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(54) **System for supporting a shuttering**

(57) A system for supporting concrete or other settable material during the construction of a foundation raft or other low level beam, the system comprising a shell having a substantially vertical support section and a cavity section, the support section having a first side against which settable material rests during formation of the raft

or beam and a second side opposite the first side, a plurality of support ties extending from the cavity section to adjacent the first side of the support section for, in use, retaining at least the support section in the desired position during curing of the settable material and means for connecting each support tie to the support section.

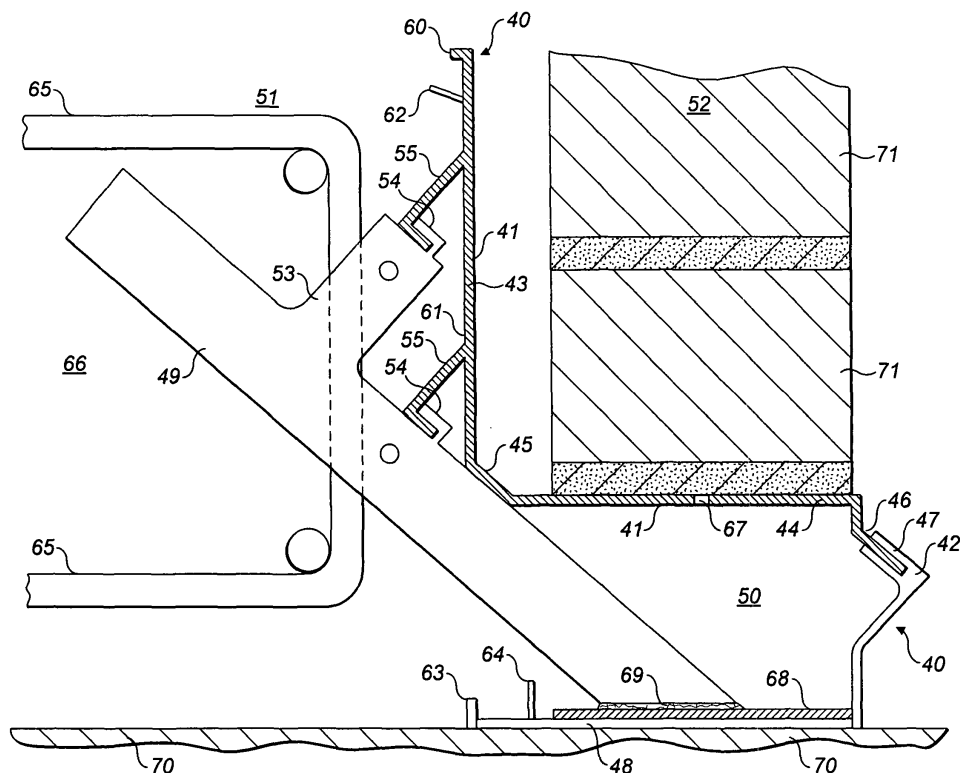


FIG. 3

Description

[0001] This invention relates to a system for supporting concrete or other settable material during the construction of a foundation raft or other low level beams.

[0002] When building on ground which is liable to subsidence or heave, it is well known to erect a building or other superstructure on a raft or beam, itself supported by piles. The underside of the raft may be spaced above the ground by a void or compressible material. The raft or beam is typically cast in situ and it typically formed by pouring concrete or other settable material into formwork which defines the desired shape of the beam or raft. Typically, this formwork takes the form of temporary shuttering, usually formed from wood or a metal such as stainless steel.

[0003] Once the settable material of the raft or beam has been cured sufficiently, the shuttering is removed and a separate support angle is provided around the edge of the raft or beam such that the appropriate wall or other blockwork can be built upon the support angle.

[0004] It has been found that, as the size of buildings increases, the size and strength of the support angle must also increase significantly in order that it can still adequately support the blockwork. However, as most known support angles are typically formed from stainless steel, there can be significant cost penalties involved in using thick sections of this material and, indeed, given the significant price differential between stainless steel and other materials, it would be advantageous to have a support system which did not necessarily require the use of stainless steel and which could still accommodate the ever increasing loads from taller and heavier buildings. A known support angle is disclosed in our earlier patent publications EP1609915 and EP1741840.

[0005] The present invention aims to provide a support arrangement which overcomes the problems described above and which improves on the arrangements disclosed in our earlier publications.

[0006] According to the present invention, there is provided a system for supporting concrete or other settable material during the construction of a foundation raft or other low level beam, the system comprising:

a shell having a substantially vertical support section and a cavity section, the support section having a first side against which settable material rests during formation of the raft or beam and a second side opposite the first side;

a plurality of support ties extending from the cavity section to adjacent the first side of the support section for, in use, retaining at least the support section in the desired position during curing of the settable material; and

means for connecting each support tie to the support section.

[0007] Thus, the present invention provides a system

in which, due to the direct connection of the support section of the shell to the support tie, adequate support and strength is provided to the shell such that it can be made from less material (for example the support section does not need to extend all the way to the lower surface on which the shell is placed) and can be formed from a lighter weight material, such as plastic, thereby significantly reducing the costs of the item. The support ties themselves would, in most situations, be formed from a metal, such as steel, in order to provide the strength, as it is these features which bear the load. However, the remainder of the system can be formed from a cheaper non metallic material.

[0008] In one example, the shell may be formed from two or more parts, including an upper molding including the support section and a lower molding defining at least part of the cavity section. The support ties and the support section preferably each have at least one L-shaped projection for cooperative engagement, although in addition or as an alternative, the support ties may be screwed, welded or tied to each of the support ties.

[0009] The L-shaped projections are shaped and positioned on the support ties and the support section to restrain the support section from being lifted away from the support ties in use.

[0010] Preferably each support tie has at least one arm extending, in use, towards the support section, the at least one L-shaped projection being provided on the arm.

[0011] The junction of the cavity and the support section preferably rests, in use, on one or more of the ties.

[0012] In the two part construction, the lower molding preferably has a receiving portion for, during formation of the support system, receiving a corresponding part of the upper molding. The connection of the upper and lower moldings may be via a snap fit fastening or by other suitable means.

[0013] A channel may be provided in the cavity section for receiving an end of the support ties. Providing a channel in the cavity allows the ties to be assembled with the shell without being fixed through the base of the cavity to the decking below. Removing the need for these fixings to pass through the base of the cavity can help to preserve the watertightness of the cavity.

[0014] Each support tie may have a foot having first and second ends. Providing the ties with a foot allows the ties to be attached to the base of the shell to maintain the correct orientation during assembly of the system and pouring of the concrete or other settable material.

[0015] First and second channels may be provided in the cavity section for receiving first and second ends of each foot. Providing a channel at the outer edge of the cavity helps to maintain the tie in the correct orientation during assembly and pouring. Providing a second channel toward the inner end of the base of the shell helps to react forces that, after pouring of the settable material, tend to rotate the substantially vertical support section, and the tie to which it is connected, away from the base and toward the second side of the vertical support.

[0016] A channel may be provided on the first side of the substantially vertical support section for receiving connections which may be attached to the support ties. Attaching the support ties via a channel facilitates assembly of the system and allows the shell to be manufactured by extrusion if desired.

[0017] The shell may be made from one integral part. Making the shell from one integral part can reduce manufacturing costs, facilitate more rapid assembly and aid in maintaining the watertightness of the shell.

[0018] The vertical section of the support section is preferably provided with means to prevent water ingress between the support section and the settable material which abuts the first side of the support section. An upwardly angled projection may be provided on the upper part of the support section, the projection extending along the entire length of the support section for retaining water which runs down the first side of the support section.

[0019] The shell preferably comprises a base and has, at the inner end of the base, at least one upstanding projection to prevent water ingress onto the base. The upstanding portion may define the inner edge of the cavity section. A second upstanding projection mainly also provided on the base.

[0020] An upper and/or a lower portion of one or more the ties may be crimped and/or may be provided with holes or indentations formed therein, thereby improving the grip of the concrete around and on the support ties.

[0021] The connection between the vertical support section and each of the support ties is preferably angled so that the retaining force supplied by the connection is angled relative to the substantially vertical support section. In this way, the substantially horizontal load applied against the first side of the support arrangement and the substantially vertical load applied to the underside of the upper portion of the cavity section by the settable material when it is poured can be balanced by the retaining force at the most appropriate angle.

[0022] The support tie preferably includes a fixing portion for, in use, connection to a surface on which the cavity section rests.

[0023] One example of the present invention will now be described with reference to the accompanying drawings, in which:

Figure 1 shows a known support angle with reinforcing tie;

Figure 2 shows a further example of a known support arrangement;

Figure 3 shows an example of the present invention; and

Figure 4 shows a further example of the present invention.

[0024] Figure 1 shows a known support angle with support gussets, as described in our own earlier publication EP1609915. A support angle 10 comprises a support member 11, integrally formed along its longer edge with

a base member 12. The base member is provided with a plurality of holes 13 through which suitable fixing means such as screws or nails can be inserted to assist in fixing the base member 12 to, for example, timber decking (not shown).

[0025] The support member 11 is provided with a number of slots 14 through which a respective support tie 15 passes from one side 16 to the other side 17 of the support member 11. The support ties are typically elongate in shape and are, for example, welded at 18 to the base member 12 and to the support member at slots 14. Each support tie has, at the opposite end to point 18, a securing portion 19 which, in use, passes into and engages with the low level beam or foundation raft which is being constructed.

[0026] The support member 11 provides support to the concrete or other settable material of the foundation raft before curing, the concrete being located on side 16 of the support member 11. The substantially horizontal base member 12 is used to secure the support angle 10 in the construction phase via holes 13 and provides permanent support to the brick work of a building. When bricks or other blockwork are loaded on the base member 12 to build a wall or other structure, the load of the wall or structure is taken up by the base member 12, but is also transferred along the support ties 15 into the concrete of the foundation raft (not shown).

[0027] Figure 2 shows a further example of known support arrangement in which a cavity forming member 30 in conjunction with the base 12 defines a cavity 31 into which, in use, concrete can be poured via openings 37. Openings 38 and the upper surface of the cavity enable air from within the cavity to be expelled as the concrete flows from side 16 through openings 37 into the cavity 31. The support elements may have additional webs 39 to secure the upper portion of the support element against the concrete pressure during curing. Openings 37 and 38 are sized to allow concrete to flow through opening 37, for air to escape the cavity 31 via openings 38, but opening 38 is sized to prevent significant overflow of the concrete outside of the cavity 31.

[0028] In the arrangement of Figure 2, after the concrete has been cured, blockwork can then be laid on the upper surface of the cavity forming member 30.

[0029] Figure 3 illustrates one example of the present invention in which a shell 40, formed of upper 41 and lower 42 moldings, acts both as the support angle and the cavity forming member shown in the previous examples. The upper molding is substantially L-shaped having a substantially vertical (when in use) support section 43 and a substantially horizontal element 44 connected to the vertical element 43 via an angled corner 45. The opposite end of the lower section 44 is formed with a foot 46 which is shaped to engage with a correspondingly shaped portion 47 on the lower molding 42. From position 47, the lower molding 42 then continues down to a base 48 which typically rests on timber or concrete decking 70. A support tie 49 (in the figure only one is shown, but

several will be used in the same way as support ties 15 from Figures 1 and 2) extends from a cavity 50 defined by the lower molding 42 and the substantially horizontal portion 44 of the upper molding 41 to a first side 51 of the substantially vertical support section 43. The support tie 49 is sized and positioned such that, in use, the angled corner 45 abuts against a portion of the support tie in order to provide support to the upper molding 41.

[0030] The lower portion of the support tie 49 may, although it is not shown, be crimped or have holes or perforations formed therein thereby increasing the hold of the concrete (not shown) on the support tie 49. Similar formations may be provided on an upper portion of the support tie 49 above arm 53 which projects away from the upper edge of the support tie 49. The support tie 49 is provided with, in this example, two L-shaped projections 54 which engage with corresponding projections 55 provided on the first side 51 of the vertical support member 43.

[0031] The position, orientation and shape of the projections is determined depending upon the relative sizes of the substantially vertical support section and the cavity 50, as if the support tie 49 is at a different angle with respect to the various elements, the retaining force that it provide, by way of the connections 54, 55, will be different.

[0032] Accordingly, the angle of the arm 53, and the projections 55 are determined such that the substantially horizontal force on the vertical support section 43 and the vertical force provided on the horizontal portion 44 (both forces due to the poured concrete before it is cured) can be balanced, thereby preventing the upper molding 41 from being lifted upwardly and to the right in Figure 3. In effect, when concrete is poured onto side 51 of the shell 40, the upper molding 41 tries to pivot around the connection with the lower molding 42, and the connection of the vertical support section to the support ties ensures that this does not happen.

[0033] The substantially vertical section may be provided with a small tab 60 which is intended to prevent water ingress down surface 61, but any water which does run down surface 61 will be caught by a projection 62 which is upwardly angled and extends along the length of the support section 41.

[0034] The base 48 of the lower molding 42 is similarly provided with a tab 63 and a further upstanding projection 64 for the same reasons.

[0035] The support ties 49 may be connected to further reinforcing material 65 provided in the concrete prior to pouring. A blow hole 67 is provided in the lower portion 44 of the upper molding such that, as concrete is poured, air can be expelled from the cavity 50.

[0036] Each tie 49 is preferably provided with a foot 68 which extends either or both of into and out of the page in Figure 3 and is connected to the main body of the tie via a weld 69. The foot 68 can then be fastened through the base 48 into the decking 70 on which the beam is being constructed. Alternatively, the foot may not be pro-

vided and/or other methods of increasing the bond between the tie and the settable material could be employed.

[0037] Once the concrete has been secured within the shell 40, brick or the blockwork 71 can be laid on top of the cavity section.

[0038] Figure 4 shows an alternative embodiment in which shell 80 is formed from one integral part. Similarly to the example shown in Figure 3, the shell has a substantially vertical (when in use) section 81 and a substantially horizontal section 82, connected by a chamfered corner 83. Blow hole 84 is provided to allow air to escape from cavity 85 as concrete is poured to the left side of shell 80. A further vertical section 86 is connected to horizontal section 82, and descends to connect with base 87. A support tie 88 is shown having a foot 89, which is attached to the main section of the support tie by a weld 90, or by other suitable attachment means. A first channel 91 is provided toward the outer edge of the cavity and accommodates one end of the foot 89. This acts to hold the support tie 88 in the appropriate orientation during assembly of the system. With the tie held in place by channel 91, connector 92 can be put in place to further provide support to the tie before and during pouring of the settable material. Bulbous end 94 of the connector 92 is located within channel 93 provided on vertical support 81. Connector 92 can then slide back and forth either into or out of the page as seen in Figure 4, such that it can be aligned with support tie 88. The elongate body of connector 92 extends towards securing feature 95 on support tie 88, such that the connector is oriented at the chosen angle relative to support tie 88. Connector 92 may be made of a material having some elastic properties if so desired. This can allow some extension of the connector such that it is in tension when holding the tie against chamfer 83. It may also allow some adjustability such that a connector of one size may be used for different shell sizes or tie sizes. The connector 92 may be made from an inelastic material such that it does not allow vertical support section 81 to move away from support tie 88. Connector 92 may alternatively be made from a rigid material to prevent vertical section 81 from moving either towards or away from support tie 88. Connector 92 may be made from separate parts whereby, for example, bulbous end 94 is separate from the elongate section and the securing means 95, and the parts are assembled together on site. Securing means 95 may be adjustable, as may the length of connector 92. Connector 92 may also be connected to vertical section 81 by some means other than channel 93.

[0039] After pouring, connector 92 acts to counter forces generated by pressure of the poured material acting against vertical section 81. The optimal angle for the connector 92 is determined depending upon the relative sizes of the substantially vertical support section 81 and the cavity 85, since if the support tie 88 is at a different angle with respect to the various elements, the retaining force that it provides by way of the connector 92 will be different.

[0040] Accordingly, the angle of the connector 88 is determined such that the substantially horizontal force on the vertical support section 81 and the vertical force provided on the horizontal portion 82 (both forces due to the poured concrete before it is cured) can be balanced, thereby countering forces tending to lift the vertical section 81 and horizontal section 82 up and to the right in Figure 4. In effect, when concrete is poured onto side 96 of the shell 80, the upper two walls 81 and 82 of the shell 80 try to pivot around the top and/or bottom of wall 86, and the connection of the vertical support section to the support ties helps to ensure that this does not happen.

[0041] Further support is provided by channel 97, provided towards the inner end of the base 87. This channel acts to retain the inner end of the foot 89 such that the pressure forces on vertical section 81 transferred to tie 88 through connector 92 are countered. Thus the tie 88 and vertical support 81 remain at the correct orientation with respect to the vertical in Figure 4.

[0042] Securing points 98 are provided such that the base 87 of shell 80 can be secured to the decking or concrete 99 underneath. These react the forces acting upon base 87 via channel 97. With a reduced need for fixings piercing the shell around cavity 85, the risk of water ingress to the cavity is greatly reduced. An additional benefit of the reduced risk of water ingress is that it is no longer necessary to use a non-corrodible material for tie 92 and foot 89. Thus cheaper corrodible metals may be used, reducing the cost of manufacture of the system.

[0043] It will be appreciated that foot 89, and connector 92 can slide along their respective channels 91, 93 and 97, into or out of the page as seen in Figure 4. This can be carried out irrespective of whether base 87 has been affixed to concrete or decking 90 via fixings 98 or not.

[0044] Although not shown in Figure 4, equivalent features to tab 60 and projection 62 of Figure 3, may be provided on upper support section 81 to aid the prevention of water ingress. Similarly, features equivalent to tab 63 and projection 64 in Figure 3 may also be provided on base 87 of shell 80.

[0045] Also similarly to Figure 3, once the settable material has cured, brick or blockwork 71 of Figure 3 can be laid on top of the cavity section 85 of Figure 4.

Claims

1. A system for supporting concrete or other settable material during the construction of a foundation raft or other low level beam, the system comprising:

a shell having a substantially vertical support section and a cavity section, the support section having a first side against which settable material rests during formation of the raft or beam and a second side opposite the first side; a plurality of support ties extending from the cav-

ity section to adjacent the first side of the support section for, in use, retaining at least the support section in the desired position during curing of the settable material; and means for connecting each support tie to the support section.

2. A system according to claim 1, wherein the shell is formed from two or more parts, including an upper molding including the support section and a lower molding defining at least part of the cavity section.
3. A system according to either claim 1 or claim 2, wherein the support ties and the support section each have at least one L-shaped projection for co-operative engagement.
4. A system according to claim 3, wherein the projections are shaped and positioned so as to restrain the support section from being lifted away from the support tie.
5. A system according to any one of the preceding claims, wherein each support tie has at least one arm extending, in use, towards the support section, the at least one L-shaped projection being provided on the arm.
6. A system according to any one of the preceding claims, wherein the junction of the cavity and support section rests, in use, on one or more of the ties.
7. A system according to claim 1, wherein connections are provided for connecting the support ties to the vertical support, the connections being arranged so as to restrain the support section from being lifted away from the support tie.
8. A system according to claim 1 or claim 7, wherein a channel is provided in the cavity section for receiving an end of the support ties.
9. A system according to claim 8, wherein each tie has a foot having first and second ends.
10. A system according to claim 9, wherein first and second channels are provided in the cavity section for receiving first and second ends of each foot respectively.
11. A system according to claim 8, wherein a channel is provided on the first side of the substantially vertical support section for receiving connections for attaching to the support ties.
12. A system according to any one of claims 7 to 11, wherein the shell is made from one integral part.

13. A system according to any one of the preceding claims, wherein the upper portion of the support section is provided with means to prevent water ingress between the support section and settable material which abuts the support tie. 5
14. A system according to any one of the preceding claims, wherein the upper part of the support section is provided with an upwardly angled projection extending along the entire length of the support section for retaining water running down the first side of the support section. 10
15. A system according to any one of claims 2 to 19, wherein the shell has a base and has, at the inner end of the base, at least one upstanding projection to prevent water ingress onto the base. 15

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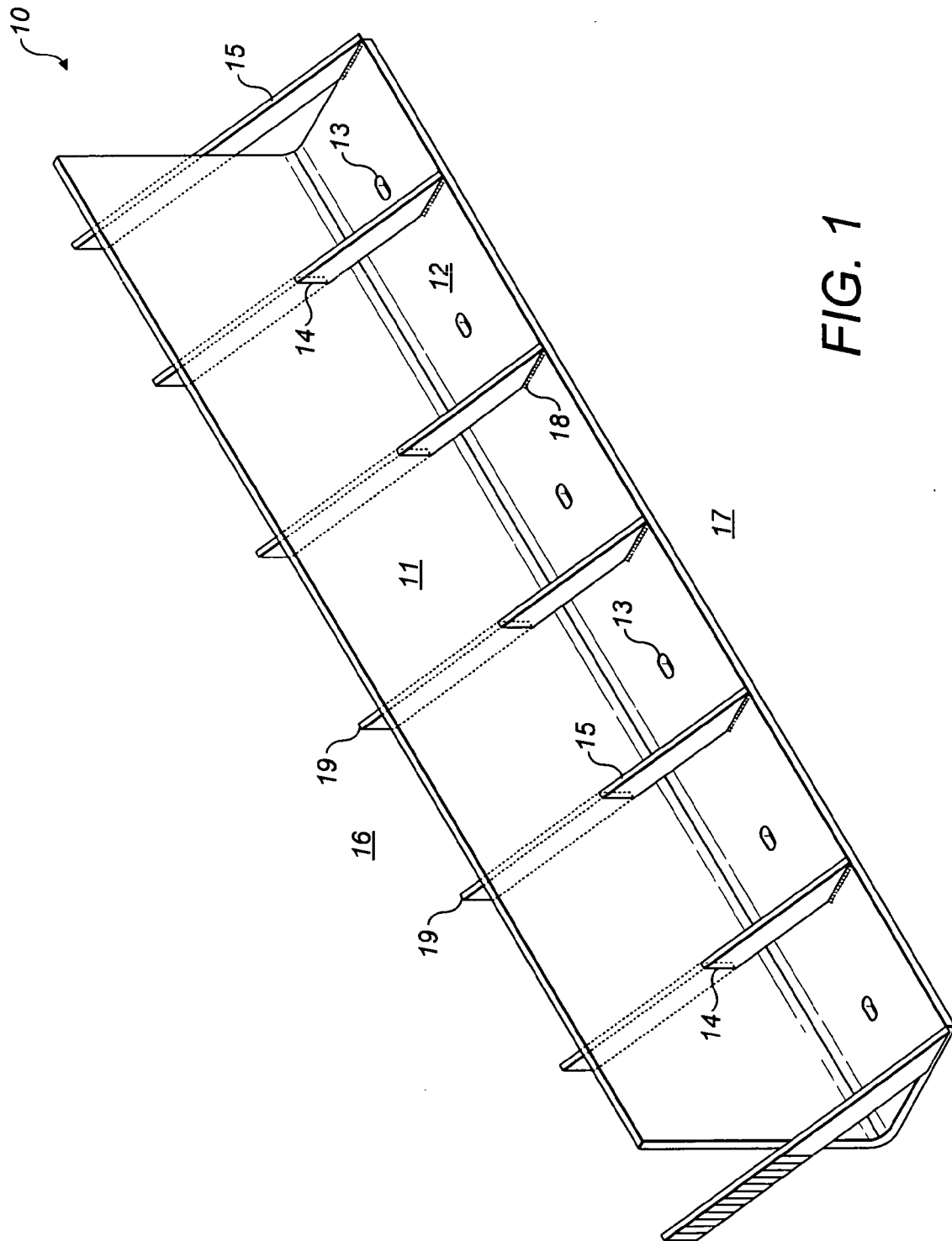
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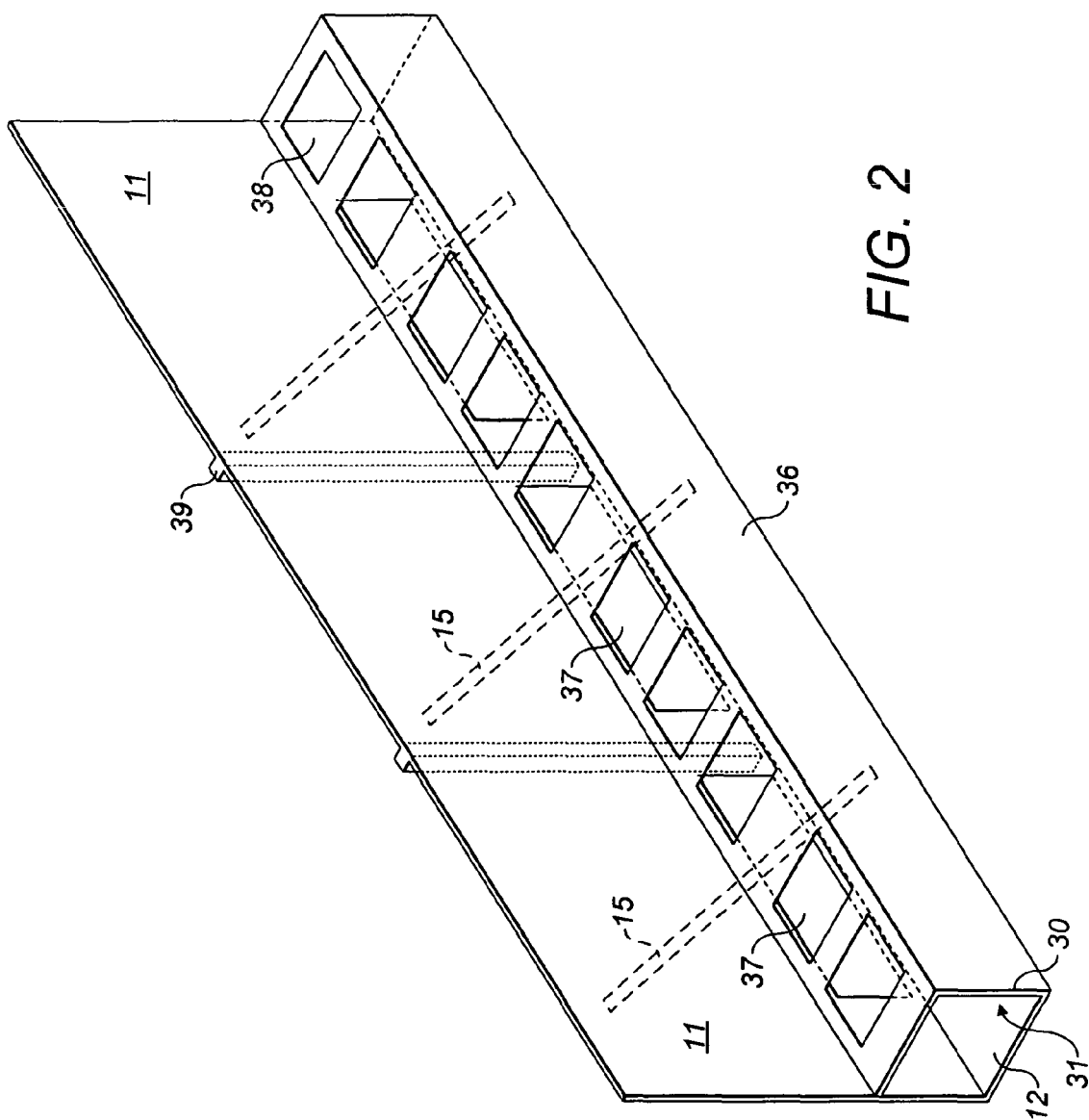
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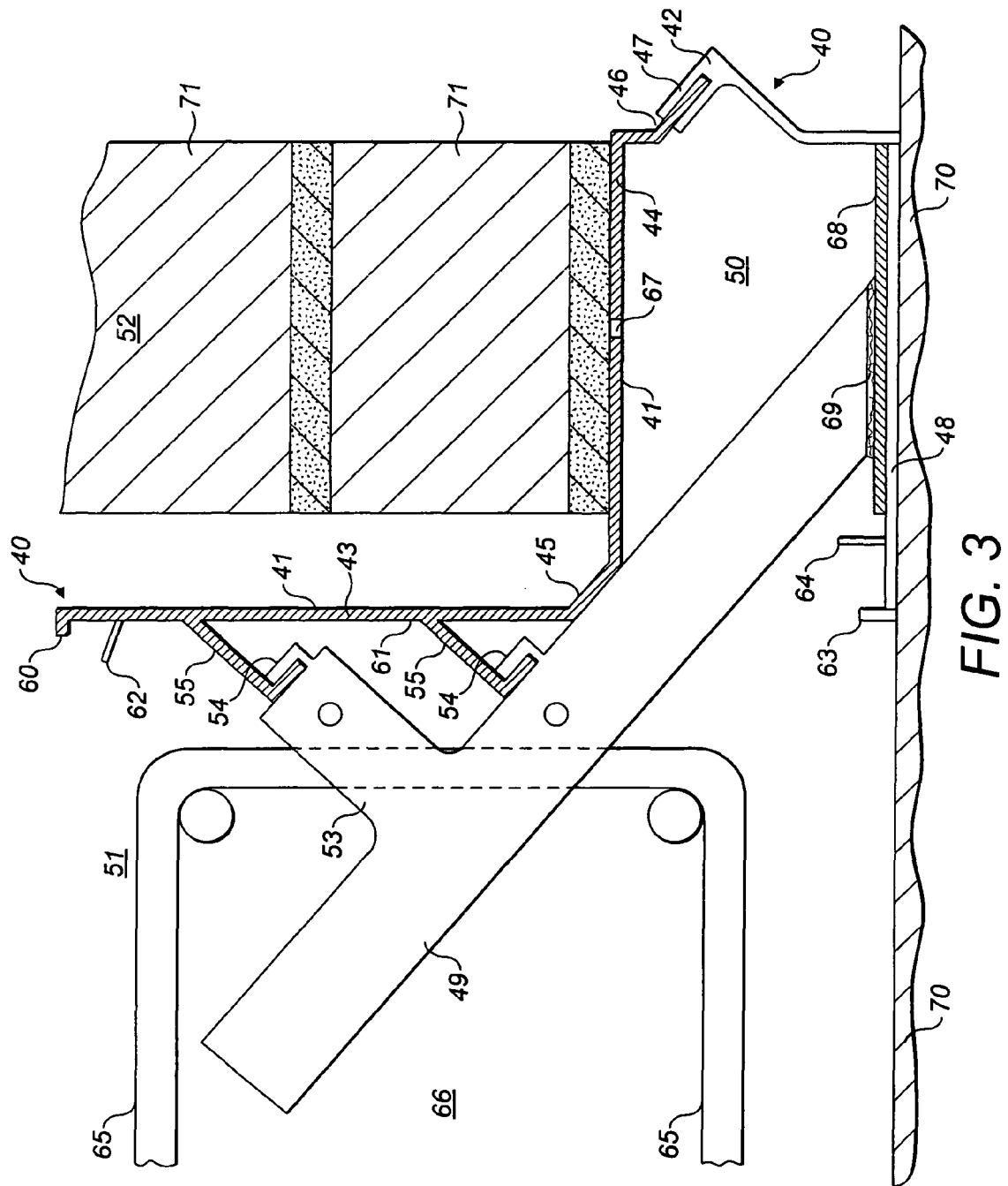
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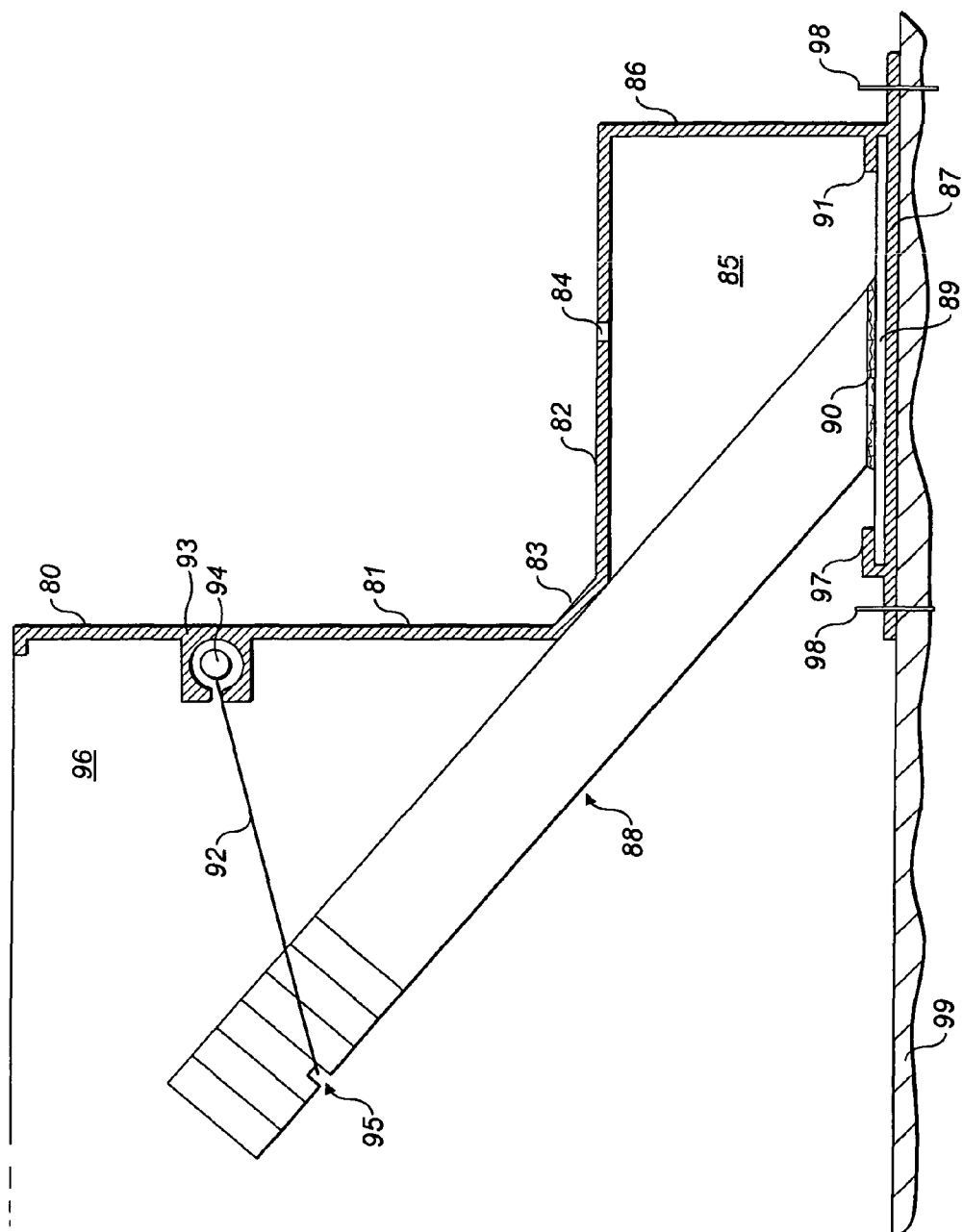


FIG. 4



EUROPEAN SEARCH REPORT

Application Number
EP 08 15 8068

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 609 915 A (KISS PAUL [GB]) 28 December 2005 (2005-12-28) * paragraph [0022] - paragraph [0035]; figures 2,3,5 *	1-9,11, 12	INV. E02D27/01
X	DE 102 22 907 A1 (DOMRES KAI [DE]) 13 March 2003 (2003-03-13) * paragraph [0007] - paragraph [0042]; figures 1a,1b *	1,2,4,7, 12	
X	US 3 819 143 A (BUTTS E ET AL) 25 June 1974 (1974-06-25) * column 4, line 52 - column 5, line 39; figure 15 *	1,2,7-9	
A	US 3 977 646 A (MOON JOHN C ET AL) 31 August 1976 (1976-08-31) * column 2, line 49 - column 4, line 20; figure 1 *	1-15	
A	US 4 151 694 A (BERG DAVID M [US] ET AL) 1 May 1979 (1979-05-01) * abstract; figure 1 *	1-15	TECHNICAL FIELDS SEARCHED (IPC) E02D E04G
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 1 October 2008	Examiner Geiger, Harald
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)



Application Number

EP 08 15 8068

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



**LACK OF UNITY OF INVENTION
SHEET B**

Application Number
EP 08 15 8068

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-5, 7-12

A system for supporting concrete with support section, cavity section and support ties which are connected to the support section by appropriate means

2. claim: 6+1

A system for supporting concrete wherein the shell rests upon the ties

3. claims: 13+1, 14+1, 15+2

A system for supporting concrete with means to prevent the entry of water

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 08 15 8068

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

01-10-2008

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1609915 A [0004] [0024]
- EP 1741840 A [0004]