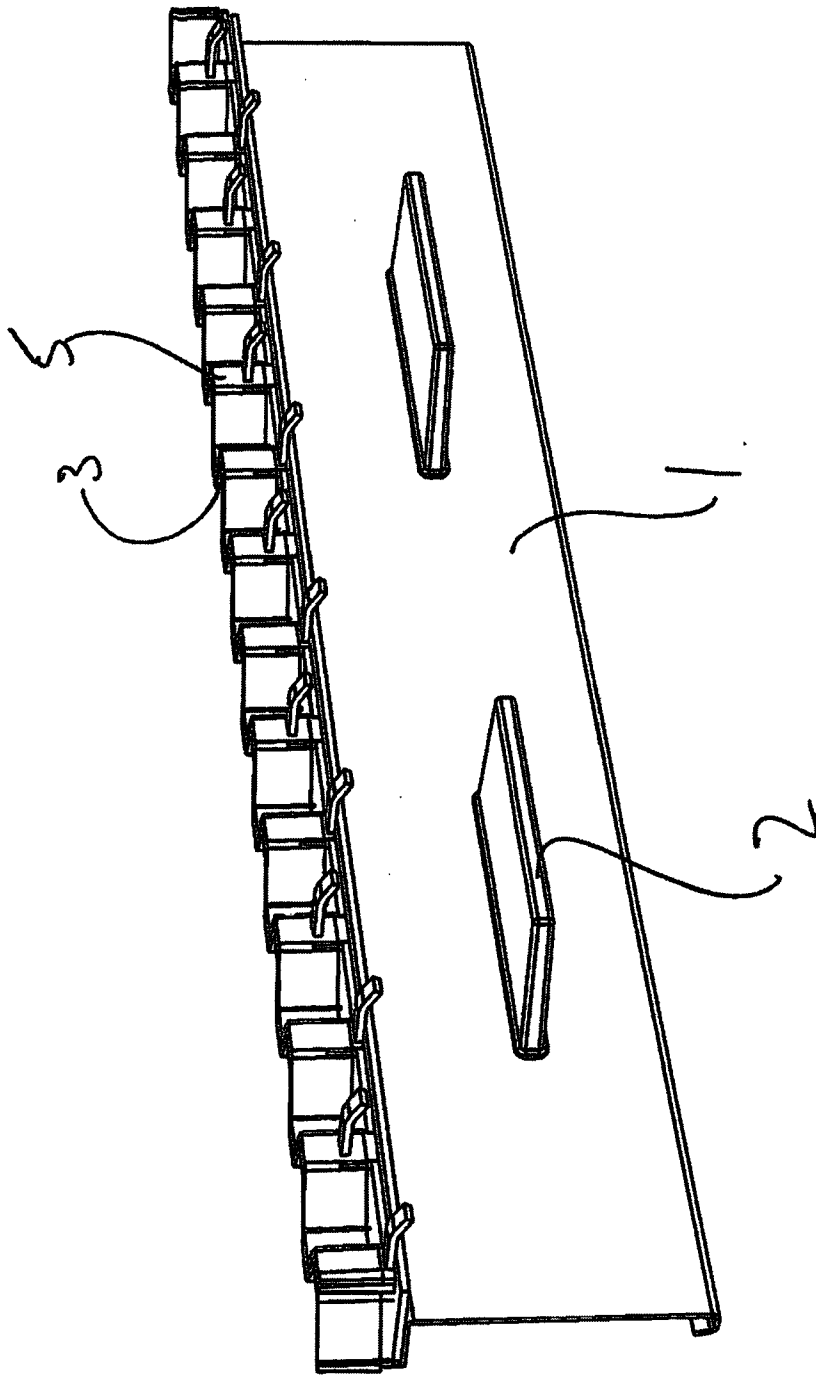


Figure 7

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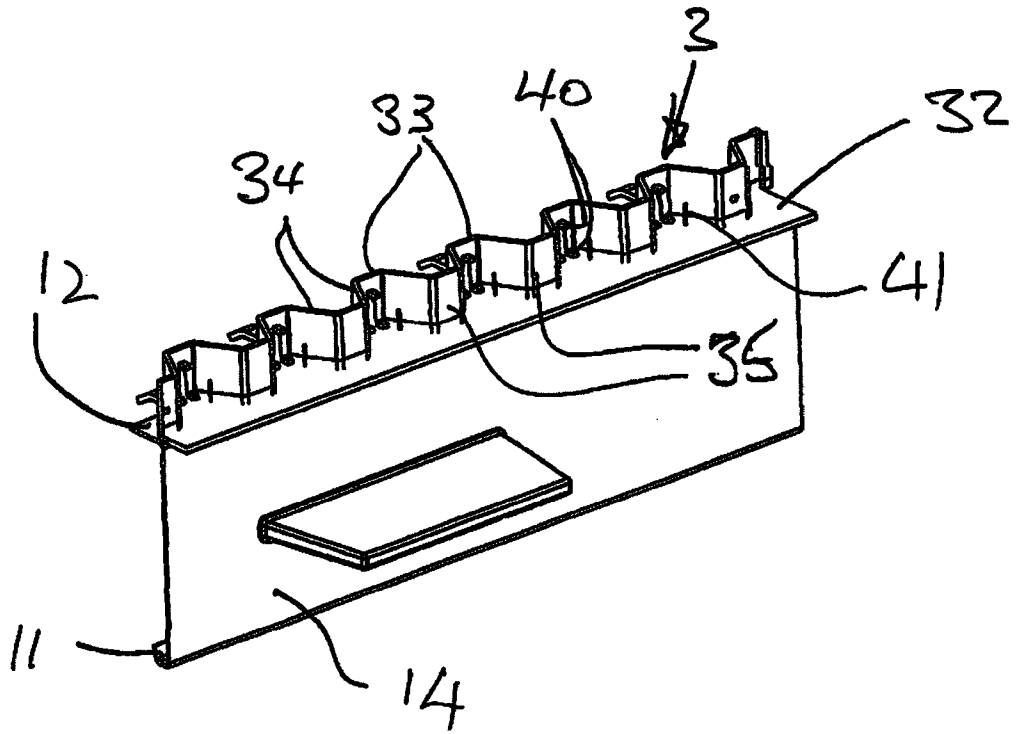


Figure 9

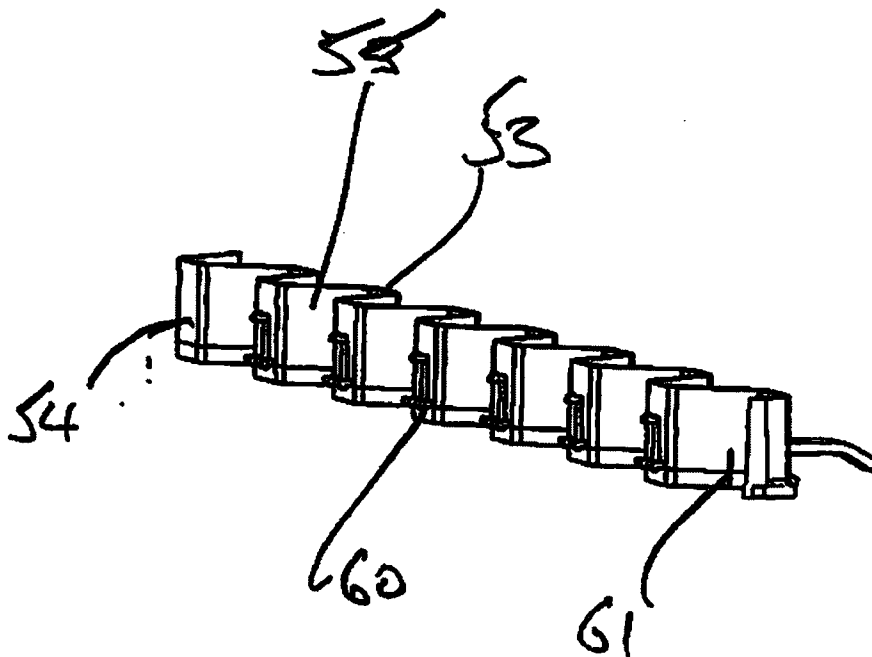


Figure 10

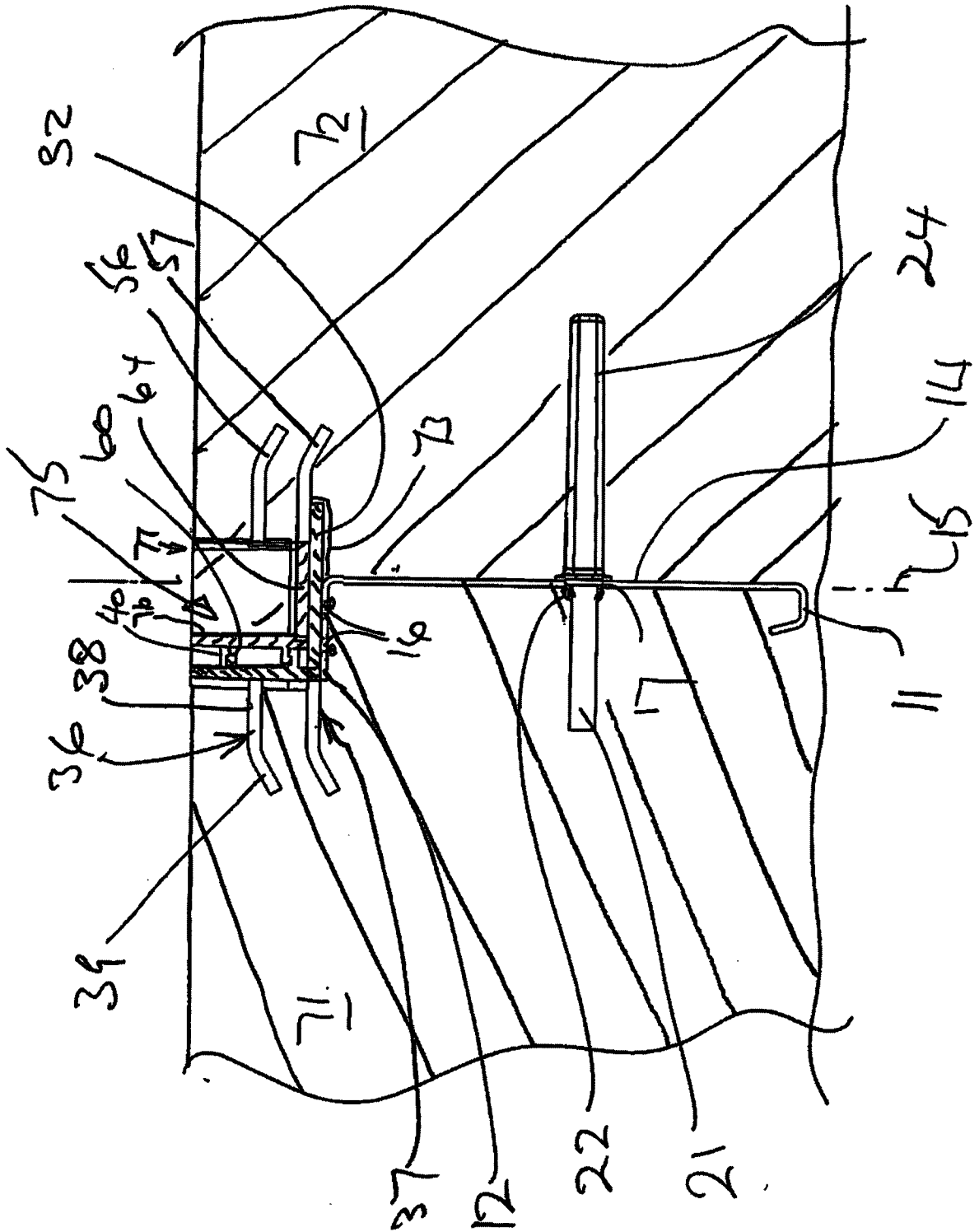


Figure 11

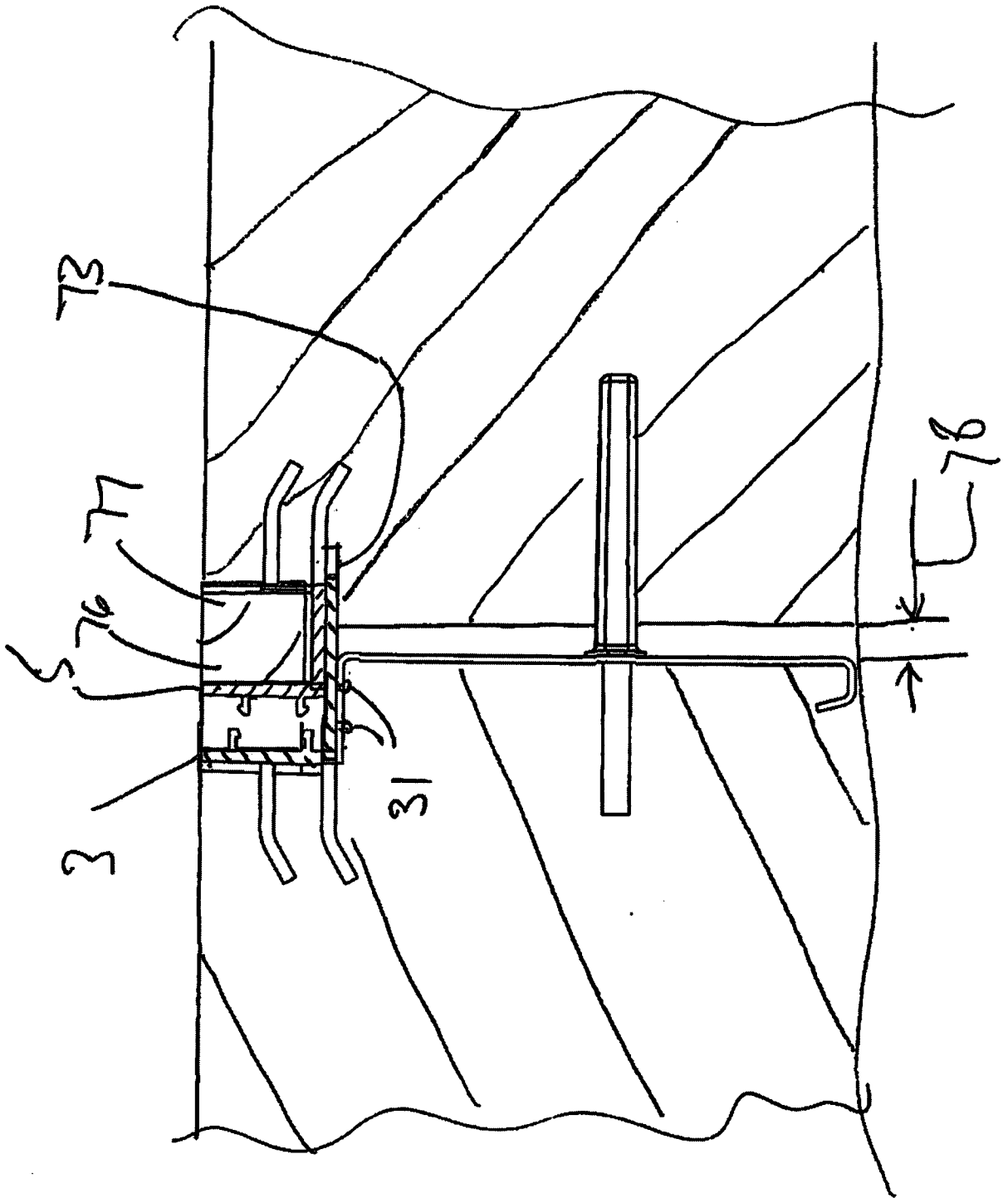


Figure 12

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2017/051425

A. CLASSIFICATION OF SUBJECT MATTER
 INV. E01C11/12 E01C11/14 E01D19/06 E04B1/48 E04B1/68
 ADD.

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)
 E01C E01D E04B E04F

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 practicable, 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	DE 10 2012 112023 A1 (HSD INDUSTRIEBELÄGE GMBH [DE]) 12 June 2014 (2014-06-12) figures 1,2 the whole document -----	1-15
X	WO 2006/016133 A1 (DEVLIN SEAMUS MICHAEL [GB]) 16 February 2006 (2006-02-16) figures 1-10 the whole document -----	1-15

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
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Date of the actual completion of the international search 31 July 2017	Date of mailing of the international search report 10/08/2017
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Klein, A
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2017/051425

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 102012112023 A1	12-06-2014	NONE	
WO 2006016133 A1	16-02-2006	NONE	