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**GB 2182369 A GB 2145445 A WO 88/02426 A1
US 4040228 A**

(58) Field of Search

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(54) Abstract Title

Floor / ceiling suspension arrangement

(57) An arrangement for suspending an article, eg. a light fitting or cable conduit, from a floor/ceiling slab 6 comprises a mould forming deck 1 forming the base 9 of the slab 6 which is provided with a recess 5. A suspension element 13 comprises at least two connected rigid members 14, 15 adjustable between first and second configurations is insertable into the recess 5. The suspension element 13 is inserted whilst in the first configuration and is pivoted about 16 and then locked to engage with the recess 5 in said second configuration. The recess 5 may be of dove tailed cross section with the ends of the suspension element 13 being correspondingly shaped. The rigid members 14, 15 may be U-shaped in their longitudinal cross section with one being nested in the other whilst locked in the second configuration. The locking means may consist of an inter-engaging depression and protrusion.

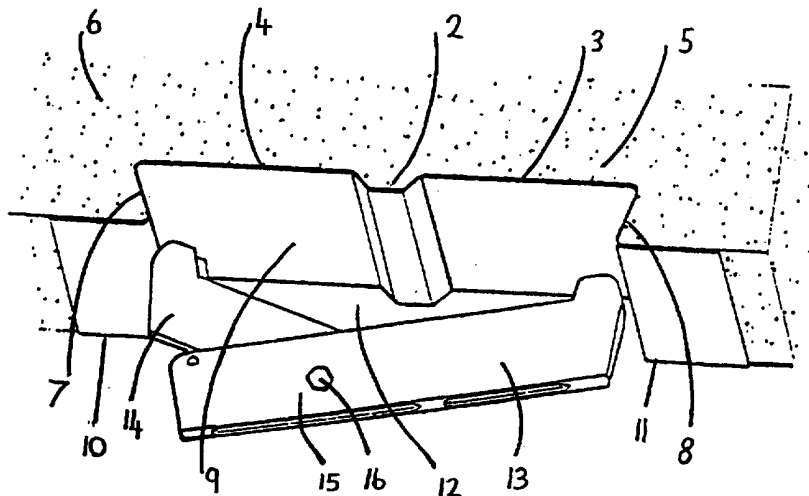


Figure 1

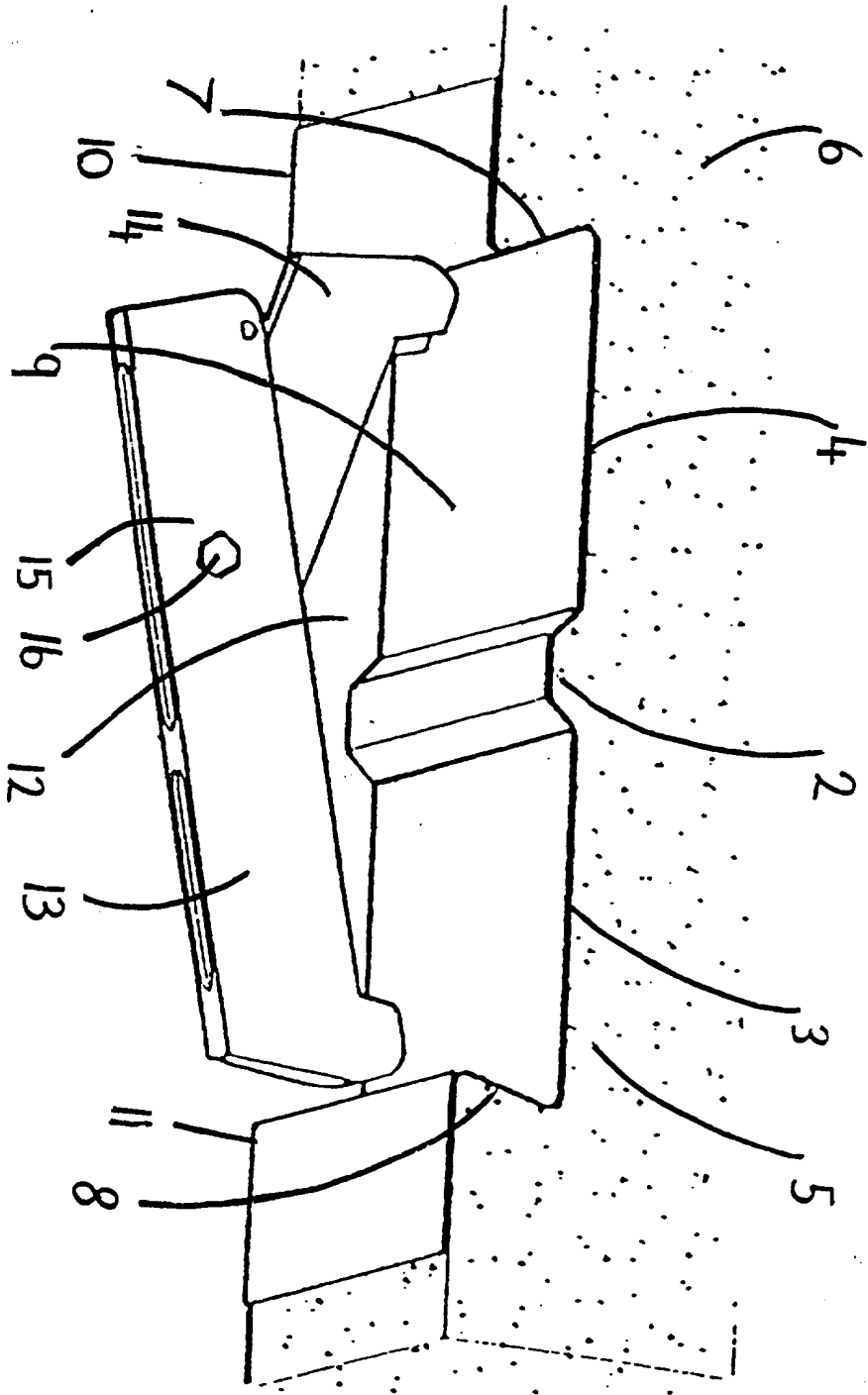


Figure 1

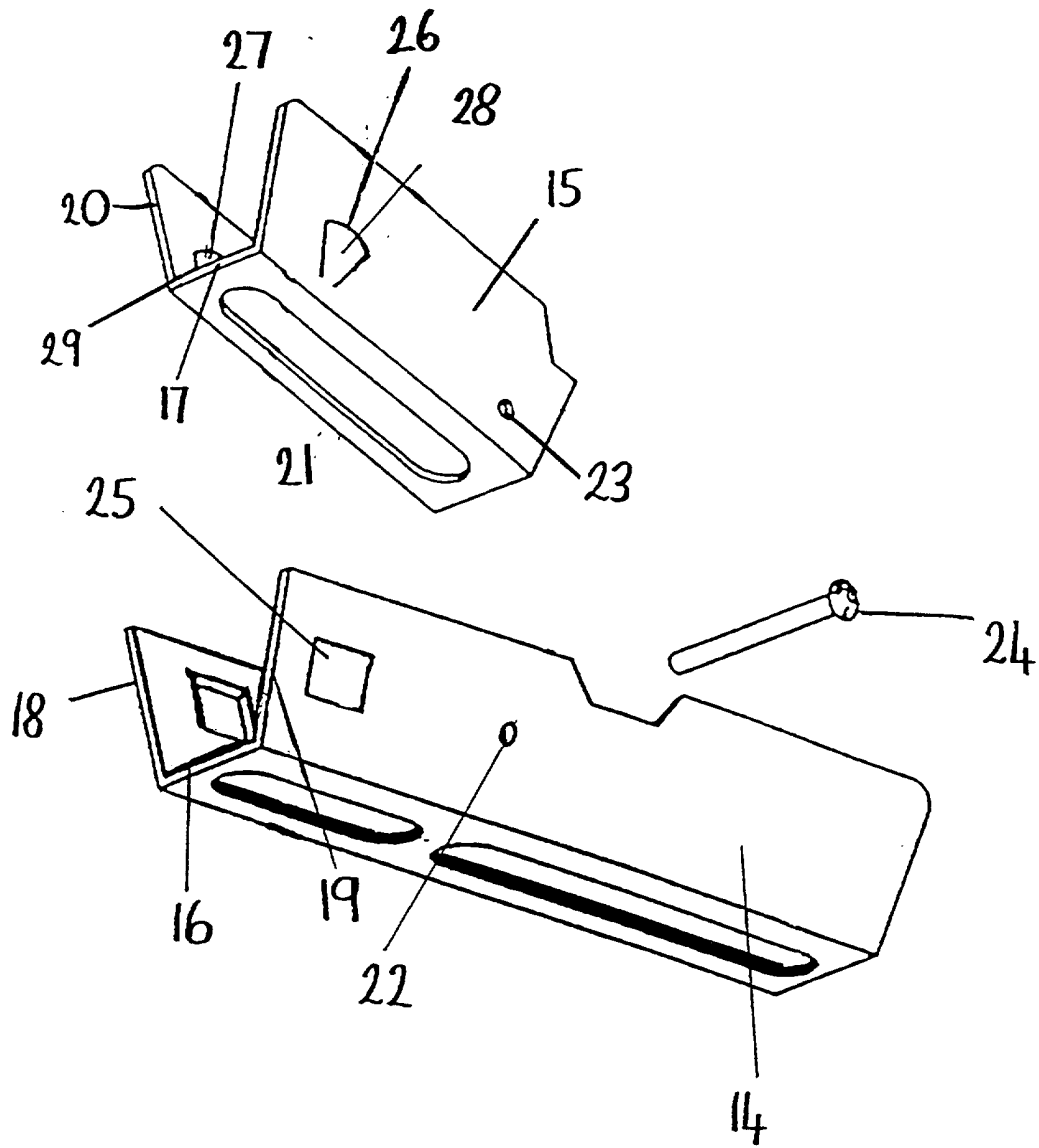


Figure 2

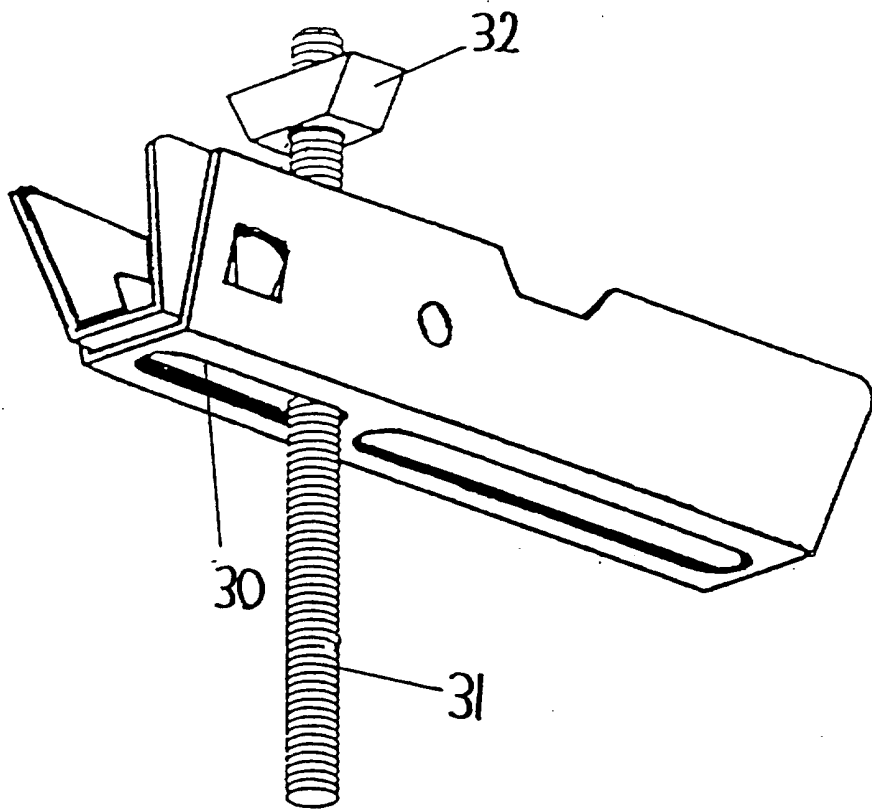


Figure 3

CEILING SUSPENSION ARRANGEMENT

This invention relates to an arrangement for suspending articles from a floor/ceiling slab, more particularly a device for suspending articles such as light fittings or cable conduits from a concrete floor/ceiling slab.

In multi-story buildings, the ceiling for one storey serves the dual purpose of being the floor for the storey above. Such floor / ceilings often have to bear substantial loads (for example, in a car park) and so are typically made from reinforced concrete slabs. These floor/ceiling slabs are typically prepared by pouring the concrete onto a metal mould forming deck, which extends between horizontal support beams of the framework of the building. The concrete sets and contracts around the deck forming a composite metal/concrete slab, to form a composite floor / ceiling slab.

It is usually required to hang objects from such floor/ceiling slabs, for example, light fittings, conduits or decorative suspended panels. One standard method of doing this in the construction industry is by mechanically or hydraulically driving metallic anchor pins upwardly into the concrete ceiling slab at high speed. These anchor pins usually have "fish hook" tips which prevent them from being removed from the ceiling after insertion. At the end of the anchor pin remote from the fish hook tips there is usually located a further hook or eye from which articles can be hung.

Such a process is relatively unreliable. If the metallic anchor pin strikes a piece of aggregate whilst being drive into the ceiling, it can be deflected laterally into an incorrect position. It is often not possible to then insert a second pin in the correct position due to the structural damage caused by the first pin. There is also a great variability in the effectiveness with which the anchor pin embeds itself in the concrete. Imperfect embedding often cannot be detected until the pin suddenly detaches itself from the ceiling during use.

The present invention provides a ceiling mould forming

deck and a suspension element for use therewith in order to suspend an article from the deck, the deck and element sealing designed to be inter-engageable.

Accordingly, in one aspect the invention provides a suspension arrangement for suspending an article from a floor/ceiling slab comprising:

a mould forming deck for forming the base of a slab to be cast thereon;

a portion of said deck having a recess in its underside, said recess having a mouth and a base;

a suspension element comprising a plurality of pivotally connected rigid members;

said suspension element being adjustable between first and second configurations by relative pivoted adjustment of said rigid members;

locking means for locking said suspension element in said second configuration;

said suspension element being insertable into said recess when in said first configuration and being interengageable with said recess when in said second configuration.

The arrangement of the invention has the advantage that the suspension element is clearly visible when locked in place in the recess. Hence, any faulty installation can be easily identified.

Also the arrangement of the invention does not cause structural damage to the concrete ceiling slab either when inserting or removing the suspension element. This can be contrasted with the anchor pin of the prior art which may cause substantial structural damage when being driven into the concrete slab.

Also, the arrangement of the invention can be assembled relatively safely. In contrast, the accidental firing of a metallic anchor pin from a hydraulic gun can cause serious operator injuries.

Preferably, the recess of the mould forming deck is a groove of constant width along its length. Only a portion of the length of the groove may be of constant width.

Alternatively, the mouth of the recess may be any one of square, oblong, circular, oval or any other shape.

Preferably, the mould forming deck recess of the current invention is dove tailed in cross section, the recess base being wider than the recess mouth.

Such a shape has an advantage that the suspension elements cannot be easily removed from such a groove when locked in the second configuration.

Preferably, the ends of said suspension element are of a shape suitable for inter-engagement with said dove tailed recess.

The suspension element of the arrangement of the current invention may comprise only two rigid members. These two members may be pivotable about a single connecting pivot between a first and second configuration.

Each of the members may be square or horizontal in a cross section perpendicular to its length.

Each of the rigid members may be U-shaped in a cross section perpendicular to its length.

Each member may have a different width to the adjacent member so enabling it to be nested in the adjacent member.

Preferably, the locking means comprises a depression in one member and a protrusion from an adjacent member, said depression and protrusion being positioned to inter-engage when said suspension element is in said second configuration.

The locking means may have a plurality of depressions located on different portions of the members.

In a further aspect of the invention there is provided a suspension element for inter-engagement with a recess in a mould forming deck comprising:

a plurality of pivotally connected rigid members,
said suspension element being adjustable between first and second configurations by relative pivotal adjustment of said rigid members;

a locking means for locking said suspension element in said second configuration;

said suspension element being insertable into said recess when in said first configuration and being interengageable with

said recess when in said second configuration.

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

Figure 1 shows a two member suspension element in the first position and a composite of a mould forming deck and concrete floor/ceiling slab.

Figure 2 is an exploded view of the two member suspension element of this embodiment.

Figure 3 is a perspective view of the two member suspension element locked in the second position. Also shown is a mechanism for hanging articles from the element.

The mould forming deck 1 shown in Figure 1 comprises a central axis 2. Extending horizontally from each side of the central axis 2 are two support panels 3, 4 which together form the base 9 of a recess 5. When in position the two support panels 3, 4 partially cover the underside of a concrete floor/ceiling slab 6 hiding it from view and preventing any small concrete particles falling onto the floor below.

Extending from each support panel 3, 4 is a side wall 7, 8. The angle of intersection between each support panel 3, 4 and the connecting side wall 7, 8 is less than 90°, that is to say the distance between the side walls 7, 8 decreases as one moves away from the base 9. The side walls 7, 8 are planar so forming a dove tailed recess. In an alternative embodiment the side walls may be concave or convex. The side walls may be slightly textured or ribbed.

The side walls 7, 8 and support panels 3, 4 together form a recess 5 in the shape of a groove of constant width along its length.

Extending integrally from each side wall 7, 8 is a tongue to the plane of the support panels 3, 4. The tongue pieces 10, 11 also cover a portion of the lower surface of the concrete floor/ceiling slab. The intersection between each of the tongue pieces and the adjacent side wall 7, 8 defines the mouth 12.

Only a small portion of the mould forming deck 1 is shown

in Figure 1. The mould forming deck 1 may be manufactured to any required length and the recess may be of any required depth or width. Preferably, the width of the recess 5 at its base 9 is less than 1 metre. More preferably it is less than 50cm. Preferably, the depth of the recess 5 (the perpendicular distance between the support panels 3, 4 and the mouth 12) is less than 60cm. More preferably it is less than 10cm. Preferably the angle of intersection between the side walls 7, 8 and support panels 3, 4 is less than 80° and greater than 20° . More preferably it is less than 70° and greater than 40° .

The mould forming deck 1 of this embodiment is manufactured from sheet steel. Other possibilities include plastics materials or rigid carbon fibre materials.

The mould forming deck 1 is typically manufactured by pressing the sheet steel to shape. Once in the correct shape the mould forming deck may be heat treated to improve its mechanical properties.

The composite of mould forming deck 1 and concrete floor/ceiling slab 6 is manufactured by connecting together a number of mould forming decks 1 to produce a composite deck of the required width. The composite deck is then arranged on a level surface with the tongue pieces 10, 11 in contact with the surface. A concrete aggregate mixture is poured into the composite deck to a depth sufficient to cover the deck recess 5 completely. Whilst being filled with concrete the composite deck is vibrated slightly to remove any air pockets trapped between the deck 1 and the concrete 6. Once filled to the correct depth the deck 1 is allowed to stand until the concrete 6 sets. Whilst setting the concrete 6 contracts around the deck 1.

Once set, the above tailed cross section of the recess 5 prevents the mould forming deck 1 from being separated from the concrete slab 6. The combined mould forming deck 1 and concrete slab 6 is then lifted into position to form a floor/ceiling slab.

Also shown in figure 1 is the suspension element 13 of the current embodiment.

The suspension element 13 comprises two members 14, 15. The two members 14, 15 can be rotated about a common pivot 16 between

a first configuration in which the two members 14, 15 are non-parallel (as shown) and a second configuration in which the two members 14, 15 are substantially parallel.

In order to inter-engage the suspension element 13 and mould forming deck 1, the suspension element 13 is firstly arranged to be in the first configuration. It is then passed through the mouth 12 of the recess 5 and rotated until its pivotal axis 17 is parallel to the side walls and base of the recess. Alternatively, the suspension element 13 may be rotated to the correct orientation before insertion into the recess 5. The ends of the suspension element 13 are then pushed upwards towards the base of the recess 5. Once the ends are in contact with the base 9 the members 14, 15 start to rotate about the pivot 16 until the suspension element 13 locks in the second configuration. When in the second configuration the ends of the members 13, 14 abut against the side walls 7, 8 of the recess 5 so holding the suspension element 13 firmly in place. Objects can now be hung from the suspension element 13.

The suspension element 13 is shown in greater detail in Figure 2. Each of the first and second members 14, 15 has a base plate 16, 17 and extending integrally from the base 16, 17 plate, side walls 18, 19, 20, 21. The angle of intersection between the base plates 16, 17 and the side walls 18, 19, 20, 21 is greater than 90° , preferably less than 150° , more preferably less than 120° .

The base plate of the second member is slightly narrower than the base plate of the first member 14. This enables the second member 15 to be nested within the first member 14 with the side walls 20, 21 of the second member 15 in contact with the side walls 18, 19 of the first member 14.

Both first and second members 14, 15 have holes 22, 23 extending through their side walls 18, 19, 20, 21. A screw 24 extends through these holes in the side wall (as shown) to form a pivot about which the members rotate between first and second configurations.

The first member 14 has a recess 25 in the inner surface of each side wall. The second member 15 has two asymmetric

protrusions 26, 27, one extending from the outer surface of each side wall 20, 21. When the suspension element 13 is in the first configuration the two members 14, 15 are free to rotate about the pivot 16. As the members 13, 14 are rotated from the first to second configurations a sloped portion 28, 29 of each protrusion 26, 27 abuts against the inner surface of the side walls 18, 19 of the first member 14. As rotation towards the second configuration is continued, the sloped portions 28, 29 of the protrusions 26, 27 force the side walls 18, 19 of the first member 14 apart. On reaching the second configuration, the protrusions 26, 27 inter-engage with the recesses 25 in the side walls 18, 19 of the first member 14 enabling the side walls 18, 19 of the first member 14 to "snap" back into their original position. Once the protrusions 26, 27 and recesses 25 are fully inter-engaged the asymmetric shape of the protrusions 26, 27 prevents them from separating from the recesses 25 hence locking the suspension element 13 in the second configuration.

Both first and second members 15 have end walls shaped to inter-engage or abut against the side walls 7, 8 in the recess 5 of the mould forming deck. In this particular embodiment the side walls 7, 8 of the recess 5 are planar and the end walls of the suspension element 13 are also planar. Other possibilities include concave side walls 7, 8 and correspondingly convex ends of the suspension element 13.

Shown in Figure 3 is the suspension element 13 of this embodiment locked in the second configuration. A series of holes 30 extends through the base plates 16, 17 of both first 13 and second 14 members. The holes 30 are arranged so that when said suspension element 13 is in the second configuration the holes 30 of one member overlap the holes of the second member enabling a bolt 31 or other rod to be passed through the beams. The bolt 31 is typically used as a suspension member from which articles can be hung and may have hooks or eyes to facilitate this.

In this embodiment the bolt 31 is held in place through the holes 31 by a threaded wedge 32. The wedge 32 fits within the U-shaped second member 15 and is threadedly inter-engaged with the bolt 31. The weight of the article (not shown)

suspended from the bolt 31 holds the wedge 32 firmly in place within the members 14, 15. Either the wedge 32 or the inner surface of the walls 20, 21 of the member 15 may be roughened or ridged to improve the friction between the wedge 32 and the second member 15. The width of the base of the wedge 32 is slightly larger than the base plate of the second member. Hence, when the wedge is forced into the second member by the weight of the article suspended from the bolt, the wedge forces apart the side walls of the second member is increasing the force with which the protrusions of this member inter-engage the depressions in the first member 14.

CLAIMS

1. A suspension arrangement for suspending an article from a floor/ceiling slab and comprising:

a mould forming deck for forming the base of a slab to be cast thereon;

a portion of said deck having a recess in its underside, said recess having a mouth and a base;

a suspension element comprising a plurality of pivotally connected rigid members;

said suspension element being adjustable between first and second configurations by the relative pivotal adjustment of said rigid members;

locking means for locking said suspension element in said second configuration;

said suspension element being insertable into said recess when in said first configuration and being interengageable with said recess when in said second configuration.

2. An arrangement according to Claim 1, wherein said recess is a groove of constant width along its length.

3. An arrangement according to Claim 1 or 2, wherein said recess is dove tailed in a cross section, the recess base being wider than the recess mouth.

4. An arrangement according to Claim 3, wherein the ends of said suspension element are of a shape suitable for inter-engagement with said dove tailed recess.

5. An arrangement according to any one of Claims 1 to 4, wherein said suspension element comprises two rigid members.

6. An arrangement according to any one of Claims 1 to 5, wherein each of said rigid members is U-shaped in cross section perpendicular to its length, each member having a different width to the adjacent member so enabling it to be nested in said

adjacent member.

7. An arrangement according to Claim 6, wherein said locking means comprises a depression in one member and a protrusion from an adjacent member said depression and said protrusion being positioned to inter-engage when said suspension element is in said second configuration.

8. A suspension element for inter-engagement with 3 recess in a mould forming deck and comprising:

a plurality of pivotally connected rigid members,
said suspension element being adjustable between first and second configurations by relative pivotable adjustment of said rigid members;

a locking means for locking said suspension element in said second configuration;

said suspension element being insertable into said recess when in said first configuration and being interengageable with said recess when in said second configuration.



Application No: GB 9712356.6
Claims searched: 1-8

Examiner: Steven McIlroy
Date of search: 12 August 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:
UK CI (Ed.P): E1D PW
Int CI (Ed.6): E04B 1/41
Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	GB 2182369 A (Cops) See whole document	-
A	GB 2145445 A (Koszta et al.) See whole document	-
A	WO 88/02426 A1 (Alwyn Pty. Ltd) See whole document	-
A	US 4040228 (The Poltior Corp.) See especially figure 1	-

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.