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(54) **BUILDING METHOD.**

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Description

The invention relates to a building method comprising placing columns in a rectangular grid arrangement, fixing horizontal supporting elements to said columns and supporting concrete floors by said supporting elements, said supporting elements forming a system of girders, each provided with a number of adjacent, spaced feed-through conduits.

Such a method is disclosed in DE-A-2324224.

According to this known method the floors consist of U- or L-shaped elements which also function as installation ducts. In view of the considerable number of elements necessary for making a floor this method is complicated and expensive.

Further the Swiss Firm Geilinger A.G. described in leaflets and in their European patent No. 0044271 a building system comprising placing columns in a rectangular grid arrangement, fixing to said columns horizontal supporting elements, and placing concrete floors which are supported by said supporting elements; the concrete floors are poured on the spot and supported on crowns fixed to the columns. The setting and supporting of the concrete floors take so much time that building speed is lower than the speed corresponding to erecting the steel structures. Further facilities such as ventilation ducts, electricity cables and computer cables have to be accomodated in separate spaces under the concrete floor, so that the total thickness of floor and facility space is great. Finally pouring concrete floors on the spot is unpopular, dirty work. In case of heavy rain and/or frost no concrete can be poured.

The object of the invention is to avoid the above mentioned disadvantages of the known methods and to this end the building method mentioned in the preamble is characterised in that the above mentioned supporting elements provide floor elements made of prefabricated hollow elements, each element having a bottom sheet, a top sheet and spacers arranged in a grid between said sheets, the bottom sheet of each floor element having laterally projecting parts at two opposite sides;
raising said floor elements until said projecting parts lie against said supporting elements;
and connecting said projecting parts to the underside of said supporting elements.

It is noted that FR-A-2142887 discloses a floor made of prefabricated hollow elements, each having a bottom sheet, a top sheet and spacers arranged in a grid shape placed between them. From this specification it is not known to connect a floor element to a supporting element by raising the floor element untill a projecting part thereof lie against a supporting element and to connect said projecting part to the underside of the supporting element.

The feed-through conduits are used for feeding through lines and cables.

The floor elements are rectangular and are fixed solely by their short sides to the girders.

If the girders are steel section beams, they will have to (and/or can) be protected against fire. In a preferred building method the rows of spacers adjacent to the projecting parts project between the feed-through conduits of the girders, while concrete is poured in the spaces bounded by the external surface of the feed-through conduits and the end faces of the spacers projecting between the feed-through conduits.

An excellent connection between the floor elements and the girders is obtained through the end faces of the spacers projecting between the feed-through conduits being made step-shaped in such a way that the space between two opposite spacers widens out step-shaped from top to bottom.

The girders are preferably steel I beams.

The steel beams can also be channel beams, in which case a reinforced concrete is placed in the channel beam.

In the case of relatively high floors, the beams can comprise two tilted channel beams held apart by transverse conduits, and the space between said beams is filled with concrete.

It is important that the reinforcement of the concrete floor elements should not be prestressed. This avoids concave or convex surfaces of the floors.

In order to ensure that the hollow between the top and bottom sheet of the floor elements can be reached easily, the top sheet is provided with apertures which are placed in a grid arrangement and can be covered with tile-type sheets abutting each other.

The invention will now be explained in greater detail with reference to the figures, in which three examples of embodiments are shown.

Figure 1 shows a perspective view of a part of a structure built according to the invention, for the sake of clarity parts of some floor elements being shown partially cut away.

Figure 2 is a section along the line II-II in Figure 1.

Figure 3 is a section along the line III-III in Fig. 1.

Figure 4 is a section along the line IV-IV in Figure 1.

Figure 5 shows a section comparable to that of Figure 4 of an alternative girder design.

Figure 6 shows a perspective view of a structure in which the preferred method according to the invention is used.

Figure 7 shows a section along the line VII-VII in Figure 6.

The structure shown comprises a number of columns 1, preferably of steel, placed in a rectangular grid arrangement. At each column a number of crowns 2 are placed above one another. The vertical distance between the crowns corresponds to the height of storey. Since such a system is known per se,

only one column with one crown is shown in Figure 1.

The invention is concerned with the way in which prefabricated floor elements are supported relative to the columns 1. The prefabricated floor elements are of dimensions of, for example, 720 x 240 cm.

In the invention according to Figures 1 - 4, girders in the form of steel channel beams 3 are fixed between the crowns 2 situated at the same level. These beams run parallel to each other, and their lengthwise direction coincides with the direction of the transverse edges of the prefabricated concrete floor elements which are fixed to the channel beams and will be described in greater detail below.

Each floor element comprises a bottom sheet 4, a top sheet 5, and fitted between said sheets spacers 6 in the form of lobes which are moulded onto the bottom face of the-top sheet and are in a grid arrangement.

The bottom sheet 4 is anchored to the lobes 6 through reinforcement ties 7 being concreted into the lobes and projecting at the bottom side, and being forced into the concrete of the bottom sheet before this concrete is set.

Figure 1 shows the bottom sheet 4 of a first floor element without top sheet and the bottom sheet 4 with top sheet 5 of the second floor element. The top sheet is provided with apertures 8 placed in a grid arrangement and covered with tile-shaped sheets 9.

It can be seen from Figure 4 that the top sheets 5 at the transverse edges of the floor elements abut one leg of a channel beam 3, while the bottom sheets 4 at their transverse edges project under the body of a channel beam 4 at 4a up to the transverse edge of the bottom sheet 4 of another floor element.

When being fitted, the floor elements are raised until the projecting parts 4a rest against the underside of the beams 3.

These parts 4a of the bottom sheet lying under the body of a channel beam are fixed to the body by means of bolts. The bolts are shown schematically in Figure 4 by dotted and dashed lines 10.

At the position of each crown 2, a recess is provided in the corners of a floor element, into which recess a part of the crown fits.

The channel beams 3 are provided with transverse feed-through conduits 11 which open out into apertures 12 in the legs of the beams 3, and which serve to carry lines or cables from a hollow space of one floor element through the channel beams 3 to the hollow space of another floor element.

Reinforced concrete is poured into the channel beams, so that the channel beams serve as permanent falsework. If the channel beams are destroyed by fire, the concrete remains in place.

The embodiment shown in Figure 5 is intended for higher floors. Instead of a channel beam 3, use is made of two channel beams 13 which are tilted through 90°, and between which transverse conduits 11 are welded, which conduits open out into openings in the body of the channel beams 13. Lock-woven mesh is placed in the space between the channel beams 13 and concrete is poured. The top sheets 5 are provided at their transverse edges with projecting reinforcement irons 14, the projecting part of which is embedded in the concrete between the channel beams 13.

In the case of the building method illustrated in Figures 6 and 7, the girders are in the form of I beams 20 which are fixed to the columns 1 without crowns between them. The hollow floor elements, comprising a bottom sheet 4, a top sheet 5, and spacers 6 placed in a grid arrangement between said sheets are fixed at their transverse end edges to the I beams 20 through the projecting parts 4a of the bottom sheet 4 being engaged with the bottom flange of the I beams and fixed by bolts 10 when the floor elements are raised.

The rows of spacers 6a adjacent to the projecting bottom sheet parts 4a are made elongated and project between the feed-through conduits 11. Concrete is poured into the spaces 21 bounded by the outer surface of the feed-through conduits and the end faces 6b of the spacers 6, so that the I beams 20 and the conduits 11 are completely embedded in concrete. This greatly improves fire safety.

Because the end faces 6b of the spacers 6a are made step-shaped in such a way that the space between two opposite spacers 6a widens out downwards in a step shape, an excellent connection is also produced between the spacers 6a and the girders 20.

The seams between the bottom sheets 4 of the floor elements are sealed with a sealer or shaped metal strip.

All kinds of facilities, including those in the field of heating, ventilation, electricity, telephone, computers, can be accommodated in the hollow floor elements, so that a separate space for these underneath the floor is not necessary. The storey height of a building can be limited as a result of this. After the fitting of a floor, it is possible to start immediately on the fitting of the next floor, which means that building can be speeded up considerably compared with a building system in which the floors are poured on the spot. It is possible to work immediately on each fitted floor, since there is no need to wait for setting and there are no supports on it for the next floor. If there are steel columns, they are enclosed with fire-resistant material.

Claims

1. Building method comprising placing columns (1) in a rectangular grid arrangement, fixing horizontal supporting elements (3; 20) to said columns (1) and supporting concrete floors by said sup-

porting elements, said supporting elements (3; 20) forming a system of girders, each provided with a number of adjacent, spaced feed-through conduits (11), characterised by
providing floor elements made of prefabricated hollow elements, each element having a bottom sheet (4), a top sheet (5) and spacers (6, 6a) arranged in a grid between said sheets, the bottom sheet (4) of each floor element having laterally projecting parts (4a) at two opposite sides;
raising said floor elements until said projecting parts (4a) lie against said supporting elements (3; 20);
and connecting said projecting parts (4a) to the underside of said supporting elements.

2. Building method according to Claim 1, characterized in that the floor elements are rectangular and are fixed solely by their short sides to the girders (3; 20).

3. Building method according to Claim 1 or 2, characterized in that the rows of spacers (6a) adjacent to the projecting parts (4a) project between the feed-through conduits (11) of the girders (20), and in that concrete is poured in the spaces (21), bounded by the external surface of the feed-through conduits (11) and the end faces (6b) of the spacers (6a) projecting between the feed-through conduits (11).

4. Building method according to Claim 3, characterized in that the above-mentioned end faces (6b) of the spacers (6a) projecting between the feed-through conduits (11) are made step-shaped in such a way that the space between two opposite spacers widens out step-shaped from top to bottom.

5. Building method according to any of the preceding claims, characterized in that the girders are steel I beams (20).

6. Building method according to Claim 1, characterized in that the steel beams (3) are channel beams, and in that reinforced concrete is placed in the channel beams.

7. Building method according to Claim 1, characterized in that the steel beams comprise two tilted channel beams (13) held apart by transverse conduits, and the space between said beams is filled with concrete.

8. Building method according to any of the preceding claims, characterized in that the reinforcement of the concrete floor elements is not prestressed.

9. Building method according to any of the preceding claims, characterized in that the top sheet (4) of each floor element is provided with apertures (8) placed in a grid arrangement, which apertures are covered with tile-shaped sheets (9) abutting each other.

Patentansprüche

1. Bauverfahren, das aufweist: Anordnen von Säulen (1) in einer rechteckigen Gitteranordnung, Befestigen von horizontalen Stützelementen (3; 20) an den Säulen (1) und Unterstützen von Betondecken durch die Stützelemente, wobei die Stützelemente (3; 20) ein System von Trägern ausbilden, von denen jeder mit einer Anzahl von nebeneinanderliegenden, beabstandeten durchführenden Kanälen (11) versehen ist, gekennzeichnet durch
Zurverfügungstellen von Deckenelementen, hergestellt aus vorgefertigten Hohlelementen, wobei jedes Element eine Bodenplatte (4), eine Deckplatte (5) und Abstandshalter (6, 6a) aufweist, die in einem Gitter zwischen den Platten angeordnet sind, wobei die Bodenplatte (4) jedes Deckenelements seitlich vorspringende Teile (4a) an zwei entgegengesetzten Seiten aufweist;
Anheben der Deckenelemente, bis die vorspringenden Teile (4a) den Stützelementen (3; 20) gegenüber liegen;
und Verbinden der vorspringenden Teile (4a) mit der Unterseite der Stützelemente.

2. Bauverfahren nach Anspruch 1, dadurch gekennzeichnet, daß die Deckenelemente rechteckig und ausschließlich durch ihre kurzen Seiten an den Trägern (3; 20) befestigt sind.

3. Bauverfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Reihen von an die vorspringenden Teile (4a) angrenzenden Abstandshaltern (6a) zwischen den durchführenden Kanälen (11) der Träger (20) hervorstehen, und dadurch, daß Beton in die Räume (21) gefüllt wird, die durch die Außenfläche der durchführenden Kanäle (11) und die Endflächen (6b) der Abstandshalter (6a), die zwischen den durchführenden Kanälen (11) hervorstehen, begrenzt sind.

4. Bauverfahren nach Anspruch 3, dadurch gekennzeichnet, daß die oben erwähnten Endflächen (6b) der Abstandshalter (6a), die zwischen den durchführenden Kanälen (11) hervorstehen, stufenförmig ausgebildet sind, so daß der Raum zwischen zwei entgegengesetzten Abstandshaltern sich stufenförmig von oben nach unten ausweitet.

5. Bauverfahren nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß die Träger Doppel-T-Stahlträger (20) sind.

6. Bauverfahren nach Anspruch 1, dadurch gekennzeichnet, daß die Träger Kanal-Stahlträger (3) sind und daß armierter Beton in den Kanalträgern angeordnet ist.

7. Bauverfahren nach Anspruch 1, dadurch gekennzeichnet, daß die Träger zwei gekippte Kanal-Stahlträger (13) aufweisen, die durch Querkanäle getrennt gehalten werden, und der Raum zwischen den Trägern mit Beton gefüllt wird.

8. Bauverfahren nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß die Armierung der Betondeckenelemente nicht vorgespannt wird.

9. Bauverfahren nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß die Deckplatte (5) jedes Deckenelements mit Öffnungen (8) in einer Gitteranordnung versehen ist, die mit fliesenförmigen Platten (9), die aneinander anstoßen, bedeckt werden.

Revendications

1. Procédé de construction comprenant la pose de piliers (1) selon un agencement réticulé rectangulaire, la fixation d'éléments de support horizontaux (3; 20) sur lesdits piliers (1) et le support des planchers en béton par lesdits éléments de support, lesdits éléments de support (3; 20) formant un ensemble de poutrelles, chacune d'elles pourvue d'une pluralité de conduites de traversée espacées, adjacentes (11), caractérisé par :
la mise en oeuvre d'éléments de plancher réalisés à partir d'éléments creux préfabriqués, chaque élément comprenant une plaque inférieure (4), une plaque supérieure (5) et des séparateurs (6, 6a) agencés de manière à former un réseau entre lesdites plaques, la plaque inférieure (4) de chaque élément de plancher comprenant des parties en saillie latéralement (4a) sur les deux côtés opposés;
le levage desdits éléments de plancher jusqu'à ce que lesdites parties en saillie (4a) reposent contre lesdits éléments de support (3; 20); et
le raccordement desdites parties en saillie (4a) sur la paroi inférieure desdits éléments de support.

2. Procédé de construction selon la revendication 1, caractérisé en ce que les éléments de plancher sont rectangulaires et ne sont fixés aux poutrelles (3; 20) que par leurs côtés courts.

3. Procédé de construction selon la revendication 1 ou 2, caractérisé en ce que les rangées de séparateurs (6a) adjacentes aux parties en saillie (4a) dépassent entre les conduites de traversée (11) des poutrelles (20) et en ce que le béton est coulé dans les vides (21) définis par la surface extérieure des conduites de traversée (11) et que les faces d'extrémité (6b) des séparateurs (6a) sont en saillie entre les conduites de traversée (11).

4. Procédé de construction selon la revendication 3, caractérisé en ce que les faces d'extrémité (6b) mentionnées plus haut des séparateurs (6a), dépassant entre les conduites de traversée (11) sont agencées en forme de gradins, de manière que l'espace entre deux séparateurs opposés s'élargisse en formant un gradin, du haut vers le bas.

5. Procédé de construction selon l'une quelconque des précédentes revendications, caractérisé en ce que les poutrelles sont des poutres en I en acier (20).

6. Procédé de construction selon la revendication 1, caractérisé en ce que les poutres en acier (3) sont des poutres en U et en ce que du béton armé est coulé dans les poutres en U.

7. Procédé de construction selon la revendication 1, caractérisé en ce que les poutres en acier comprennent deux poutres en U inclinés (13), maintenus écartés par des conduites transversales, et que l'espace entre lesdites poutres est rempli de béton.

8. Procédé de construction selon l'une quelconque des précédentes revendications, caractérisé en ce que l'armature des éléments de plancher en béton n'est pas précontrainte.

9. Procédé de construction selon l'une quelconque des précédentes revendications, caractérisé en ce que la paroi supérieure (4) de chaque élément de plancher est pourvue d'ouvertures (8) disposées en forme de réseau, lesdites ouvertures étant recouvertes de plaques en forme de dallage (9) à pose jointive.

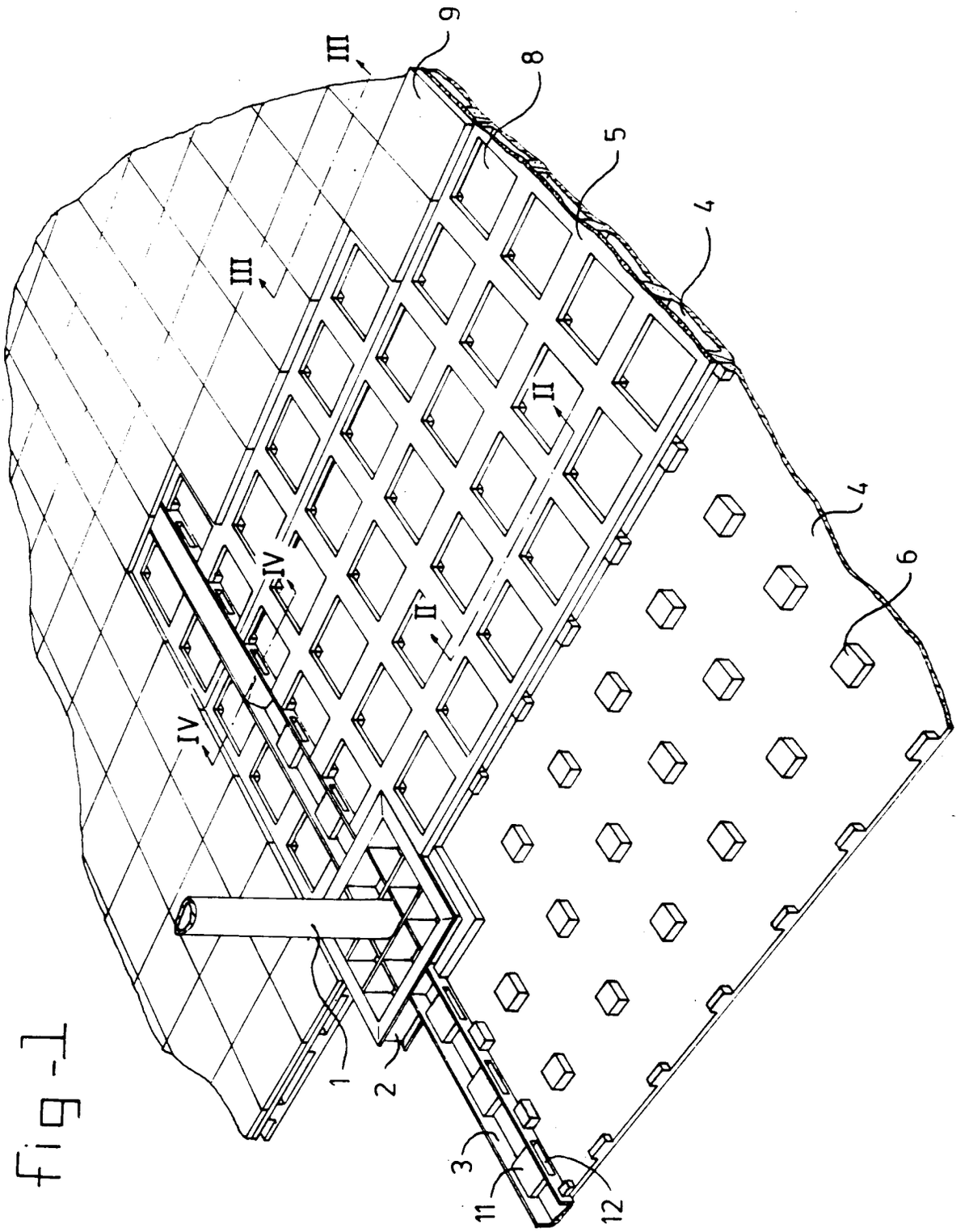


fig-1

Fig-2

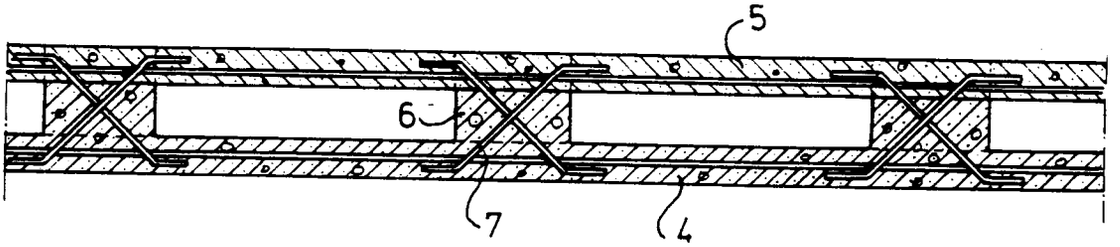


Fig-3

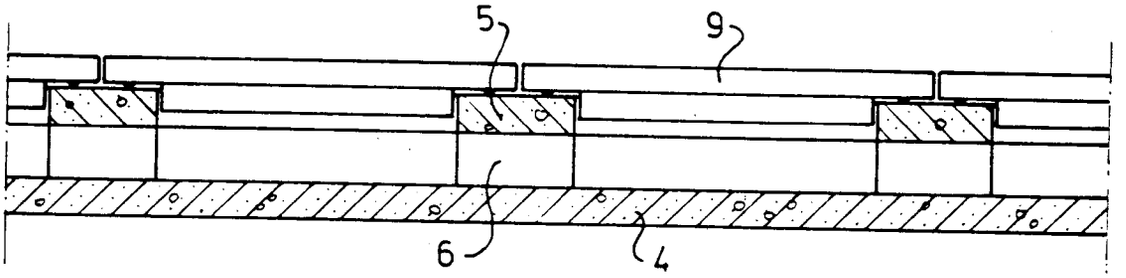


Fig-4

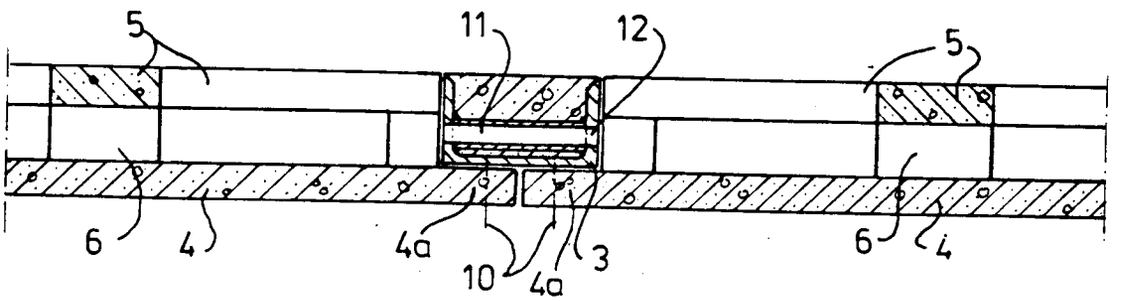
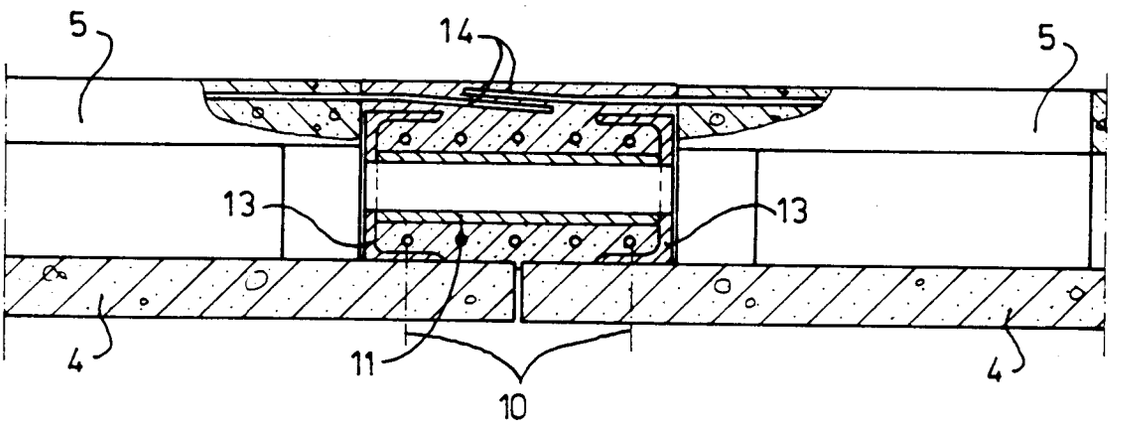


Fig-5



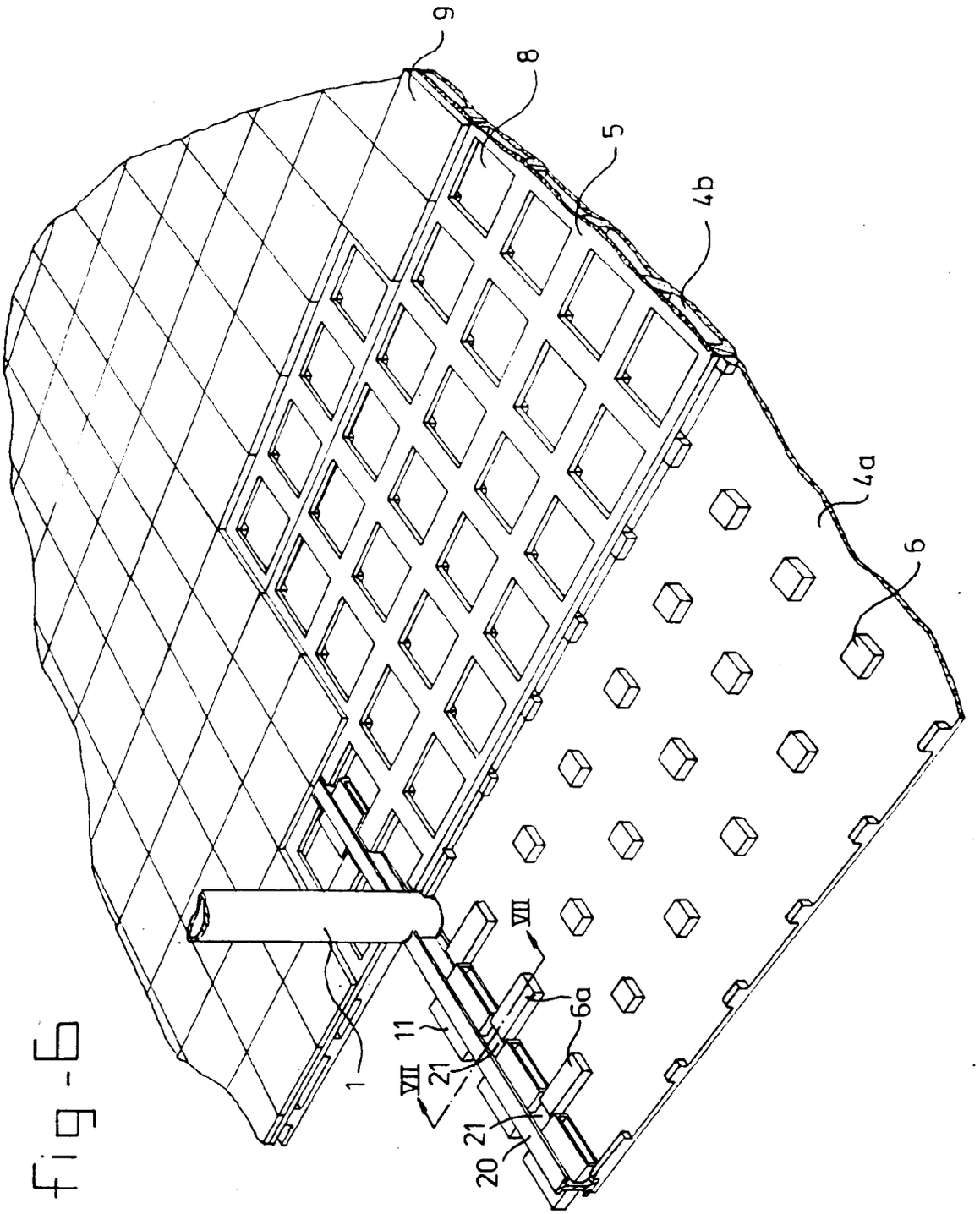


fig-6

Fig-7