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(54) **A METHOD FOR ATTACHING A LIFTING ELEMENT TO A CONCRETE BODY**

(57) A method for attaching a lifting element (6) to a concrete body (1, 12), wherein a hole (11) is drilled into the body (1, 12) when it is in a cured phase, after which a fixation part (10) of the lifting element (6) is fixed into said hole (11). The fixation part of the lifting element (6) comprises a self-tapping screw (10) which is screwed into said hole (11).

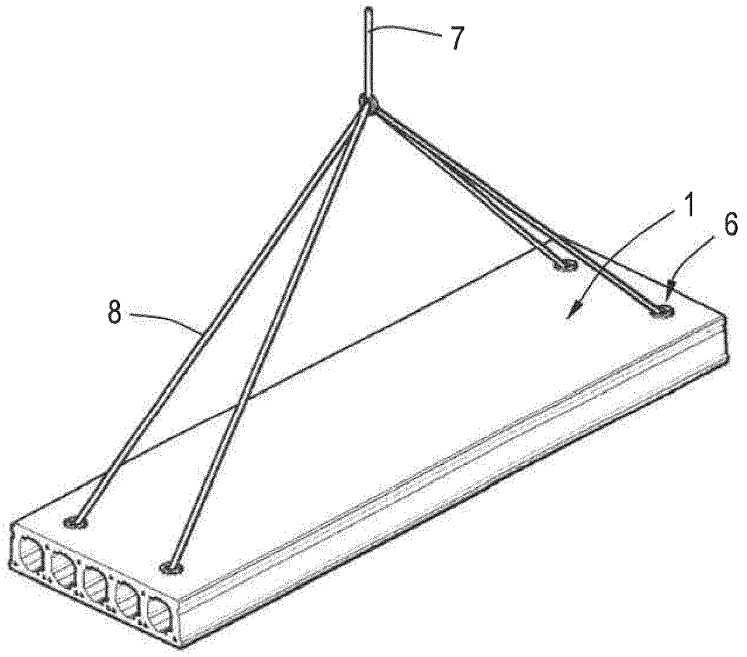

Fig.1

EP 3 103 756 A1

Description

[0001] The present invention relates to a method for attaching a lifting element to a concrete body.

[0002] A known method for attaching a lifting element to a concrete body is installing a lifting loop in a fresh concrete body when the concrete is not cured yet.

[0003] Furthermore, several methods of lifting a concrete body are known. For example, for hoisting conventional hollow-core slabs there are lifting systems which comprise mechanical clamps which support the slab. The clamps fit in recesses at opposite side walls of a hollow-core slab. A hollow-core slab comprises an upper layer and a lower layer, whereas vertical webs connect the upper layer and the lower layer. The vertical webs form walls between open channels or cores which extend in longitudinal direction of the slab. The recesses at opposite side walls for receiving a pair of clamps are mostly located just below the level of the upper layer. It may be clear that the clamping force must be limited in order to avoid damaging the slab upon clamping; on the other hand, the clamping force must provide sufficient hold to the concrete slab. Since this forms a safety risk during hoisting upon transporting and installing hollow-core slabs, safety measures are required in practice. Another disadvantage of the mechanical clamps is their relatively heavy weight and bulky shape.

[0004] As described above, installing lifting loops in fresh concrete bodies is known. For example, in case of a hollow-core slab a part of the fresh slab is broken away at a hollow core and the lifting loop is installed such that it bears against pre-stressing strands of the slab. Particularly, in case of manufacturing a slab by means of a slip form process, it is difficult to incorporate the lifting loops during the manufacturing process and removing fresh concrete appears to be more efficient. It is, however, still undesired that the entire manufacturing process is decelerated by an intermediate step of installing the lifting loops before curing or hardening the concrete slab.

[0005] Furthermore, in case of integrating a lifting element in a concrete body during the manufacturing process before curing the concrete body, it is not possible or at least difficult to check whether the lifting element is secured appropriately in the concrete body.

[0006] The present invention aims to provide a method which simplifies the process of manufacturing and handling concrete bodies.

[0007] For this purpose, a hole is drilled into the concrete body when it is in a cured phase, after which a fixation part of the lifting element is fixed into said hole, wherein the fixation part of the lifting element comprises a self-tapping screw which is screwed into said hole.

[0008] Drilling a hole in a cured body provides a relatively small and well-defined amount of removed concrete, contrary to removal of a relatively large amount of concrete in case of breaking away parts of fresh concrete. This means that after installing the concrete body it is only a drilled hole that has to be filled with concrete afterwards, if the fixation part of the lifting element is to be removed. It is also possible to cover the hole by means of a cap or to leave it open or to leave the lifting element in the concrete body. Another advantage of the method according to the invention is that the moment of installing the lifting element can be chosen arbitrarily, for example directly after hardening the concrete body in a factory or after transport to a site where the body must be installed. Since the fixation part of the lifting element comprises a self-tapping screw which is screwed into the hole, the lifting element can be fixed to the concrete body very quickly. Besides, a splitting force onto the surrounding walls of the hole is limited or negligible, hence minimizing a force onto the concrete in radial direction of the self-tapping screw.

[0009] The lifting element may comprise a ring-shaped portion for receiving a hook of a hoisting device, but alternative shapes are conceivable.

[0010] In a practical embodiment the concrete body is manufactured by means of a slip form process or an extrusion process. In particular for this type of manufacturing concrete bodies it is advantageous to fix the lifting element to the body afterwards in order to minimize disturbances of the manufacturing process.

[0011] The centreline of the hole may be angled with respect to an upper face of the concrete body. In that case a hoisting cable may be engaged to the lifting element such that the hoisting cable extends vertically above the body, but the lifting element exerts a lateral force on the wall of the hole. This means that it becomes more difficult to pull the lifting element out of the hole, which may be advantageous if the fixation part comprises a self-tapping screw, for example.

[0012] In case of a hollow-core slab the hole may at least partly be drilled into a web between two adjacent hollow cores of the slab.

[0013] The hole and the lifting element may be adapted such that the lifting element is located below an upper surface of the concrete body adjacent to the lifting element. In this case the lifting element does not project from the concrete body and may be left in the concrete body after installation thereof.

[0014] In an alternative embodiment a hole is drilled into the concrete body when it is in a cured phase, after which a fixation part of the lifting element is fixed into said hole, wherein the concrete body comprises a hollow-core slab, which is manufactured by means of a slip form process or an extrusion process.

[0015] The invention is also related to a method for lifting a concrete body comprising a lifting element which is attached thereto by a method as described hereinbefore, wherein a hoisting cable is connected to the lifting element.

[0016] Alternatively, at least two lifting elements may be attached to the concrete body, wherein said lifting elements are located at a horizontal distance from each other and wherein hoisting cables are connected to the lifting elements such that resultant upward forces on the

lifting elements are angled with respect to the respective centrelines of the holes.

[0017] In case of vertical holes in a planar concrete body the resultant lifting forces extend obliquely with respect to the plane of the body.

[0018] The invention will hereafter be elucidated with reference to the schematic drawings showing embodiments of the invention by way of example.

Fig. 1 is a perspective view of a hollow-core concrete slab in which lifting elements are attached by means of an embodiment of a method according to the invention.

Fig. 2 is a similar view as Fig. 1, but showing a different concrete body.

Fig. 3 is an enlarged cross-sectional view of the concrete body according to Fig. 2, showing a number of possible lifting elements.

Figs 4 and 5 are similar views as Fig. 3, but related to the embodiment of Fig. 1.

[0019] Fig. 1 shows a concrete body in the form of a hollow-core concrete slab 1 which is manufactured by means of a slip form process. Figs. 4 and 5 show that the slab 1 comprises an upper layer 2 and a lower layer 3. The upper layer 2 and the lower layer 3 are connected to each other via vertical webs 4 which extend in longitudinal direction, hence forming elongate cavities between the webs 4. Furthermore, the slab 1 comprises pre-stressing strands 5, which extend in longitudinal direction of the slab 1.

[0020] Fig. 1 shows that the slab 1 is lifted at four lifting elements 6, but a higher number of lifting elements 6 per slab 1 is conceivable. The lifting elements 6 are connected to a central hoisting cable 7 through four intermediate hoisting cables 8. The cables 7, 8 may be ropes, steel cables, chains or the like.

[0021] Fig. 4 shows more than two lifting elements 6 at a cross-section of the slab 1, but this is only for illustrative reasons. The lifting elements 6 have different dimensions and shapes and different orientations with respect to the slab 1. In Fig. 4 three of the five lifting elements have a lifting ring 9 and a self-tapping screw 10, which forms a fixation part of the lifting element 6. The lifting ring 9 and self-tapping screw 10 may be made of one piece, but alternatively they may be separate parts. The other two lifting elements 6 as shown in Fig. 4 have respective lifting heads 9', instead of lifting rings. The lifting elements 6 including lifting heads 9' are not entirely screwed into the slab 1 in order to leave room between the lifting heads 9' and the upper surface of the slab 1 in order to allow to receive a hoisting hook between the respective lifting heads 9' and the upper surface of the slab 1. One of the lifting heads 9' is received in a recess in the upper surface of the slab 1; this is also conceivable in case of a lifting ring 9.

[0022] After installing the slab 1 the lifting element 6 can be left in the slab 1 and possibly covered by a cap. In Fig. 5 the left lifting element 6 has a lifting ring 9 and the right lifting element 6 has a planar lifting head 9'. Figs. 4 and 5 show holes 11 at the locations of the respective lifting elements 6. The holes 11 are drilled into the slab 1 when it is in a cured phase. This means that the concrete of the slab 1 is already hardened such that the moment of drilling the holes 11 can be selected after the slip form process whenever it suits.

[0023] After drilling the holes 11 the lifting elements 6 are mounted to the slab 1 by screwing their self-tapping screws 10 into the respective holes 11. The self-tapping screws 10 tap cooperating threads into the cured concrete of the slab 1.

[0024] Fig. 5 shows that in this case the centrelines of the holes 11 are substantially perpendicular to the plane of the slab 1, i.e. substantially vertical in case of considering the plane of the slab 1 horizontally. As illustrated in Fig. 1 the intermediate hoisting cables 8 are angled with respect to the plane of the slab 1, which means that the resultant forces on the respective lifting elements 6 are angled with respect to the centrelines of the respective holes 11. As a consequence, the lifting elements 6 also exert lateral forces onto the slab 1, which provides increased resistance against pulling out the lifting elements 6 from the slab 1. Alternatively, it is possible that the intermediate hoisting cables 8 extend vertically from the lifting rings 9 of the lifting elements 6, but the self-tapping screws 10 and the corresponding holes 11 are angled with respect to the plane of the slab 1, for example as shown by the second lifting element 6 from the left in Fig. 4.

[0025] Figs. 2 and 3 shows an alternative concrete body 12 which has the same outer shape and dimensions as the hollow-core slab 1 as shown in Figs. 1, 4 and 5. The concrete body 12 is not provided with elongate hollow cores. The lifting elements 6 may have similar dimensions and shapes and orientations with respect to the concrete body 12 as in case of the hollow-core slab 1.

[0026] The invention is not limited to the embodiments as shown in the drawings and described hereinbefore, which may be varied in different manners within the scope of the claims and their technical equivalents. It is conceivable that the fixation part of the lifting element is in the form of an alternative clamping system rather than a self-tapping screw.

Claims

1. A method for attaching a lifting element (6) to a concrete body (1, 12), **characterized in that** a hole (11) is drilled into the body (1, 12) when it is in a cured phase, after which a fixation part (10) of the lifting element (6) is fixed into said hole (11), wherein the fixation part of the lifting element (6) comprises a self-tapping screw (10) which is screwed into said hole (11).

2. A method according to claim 1, wherein the body (1, 12) is manufactured by means of a slip form process or extrusion process.

3. A method according to claim 1 or 2, wherein the concrete body comprises a hollow-core slab (1).

4. A method according to one of the preceding claims, wherein the centreline of the hole (11) is angled with respect to an upper face of the concrete body (1, 12).

5. A method according to claim 3, wherein the hole (11) is at least partly drilled into a web (4) between two adjacent hollow cores of the slab (1).

6. A method according to one of the preceding claims, wherein the lifting element (6) comprises a ring-shaped portion (9) for receiving a hook of a hoisting device.

7. A method according to one of the preceding claims, wherein the hole (11) and the lifting element (6) are adapted such that the lifting element (6) is located below an upper surface of the concrete body (1, 12) adjacent to the lifting element (6).

8. A method for attaching a lifting element (6) to a concrete body (1, 12), **characterized in that** a hole (11) is drilled into the body (1, 12) when it is in a cured phase, after which a fixation part (10) of the lifting element (6) is fixed into said hole (11), wherein the concrete body comprises a hollow-core slab (1) which is manufactured by means of a slip form process or an extrusion process.

9. A method for lifting a concrete body (1, 12) comprising a lifting element (6) which is attached thereto by a method according to one of the preceding claims, wherein a hoisting cable (8) is connected to the lifting element (6).

10. A method for lifting a concrete body (1, 12) comprising at least two lifting elements (6) which are attached thereto by a method according to one of the claims 1-8, wherein said lifting elements (9) are located at a horizontal distance from each other and wherein hoisting cables (8) are connected to the lifting elements (6) such that resultant upward forces on the lifting elements (6) are angled with respect to the respective centre lines of the holes (11).

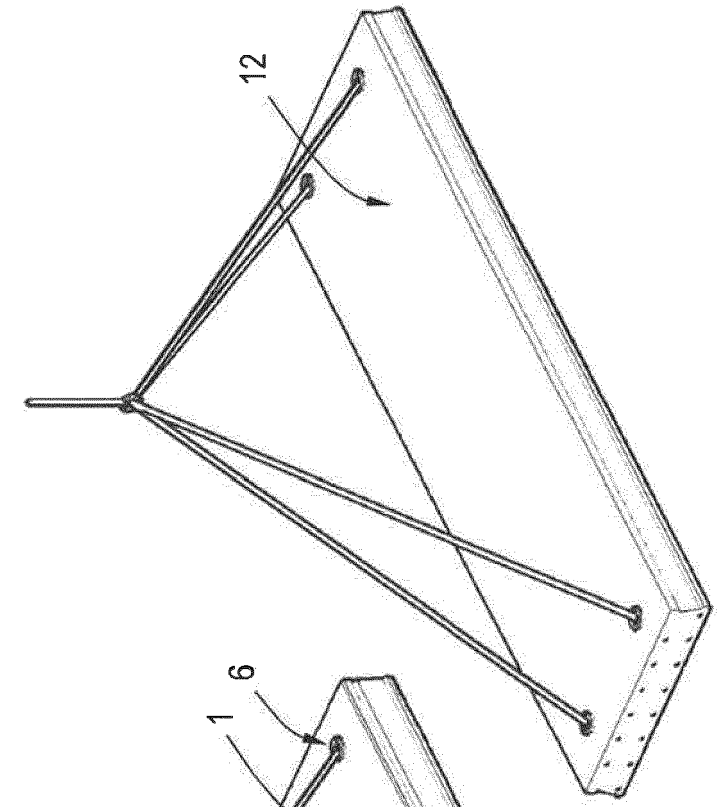

Fig.2

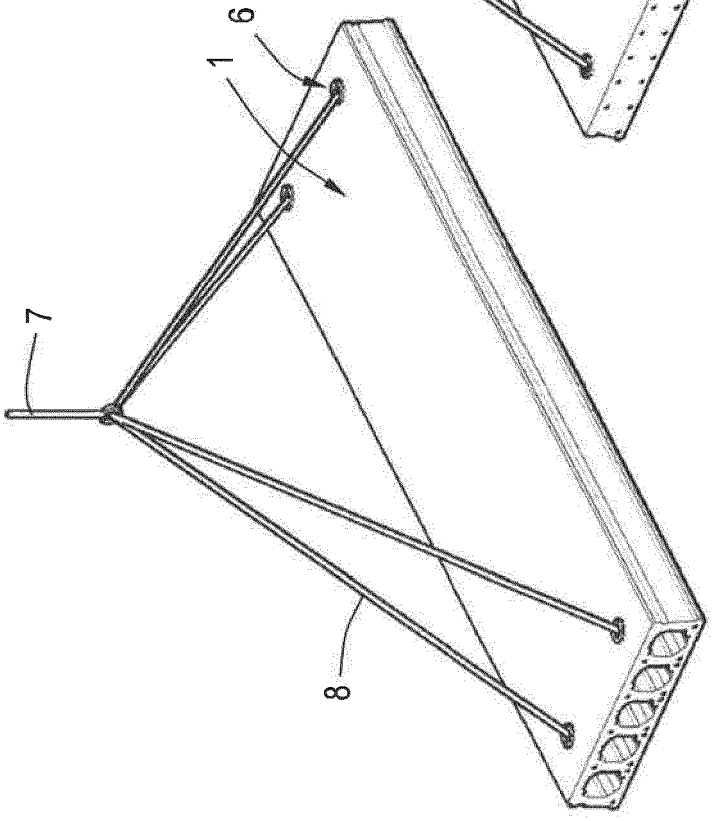

Fig.1

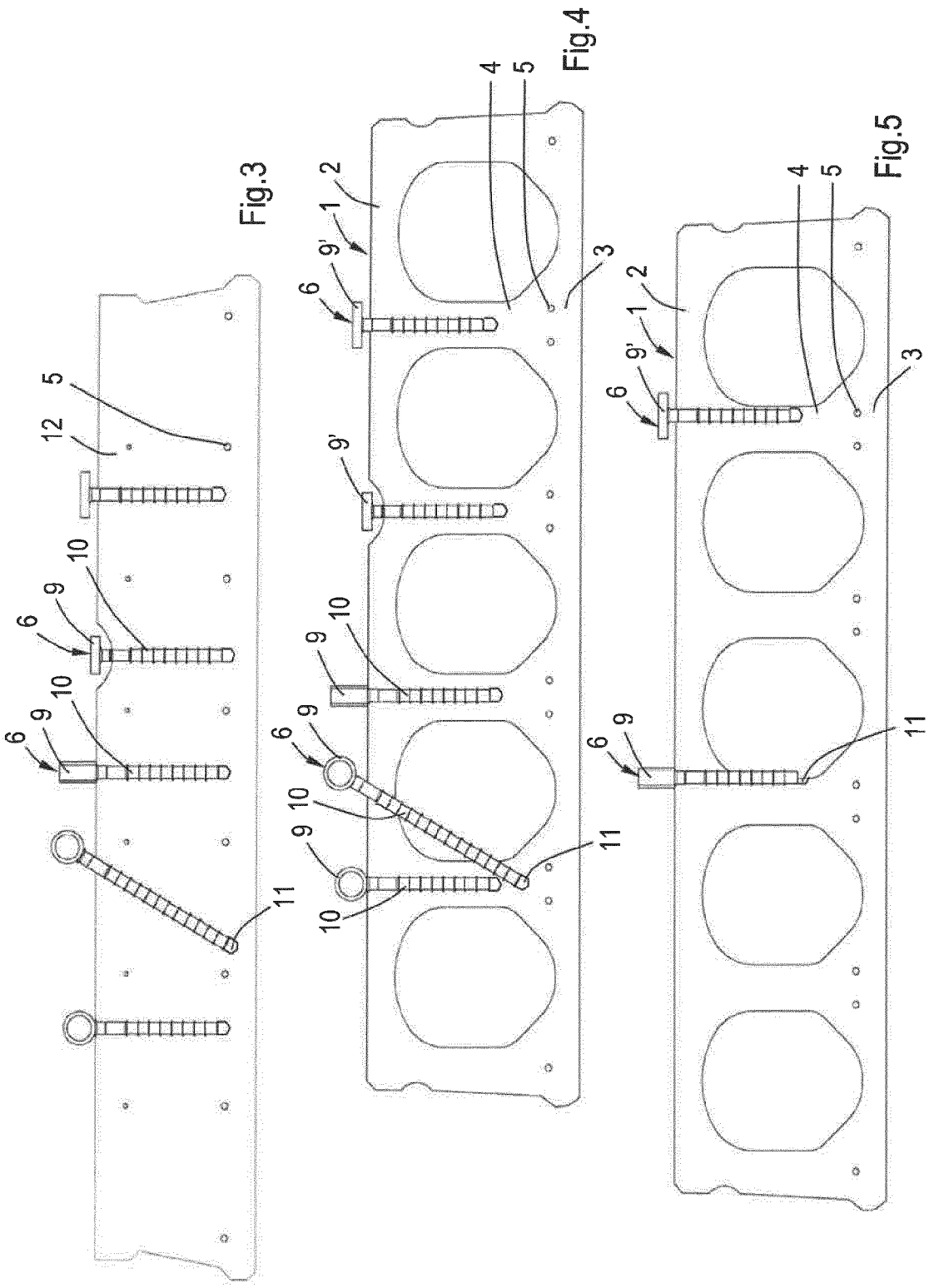
Fig.3
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Fig.5
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EUROPEAN SEARCH REPORT

Application Number
EP 15 17 0964

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2012/306226 A1 (ALBA TONY J [US]) 6 December 2012 (2012-12-06)	1,4-6,9	INV. B66C1/66
Y	* paragraphs [0002], [0024] - [0039] * * figures 1, 2, 5-7, 11, 12 *	2,3	E04G21/14
X	DE 100 08 342 A1 (WAKAI SANGYO KK [JP]) 30 August 2001 (2001-08-30) * abstract * * columns 1-3 * * figures 1-6 *	1,4,7	
X	FR 2 712 268 A1 (RECTOR SA [FR]) 19 May 1995 (1995-05-19)	8-10	
Y	* abstract * * page 4 - page 6 * * figures 1-3 *	2,3	

TECHNICAL FIELDS SEARCHED (IPC)

B66C
E04B
E04G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	18 September 2015	Dijoux, Adrien

CATEGORY OF CITED DOCUMENTS

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18-09-2015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2012306226 A1	06-12-2012	NONE	
DE 10008342 A1	30-08-2001	NONE	
FR 2712268 A1	19-05-1995	NONE	

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