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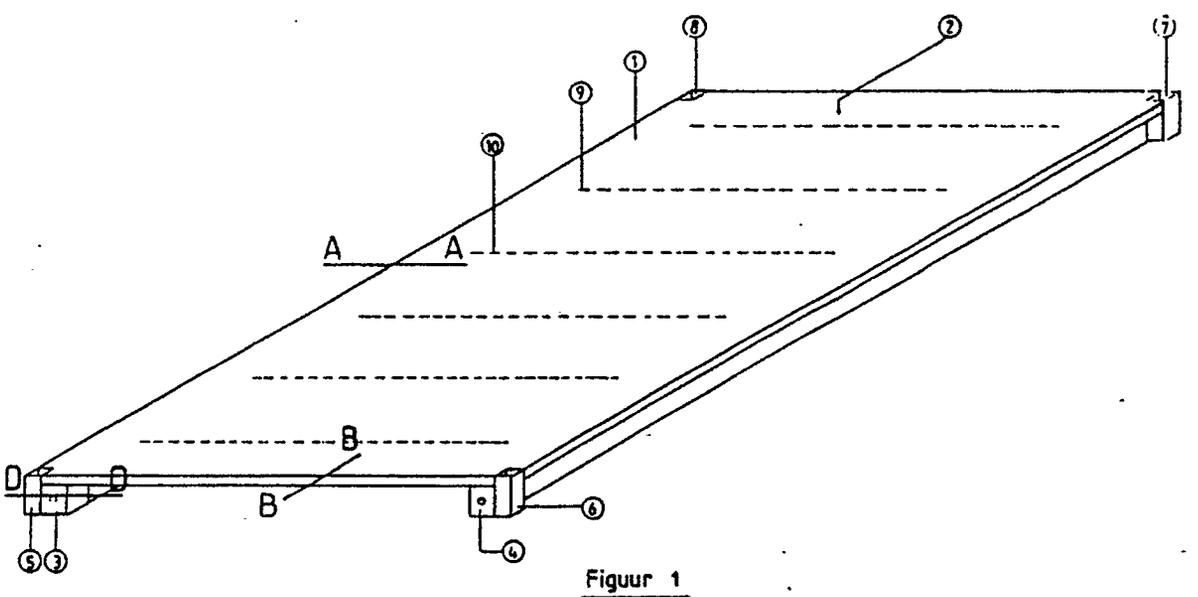
(54) Smooth, light concrete floor.

(57) Concrete floor to span the distance between supports, consisting of a plate-shaped part (1), reinforced and with a smooth surface (2) with underneath it, longitudinally, beams of prestressed concrete (3,4) and between those beams (3,4), diagonally, underneath the plate-shaped part (1) projecting rows of a zigzag reinforcement (11,12). That zigzag reinforcement (11,12) is connected underneath the floor to a tie rod (17) and in the plate-shaped part to rods (13,14) that are part of the reinforcement in the plate-shaped part.



Figuur 1

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The invention relates to a concrete floor to span the distance between two supports, consisting of a plate-shaped part, reinforced and with a smooth surface, with underneath it, running in the direction of the span length of support, forming one whole with that part, prestressed concrete beams.

Such a concrete floor is for instance known from the published European patent application no. 87202345.2, publication no. 0273492. By using beams of prestressed concrete, which are previously, separately manufactured and cured, lifting of the floor at a later date is prevented. The construction with the prestressed beams has as a further consequence, that at a similar distance to be spanned and at the same requirements as to strength imposed on the components, a thinner plate-shaped part will suffice. For instance, a floor of such a construction may span, at a width of 3 meter, a distance of 6 meter, resting thereby on four supporting points. In order to satisfy certain requirements as to strength imposed on the components, the floor should have a thickness of for instance 10 cm.

As already known, in particular when using the relatively heavy material 'concrete', it is always strived for to keep the amount of concrete necessary for a certain construction that must satisfy certain requirements as to strength imposed thereon, as small as possible. In case of concrete floors as described above, this means, that such a floor should be as thin as possible.

A concrete floor according to the invention thereto shows the characteristic that - in combination with the afore-mentioned prestressed concrete beams, between them vertical zigzag reinforcements - girders - are diagonally placed on those beams, each consisting of two, mainly parallel rods that form part of the reinforcement in the plate-shaped part, a parallel thereto, underneath the floor and between the beams running third rod - the tie rod - and in each of the fields, defined by a first rod and the tie rod and by a second rod and the tie rod, a zigzag formed rod that with its upper ends is connected to the first rod and the second rod respectively and with its lower ends to the tie rod.

The reinforcement in the plate-shaped part goes both in the longitudinal direction and diagonally. Hence it concerns here the combination of the application of two measures, which each on itself already lead to a thinner floor - and hence to saving of weight - for a spanning of a certain length, with a certain width and satisfying certain requirements as to strength imposed thereon and which in combination may lead to a floor that, when only using the prestressed beams, demands a thickness of 10 cm, now only requires a thickness of 5 cm.

Such a floor has also as an additional advantage that the transverse reinforcement may serve as support for the pipes etc. which might be installed underneath the floor.

The floor according to the invention has various versions, of which some preferred embodiments.

Thus, a preferred form of a floor according to the invention is characterized in that the prestressed beams run in the direction of the largest span length of support. In that case, the most benefit will be gained from the construction according to the invention. Such a floor is preferably, at its bottom, at the corners, provided with support elements. The use of support elements makes it possible to exactly equalize the distance between the floor surface and point of support-the bottom of the element -, so that a flat bearing of the floor is guaranteed. The latter is in particular important when some floor elements are placed against each other and thereby roughnesses at the transition of one element to the other, must be prevented. Preferably, these support elements are mounted on the prestressed beams - and this by means of anchoring plates that are at the far ends of the prestressed beams. Further, they are preferably also mounted on the plate-shaped part in behalf of the transfer of moment thereon. Cases are successfully used as support elements in which for instance the posts, columns that bear the roof or floor lying thereon, may find a place.

The cases can easily be made equally high, so that for instance the said 'seamless' transition between floor elements may be realized.

Instead of cases, also angled profiles may be used with the desired effect.

But it is also possible to use the bottoms of the ends of the prestressed beams as support points. Or, when the beams do not run entirely to the edge of the plate-shaped part, the protruding piece of that part may also serve as support point.

The invention also includes a method to make concrete floors as described afore.

In the earlier mentioned European patent application no. 87202345.2, it is described how very simply a concrete floor with a smooth bearing surface may be constructed: pour the floor in a mould with a smooth bottom and then turn the thus obtained element. That principle is according to the invention also used to make the floor with the combination of prestressed concrete beams and a zigzag reinforcement protruding from under the floor. At a floor with in front and behind of the beams protruding edges of the plate-shaped part that function as bearing surface, it should be taken care that these edges have smooth surfaces and that at that spot, the thickness of the plate-shaped part is exactly defined; this to guarantee the horizontal position and a seamless lying against the other floor segments.

The invention will be further explained by means of the drawings, in which

Fig. 1 shows an oblique projection of a concrete floor according to the invention;
Fig. 2 a front-view of such a floor
Fig. 3 a longitudinal section thereof.
Fig. 4 shows a sectional view according to A-A;
Fig. 5 idem, but now 'isolated';
Fig. 6 shows a sectional view according to B-B;
Fig. 7 idem, but now 'isolated';
Fig. 8 shows a top view of a corner and
Fig. 9 a sectional view through a corner according to D-D and
Fig. 10 an oblique projection of the construction at a corner;
Fig. 11 shows an alternative possibility for a bearing surface according to B-B and
Fig. 12 an alternative possibility for a bearing surface in front view.

In Fig. 1, the plate-shaped part with the smooth (floor)surface 2 is 1. Below part 1 are the prestressed concrete beams 3 and 4, which stretch in the direction of the span length of support underneath the plate-shaped part. In the case drawn: in the direction of the largest span length of support.

At the corners of the plate-shaped part 1 are the support elements 5, 6, 7 and 8, which, in the drawn example, consist of (vertical) cases. These cases 5, 6, 7 and 8 form with their bottoms the bearing points for the floor.

Since a floor of this type is constructed according to the method of the invention by pouring concrete mortar at the smooth bottom of a (steel) mould, it will be possible, before the concrete mortar is poured, to place on that bottom, there where the corners of the floor will be, said cases. By giving those cases a mutually exact length, one can take care that the distance between the floor surface 2 and a bearing point is always the same and that hence a floor can be laid exactly horizontal and that floor elements can be put against each other without discontinuities - staggerings - appearing in the thus to be formed larger surface.

Between the prestressed beams 3 and 4 below part 1 is the zigzag reinforcement, running according to the dotted lines 9, 10 etc.. This zigzag reinforcement is shown in more detail in figures 2 and 3, in which 1 is again the plate-shaped part with surface 2; 3 and 4 are the prestressed beams, which at the corners are flanked by the support elements 5 and 6. Between the beams 3 and 4 runs the zigzag reinforcement, which consists of the zigzag rods 11, 12 etc. that are welded in the plate-shaped part 1 to rods 13, 14 running diagonally to the direction of the prestressed beams, which rods themselves again form part of the reinforcement in that plate-shaped part 1 - and which have been fastened with their other points 15 to the tie rod 17 running underneath the plate-shaped part 1.

In Fig. 3, it is clearly to see that a row of zigzag reinforcement consists of two zigzag rods 11, 12, each starting from the tie rod 17, connected to an 'own' rod 13 and 14 respectively in the plate-shaped part 1. The zigzag rods 11 and 12 are each lying in an own flat surface, which two surfaces enclose at the tie rod 16 a sharp angle α.

In Fig. 4, which is a sectional view of the floor according to A-A, it is clearly to see how a zigzag rod 11 or 12 is fastened to a rod 13 and 14 respectively, which form part of the reinforcement in the plate-shaped part 1. With 18, the reinforcements in the prestressed beam 3, 4 are indicated.

Fig.5 shows a similar sectional view of the floor, but now of a floor in which insulation 19 and 20 have been fitted.

Fig.6 and Fig.7 show sectional views of the floor according to B-B, without and with insulation respectively.

Fig.8 shows a top view of a corner of a floor, with therein a case 5 and in Fig.9 it is drawn how that case 5 via the anchoring rod 23 has been anchored into the plate-shaped part 1 and into the end of a beam 3 and 4 respectively. In connection with the latter, a prestressed beam 3, 4 is provided at its top ends with steel plates 16 that have been put in before pouring the concrete mortar. Those plates 16 are being kept at the desired distance with respect to each other by the anchoring rods 21. The cases 5 - or possibly other support elements - have been fastened to the plates 16 by welds, or with the help of bolts.

In Fig. 10, an oblique projection of the corner of a floor, is again clearly shown what is stated at Fig.9: the steel plates 16, the anchoring rods 21 in the prestressed beams 3, 4 and the anchoring rod 23 - which is lying before the zigzag reinforcement - in the plate-shaped part 1.

In Figures 11 and 12, alternative ways for the bearing of the floor are indicated: according to Fig. 11 bearing takes place directly underneath part 22, protruding over beam 3, 4, of the plate-shaped part 1 - for which it is necessary to determine at the spot the thickness of the plate-shaped part 1 in order to enable an exact location of the floor. According to fig.12, bearing takes place directly underneath the prestressed beam 3,4.

Claims

1. Concrete floor (1) to span the distance between two lying supports, consisting of a plate-shaped part (1), reinforced and with a smooth surface (2) with underneath this, running in the

direction of the span length of support, forming one whole with that part (1), prestressed concrete beams (3,4),
characterized in that there are diagonally to those beams (3,4), between them, vertical zigzag reinforcements (11,12) - girders -, each consisting of two, mainly parallel rods (13,14) that form part of the reinforcement in the plate-shaped part, a parallel thereto, underneath the floor and between the beams running third rod - the tie rod (17)-and in each of the surfaces, defined by a first rod (13) and the tie rod (17) and by a second rod (14) and the tie rod (17), a zigzag formed rod (11 and 12 resp.) that with its upper ends is connected to the first rod (13) and the second rod (14) respectively and with its lower ends (15) to the tie rod (17).

2. Concrete floor according to claim 1, characterized in that the prestressed beams are running in the direction of the largest span length of support.

3. Concrete floor according to claim 1 or 2, characterized in that the floor at its bottom is provided at the corners with support elements, which at their side that is turned away from the floor form bearing points.

4. Concrete floor according to claim 3, characterized in that the support elements are fixed to the prestressed beams and also to the plate-shaped part.

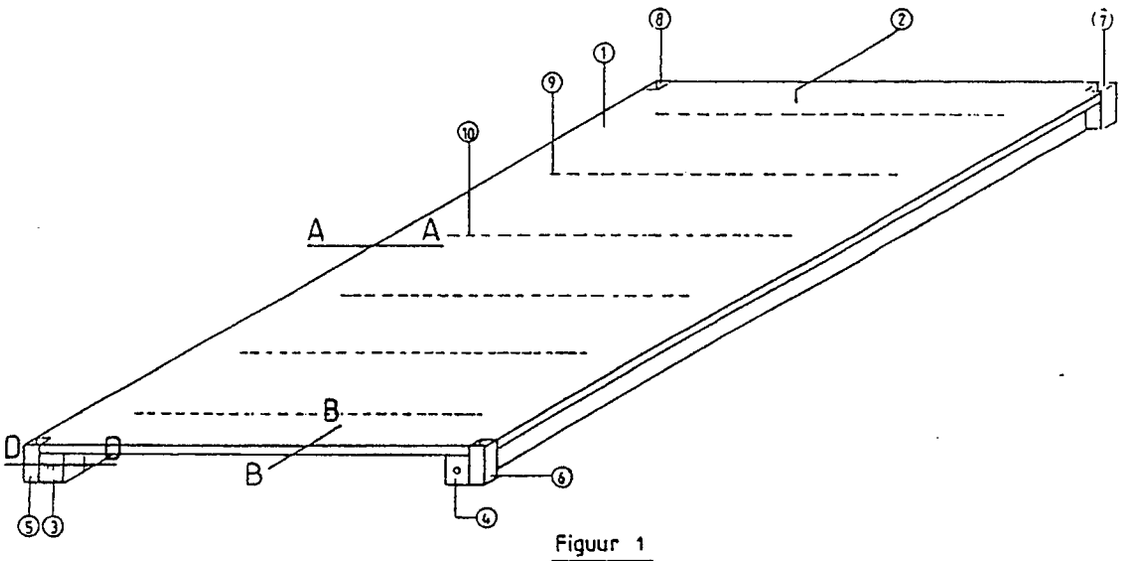
5. Concrete floor according to claim 3 or 4, characterized in that the support elements are cases.

6. Concrete floor according to claim 3 or 4, characterized in that the support elements are angled profiles.

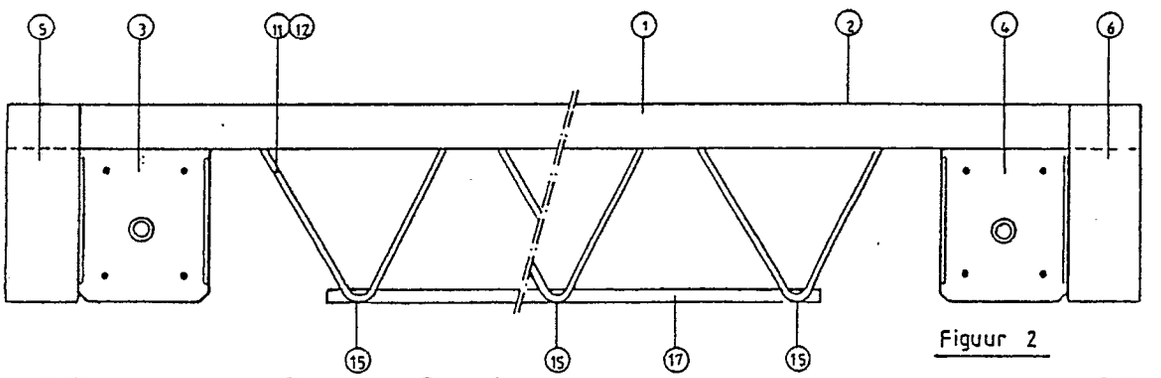
7. Concrete floor according to claim 1 or 2, characterized in that the bottom sides of the ends of the prestressed beams are the bearing points for the floor.

8. Concrete floor according to claim 1, characterized in that the prestressed beams do not run entirely to the edge of the plate-shaped part and that the protruding parts are bearing points for the floor.

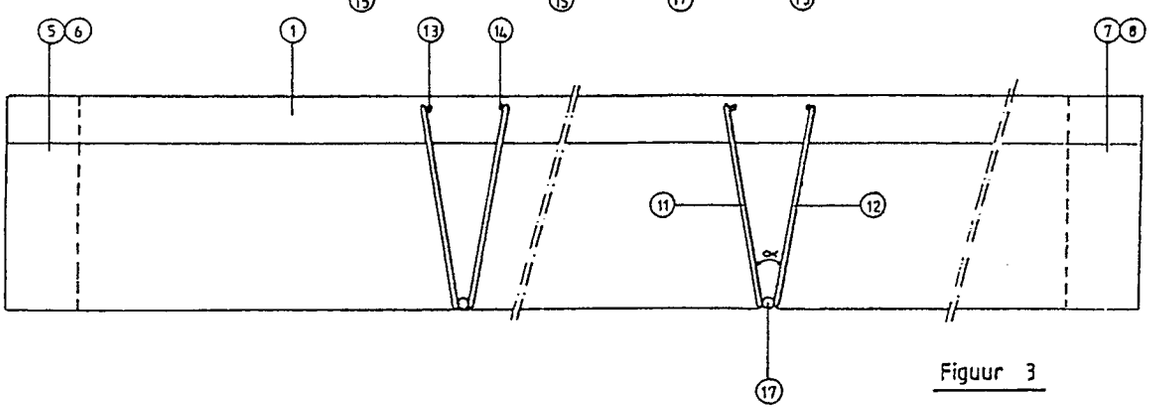
9. Method for the construction of a concrete floor according to one or more of the previous claims,
characterized in that
- first in a boarding with a smooth bottom and with smooth sidewalls, prestressed concrete beams are longitudinally 'hung' at a distance above the bottom that equals or is smaller than the desired thickness of the floor;
- then between the beams, squarely thereon, rows of vertical zigzag reinforcements - girders - are fitted, each consisting of two, mainly parallel rods that run underneath the beams, above the bottom, a parallel thereto and between two beams running third rod - the tie rod -and in each of the surfaces, defined by a first rod and the tie rod and by a second rod and the tie rod, a zigzag formed rod that with its bottom ends is fitted to the first rod and the second rod respectively and with its top ends to the tie rod;
- then the concrete mortar is poured on the reinforcement present in the mould underneath the beams until it reaches a height, equal to the desired thickness of the floor, the concrete mortar is vibrated and then cured;
- finally the thus obtained construction is taken out of the mould and turned upside down.



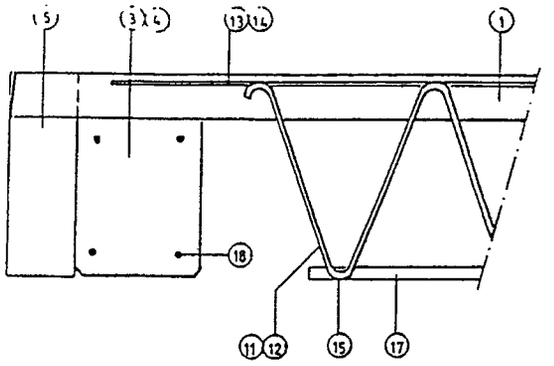
Figuur 1



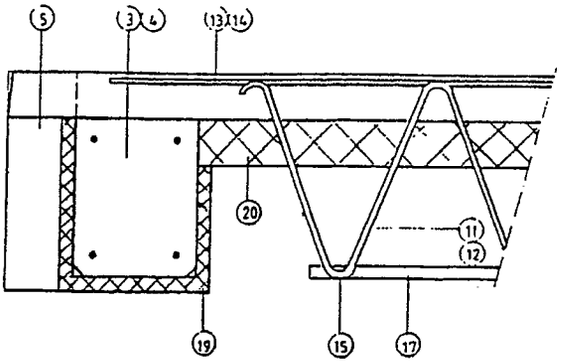
Figuur 2



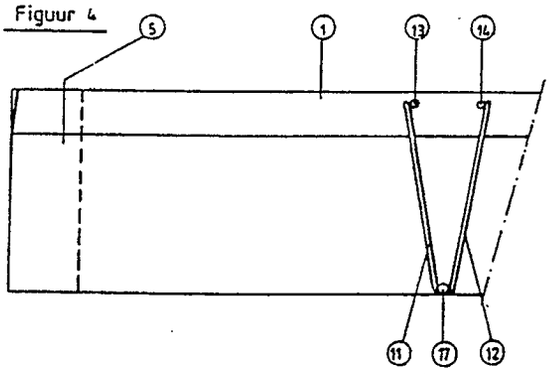
Figuur 3



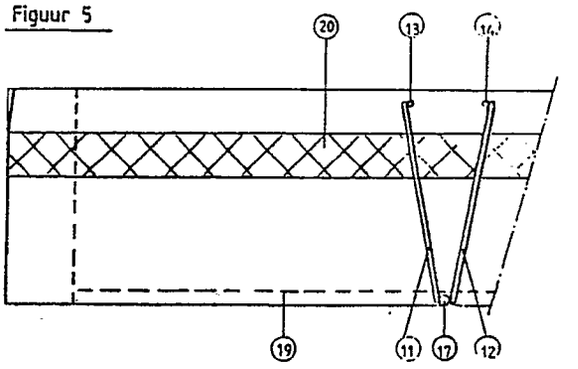
Figuur 4



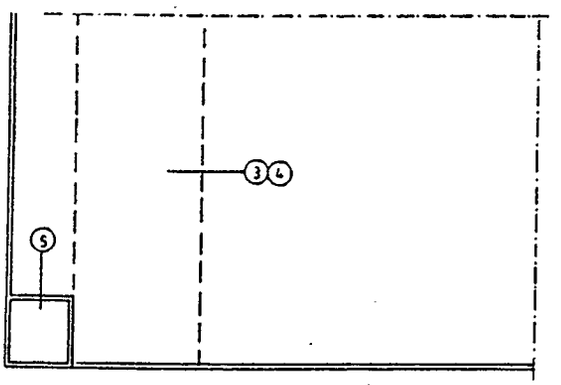
Figuur 5



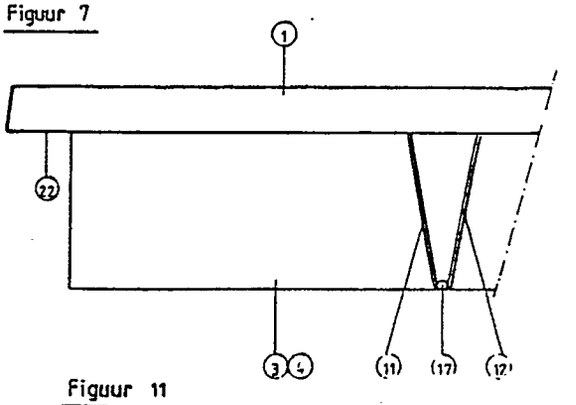
Figuur 6



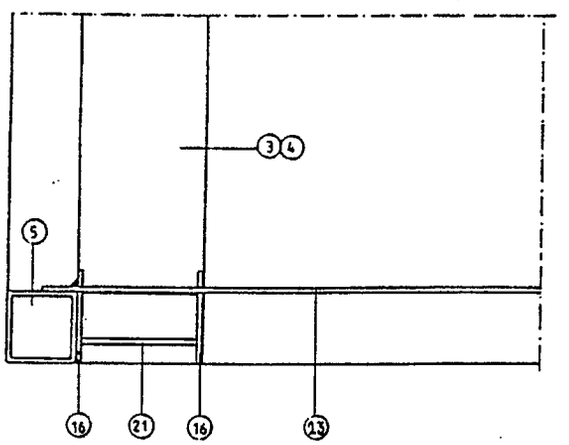
Figuur 7



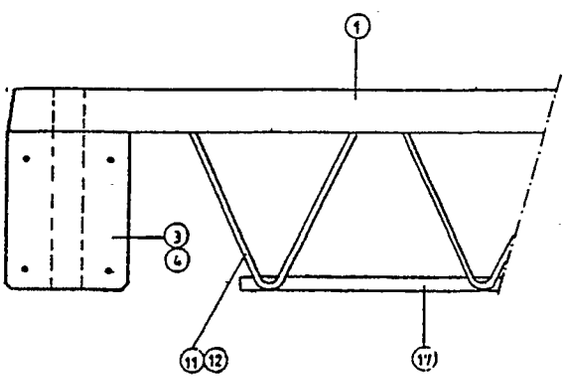
Figuur 8



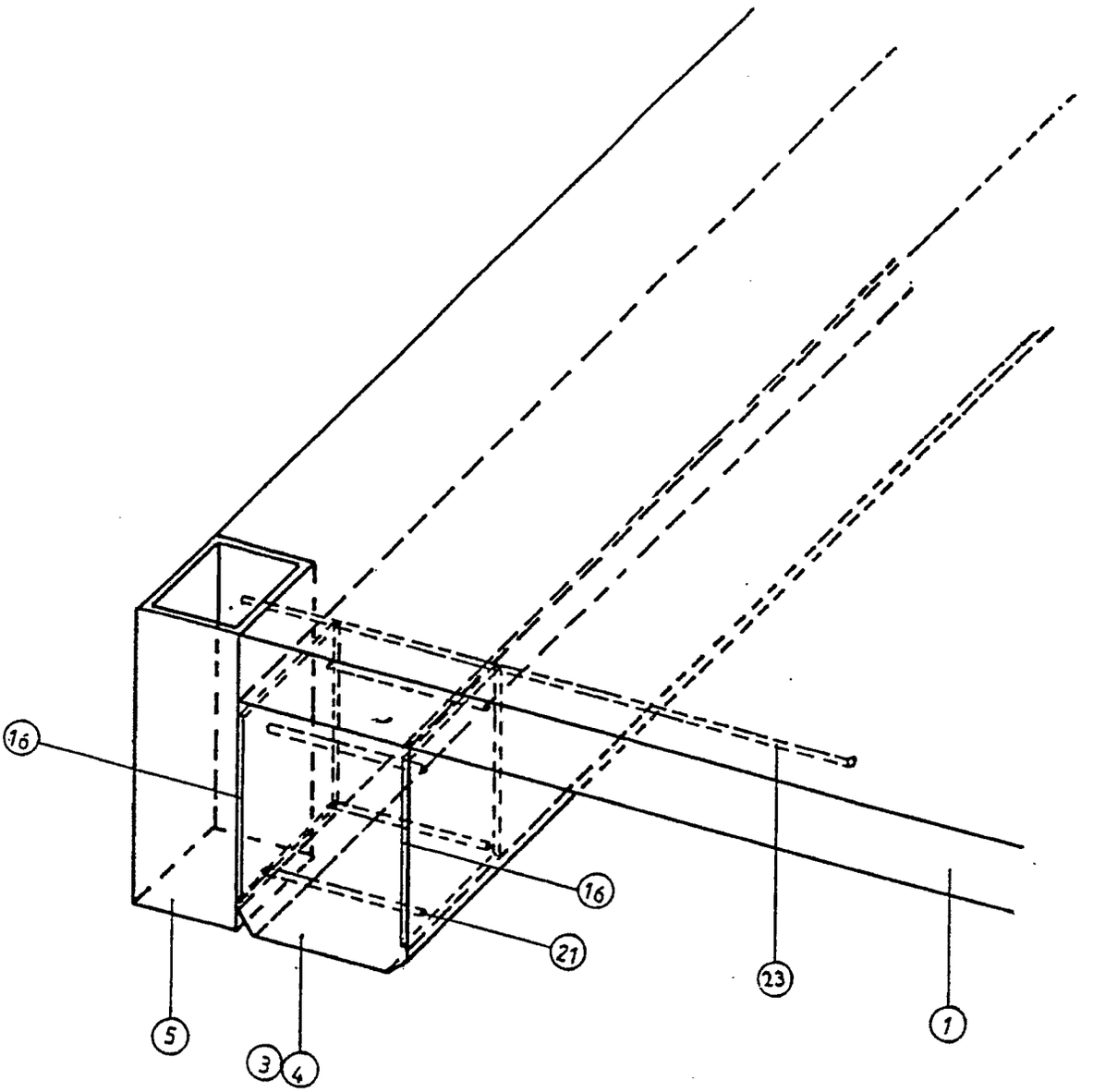
Figuur 11



Figuur 9



Figuur 12



Figuur 10

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 20 0557

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.5)
X,Y	FR-A-2 123 160 (GAUTER) * page 3, line 22 - page 3, line 39 * * page 4, line 4 - page 4, line 24; figures 1-9 *	1,2-9	E 04 B 5/02 E 04 C 2/50
Y	NL-A-7 804 547 (WAARDO BETON) * page 1, line 14 - page 3, line 2; claims 1,2; figures 1-3 *	2	
Y	DE-A-3 623 917 (VEB BAU- UND MONTAGEKOMBINAT OST BETRIEB FORSCHUNG) * column 3, line 49 - column 4, line 27; figures 1-6 *	3,4,5	
Y	AU-A-5 766 48 (RIEKIE & SIMPFENDORFER) * page 6, line 11 - page 8, line 7; figures 1-9 *	3,4,6	
Y	NL-A-7 213 760 (HOLLANDSCHE BETON GROEP) * page 3, line 16 - page 3, line 23 * * page 4, line 34 - page 5, line 35 @ page 6, line 17 - page 6, line 30; figures 1-7 *	7	
Y	US-A-3 848 381 (BLOXOM) * column 6, line 30 - column 6, line 36; figures 1,4-6 *	8	
Y	FR-A-2 578 276 (S.A.R.E.T.) * page 6, line 19 - page 10, line 11 * * page 11, line 23 - page 13, line 15 @ page 13, line 30 - page 13, line 35; figures 1,2,3,6-10 *	9	TECHNICAL FIELDS SEARCHED (Int. Cl.5) E 04 B E 04 C
A	US-A-4 495 688 (LONGPRE) * column 3, line 36 - column 4, line 57; claim 1; figures 1,2,5-7 *	9	

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	21 June 91	HENDRICKX X.

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
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O: non-written disclosure
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E: earlier patent document, but published on, or after the filing date
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