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

(11) EP 2 644 803 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
02.10.2013 Bulletin 2013/40

(51) Int Cl.:
E04G 21/14 *(2006.01)*

(21) Application number: **13158500.2**

(22) Date of filing: **11.03.2013**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **27.03.2012 FI 20125342**

(71) Applicant: **Elematic Oy Ab**
37801 Toijala (FI)

(72) Inventor: **Korkiamäki, Pekka**
37800 Toijala (FI)

(74) Representative: **Berggren Oy Ab**
P.O. Box 16
Antinkatu 3 C
00101 Helsinki (FI)

(54) Method for bracing a concrete element lifting loop, and support piece for a concrete element lifting loop

(57) A method for bracing a lifting loop (3, 13) for a concrete element (2, 12) at least during a concrete element lifting operation effected by using the lifting loop, whereby the lifting loop is at least partially located inside a recess prepared on a surface of the concrete element, in which method at least forces, which are longitudinal relative to a concrete element to be lifted and which are applied to the lifting loop, are conveyed to the concrete element to be lifted by means of a support piece (1, 11) to be set at least partially in said concrete element's recess prepared in association with the lifting loop. The invention relates also to such a lifting loop support piece.

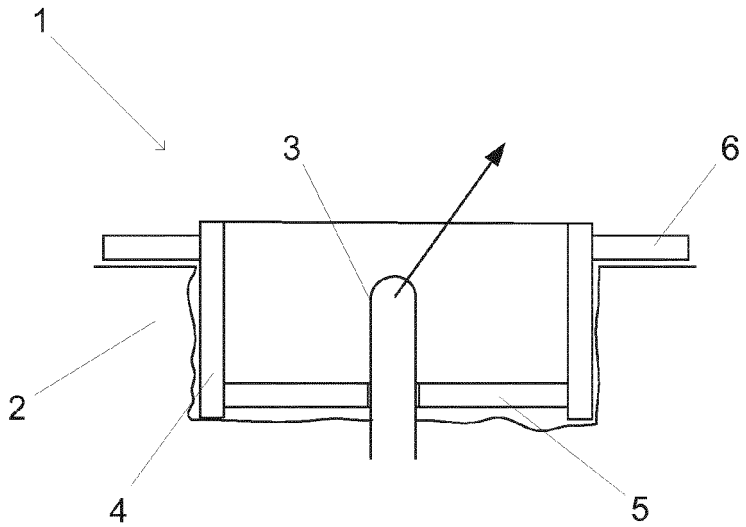

FIG. 1A

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Description

[0001] The invention relates to the bracing of lifting loops of a concrete element, such as a slipformed hollow core or massive slab, as the concrete element is being lifted. More specifically, the invention relates to a method for bracing a lifting loop at least during a concrete element lifting operation, and to a support piece for use in association with a concrete element lifting loop at least during a lifting operation.

[0002] Concrete elements are supplemented during the fabrication thereof typically with various lifting loops, said lifting loops having crane hooks secured therein for lifting the concrete elements. These lifting loops enable the crane-effected lifting and placement of heavy concrete elements to proceed in a speedier, more convenient, and safer fashion.

[0003] The lifting loops for slipformed slabs, particularly in the case of hollow core slabs, are typically attached to the slab after the slipforming prior to the curing of concrete mix.

[0004] In hollow core slabs, the lifting loop is typically installed by breaking the top surface of a fresh hollow core slab either in line with a cavity or in line with a neck between the cavities, and by placing a lifting loop-forming part in the thus obtained recess. In order to ensure the attachment of a lifting loop, the lifting loop-forming part can be set to bear against the pre-stressing strands of a hollow core slab, for example by placing the lifting loop-forming part's end sections under the hollow core slab's pre-stressing strands.

[0005] The lifting loop-forming part is generally formed from a metal bar bent to suitable form, which form comprises a lifting loop forming portion and end portions to be set inside the slab in concrete, and possibly under the pre-stressing strands of a slipform-cast concrete slab.

[0006] Lifting loops are also generally set in slipformed slabs in such a way that the highest point of a lifting loop becomes substantially flush with the slab's top surface having a recess prepared around the lifting loop for enabling the attachment of lifting hooks to the lifting loop. When a lifting loop is located in such a recess, it is not be necessary to separately remove the lifting loop from the slab after the lifting and placement of the slab as an unbroken and smooth top surface for the slab is readily established by filling the lifting loop recess for example with mortar or some other appropriate leveling compound.

[0007] In the case of hollow core slabs, into an opening broken in the hollow core slabs' top surface during the installation of a lifting loop, around the lifting loop, is inserted a typically plastic cup-shaped component in order to prevent the leveling compound from spreading into the cavities of a hollow core slab in the process of finishing the top surface smoothness after the hollow core slab has been installed in place.

[0008] Lifting loops have been typically placed on the top surface of slipformed slabs, such that on each end zone of a slab have been mounted two lifting loops side by side. In this case, the lifting of slabs is performed by means of a lifting boom for enabling the elimination of excessive oblique loads on the lifting loops. Excessive oblique loads may lead to the lifting loop-forming part changing its position in a slab to be lifted, and thereby to the deterioration of their attachment, which in the worst case scenario results in a disengagement of the lifting loop from the slab during a lifting operation, and hence in a disintegration of the slab to be lifted and in possible personal injuries on the construction site.

[0009] In a solution according to the present invention, into a recess prepared for a lifting loop in a slipform-cast concrete element, in the vicinity of a lifting loop, is inserted a support piece, which support piece is used for bracing the lifting loop in a concrete element, at least in a longitudinal direction of the concrete element. Thus, at least those forces, which are lengthwise of the concrete element and which are applied to the lifting loop in a concrete element lifting operation, can be successfully conveyed from the lifting loop to the concrete element to be lifted. In this case, the lifting of a concrete element can be carried out without a lifting boom, thus facilitating and expediting the handling and placement of concrete elements by lifting, particularly on a construction site.

[0010] In the present invention the lifting loop, or the part forming the lifting loop, is formed from a metal bar by bending the metal bar to a suitable shape. These type of lifting loop-forming parts are known from publications EP 1 878 854 and WO 2008/025894, for example.

[0011] In a solution of the invention, the support piece for a lifting loop is preferably constructed in such a way that also some of the forces, which deviate from the longitudinal direction of a concrete element and which are applied to the lifting loop in a concrete element lifting operation, are conveyed thereby to the concrete element.

[0012] In a solution of the invention, the support piece for a lifting loop is preferably constructed in such a way that it clamps in place once a lifting hook has been inserted inside the lifting loop. Hence, the lifting hook keeps the lifting loop support piece stationary during a lifting operation, at which time the forces applied to the support piece are at their maximum. Thereby, a dislodgement of the support piece as a result of forces applied thereto can be prevented in a lifting operation.

[0013] In a solution of the invention, the support piece for a lifting loop is preferably a separate element, which is placed in a concrete element lifting loop recess to brace the lifting loop prior to a concrete element lifting operation, and the support piece is removed from the concrete element after the lifting operation. Thus, the support piece can be preferably integrated as a piece of the lifting equipment used in concrete element lifting, especially by placing the support piece in association with a lifting hook used in the lifting operation.

[0014] The support piece for use in a solution of the invention is particularly useful in the process of lifting massive or hollow core slabs.

[0015] The support piece according to the invention for a concrete element lifting loop comprises a section setting against a side wall of the recess prepared around the concrete element lifting loop, and a section which connects the said section setting against recess side wall and the outer surface of the lifting loop for conveying from the lifting loop to the concrete element at least forces which are lengthwise of the concrete element and applied to the lifting loop in a lifting operation.

[0016] The support piece of the invention comprises, preferably at an upper edge of the section of the support piece setting against a side wall of the recess, a section setting against an outer surface of a concrete product, i.e. a section setting against a surface surrounding the recess for the concrete product lifting loop. This section, which sets against the outer surface of a concrete product, improves a bracing action of the support piece, as well as immobility of the support piece.

[0017] The support piece of the invention is preferably constructed in such a way that the section, which connects the section setting against a side wall of the concrete element's recess and an outer surface of the lifting loop, has the length of its cross-section matching substantially the diameter of the concrete element's recess, this connecting section having an opening, the width of which opening matches substantially the width of the lifting loop. In addition, the discussed opening has a length which may preferably match the respective dimension of a lifting loop to be placed in the opening.

[0018] More specifically, the features distinguishing a method of the invention are presented in claim 1, and the features distinguishing a support piece of the invention are presented in claim 7.

[0019] The invention will now be described more precisely by way of example with reference to the accompanying figures, in which

figs. 1A and 1B show schematically one solution of the invention set in association with a concrete element lifting loop, and

figs. 2A and 2B show schematically one optional solution of the invention set in association with a concrete element lifting loop.

[0020] Figs. 1A and 1B illustrate schematically one support piece 1 of the invention set in association with a lifting loop 3 for a concrete element, which in this case is a hollow core slab 2. Fig. 1A shows the support piece 1 in cross-section, and fig. 1B shows the support piece in a plan view.

[0021] The support piece 1 consists of a section 4 setting against a side surface of an opening or recess prepared in the hollow core slab 2, a section 5 connecting the section 4 setting against the recess' side surface and an outer surface of the lifting loop 3, and a section 6 setting against a top surface of the hollow core slab 2.

[0022] In the embodiment of figs. 1A and 1B, the support piece 1 has its section 4 in a substantially cylindrical shape, which is covered by the bottom-mounted section 5, said section 5 being formed with a cut or opening, in which the lifting loop 3, as shown in the figure, sets at least in a longitudinal direction of the hollow core slab with substantially tightly. The section 6, which is attached to an upper edge of the section 4 of the support piece 1, is in this case a flange type extension circling the section 4 along its upper edge.

[0023] When lifting the hollow core slab 2 by the lifting loop 3, said lifting loop is subjected to an oblique stress in the direction indicated by an arrow in fig. 1A. In this case, the lifting loop 3 bears against the section 5 of the support piece 1, said section 5 transferring the stress to the walls of the hollow core slab's 2 recess via the section 4. Hence, the oblique stress, inflicted on the lifting loop 3 by lifting the hollow core slab 2, is not allowed to bend the entire lifting loop-forming part as the lifting loop's portion remaining outside the support piece only bears a substantially vertical component of the lifting stress. Thus, a hollow core slab fitted with lifting loops of the invention can be lifted without a separate lifting boom.

[0024] The support piece 1 is preferably made of metal, such as for example sheet steel, and it preferably constitutes a piece of lifting equipment attachable to the lifting loop 3. This being the case, the support piece 1 is preferably not part of a lifting loop assembly fixed to the hollow core slab 2.

[0025] Regarding the embodiment shown in figs. 1A and 1B, it should be noted that the section 4, which sets against the side surface of a hollow core slab's recess, need not necessarily extend all the way to the bottom of a formed recess, and the section 5, which connects the lifting loop 3 and the section 4, need not necessarily be located on the bottom of a recess. In a solution of the invention, just the distance of the section 5 from an upper surface of the lifting loop 3 is required to be such that a lifting hook to be placed in a lifting loop can be fitted in its position in the lifting loop 3. Thereby, the lifting hook clamps the support piece 1 in its position and prevents its displacement from the hollow core slab's recess in response to forces applied to the support piece during a lifting operation.

[0026] Figs. 2A and 2B illustrate schematically one optional support piece 11 of the invention set in association with a lifting loop 13 for a concrete element, which is in this case is a hollow core slab 12. Fig. 2A shows the support piece 11 in cross-section, and fig. 2B shows the support piece in a plan view.

[0027] In this embodiment, the support piece 11 consists of a section 14 setting against just a portion of the side surface of an opening or recess prepared in the hollow core slab 12, a section 15 connecting the section 14 and an outer surface of the lifting loop 13, and a section 16 setting against a top surface of the hollow core slab 12 over an extent of the section 14.

[0028] The thus constructed support piece 11 supports the lifting loop 13 in a lifting operation of the hollow core

slab 12 preferably for example only in a longitudinal direction of the hollow core slab, the sections 14 and 16 being located towards the longitudinally central region of a hollow core slab. The component forces in substantially other directions inflicted on the lifting loop 11 by a lifting operation of the hollow core slab 12 are borne by the structure of the lifting loop 11.

[0029] In comparison to the embodiment of figs. 1A and 1B, the embodiment of figs. 2A and 2B enables providing a support piece in more stripped construction, which reduces manufacturing and material costs, yet it is sufficient for supporting the lifting loop in the most essential bending stress direction,

[0030] With regard to the foregoing examples, it is obvious that these are subject to a multitude of modifications and variations within the scope of the invention, as evident for a person skilled in the art. Therefore, the foregoing embodiments of the invention are by no means limitative regarding the invention, but the scope of protection for the invention is solely defined in accordance with the appended claims.

Claims

1. A method for bracing a lifting loop (3, 13) of a slipform-cast concrete element (2, 12) at least during a concrete element lifting operation effected by using the lifting loop, whereby the lifting loop is formed from a metal bar and is at least partially located inside a recess prepared on a surface of the concrete element, in which method at least forces, which are longitudinal relative to a concrete element to be lifted and which are applied to the lifting loop, are conveyed to the concrete element to be lifted by means of a support piece (1, 11) to be set at least partially in said concrete element's recess formed in association with the lifting loop.

2. A method according to claim 1, in which method also forces, which deviate from a longitudinal direction of the concrete element and which are applied to the lifting loop (3), are conveyed via the support piece (1) to the concrete element to be lifted (2).

3. A method according to claim 1 or 2, in which method said support piece (1, 11) is a separate element, which is placed, prior to a concrete element lifting operation, in association with said recess of the concrete element (2, 12) and the lifting loop (3, 13) located in the recess, and which support piece is removed from the concrete element after the lifting operation.

4. A method according to any of claims 1-3, in which method said support piece (1, 11) is fitted in association with a lifting hook to be secured in the lifting loop (3, 13).

5. A method according to any of claims 1-4, in which method the support piece (1, 11) is clamped in position by placing a lifting hook in the lifting loop (3, 13) braced by the support piece.

6. A method according to any of claims 1-5, wherein the slipform-cast concrete element is a massive or hollow core slab (2, 12).

7. A support piece (1, 11) for a lifting loop (3, 13) formed from a metal bar and located in a slipfom-cast concrete element (2, 12), said support piece comprising a section (4, 14) setting against a wall of a recess prepared in association with a concrete element lifting loop, and a section (5, 15) connecting the section setting against said recess' wall and an outer surface of the lifting loop for conveying from the lifting loop to the concrete element at least forces, which are applied to the lifting loop in a concrete element lifting operation and which are longitudinal relative to the concrete element.

8. A support piece (1, 11) according to claim 7, said support piece comprising, at an upper edge of said section (14) setting against the wall of said recess, a section (6, 16) setting against a top surface of the concrete product (2, 12).

9. A support piece (1, 11) according to claim 7 or 8, said support piece having been fitted in association with a lifting hook to be used in a lifting operation of the concrete element (2, 12).

10. A support piece (1, 11) according to any of claims 7-9, wherein the section (5, 15), which connects the section (4, 14) setting against a wall of the concrete element's (2, 12) recess and an outer surface of the lifting loop (3, 13), has the length of its cross-section matching substantially the diameter of the concrete element's recess, this connecting section (5, 15) having an opening, the width of which opening matches substantially the width of the lifting loop.

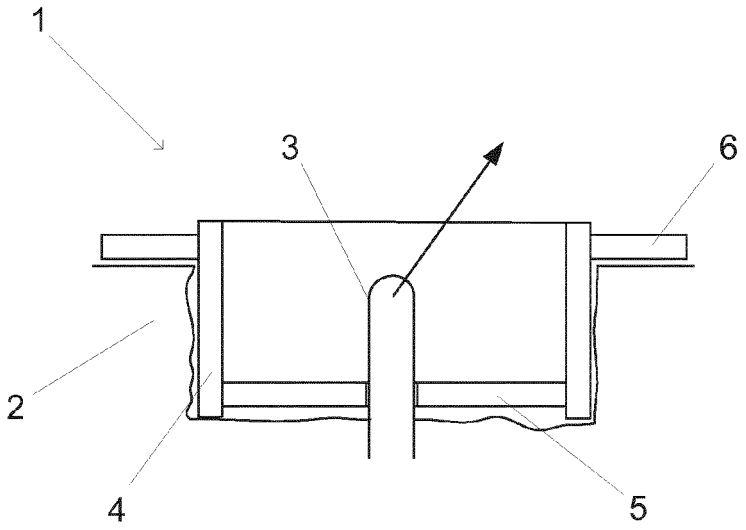

FIG. 1A

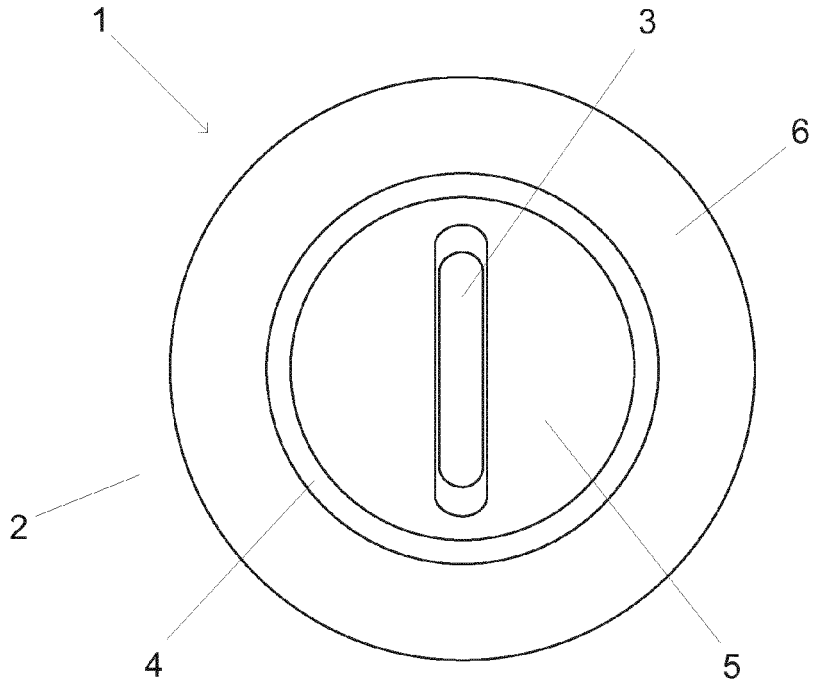

FIG. 1B

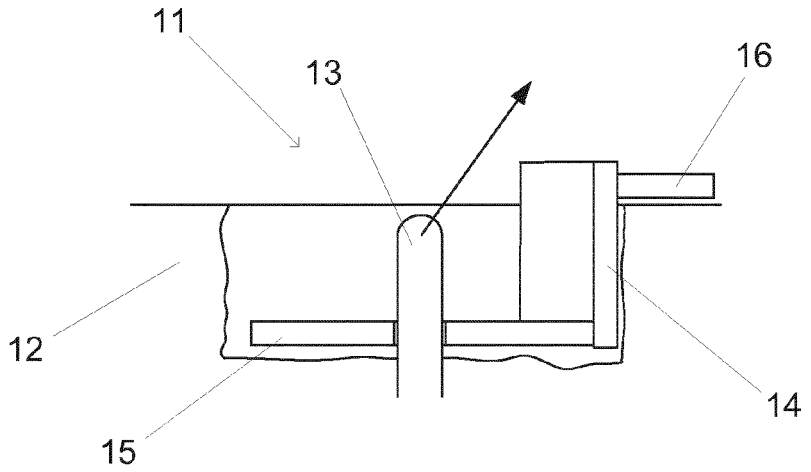

FIG. 2A

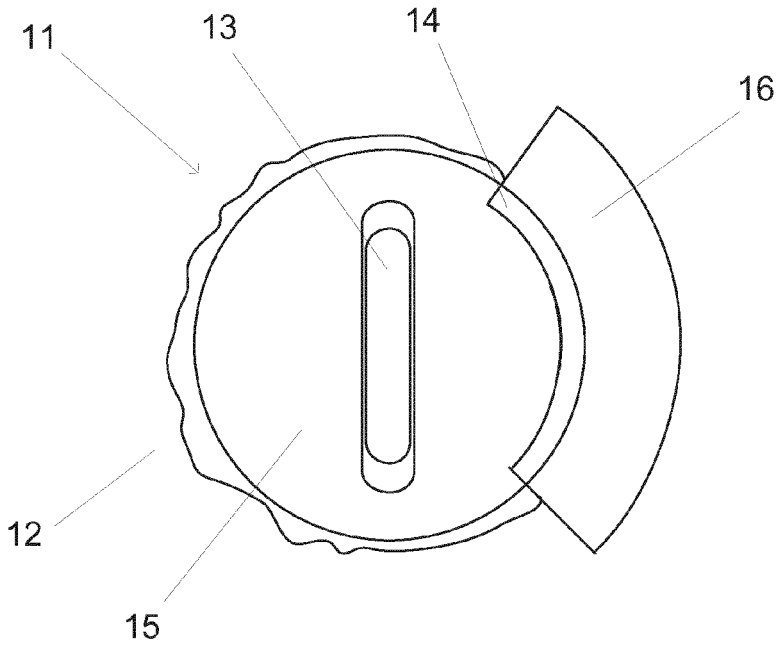

FIG. 2B

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1878854 A **[0010]**
- WO 2008025894 A **[0010]**