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71 Applicant: Leonardis, Nicola
 23 Mayfred Avenue
 Hope Valley South Australia (AU)

72 Inventor: Leonardis, Nicola
 23 Mayfred Avenue
 Hope Valley South Australia (AU)

74 Representative: Jones, Colin et al
 W.P. THOMPSON & CO. Coopers Building Church Street
 Liverpool L1 3AB (GB)

54 Improvements relating to building foundation form work.

57 A building foundation form work arrangement in which a plurality of boxes (1) are located on a supporting level surface and are kept apart to leave channels (4) between the boxes (1), and spacers (22) engaging respective sides of each of the corners of the boxes (1) so as to hold these in position against substantial lateral dislodgement forces when concrete is poured into the channels (4).

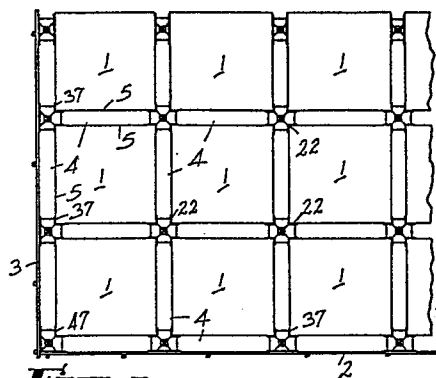


FIG 1

Description

IMPROVEMENTS RELATING TO BUILDING FOUNDATION FORM WORK.

The present invention relates to building foundation form work including a spacer useful in form work, and a method of constructing and using form work for building foundations.

Conventionally, for providing building foundations, trenches are cut into the ground and the concrete is poured into these trenches. The level of the concrete is sometimes above the level of the ground by constraining the flow of concrete above the level of the ground by employing ground form work.

The work involved in cutting the trenches and laying up the form work is extremely labour intensive and thus, expensive, but furthermore, it substantially constrains the style of foundation that is most appropriate for a particular application.

In other words, on many occasions, especially where soil is known to be soft or expansive over different seasons, it would be advantageous to employ an integral slab on which the building would sit, but hitherto the cost of this would be so high as to make it in many cases impractical.

The present invention seeks to reduce the cost of providing a foundation for a building, which foundation will be sufficiently strong to resist substantially expansive soils.

It has previously been known to propose lost form work and also to include rectilinear elements within a foundation form work so that concrete is then poured over these so that they are subsequently incorporated into the foundation. However, the problem has been the cost of providing such elements, which have been previously proposed as being constructed of polystyrene foam.

More recently a cardboard box has been proposed, which has considerably reduced the potential cost of this part of the foundation form work, but there has been a major problem in respect of holding such cardboard boxes in relation to one another, in such a way that the boxes will retain with sufficient integrity, their relative position especially during the pouring thereover of concrete, and secondly such that any means that might be used to hold the boxes in a relative position do not of themselves unreasonably reduce the integrity of any foundation that is subsequently formed. The problem particularly arises due to the inherent constructional characteristics of a cardboard box and the extremely high forces that result when concrete is being poured in a channel on one side of a box where there is no equivalent material on the opposite side of the box. Also, such side pressure will be aggravated by the vibration, conventionally used by concrete pourers, to ensure removal of voids within the foundation being poured.

The present invention resides in a building foundation form work arrangement in which a plurality of boxes are located on a supporting level surface, and are kept apart to leave channels between each side of each of the boxes by spacers within the channels between the boxes, at least one spacer engaging against both sides adjoining a

corner of a first box, and at the same time against both sides adjoining a corner of a second box adjacent the first box.

It has been found that cardboard boxes of the type being discussed can be sufficiently held against lateral pressures if there are means which engage against respective sides in the vicinity of the corner of the box. This is achieved by providing a spacer which engages against both sides of a corner of a first box, and at the same time against both sides of a corner of a second box, adjacent the first, wherein the two boxes defined therebetween a channel, and accordingly provide substantive resistance to such distortional pressures as previously discussed.

Preferably, the spacer engages against both sides adjoining a corner of each of four adjacent boxes with the corners at a common location.

According to another aspect of the present invention, a method of preparing a form work arrangement for the pouring of a foundation for a building comprises the steps of locating within a boxed area and over a substantially level area of supporting surface, a plurality of boxes each of which are kept apart from one another, to leave channels between the respective sides of the boxes, locating within the respective channel shapes a spacer such that the spacer engages against both sides adjoining a corner of a first box, and at the same time against both sides adjoining a corner of a second box adjacent the first box, effecting support within the channels, on the spacer, of a reinforcement rod, and then pouring concrete into the channels and over the boxes to form a building foundation.

One particular problem that may be associated with locating spacers in the manner described in accordance with the present invention, is that these spacers, in some cases, may aggravate a weakness in the structural strength of the foundation thus poured.

If, for instance, a concrete block is located midway between respective corners of the same box and this is supported on the ground within the channel, and furthermore this block has a width which defines the channel width and is used then as a block to support reinforcing rods, then it is found that this may result in a localised weakening of the concrete where the foundation concrete meets the concrete block material. If this does fracture, while not structurally necessarily dangerous, there may result an access of water which, through capillary action, can reach the steel reinforcing rod or rods.

This can be avoided by ensuring that concrete for the foundation extends to form an integral portion of concrete below the main body of any spacer. This is achieved by providing that each spacer, while having a substantially large outermost engaging surface to bear against the side of a box, nonetheless has frame members which have a lowermost edge which is substantially above the lowermost edge of such outermost engaging surface and, as such, is above

any supporting ground level surface.

In this way, a relatively large volume of concrete is allowed to flow and set below such frame members thereby maintaining as much as possible the structural integrity of the concrete.

One further problem that may be experienced, is the fact that in some cases the foundation will be required to be somewhat deeper than might be considered standard, and it has been found uneconomical to provide boxes which has substantially different heights as a range.

It has been proposed that conventional shaped boxes be located one upon the other to provide thereby a double thickness, but the problem has been the same as hitherto experienced, that is, how is the sideways pressure resisted when the foundation is being poured.

In respect of the present invention, it is proposed that there be securing means provided for locating respective corners of the boxes for the box location purposes previously described, wherein one of the boxes is located above the second box, and so defining together, coplanar sides effecting a channel between such sides and other such boxes. Such securing means preferably engage against both sides adjoining a corner of a first box and at the same time against both sides adjoining a corner of a second box where the first box is located above but resting on the second box.

The invention is described further hereinafter, by way of example only, with reference to accompanying drawings, in which:-

Fig.1 is a plan view of one embodiment of a typical building foundation form work arrangement in accordance with the present invention;

Fig.2 illustrates a partly cut-away and partially opened cardboard box in accordance with the embodiments of the present invention;

Fig. 3 illustrates one embodiment of a spacer as incorporated within channels at a crossing over location and where four corners of respective adjacent boxes meet at a common location, in accordance with the present invention;

Fig.4 illustrates another embodiment of a spacer adapted to be used where two corners meet and there is a T-junction of the channels as shown in Fig.1, in accordance with the present invention;

Fig.5 illustrates one embodiment of a spacer, used with one corner of a box, in accordance with the present invention;

Fig.6 illustrates one embodiment of an arrangement for spacing the box elements apart from corner locations;

Fig.7 is a perspective view showing the application of spacers as illustrated in Figs. 4, 5 and 6;

Fig.8 is a plan view in some greater detail of a spacer as in Fig.3 being used in conjunction with reinforcing rods and engaging against the adjacent sides of the corners of four boxes;

Fig.9 is a perspective drawing illustrating the manner in which the form work is used and illustrating the technique for pouring concrete in channels formed between the respective

boxes and over the top of these;

Fig.10 illustrates in perspective detail one embodiment of spacers for holding two boxes in adjoining relationship one above the other in combination with a general spacer as in Fig.3;

Fig.11 is a more general view of the apparatus of Fig.10; and

Fig.12 is a perspective view of a spacer used when the boxes are located one above the other as illustrated in Figs.10 and 11.

Referring to the drawings, and in particular to Fig.1, there is shown a plurality of boxes which are supported on level ground and which are surrounded by perimeter form work 2, 3, the boxes 1 and the perimeter form work 2 all being held in spaced apart relationship so as to leave a plurality of channels 4 between the respective sides 5 of the boxes 1 and the perimeter form work 2 and 3.

Each of the boxes 1 in particular as shown in Fig.2 are comprised of cardboard having an external surface coated with an appropriate water repellant material such as a wax, but which otherwise comprise cardboard conventionally reinforced with a corrugated layer within each planar surface, the box 1 including a top 6, a bottom 7 and sides 8, 9, 10 and 11, the sides each defining a flat side and each being arranged to provide in plan, a square shape together with the flat top 6 and the flat bottom 7. Side 10 has been opened out to show a top flap 12, a bottom flap 13 and side flaps 14 and 15. These are folded over so as to lie one against the other and to provide mutual reinforcing therefor for the side of the box thus formed.

In a similar manner, side 11 comprises two flaps one folded over the other, shown particularly at 16 and 17, and likewise side 8 has two flaps 18 and 19.

Internally, the box 1 is reinforced by typical egg-crate type reinforcement which comprises a plurality of transverse members 20 which interlock with crossing members 21 each of the members 20 and 21 being comprised of corrugated strengthened cardboard and each defining a vertical plane extending to immediately below the top 6 and above the bottom 7 so as to provide vertical support for the top 6. In a similar manner, the ends butt against the respective sides and also provide at least some reinforcing strengthening of these sides.

Such reinforcement and strengthening is provided to such an extent that a foundation laying worker can walk on top of the box, and also it is such that the boxes can resist lateral deformation under the relevant stresses involved.

Each of the boxes 1 are located so as to leave channels 4 between the respective sides, and in accordance with this embodiment there is provided a spacer 22 which in plan view is of cruciform shape but which provides at four symmetrically located positions a concave shape shown typically at 23 which has outermost engaging faces 24 and 25 which will engage against both sides adjoining a corner of a box 1. It is requisite that there be a relatively significant bearing surface which can engage against an effective area of the side of a cardboard box, and furthermore that this will engage both against an edge at the corner of a box and

across the bottom of the box where there is also the bottom 7 which also provides additional reinforcement for the box.

Accordingly, engaging surfaces 24 and 25 are of substantial cross-sectional area (each being preferably 55 mms wide and 55 mms high) and are adapted with respect to the remaining parts of the spacer 22 to sit with lowermost edges 26 on the same level surface that is supporting the box 1. There are, in respect of the spacer 22, four such arrangements as shown further at 27, 28 and 29, each of these being supported in the relative position which provides a concave shape defining the position of four corners of respective adjacent boxes by frame elements 30 and 31. The respective frame elements 30 are each raised significantly above the ground level and indeed have an upper surface which lies flush with the upper surface 32 or the engaging surface typically at 24.

Midway and extending above such surface level at 32 is an open U-shape 33 which is adapted to receive and support reinforcing rods.

These may be crossing rods and the height of the upwardly open U-shape slots both at 33 and in a centre raised portion at 34, are of sufficient height so as to support first rods in one direction, and then second rods in a crossing direction lying above the first rod.

Such an arrangement is best illustrated in Fig.10, in which the rods are shown at 35 and 36, although the spacer in this case does not have such high sides for its open U-shape slot. The rods fit closely in the width of the slot and therefore secure the spacers collectively tightly together. This securing effect is assisted where the rods cross over and the spacers then become tightly locked together. The diagonal frame members 31 provide for cross bracing, and also because of their general thickness, provide substantial support for such reinforcing rods. The members 31 are raised so as to be significantly above any ground supporting level so as to allow firstly for concrete to pass fully beneath such frame members, and also to ensure an effectively continuous thickness which will effectively resist localised fracturing under stress conditions and therefore resist capillary water egress to the metallic reinforcing rods.

The spacer 37 as illustrated in Fig.4, and also illustrated in Fig.1, is similar to the spacer 22 except that it has one side at 38 adapted to engage against perimeter form work only, thereby leaving only two right-angulantly concave portions at 39 and 40, to engage against both sides adjoining a corner of the respective boxes 1. In the same manner, the bottommost edges, typically at 41 and 42, are adapted to sit on the same level surface that the boxes 1 are adapted to sit on, and the frame elements 43 and 44 are all located well above such ground support to allow for concrete to flow fully beneath these and of such thickness to provide adequate support for openly upward U-shape slots 45 to the side and 46 at the centre.

Fig.5 illustrates a spacer 47 which has the same fundamental elements of the previous spacer, but in this case has only one right-angulantly concave part

48, the remaining outer engaging surfaces at 49 and 50 are adapted to engage against the inner sides of form work such as at 2 and 3 in Fig.1, and to also rest on the lowermost ground level surface so that frame members 50 and 51 are supported well above the ground surface.

In Fig.6 there is illustrated a spacer 52 which does not engage any corners of the boxes but includes two sides 53 and 54 each of the sides being of substantial area so as to provide substantial bearing surface against the sides of a respective box 1 but in each case, frame members 55, 56 and 57 are all located so as to be well above lowermost support level 58 and 59 so that concrete can pass fully, and be continuous below the respective frame members 55, 56 and 57 which in turn provides for reinforcing at such positions at 60, 61 and 62.

The slots 63 and 64 are generally superfluous except for reducing the total quantity of plastic necessary in respect of each of these spacers which are in each case manufactured by injection moulding from an appropriate plastics material such as polypropylene.

In the application of the invention to a foundation, it is conventional to further provide steel fabric 65 which is supported by supports 66 resting on the top 6 of a box 1. As shown in Fig.9, a worker 67 may then safely step on the fabric 65 and support concrete outlet 68 whereby concrete 69 is effectively poured into the various channel shapes 4 and across the upper most surface over the top 6 of the various box elements 1.

In Figs.11 and 12 there is a spacer 70 which acts to maintain the relative spaced relationship of boxes 1 when located one above the other. This is achieved by having engaging faces 71 and 72 engaging against both sides typically at 73 and 74 of a box 1, and there being a spike 75 and a spike 76 located so as to pierce through the respective top and bottoms at the corner position of the respective boxes 1. These, thereby, positively locate and capture the respective boxes and hold them in a relative position one with respect to the other.

The method of using the elements described is to prepare ground as level, surround this with perimeter form work 2, 3 and then locate sequentially, a variety of spacers as appropriate and then boxes 1 so that these extend fully across the defined area. Boxes of different overall shape and area may be used if the defined area is not appropriately covered by the shapes described.

For parts of a building which are to be higher than others, these can then be provided with a higher foundation part by supporting one box upon the other and joining these in the manner described.

While the spacers have been described as being formed of plastic, these may be made from other compatible materials, such as steel sheet, which may be cut and folded into an appropriate shape.

Claims

1. A building foundation form work arrangement characterized by a plurality of boxes (1)

located on a supporting level surface and kept apart to leave channels (4) between each side of each of the boxes (1) by spacers (22) within the channels (4) between the boxes (1), at least one spacer (22) engaging against both sides adjoining a corner of a first box, and at the same time against both sides adjoining a corner of a second box adjacent the first box.

2. A building foundation form work arrangement according to claim 1, wherein the spacer (22) engages against each of two sides adjoining each of the corners of four adjacent boxes (1) with corners at a common locations.

3. A building foundation form work arrangement according to claim 1 or 2, wherein each of the boxes (1) has vertical reinforcing partitions (20) within each of the boxes.

4. A building foundation form work arrangement according to any preceding claim, in which the boxes are each formed of cardboard.

5. A building foundation form work arrangement according to claim 1 or 2, in which each of the boxes (1) has four sides, a top and a bottom, is comprised of cardboard and has extending in crossing interlocking relationship cardboard planar strips (20) acting as vertical reinforcing partitions extending from a bottom of a respective box to a top of a respective box (1), and each from a first side to an opposite side of the box (1).

6. A building foundation form work arrangement according to claim 2, wherein the spacer (22) is of a cruciform shape in plan and includes for each of eight sides of the respective boxes, an outermost engaging surface that is planar.

7. A building foundation form work arrangement according to any of the preceding claims, wherein the spacer (22) includes outermost planar surfaces engaging against the sides of respective adjacent boxes (1), and frame members (30) holding such outermost engaging surfaces which frame members (30) have a lowermost edge which is substantially above the supporting level surface.

8. A building foundation form work arrangement according to any of the preceding claims, in which the spacer (22) includes means to support and locate a reinforcement rod (35,36) within a channel (4).

9. A building foundation form work arrangement according to claim 8, wherein the means for providing support for a reinforcement rod include a portion of the spacer that has an upwardly open slot (33,34).

10. A building foundation form work arrangement according to any of the preceding claims, wherein at least one box is located above another box and there is a joining spacer (71) engaging against adjacent sides or a corner of a first of the boxes where this is a lowermost box, and against adjacent sides of the corner of a second of the boxes which is above the first of the boxes and wherein the said corner is above the corner of the first said box.

11. A building foundation form work arrange-

ment according to claim 10, wherein the joining spacer (71) includes two spikes (75,76) a first engaging within a first of the boxes (1) and a second within a second of the boxes (1) so as to hold thereby, the engaging surfaces of the spacers against the respective sides of the respective boxes.

12. A spacer (22) for a building foundation form work arrangement wherein a plurality of boxes are located in spaced apart relationship to define therebetween channels, the spacer (22) being characterized in that it includes outermost engaging surfaces adapted to engage against both sides adjoining a corner of a first box, and at the same time against both corners adjoining a corner of a second box adjacent the first box.

13. A spacer according to claim 12, wherein the spacer (22) is of cruciform shape in plan having thereby eight engaging outermost surfaces adapted to engage respectively against both sides adjoining a corner of each of four adjacent boxes with the corners at a common location.

14. A spacer according to claim 13, wherein there is included an upwardly extending medially positioned part having an upwardly open U-shape slot (34) therein adapted to support and hold a reinforcing rod (35,36) thereby.

15. A spacer according to claim 12,13 or 14, wherein each of the outermost engaging surfaces is held by a frame member (3) extending between at least one other of the outermost engaging surfaces, each of the frame members having a lowermost surface which is substantially above a lowermost edge of each of the engaging surfaces such that concrete can extend contiguously beneath each of the said frame members.

16. A spacer according to claim 12,13,14 or 15, wherein the spacer (22) is moulded from plastics material.

17. A method of preparing a form work arrangement for the pouring of a foundation for a building which comprises the steps of locating within a boxed area and over a substantially level area of supporting surface, a plurality of boxes (1) each of which are kept apart one from the other to leave channels (4) between the respective sides of the boxes (1), locating within the respective channel shapes (4) a spacer (22) such that the spacer engages against both sides adjoining a corner of a first box, and at the same time against both sides adjoining a corner of a second box adjacent the first box, and effecting support within the channels (4), on the spacer (22), of a reinforcement rod (35,36).

18. A method of preparing a form work arrangement according to claim 17, wherein each of the boxes are comprised of cardboard, and the spacer (22) is such that it engages against both sides adjoining a corner of each of four boxes with the corners at a common location.

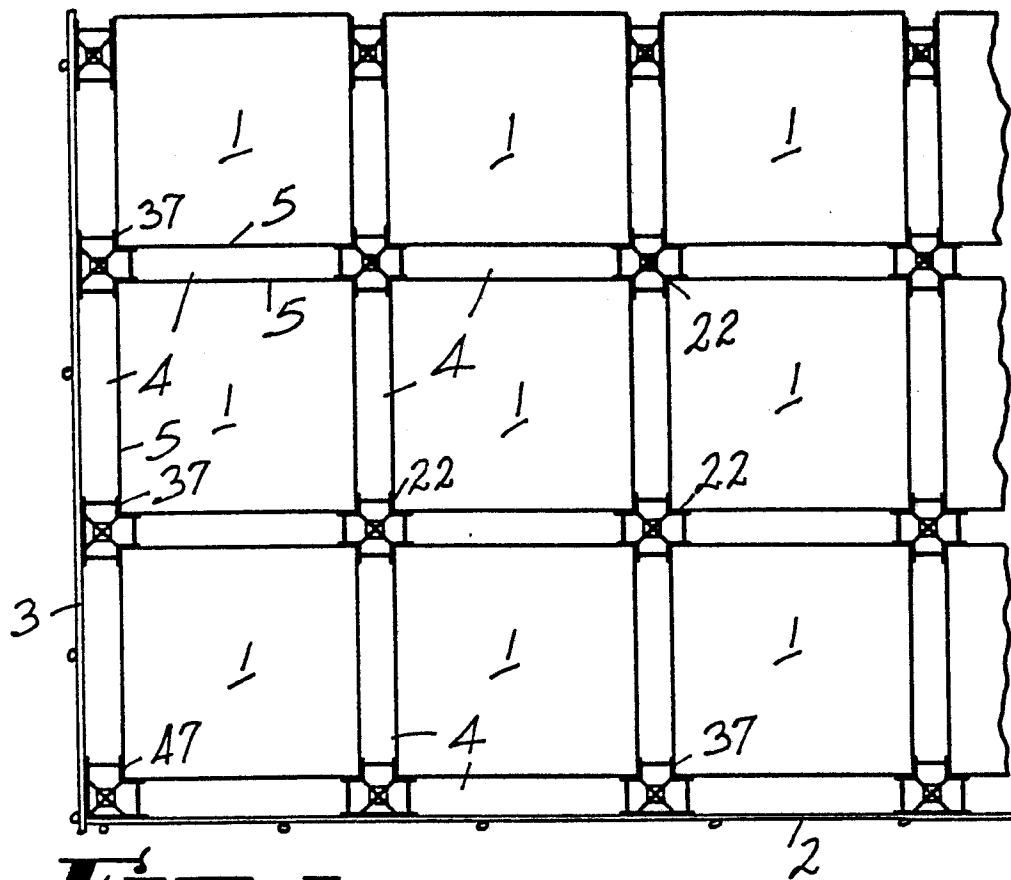


FIG 1

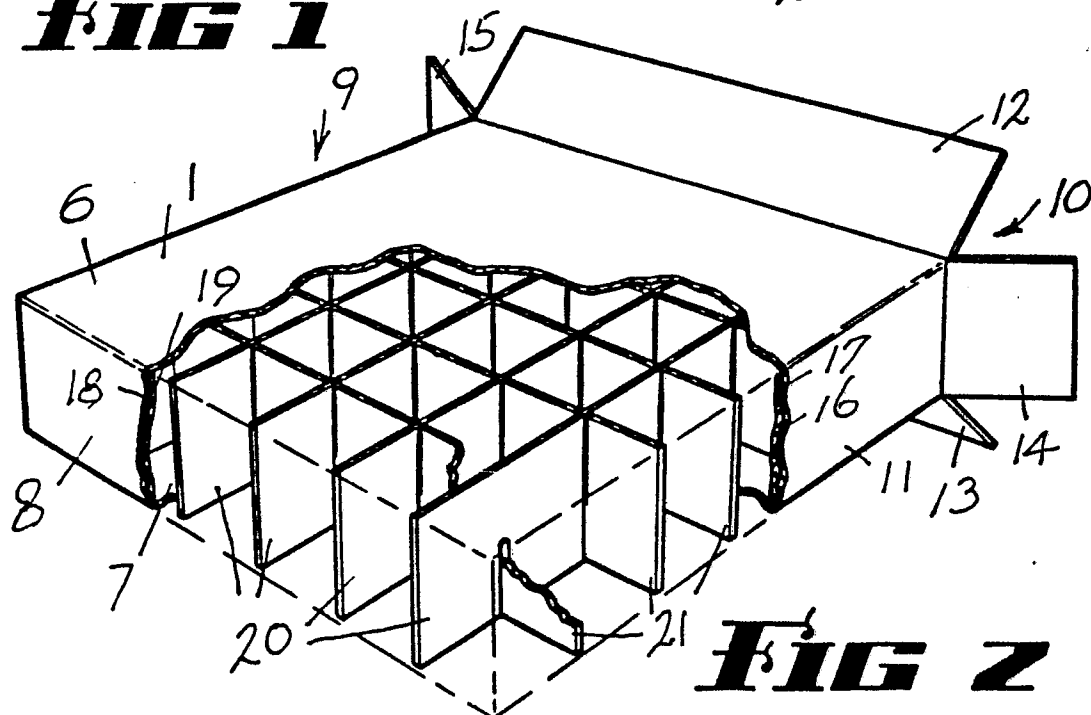


FIG 2

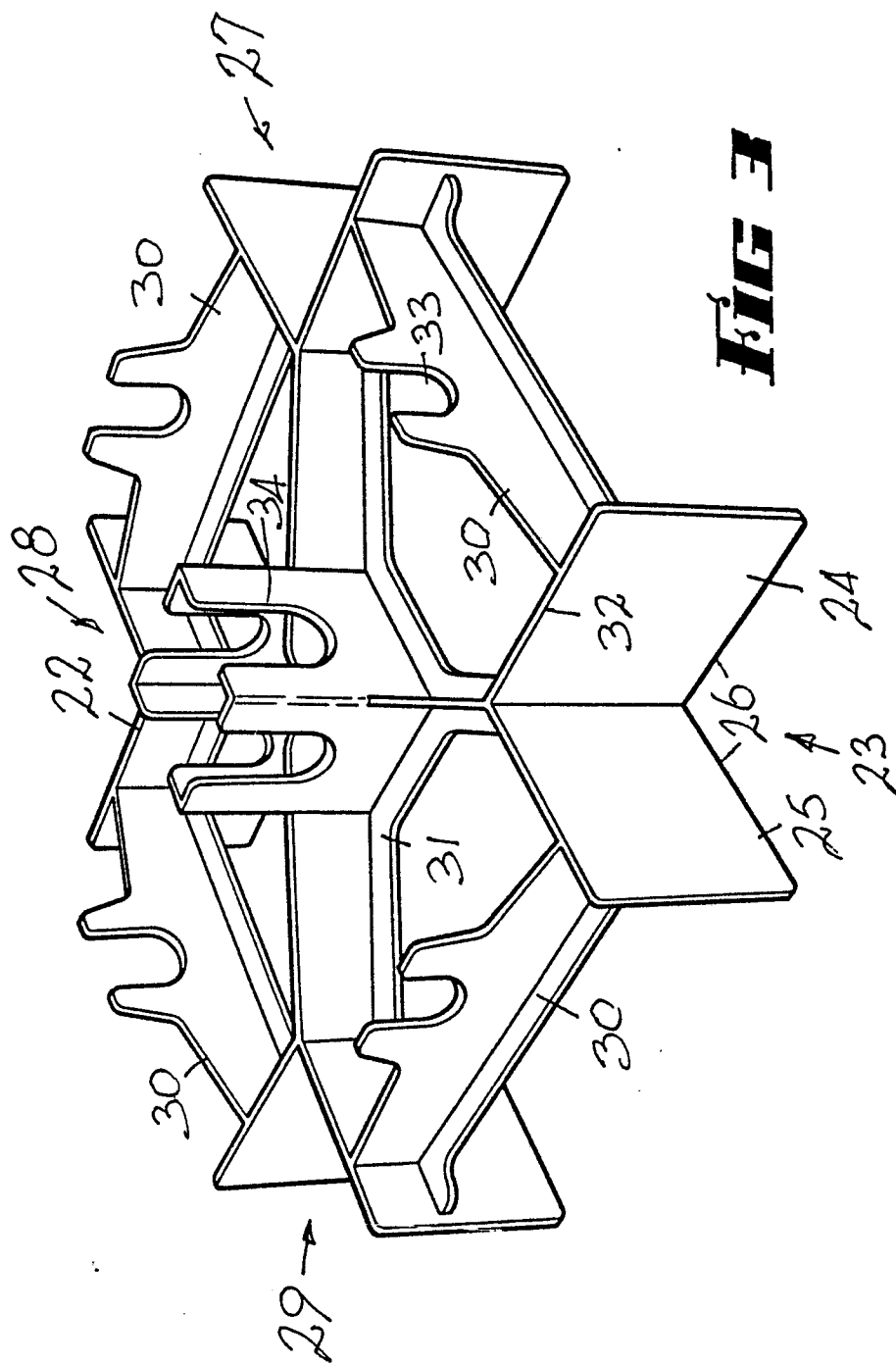
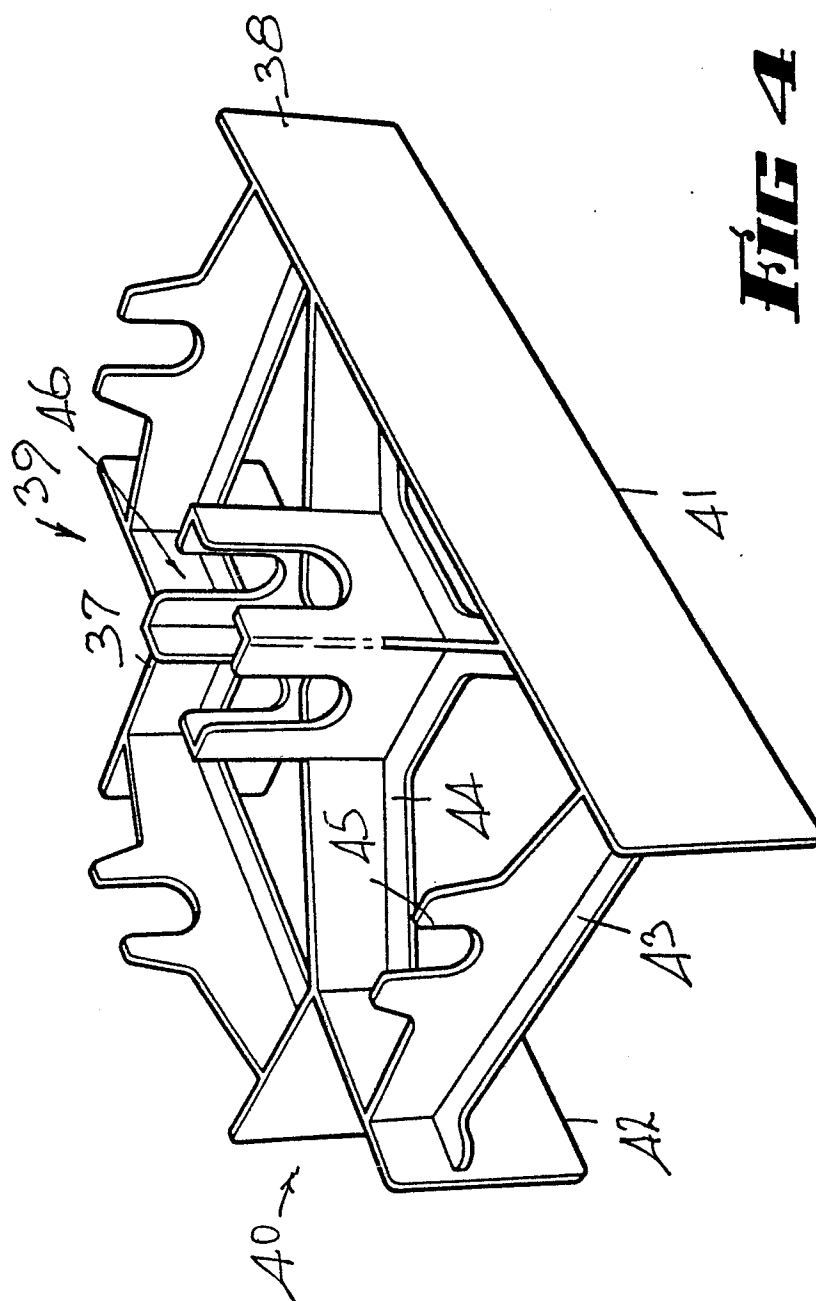


FIG 3

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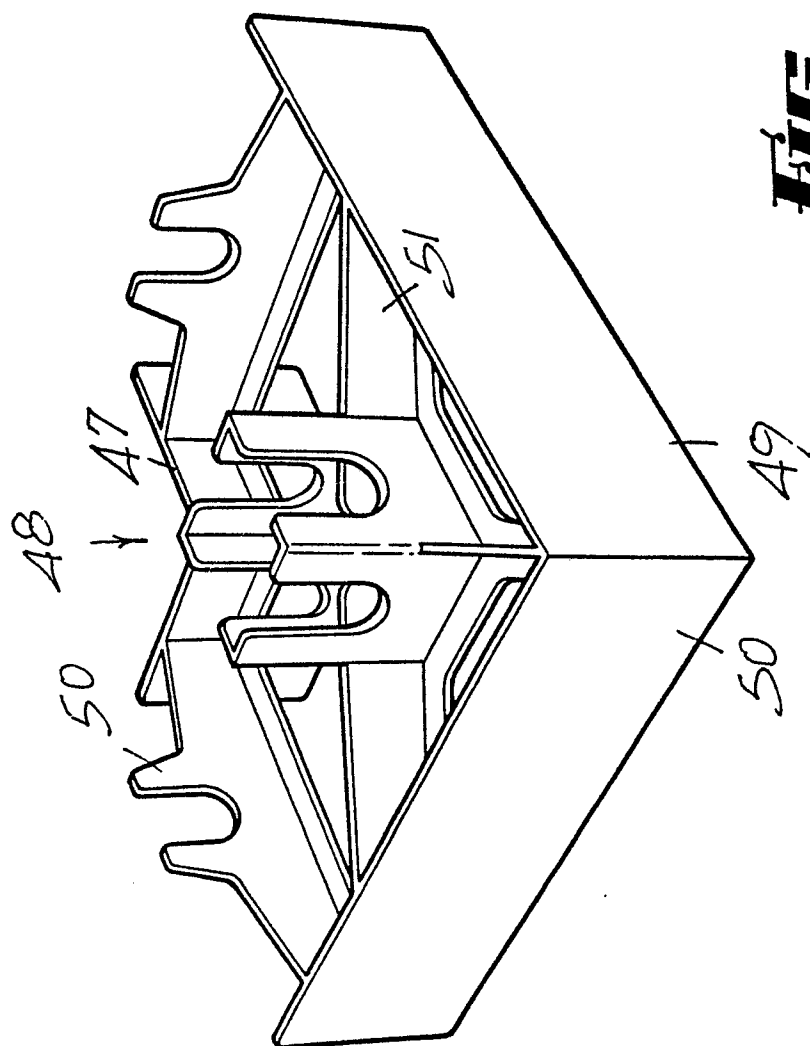


FIG 5

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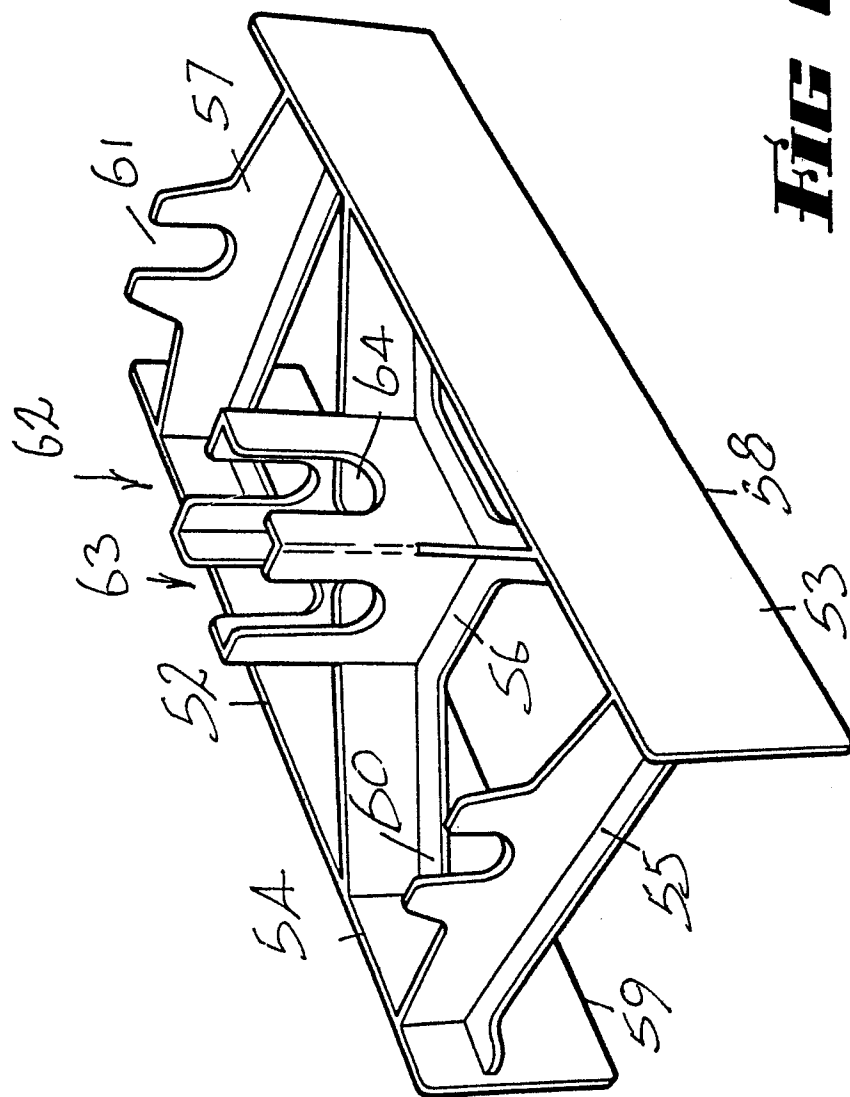


FIG 5

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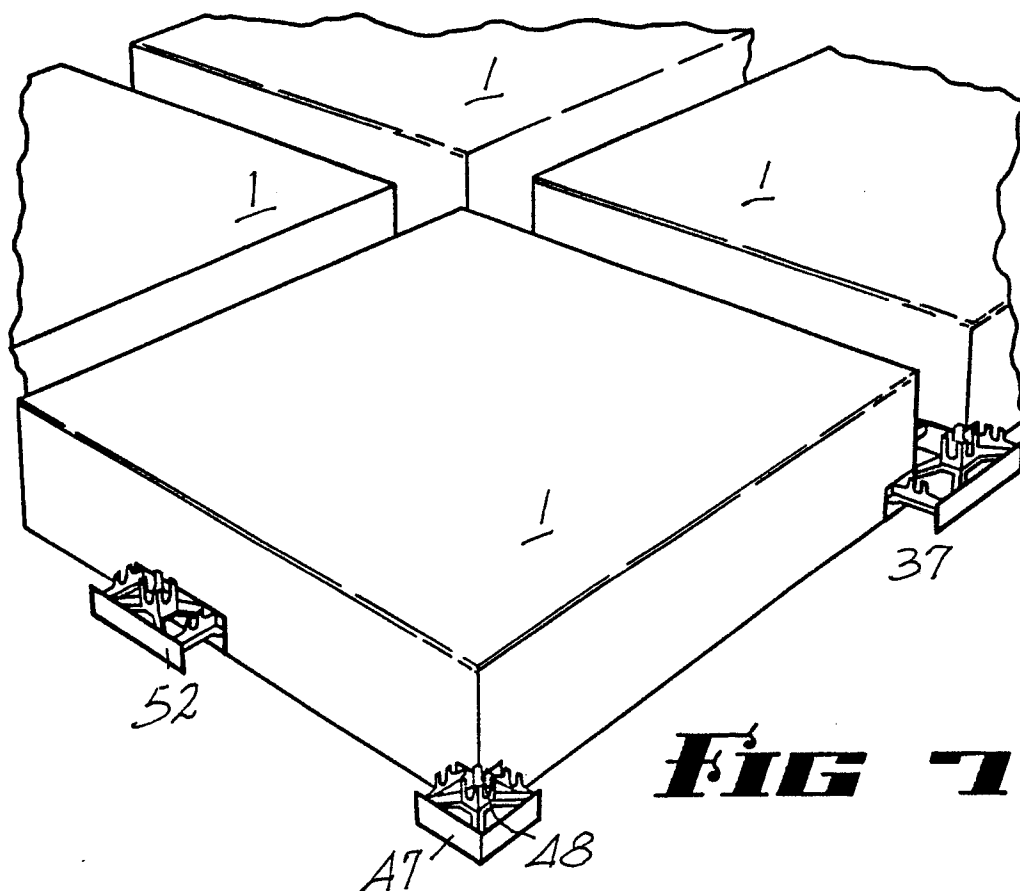


FIG 7

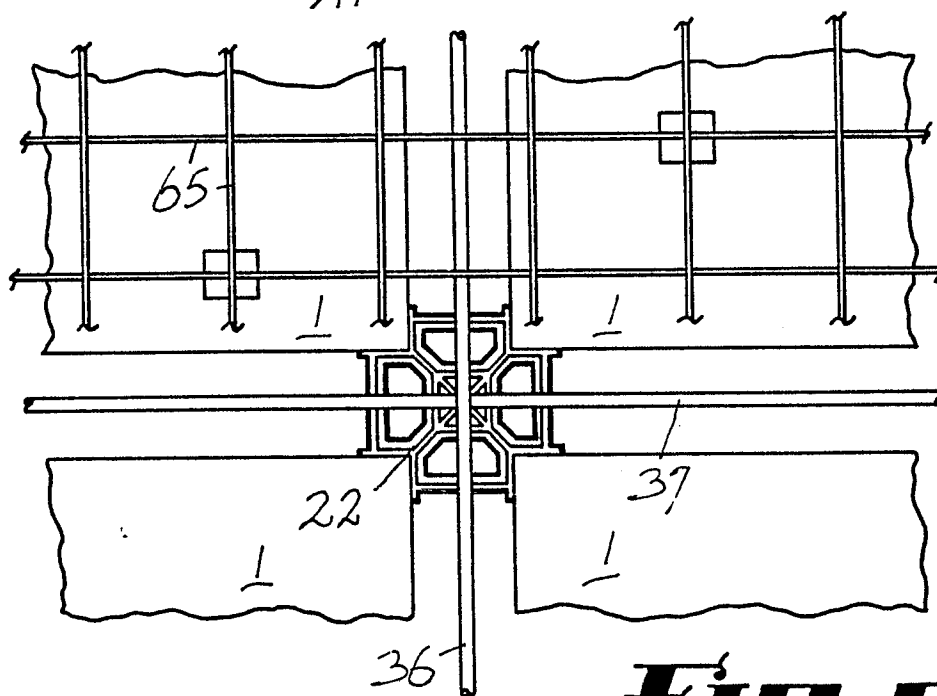
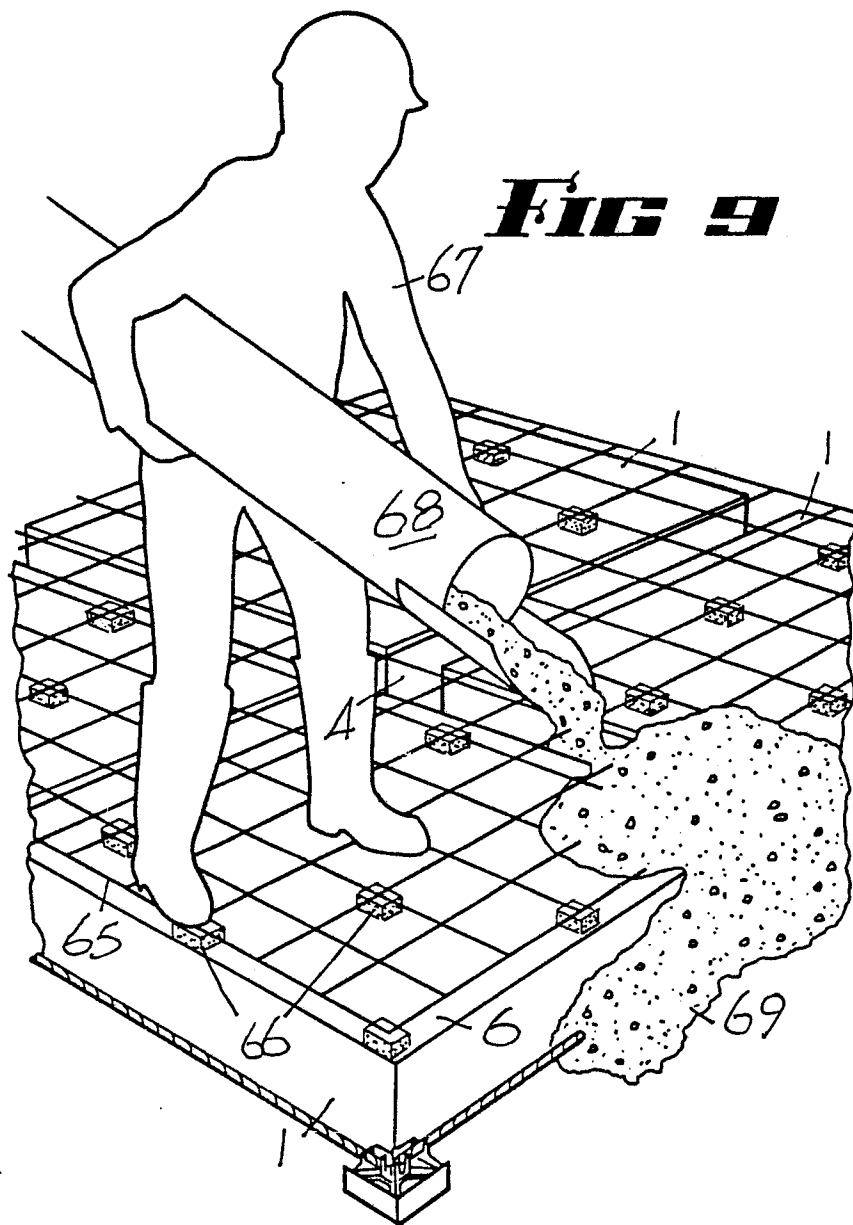
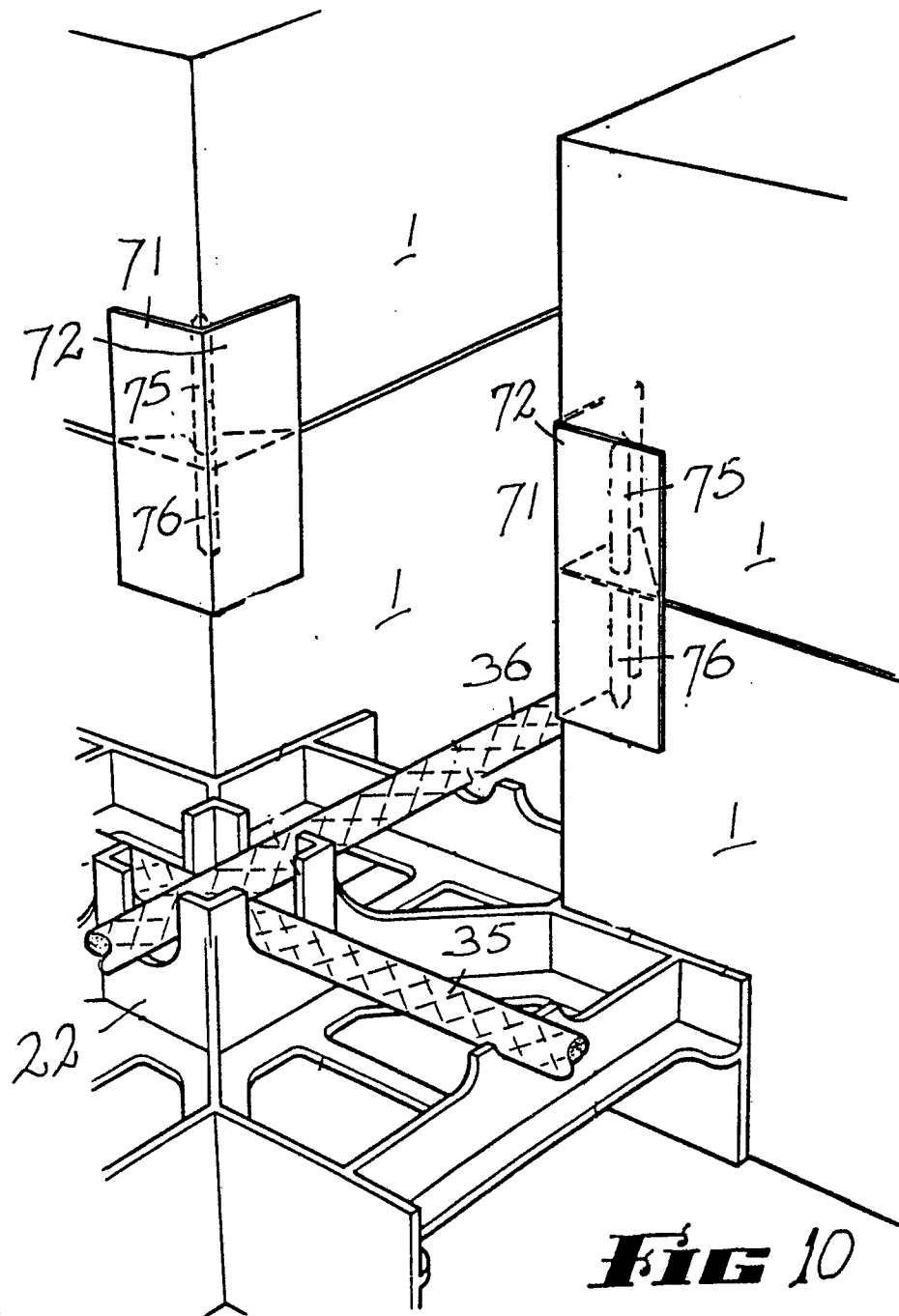


FIG 8

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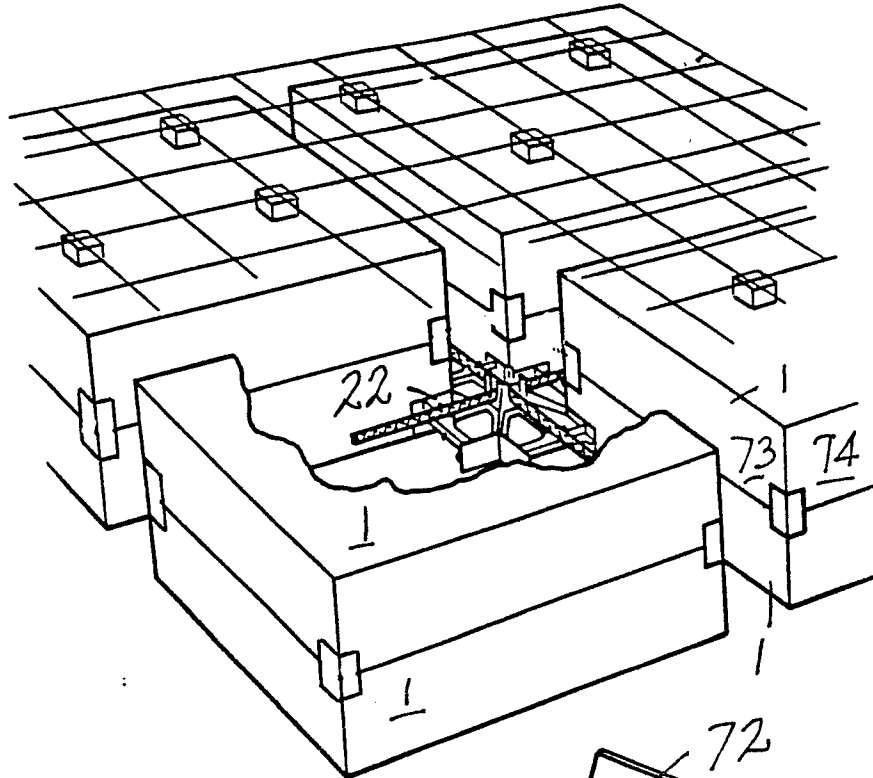


FIG 11

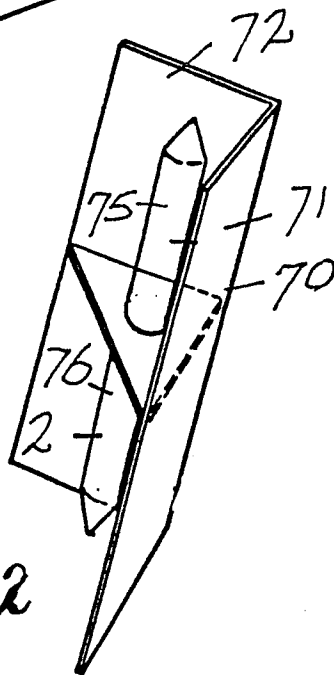


FIG 12



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 87 30 9345

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	FR-A- 371 049 (A. BÜLLA) * Whole document *	1,2,12, 13,17	E 02 D 27/02
Y		3,4,5, 18	E 04 B 5/32
A	----	8	
X	GB-A-1 407 699 (P.E. PRODUCTS LTD) * Page 2, lines 46-49,67-80; figure 1 *	1,2,6, 12,13, 17	
Y		18	
Y	---- US-A-3 238 278 (C.H. STARK) * Column 2, lines 17-38; figures 5,6 *	3,4,5, 18	
A	---- US-A-3 624 978 (J.P. SKINNER) * Column 1, lines 34-49; column 2, lines 35-53; figure 3 *	1,17	
A	---- GB-A-2 012 242 (L. LEONARD) * Claim 3; figure 2 *	10,11	
A	---- FR-A-2 153 288 (CO/DATA CORP.) -----		TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			E 02 D E 04 B B 65 D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 18-01-1988	Examiner BIRD,C.J.
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	