(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 020 583 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
19.07.2000 Bulletin 2000/29

(51) Int. Cl.[7]: **E04B 5/38**

(21) Application number: **00870002.3**

(22) Date of filing: **05.01.2000**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **11.01.1999 BE 9900012**

(71) Applicants:
- **MARMORITH BETONINDUSTRIE**
  B-3530 Houthalen-Helchteren (BE)
- **W. van Opzeeland Beheer B.V.**
  5251 PT Vlijmen (NL)

(72) Inventors:
- **Houben, Ewaldus Alfonsus Mr.**
  3530 Houthalen-Helchteren (BE)
- **Van Opzeeland, Wilhelmus Egidius Jozef, Mr.**
  5251 ZA Vlijmen (NL)

(74) Representative:
Van Reet, Joseph et al
Gevers & Vander Haeghen,
Patent Attorneys,
Rue de Livourne 7
1060 Brussels (BE)

(54) Beam bottom, method for the production thereof and for the production of a beam therewith

(57) The invention relates to a beam bottom, comprising a concrete slab (1) with main reinforcement bars (2) for said beam extending in the longitudinal direction therein, and with stirrups (3) extending in the transverse direction of the concrete slab (1) and intended for absorbing transverse forces in said beam, which stirrups (3) extend below said main reinforcement bars (2) and project to a predetermined height above the concrete slab (1). In addition, at least one lattice girder (4) is embedded in the concrete slab, which lattice girder likewise projects above the concrete slab, and on which said stirrups (3) rest. In particular, the stirrups (3) are suspended over the lattice girders (4). In this way the stirrups (3) can easily be retained in position during the pouring of the concrete slab (1).

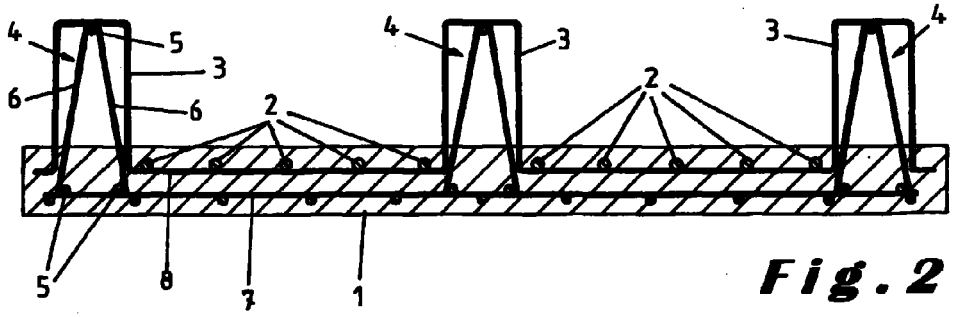

Fig. 2

EP 1 020 583 A1

Description

[0001] The present invention relates to a beam bottom intended for forming a bottom part of a reinforced concrete beam, and comprising a concrete slab with main reinforcement bars for said beam extending therein in the longitudinal direction, and with stirrups extending in the transverse direction of the concrete slab and intended for absorbing transverse forces in said beam, which stirrups extend below said main reinforcement bars and project to a predetermined height above the concrete slab.

[0002] Such a beam bottom is already known in practice. In the known beam bottom the concrete slab contains as the only reinforcement the main reinforcement bars running in the longitudinal direction and the stirrups projecting above the concrete slab. A problem with these beam bottoms is that during the pouring of the concrete it is difficult to keep the stirrups in their upright position. Moreover, during transportation the projecting parts of these stirrups are not supported, so that they are easily buckled. Finally, in this known beam bottom the top parts of the stirrups are provided in such a way that they also extend around the top main reinforcement bars of the beam to be produced with them. This therefore means that on site these main reinforcement bars have to be guided through the stirrups, which is a time-consuming job.

[0003] The object of the invention is then to propose a new beam bottom, in which the projecting stirrups can be held more easily in place during the pouring of the concrete for this beam bottom.

[0004] To this end, the beam bottom according to the invention is characterized in that in addition at least one lattice girder is embedded in the concrete slab, in the longitudinal direction thereof, which lattice girder likewise extends above the concrete slab, and on which said stirrups rest, at least during the pouring of the concrete slab. At least two lattice girders are preferably embedded in the concrete slab.

[0005] Owing to the fact that the stirrups rest upon the lattice girder(s), they cannot fall over during the pouring of the concrete for the concrete slab, and can thus be held easily in place. If necessary, temporary slats can also be placed upon the lattice girders, on which slats the stirrups rest, and which slats are then removed after the concrete slab has set, although it is preferable for the stirrups to be made to rest directly upon the lattice girders, so that these additional steps are avoided. Furthermore, the stirrups can rest slightly obliquely on the lattice girders, in which case they can then be straightened out after the concrete slab has set. However, in a preferred embodiment of the beam bottom according to the invention said stirrups are suspended over the lattice girders at least during the pouring of the concrete slab.

[0006] In a further preferred embodiment of the beam bottom according to the invention said stirrups are formed by a reinforcement bar extending in the transverse direction of the concrete slab, which reinforcement bar is folded in such a way that at the level of the lattice girders in each case it forms a stirrup which rests upon the respective lattice girder, said main reinforcement bars resting at least upon the parts of the reinforcement bar which extend between the lattice girders, at least during the pouring of the concrete slab. In this embodiment the reinforcement bar is in particular in the form of a square wave whose peaks may have oblique sides and possibly a pointed top.

[0007] The reinforcement bar can extend uninterrupted virtually from the one longitudinal side of the concrete slab to its other longitudinal side, or can be interrupted and be composed of two or more parts which overlap each other in the parts between the lattice girders.

[0008] The invention also relates to a method for the production of a beam bottom according to the invention. This method is characterized in that at least one lattice girder is placed in a mould for pouring a concrete slab, stirrups are then made to rest upon said lattice girder, which stirrups at the bottom extend further in the transverse direction of the concrete slab, main reinforcement bars of a beam to be made with the beam bottom are laid upon these parts of the stirrups extending in the transverse direction, and concrete is poured into the mould until the main reinforcement bars, the lattice girder and the stirrups are embedded, but the latter two still project above the concrete.

[0009] The invention also relates to a method for the production of a concrete beam with a beam bottom according to the invention. This method is characterized in that main reinforcement bars for the top side of the beam are placed at a distance above the stirrups of the beam bottom, and transverse reinforcement bars are suspended from these main reinforcement bars, said transverse reinforcement bars extending downwards between the main reinforcement bars and at least partially overlapping the upright parts of the stirrups of the beam bottom.

[0010] An advantage of this method is that the top main reinforcement bars are easier to place than in the case of the known technique, in which these bars have to be inserted through the stirrups of the beam bottom. Providing the necessary overlap between the downward extending transverse reinforcement bars and the upright parts of the stirrups of the beam bottom also produces a beam in which the transverse reinforcement surrounds the main reinforcement bars, as required according to certain standards.

[0011] Further advantages and special features of the invention will emerge from the description which follows of a number of preferred embodiments of the beam bottom and the method according to the invention. This description is, however, merely given as an example and is not intended to limit the scope of the invention. The reference numerals used relate to the appended

drawings, in which:

Figure 1 shows diagrammatically a perspective elevational view of a beam bottom according to the invention;

Figure 2 shows a cross section through the beam bottom according to Figure 1;

Figure 3 shows diagrammatically a cross section through the beam bottom according to Figure 1, placed in a structure which has floor slabs, formwork and additional beam reinforcement, the concrete for the beam and the floor also having already been poured; and

Figure 4 shows a cross section through a beam bottom according to the invention, on which a number of different designs of the stirrups are illustrated.

[0012] The invention generally relates to a beam bottom which is intended for forming the bottom part of a supporting beam.

[0013] The term beam here should be understood as meaning not only the usual beams with a width which can generally go up to approximately 0.5 metre, but also so-called reinforced strips with a width which can go up to, for example, 2.4 or 3.6 metres, or even more. For the manufacture of the beam, an additional reinforcement is further placed on top of the beam bottom, after which concrete is poured onto the beam bottom, around this additional reinforcement. One of the advantages of this method is, for example, that the floor slabs which are to be supported by the beam no longer have to rest on the beam, but can now be poured from the side into the beam at the same time as the further formation of the beam.

[0014] The beam bottoms shown in the figures consist substantially of a concrete slab 1 with a reinforcement embedded therein. This reinforcement is formed in the first place by the main reinforcement bars 2, which must be provided in the underside of the beam to be formed, and which extend in the longitudinal direction thereof. In addition, the reinforcement embedded in the concrete slab comprises stirrups 3, which also extend in the transverse direction of the concrete slab 1. The essential feature of these stirrups 3 is that, on the one hand, they project a predetermined distance above the concrete slab 1 and, on the other hand, extend below the main reinforcement bars 2 in such a way that they will be able to absorb the transverse forces which will occur in the beam. According to the invention, the reinforcement provided in the beam bottom also comprises at least one, but preferably two or more lattice girders 4, which, like the stirrups 3, are partially embedded in the concrete slab 1 and project above said slab 1. In the embodiment shown in the figures the lattice girders are formed by three iron bars 5, which, viewed in cross section of the beam bottom, are disposed in a triangle and in the upright sides of said triangle are welded together by an iron bar 6 which is folded in a sinusoidal or sawtooth shape. Such lattice girders 4 are already in general use for making concrete floor slabs and can easily be embedded in a similar manner in the concrete slab 1 of the beam bottom according to the invention. However, in the beam bottoms according to the invention yet other types of lattice girders can be used, for example lattice girders which are square or rectangular in cross section. Finally, as can be seen from Figure 2, in the beam bottom shown a reinforcement net 7 is also provided. Said reinforcement net need not necessarily always be present, since the lattice girders can also be kept upright in another way. The lattice girders can be suspended from, for example, transverse bars, which are removed again after pouring of the concrete slab.

[0015] As in the known beam bottoms, the stirrups 3 can be formed by reinforcement bars which form a closed ring and therefore have to be pushed over the lattice girders 4 and the main reinforcement bars 2. For the production of the beam bottoms it is therefore simpler to use stirrups 3 which, as shown in Figure 2, are formed by a reinforcement bar 8 which extends in the transverse direction of the concrete slab 1 and is folded in such a way that at the level of the lattice girders 4 it forms one of said stirrups 3 in each case. Said main reinforcement bars 2 can then rest upon the parts of the reinforcement bar 8 which extend between the lattice girders 4, and possibly also upon the parts extending beyond that.

[0016] The stirrups 3 shown in the figures are formed by an uninterrupted reinforcement bar 8 extending virtually from the one longitudinal side of the concrete slab 1 to the other longitudinal side thereof. However, it is also possible according to the invention for this reinforcement bar 8 to be interrupted and to be composed of two or more parts which overlap each other in the parts between the lattice girders 4. The overlaps mean that the interrupted reinforcement bar 8 is also suitable for absorbing the transverse forces occurring.

[0017] The importance of the use of the lattice girders 4 in the beam bottom according to the invention is not only that the sturdiness of the beam bottom is increased as a result, in such a way that the concrete slab 1 can be made thinner (for example, a thickness of 5 to 20 cm, and preferably between 7 and 13 cm) and the transportation and the positioning of the beam bottoms is simplified in this way, but a major advantage of the lattice girders 4 is above all that during the pouring of the concrete slab 1 the stirrups 3 according to the invention can rest upon the lattice girders 4, and in particular may even be suspended from them.

[0018] For the production of the beam bottom shown in Figures 1 and 2, the reinforcement net 7 is first placed in a mould for pouring the concrete slab 1. The necessary lattice girders 4 are then placed on this net 7. The reinforcement bars 8, which can form the stirrups 3, can then simply be suspended over the lattice girders at the desired distances from each other. Since greater

transverse forces will occur at the ends of the beam than in the centre, the stirrups 3 can even be placed at a shorter distance from each other at the ends than in the centre, without this causing additional problems. The main reinforcement bars 2 can then be laid upon the bottom parts of the stirrups 3 which are suspended between the lattice girders, above the net 7. The concrete for the concrete slab 1 can subsequently be poured, without an additional support of the stirrups 3 being required for holding the latter in the correct position.

[0019] In the embodiment described above the stirrups 3 have a height which is less than the height of the lattice girders 4, in such a way that their bottom ends hang free above the net 7 upon which the lattice girders 4 are resting. The stirrups 3 may also be made higher if desired, in such a way that they ultimately rest slightly obliquely with their top side upon the lattice girders 4 and their bottom side upon the net 7. After the concrete slab 1 has set, the parts of the stirrups projecting above the slab can then be straightened, if desired. On the other hand, a slat, for example, can be placed upon the lower lattice girders 4, from which slat the stirrups 3 are then suspended, and which slat can be removed again after the concrete slab has set.

[0020] Figure 4 shows a number of variant designs of the parts of the stirrups 3 projecting from the concrete slab 1. The first three variant designs are intended for making the stirrups 3 project above the lattice girders 4. To this end, these stirrups 3 have a transverse part with which they rest upon the lattice girders 4 or are suspended therefrom.

[0021] In the first variant embodiment this transverse part is formed by a transverse bar 9, which is welded at the level of the top side of the lattice girders 4 between the two legs of the stirrup 3. In the second embodiment the projecting part of the stirrup 3 is folded in a seat shape, in such a way that the part 10 of said stirrup 3 which narrows in the transverse direction rests upon the lattice girder 4. In the third embodiment the stirrup 3 is made narrower, one upright leg being folded to form a protuberance 11 projecting in the transverse direction and resting upon the transverse girder 4. In the fourth embodiment of the stirrups the stirrup 3 does not project above the lattice girder 4, and this lattice girder therefore had to be higher. The legs of the projecting part of the stirrup 3 are slightly oblique instead of straight in this case.

[0022] The way in which a concrete beam can be made with the beam bottoms according to the invention is illustrated in Figure 3.

[0023] In this figure the beam bottom with the concrete slab 1 is placed on columns (not shown). Floor slabs 12, which are to be borne by the beam to be formed, are placed in their correct position next to the beam bottom, on supports 13. These floor slabs 12 can also be replaced by other floor types, for example burnt clay or concrete floor elements or pots and beams. The beams of the supports 13 in this case are preferably placed against the beam bottom in such a way that said beams form formwork between the bottom side of the floor slabs 12 and the side of the beam bottom. As is customary, the floor slabs 12 also comprise lattice girders 14. Reinforcement nets 15 are placed on said lattice girders, on which reinforcement nets the main reinforcement bars 16 for the top side of the beam can be placed. As can be seen clearly from Figure 3, the stirrups 3 of the beam bottom do not extend above these main reinforcement bars 16. In order to guarantee that the transverse forces are absorbed, transverse reinforcement bars 17 are therefore suspended from the main reinforcement bars 16, in such a way that said transverse reinforcement bars at least partially overlap the upright parts of the stirrups 3. In the embodiment according to Figure 3 said transverse reinforcement bars 17 are folded in a similar way to that of the reinforcement bar 8 for the stirrups 3. By comparison with the insertion of the main reinforcement bars 16 through the stirrups 3, this design offers the advantage that the main reinforcement bars 16 and the transverse reinforcement bars 17 are easier to place in position. In a variant embodiment the transverse reinforcement bars 17 can also be composed of two or more overlapping parts, which can be particularly advantageous for broader beams. After the reinforcements have been placed in position, the concrete 18 for the beam, together with the concrete for the floor, can then be poured.

[0024] In the beam which is produced with the beam bottom according to the invention it is important for the transverse reinforcement bars 17 which are placed upon the top main reinforcement bars 16 to overlap the stirrups 3 projecting from the beam bottom over a sufficiently great distance, in order to be able to absorb the transverse forces. In a preferred embodiment, for this purpose the stirrups 3 project to a height of at least 16 to 20 cm above the concrete slab 1 of the beam bottom. Owing to the fact that the projecting parts of the stirrups 3 are closed, they do not constitute dangerous projections on which anyone could be seriously injured.

[0025] It will be clear from the description given above of a number of embodiments of the beam bottom according to the invention that numerous further modifications can be made thereto without going beyond the scope of the invention as set out in the appended claims.

[0026] For instance, it will be clear that, instead of three, more or fewer lattice girders can also be provided in the beam bottom, and that the beam bottom can be produced in various standard widths, for example in widths of 60, 120, 180 and 240 cm, with 2, 3, 4 and 5 lattice girders respectively. For all these widths, owing to the presence of the lattice girders, the minimum thickness of the concrete slab is only 5 cm. It is also possible to provide the concrete slab 1 with an upright concrete side edge, for example along the longitudinal sides

thereof or around the full periphery, which ensures additional sturdiness of the concrete slab.

Claims

1. Beam bottom intended for forming a bottom part of a reinforced concrete beam, and comprising a concrete slab with main reinforcement bars for said beam extending therein in the longitudinal direction, and with stirrups extending in the transverse direction of the concrete slab and intended for absorbing transverse forces in said beam, which stirrups extend below said main reinforcement bars and project to a predetermined height above the concrete slab, characterized in that at least one lattice girder is embedded in the concrete slab, in the longitudinal direction thereof, which lattice girder also extends above the concrete slab, and on which said stirrups rest, at least during the pouring of the concrete slab.

2. Beam bottom according to Claim 1, characterized in that said stirrups are suspended over said lattice girder at least during the pouring of the concrete slab.

3. Beam bottom according to Claim 1 or 2, characterized in that at least two lattice girders are embedded in the concrete slab, in the longitudinal direction thereof.

4. Beam bottom according to Claim 3, characterized in that said stirrups are formed by a reinforcement bar extending in the transverse direction of the concrete slab, which reinforcement bar is folded in such a way that at the level of the lattice girders in each case it forms one of said stirrups which rest upon the respective lattice girder at least during the pouring of the concrete slab, said main reinforcement bars resting at least upon the parts of the reinforcement bar which extend between the lattice girders.

5. Beam bottom according to Claim 4, characterized in that said reinforcement bar extends uninterrupted virtually from the one longitudinal side of the concrete slab to its other longitudinal side.

6. Beam bottom according to Claim 4, characterized in that said reinforcement bar is interrupted and is composed of two or more parts which overlap each other in the parts between the lattice girders.

7. Beam bottom according to one of the preceding claims, characterized in that said lattice girder is situated in the concrete slab on top of a reinforcement net.

8. Beam bottom according to Claim 7, characterized in that said main reinforcement bars are situated above said net.

9. Beam bottom according to one of the preceding claims, characterized in that said stirrups rest with a transverse part upon said lattice girder and further project above said lattice girder.

10. Beam bottom according to one of the preceding claims, characterized in that said stirrups project to a predetermined height of at least 16 to 20 cm above the concrete slab.

11. Method for the production of a beam bottom according to one of the preceding claims, characterized in that at least one lattice girder is placed in a mould for pouring a concrete slab, stirrups are then made to rest upon said lattice girder, which stirrups extend at the bottom further in the transverse direction of the concrete slab, main reinforcement bars of a beam to be made with the beam bottom are laid upon these parts of the stirrups extending in the transverse direction, and concrete is poured into the mould until the main reinforcement bars, the lattice girder and the stirrups are embedded, but the latter two still project above the concrete.

12. Method according to Claim 11, characterized in that the stirrups are suspended from the lattice girder.

13. Method according to Claim 11 or 12, characterized in that a reinforcement net is first placed in the mould before the lattice girder is placed, after which the lattice girder is placed upon said net.

14. Method for making a concrete beam with a beam bottom according to one of Claims 1 to 10, characterized in that main reinforcement bars for the top side of the beam are placed at a distance above the stirrups of the beam bottom and transverse reinforcement bars are suspended from these main reinforcement bars, said transverse reinforcement bars extending downwards between the main reinforcement bars and at least partially overlapping the upright parts of the stirrups of the beam bottom.

15. Method according to Claim 14, characterized in that a reinforcement net is placed first of all above the stirrups of the beam bottom, on which reinforcement net the main reinforcement bars for the top side of the beam are then placed.

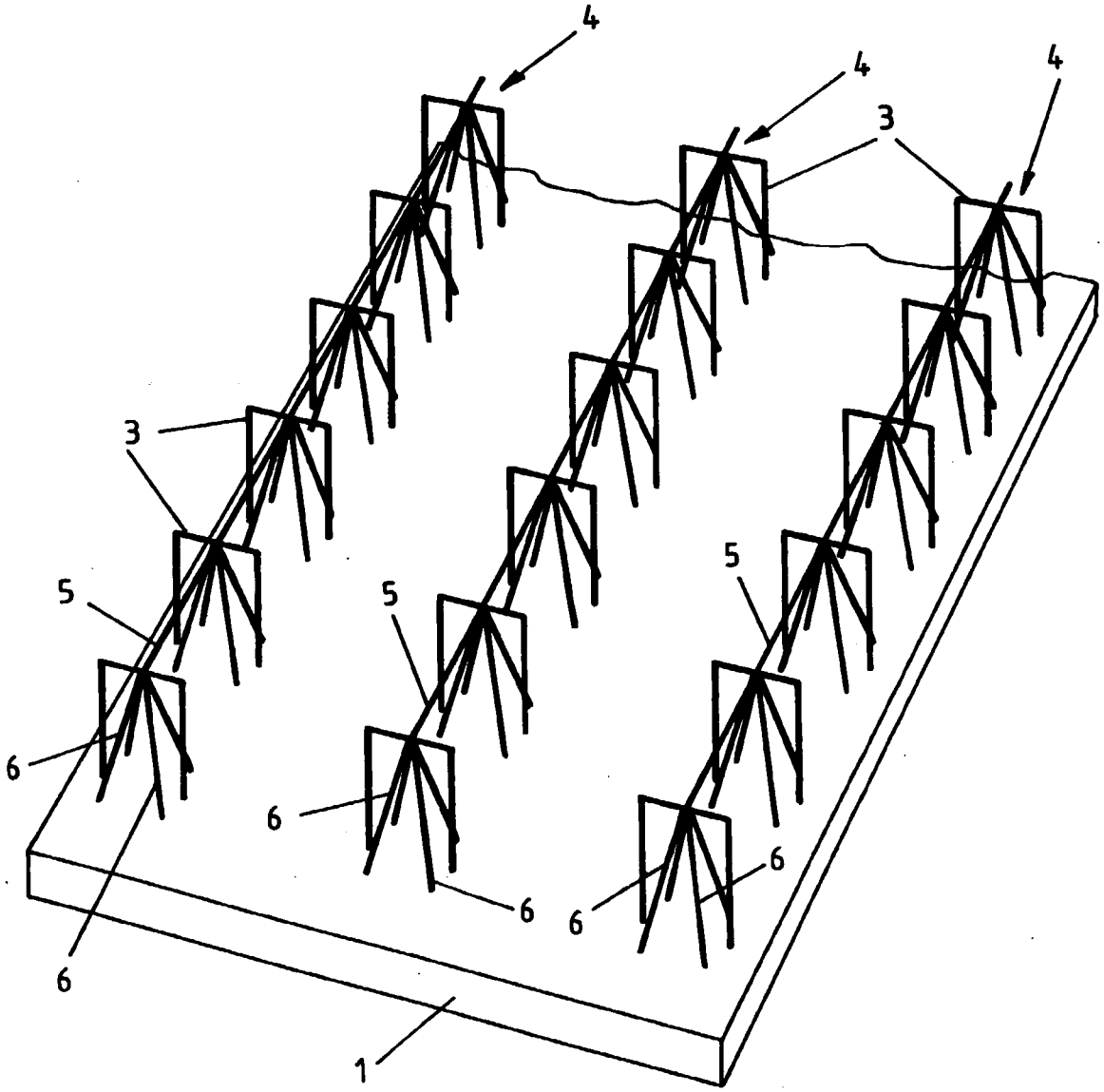

Fig. 1

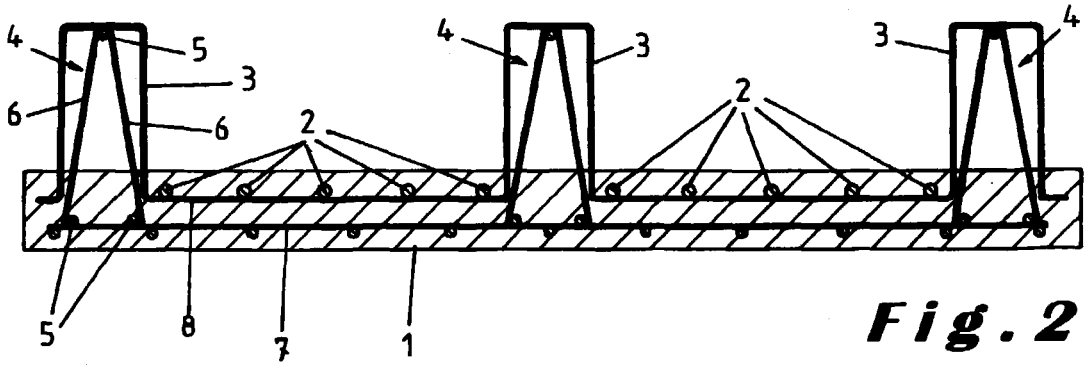

Fig. 2

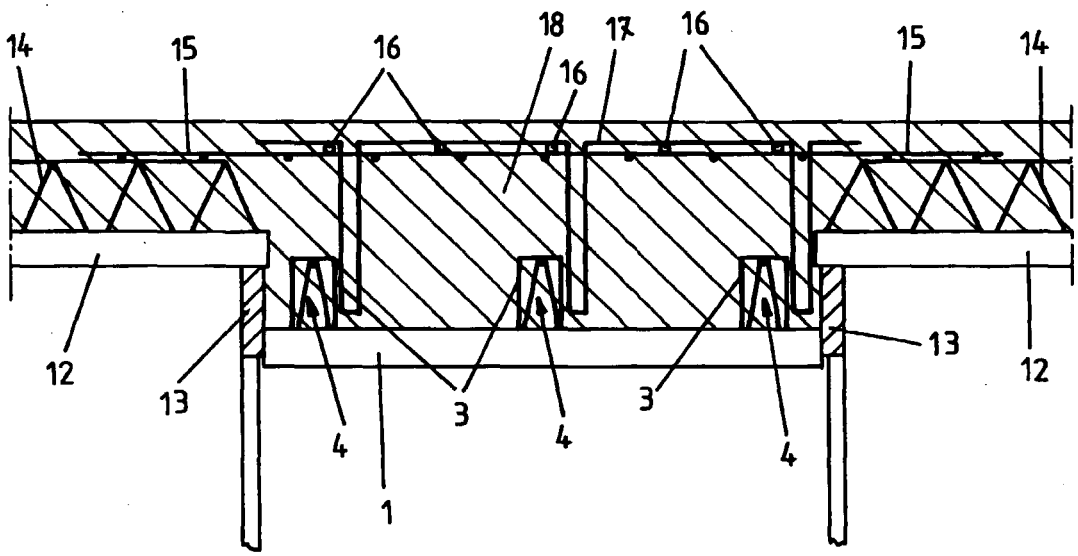

Fig. 3

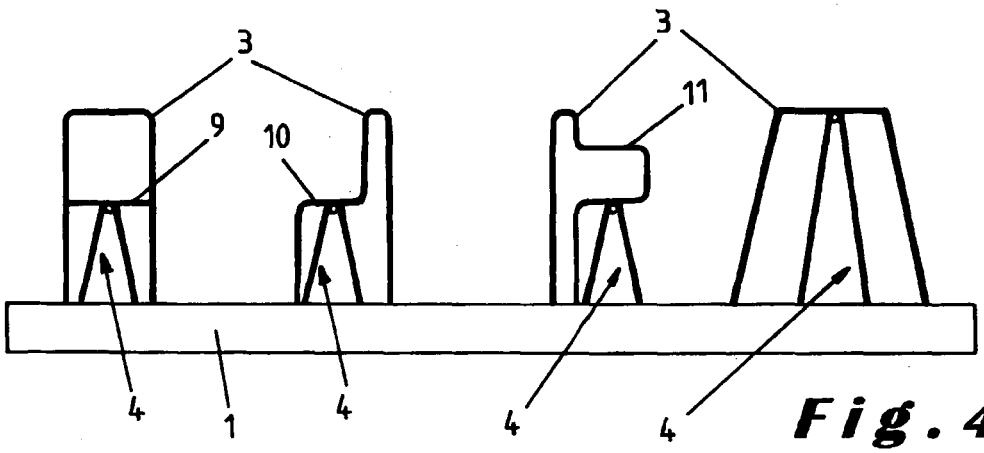

Fig. 4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 87 0002

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.7)
Y	BE 721 625 A (BUYSE) 3 March 1969 (1969-03-03) * page 4, paragraph 6 - page 5, paragraph 2 * * figures 1-4 *	1-3, 11-13	E04B5/38
Y	COMMISSION SCIENTIFIQUE ET TECHNIQUE DU BÂTIMENT: "DÉCISION N 2772: PRÉDALLE VIBRO-BÉTON PRÉBATRA" CAHIERS DU C.S.T.B., no. 99, 1969, pages 1-4, XP002111778 PARIS bladzijde 1, "II. ÉLÉMENTS", alinea 2-3 bladzijde 2-3: figuren	1-3, 11-13	
A	DE 19 51 565 A (KRÜCKL, EISENHANDEL OHG) 22 April 1971 (1971-04-22) * page 6, paragraph 9 - page 9, paragraph 1 * * figures 1-4,7 *	1,3-5,7, 11,15	
A	DE 20 64 462 A (HUBMANN) 20 July 1972 (1972-07-20) * page 1, paragraph 3 * * page 2, paragraph 7 - page 3, paragraph 4 * * figures 1-5 *	1,6,11, 14	TECHNICAL FIELDS SEARCHED (Int.Cl.7) E04B E04C
A	DE 30 37 891 A (FILIGRANBAU ZENTRALE FUER TECH) 13 May 1982 (1982-05-13) * page 7, paragraph 6 - page 8, paragraph 1 * * page 10, paragraph 4 * * figures 1-3 *	1,3	
A	GB 1 424 755 A (VIGAREX ETS) 11 February 1976 (1976-02-11) * claim 1; figures 1-5 *	1	

-/--

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	13 April 2000	Hendrickx, X

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

EPO FORM 1503 03.82 (P04C01)

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 87 0002

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.7)
A	COMMISSION SCIENTIFIQUE ET TECHNIQUE DU BÂTIMENT: "DÉCISION N 1863: PRÉDALLE VIBRO-BÉTON" CAHIERS DU C.S.T.B., no. 67, 1964, pages 1-3, XP002111779 PARIS bladzijde 2: figuren	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	13 April 2000	Hendrickx, X

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 00 87 0002

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.

13-04-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
BE 721625 A	03-03-1969	NONE	
DE 1951565 A	22-04-1971	NONE	
DE 2064462 A	20-07-1972	NONE	
DE 3037891 A	13-05-1982	NONE	
GB 1424755 A	11-02-1976	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82