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(54) **Method for providing a hoisting hook in a prefabricated concrete element such as a hollow-core slab floor**

(57) A method for fitting a hoisting hook in a prefabricated concrete element which includes at least one channel (3) extending substantially parallel to a surface (2) of the concrete element, the method comprising:

- placing an uncured concrete-like material (5) via a passage to the channel, in a part of the channel (3)

- located at least near the passage;
- placing the hoisting anchor (25) in the uncured concrete-like (5) material, characterized in that the method further comprises
- dosing the uncured concrete-like (5) material in a predetermined amount.

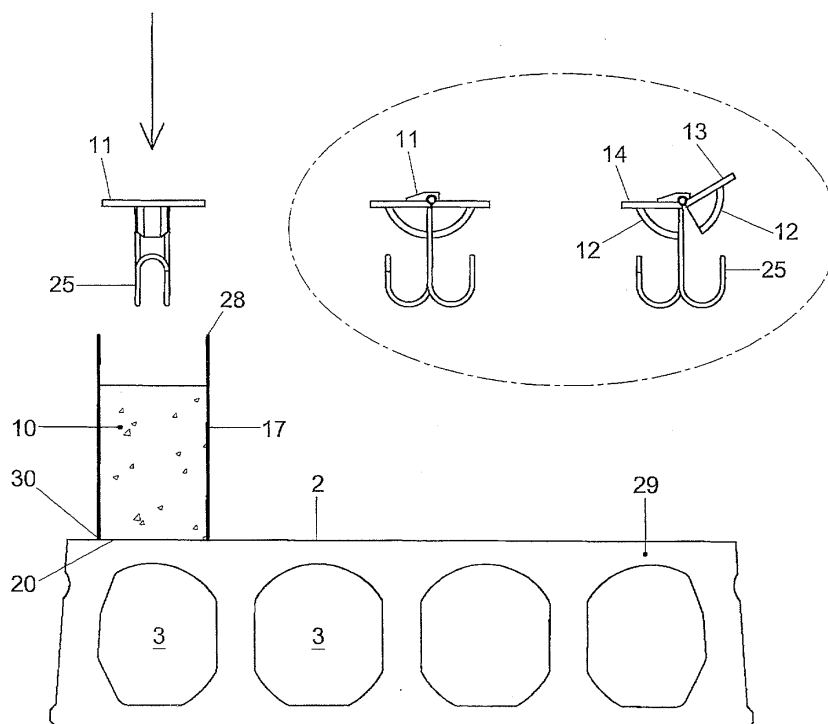


Fig. 1b

Description

[0001] The invention relates to a method for fitting a hoisting hook in a prefabricated concrete element which includes at least one channel extending substantially parallel to a surface of the concrete element, the method comprising:

- placing an uncured concrete-like material, via a passage to the channel, in a part of the channel located at least near the passage;
- placing the hoisting anchor in the uncured concrete-like material.

[0002] It is noted that the at least one channel extending substantially parallel to a concrete surface is provided in the element during the forming of the concrete element. In other words, no material needs to be removed from the concrete element for the purpose of forming such a channel.

[0003] Such a method is known from practice.

[0004] The known method is used to enable for instance a so-called hollow-core slab floor to be displaced with a hoisting device. Such hollow-core slab floors are frequently used in house and utility building. Also to be considered in this connection is a concrete element in the form of a so-called wing slab floor such as it is described, for instance, in EP 0 825 307. Especially in hollow-core slab floors and in a concrete element formed as a wing slab floor having width dimensions that deviate from standard width dimensions, hoisting hooks are fitted according to the known method for the purpose of displacement and stacking in the factory. To that end, especially in the case of non-standardized slabs, as a rule shortly after the forming of the concrete slab, locally openings are made in the still fresh concrete of one of the surfaces for forming the passage to one or more of the channels. Next, via the passage, in the part of the channel located adjacent the passage, a concrete-like material having a particular flowability is poured or pressed. The hoisting hook is placed in this uncured concrete-like material. These activities are performed manually and so are not sufficiently reproducible.

[0005] A problem here is that each time after fitting a hoisting hook, it is difficult to establish to what extent the anchorage of the hoisting hook meets stated safety requirements. As a result, the slabs may only be lifted to a height such that it is clear that no one could find himself under the slab. Before such a hollow-core slab floor or different concrete element may be delivered at the site where the slab is to be assembled, it is required, according to regulations, that measures be taken to make impermissible and hazardous use of the hoisting hook during assembly impossible. This is typically done by grinding off the parts of the hoisting hook that project outside the surfaces.

[0006] An object of the invention is to provide a method for fitting a hoisting hook in a concrete element with

channels, such that the hoisting hook is anchorable in the concrete element in a manner which is safer and more reproducible compared with the known method.

[0007] The stated object has been achieved with the method according to the invention, which is characterized in that the method further comprises the dosing of the uncured concrete-like material in a predetermined amount.

[0008] It can be determined beforehand what amount of uncured concrete-like material is necessary to obtain an anchorage of the hoisting hook that meets safety requirements. This determination may have been done on the basis of previously performed tests with such combinations of, for instance, a hollow-core slab floor, a hoisting hook and an amount of concrete-like material for anchoring the hoisting hook. By dosing, that is, supplying the uncured concrete-like material in a predetermined amount, it is possible, for instance on the basis of the previously performed tests, to readily determine in advance whether the hoisting hook is anchorable according to the safety requirements imposed. Moreover, at least a considerable part of the method is highly reproducible.

[0009] A further embodiment of a method according to the invention is characterized in that dosing comprises: filling a reservoir with the predetermined amount of uncured concrete-like material and completely emptying the reservoir.

[0010] This provides the possibility of a simple check. For if the reservoir is empty, sufficient uncured concrete-like material will have been supplied for a safe anchorage of the hoisting hook. Preferably, dosing is done in an automated manner, so that a natural variation in the amount of uncured concrete-like material that accompanies human action is precluded. Dosing can be done, for instance, with the aid of a conveyor screw. Automation moreover enhances the reproducibility and hence the reliability of the method.

[0011] A particular embodiment of the method according to the invention is characterized in that the method comprises: checking the complete emptying of the reservoir.

[0012] This makes it possible to make sure that the uncured concrete-like material has been supplied completely and hence can end up in a part of the channel located at least near the passage. This means that the anchorage can meet the safety requirements imposed. An anchorage that meets the safety standards generally provides the advantage that the hoisting hook may also be used in the assembly and hence it is not necessary anymore, to prevent impermissible and hazardous use of the hoisting hook, to grind off the hoisting hook before it is transported from the factory to the site of assembly. When the anchorage of the hoisting hooks meets the safety requirements, the current use of hoisting clamps in general, and in particular the necessity for special hoisting means and hoisting methods for slabs deviating from, for instance, the standard width dimensions, has

become redundant. Also the use of safety chains, to be fitted under the slabs and the safety clamps, can be dispensed with. This provides as an important advantage that the assembly operations can take place more readily and faster. An anchorage that meets the safety requirements imposed moreover makes it possible to use it for constructional purposes as well. To be considered here is the constructional jointing of construction parts, fixing temporary shores and safety provisions and for fixing so-called life lines of executive personnel at the moment when other provisions are still lacking.

[0013] Preferably, the check of the complete evacuation of the reservoir takes place automatically. Thus, for instance, the reservoir may be weighed electronically. If the weight as determined after the evacuation of the reservoir is higher than the weight of the reservoir itself, it will be clear that the reservoir is not completely empty. In that case, the weighing device can produce a signal to indicate that the reservoir is not completely empty. Thereupon, measures can be taken that are aimed at preventing an unchanged progress of the fitting of the hoisting hook in the concrete element.

[0014] In a further elaboration, accordingly, the method further comprises: automatically interrupting the placement, via the passage, of the concrete-like material and/or the placement of the hoisting anchor if the reservoir has not been evacuated completely. This provides the possibility of preventing a deficit of uncured concrete-like material being used for anchoring the hoisting anchor.

[0015] Such an embodiment comprises in particular: if necessary, supplementing an amount of concrete-like material already evacuated from the reservoir with concrete-like material left behind in the reservoir, for enabling the predetermined amount of the concrete-like material to be placed via the passage to the channel in the part of the channel located closed to the passage.

[0016] A method according to this embodiment leads to a guarantee with regard to, for instance, the amount of uncured concrete-like material that is received in a channel of, for instance, a hollow-core slab floor, for anchoring the hoisting hook.

[0017] A more particular embodiment of the method according to the invention is characterized in that placing the hoisting hook in the uncured concrete-like material is done with the aid of a movable holder with which a part of the hoisting hook is detachably connected.

[0018] Preferably, placing the hoisting hook is done automatically. Thus, for instance, the holder with the hoisting hook detachably connected thereto can be automatically suspended above a position on the surface of the concrete element so as to be displaced from there into the, or even with the, uncured concrete-like material into the channel. After placement in the uncured concrete material, the holder can be uncoupled from the hoisting hook. The holder is then reusable for placing a next hoisting hook at a different position. The hoisting hooks, albeit at mutually different positions, are all

placed in the uncured concrete material in the same manner, with a same orientation. This orientation can naturally be chosen such that the anchorage thereby meets the safety requirements. When placement is automatic, reproducibility is high and hence it is possible to determine in advance that anchorage will meet the pertinent safety requirements in that regard as well.

[0019] A particular embodiment of the method comprises: pressing the predetermined amount of the concrete-like material through a surface of the concrete element for forming the passage and for placing the uncured concrete-like material via the passage to the channel in the part of the channel located at least near the passage.

[0020] This provides the advantage that forming the passage and placing the uncured material via the passage in the part of the channel located near the passage take place in one step. This accelerates and simplifies the fitting of the hoisting hook. The dose of the uncured material in this case is preferably predetermined such that, together with the concrete material pressed out of the surface, sufficient material is present for anchoring the hoisting anchor.

[0021] In an alternative embodiment of the method, the passage to the channel is formed in the prefabricated concrete element when the concrete element is still uncured. Forming the passage then takes relatively little energy. Further, loose uncured concrete material produced for the purpose of making the passage, is compacted in the channel using vibrations. This improves *inter alia* the bonding of this concrete material with the inner walls of the channel.

[0022] An advantageous variant of the method comprises: vibrating the holder of the hoisting hook during at least a part of the placement of the hoisting anchor in the uncured concrete-like material.

[0023] This entails the uncured concrete material being further compacted with a relatively light pressure. This prevents, for instance, a laterally unsupported partition wall between channels being deformed. This also enhances reproducibility of the anchorage. In particular when this takes place simultaneously with the placement of the uncured concrete-like material in the part of the channel located near the passage, the method for fitting a hoisting hook, for instance in a hollow-core slab floor, can be carried out fast, simply and reliably.

[0024] A still more advantageous variant of the method comprises: providing a constructional hoisting hook. This provides the possibility for the hook to be used additionally for assembly of the concrete element.

[0025] Furthermore, the method may further comprise: fitting the hoisting hook in the prefabricated concrete element in such a manner that the hoisting hook is disposed wholly between the outer surfaces of the concrete element.

[0026] This provides the advantage that it is not necessary anymore to grind off the hoisting hooks after use. The open space formed by the lugs, which space is sit-

uated between the upper part of the hoisting hook and the amount of concrete-like material provided in the channel, can, after this space has first been utilized for fitting fixing means for hoisting and/or mounting the concrete element, be further filled up with a cement-like layer which comes to lie flush with the surface of the concrete element.

[0027] The invention will presently be elucidated with reference to a drawing. In the drawing:

Figs. 1a, 1b and 1c show, by way of example, schematically and in cross section, an embodiment of the method according to the invention; and Fig. 2 shows, by way of example, in cross section a first product of the method according to the invention;

Fig. 3 shows, by way of example, the hoisting of a product of the method according to the invention; Fig. 4 schematically shows an example of a concrete element formed as a wing slab floor, in which a hoisting hook can be fitted using the method according to the invention; and

Fig. 5 shows, by way of example, in cross section, a second product of the method according to the invention.

[0028] In the drawing, equal parts have been provided with equal reference characters, unless indicated otherwise.

[0029] Fig. 1a shows a cross section of a concrete hollow-core slab floor 1 which is provided with two opposed surfaces 2. Situated between the surfaces 2 are channels 3 which extend parallel to the surfaces 2. Fig. 1a further shows a hopper 4 which will typically be included in a mobile machine frame (not shown). In the hopper 4 moist mortar 5 has been included. Disposed under the hopper 4 is a supply element, such as, for instance, the conveyor screw 6 or a conveyer belt (not shown). Fig. 1a further shows a reservoir 7 that is provided with a sealing element 9. The reservoir 7 with the sealing element 9 is attached to a weighing element 8. From the hopper 4, the reservoir 7 can be filled, using the conveyor screw 6, with a predetermined amount of moist mortar. This amount can be predetermined on the basis of many factors. What plays a role here, for instance, are the dimensions of the channels 3 and the material properties of the uncured concrete-like material, in this case the moist mortar. The desired amount can have been predetermined with the aid of calculations and/or tests. An important criterion for the prior determination in the method of the amount of moist mortar to be supplied to the reservoir 7 are the safety requirements to be met by the anchorage of the hoisting hook 25. The weighing element 8 is preferably provided with a control element that stores a database including the predetermined amount of mortar for every current combination of the above-mentioned factors. After the data of the hollow-core slab floor 1 and, for instance, the number of hoisting

hooks 25 to be fitted, have been entered in the control element, not shown, the weighing element 8 indicates, on the basis of the database, when the reservoir 7 is filled with the required predetermined amount 10. Here, timely, a signal is given to the conveyor screw 6, so that the supply of the moist mortar 5 is stopped in time. In this way, in this example, the moist mortar 5 is dosed.

[0030] Using the mobile machine frame, not shown, a guiding chute 17 is moved along a longitudinal edge of the concrete slab 1 to a position from where, through a displacement of the guiding chute 17 across the concrete slab 1, the guiding chute 17 can end up above a desired position 20 at one of the surfaces 2. Similarly, the reservoir 7, if necessary, is also moved across the concrete slab 1. Upon arrival above a desired position of the guiding chute 17, the sealing element 9 at the bottom 21 of the reservoir 7 is opened.

[0031] Fig. 1b shows a movable holder 11 which is provided with hinging parts 13 and 14 to which lugs 12 are attached. A hoisting hook 25 is mechanically coupled in the holder 11 between the lugs 12. In the part of Fig. 1b surrounded by a broken line 22, a side elevation of the holder 11 with the hoisting hook 25 is shown. The hoisting hook 25 in this example is clamped between the hinged parts 13 and 14 by moving these out of a closed position, then placing the hoisting hook 25 between the parts 13 and 14 and bringing the parts 13 and 14 into the closed position again.

[0032] The holder 11 with the hoisting hook 25 mechanically coupled thereto is placed above the guiding chute 17. To that end, the holder 11 may be connected with the guiding chute 17 so as to be vertically movable. The sealing element 9 is removed from a position between the reservoir 7 and the upper side 28 of the guiding chute 17, for instance by sliding it clear. By weighing the reservoir 7 with weighing element 8, it is checked whether all of the concrete-like material has ended up in the guiding chute 17. If necessary, the progress of the method halts and/or a signal is delivered until, for instance through manual tapping, all mortar has left the reservoir 7. The signal produced can mean, for instance, that the reservoir 7 cannot be moved away anymore. Next, the hoisting hook 25 together with the predetermined amount of moist mortar 10 is pressed through the surface 2, whilst preferably the holder 11 with the hoisting hook 25 is caused to vibrate during at least a part of a downward movement, for further compacting the mortar. The holder 11 with the hoisting hook 25 is preferably, as shown in Fig. 1c, pressed downwards so far that the hoisting hook 25 is situated preferably just below the surface 2 and the lugs 12 of the holder 11, after uncoupling of the hoisting hook 25, leave an open space 18 under a topmost point of the hoisting hook 25. Into this open space 18, a hoisting means 16 having a fixing means 26 attached thereto can be inserted for fixing a hoisting device, not shown, to the hoisting hook 25.

[0033] Fig. 2 shows a situation in which the hoisting hook 25 fitted in the concrete slab 1 is additionally em-

played for constructional purposes. Thus, the hollow-core slab floor 1 can be attached to a wall part 24. A temporary upstand 27 can optionally be attached as an edge protection.

[0034] Fig. 3 shows a situation where the concrete hollow-core slab floor 1 which is provided with four hoisting hooks 25, is hoisted with the aid of a cross-line 16.

[0035] The prefabricated concrete element can comprise a concrete element formed as a wing slab floor 41. An example of such a shaped concrete element is shown in Fig. 4. The shape of a wing slab floor 41 is further described in EP 0 825 307. Such a wing slab floor 41 can be manufactured according to a method with which the hollow-core slab floor can also be manufactured. In that case, the concrete element formed as wing slab floor is not provided with reinforcement wires.

[0036] In a concrete element formed as a wing slab floor that has been manufactured according to a method for manufacturing the hollow-core slab floor, a hoisting hook can likewise be provided with the aid of a method according to the invention. Fig. 4 shows analogously to Fig. 1c what a product produced according to the method may look like in that case. Fig. 4 shows a cross section of a concrete wing slab floor 41 which is provided with two opposed surfaces 2 and two "wings" 40 which can be relatively narrow. It is also possible for the wing slab floor to be provided with just one wing which is arranged on one side of the concrete element. The wings 40 can also "frame" the concrete element 41. On a top surface 43, in use, after assembly on the construction site, conduits are laid, whereupon a channel formed partly by the top surface 43, and a side face 44 is filled with concrete-like material for finishing and reinforcing the constructed floor. The concrete element 41 can further, as stated earlier, be in the form of a wing slab floor as described in EP 0 825 307.

[0037] Many variants on the above-discussed example are possible. For instance, in case of a thick upper deck 29 above the channel, the bottomless guiding chute 17 can be provided with a cutting edge 30 to weaken the upper deck 29 during positioning or during the downward movement of the holder 11 with the hoisting hook 25. Instead of making a passage in the surface 2 to the channel 3 located under the surface 2 by pressing the concrete-like material 10 and the hoisting hook 25 through the surface 2, it is also possible first to provide the passage and subsequently to place the predetermined amount of mortar 10 in the passage and the part of the channel 3 located near the passage. In this case, the concrete element may already be cured when the passage is made. Such placement can take place simultaneously with the hoisting hook 25. However, the hoisting hook 25 can also be pressed later in the uncured concrete-like material 10, such as, for instance, moist mortar.

[0038] The order of the steps does not need to be entirely as described hereinabove. For instance, as stated, first a passage can be made, which is subsequently

filled with mortar. It may be advantageous to provide the passage to a channel shortly after the manufacture of the concrete element, since the concrete element is then still uncured and the provision of the passage can take relatively little energy. In that case, the passage can be formed with the aid of a means for making recesses in an uncured concrete element. Such a means can be, for instance, a ram or a piston.

[0039] When using a ram, loose uncured concrete material will end up in the channel when making the passage. Preferably, with the aid of, for instance, vibrations, this is compacted and adhered to the inner walls of the channel. These vibrations can optionally be transmitted using the ram also.

[0040] In that case, when determining the predetermined amount of uncured concrete-like material that is placed in the part of the channel located at least near the passage, the material having ended up in the channel for the purpose of making the passage, as well as any compaction thereof, should be taken into account.

[0041] It is conceivable that the hoisting hook 25 is first placed in the passage and that subsequently the mortar is placed in the passage. It is also possible that an upper side of the channel 13 is free of concrete material 29. In other words, the channel 13 is present as a kind of gutter in the surface 2 of the concrete element. In that case, the passage is of course already present. Preferably, the passage is relatively small with respect to the channel 3, so that through this design too, an anchoring effect can be obtained.

[0042] All these variants can be simply reduced to practice by the skilled person. The flowability and moistness of the mortar can play a critical role in determining the optimum sequence of the steps. In any case, an uncured concrete material is to be involved, which is used for anchoring the hoisting hook 25. The moist mortar, mortar and the like fall within the term uncured concrete material. In general, this concrete material is of the same kind as the concrete material from which the concrete element has been manufactured. The use of a different type of concrete, however, is not precluded. Thus, it is possible to use a low-shrink or shrink-free concrete-like material. Even concrete-like materials that expand during curing are conceivable.

[0043] The hollow-core slab floor and the concrete element designed in the form of a wing slab floor can have any desired dimension. The number of channels can differ per slab. Also, the cross section of the channels can differ per slab. The predetermined amount of uncured concrete material that is used for anchorage of the hoisting hook is determined *inter alia* by the dimensions and other characteristics of the hollow-core slab floor or the concrete element designed in the form of a wing slab floor. The invention is furthermore not limited to the use in hollow-core slab floors and the concrete element designed in the form of a wing slab floor. The method can be carried out for the purpose of hoisting any prefabricated concrete element that is provided with such chan-

nels. The hoisting hook can also be provided for constructional purposes as represented in Fig. 2.

[0044] All such variants are understood to belong to the invention.

Claims

1. A method for fitting a hoisting hook in a prefabricated concrete element which includes at least one channel extending substantially parallel to a surface of the concrete element, the method comprising:

- placing an uncured concrete-like material via a passage to the channel in a part of the channel located at least near the passage;
- placing the hoisting anchor in the uncured concrete-like material, **characterized in that** the method further comprises
- dosing the uncured concrete-like material in a predetermined amount.

2. A method according to claim 1, **characterized in that** dosing comprises:

- filling a reservoir with the predetermined amount of uncured concrete-like material and completely emptying the reservoir.

3. A method according to claim 1 or 2, **characterized in that** dosing takes place in an automated manner.

4. A method according to claim 2 or 3, **characterized in that** the method comprises:

- checking the complete emptying of the reservoir.

5. A method according to claim 4, **characterized in that** the checking of the complete emptying of the reservoir takes place automatically.

6. A method according to claim 5, **characterized in that** the method comprises:

- automatically interrupting the placement, via the passage, of the concrete-like material and/or the placement of the hoisting anchor if the reservoir has not been emptied completely.

7. A method according to any one of claims 4-6, **characterized in that** the method comprises:

- if necessary, supplementing an amount of concrete-like material already evacuated from the reservoir, with concrete-like material left behind in the reservoir, for enabling the predetermined amount of the concrete-like material to be

placed, via the passage to the channel, in the part of the channel located near the passage.

8. A method according to any one of the preceding claims, **characterized in that** placing the hoisting hook in the uncured concrete-like material is done with the aid of a movable holder with which a part of the hoisting hook is detachably connected.

9. A method according to claim 8, **characterized in that** the method further comprises:

- vibrating the holder of the hoisting hook during at least a part of the placement of the hoisting anchor in the uncured concrete-like material.

10. A method according to any one of the preceding claims, **characterized in that** the placement of the hoisting hook takes place automatically.

11. A method according to any one of the preceding claims, **characterized in that** the method comprises:

- pressing the predetermined amount of the concrete-like material through a surface of the concrete element for forming the passage and for placing the uncured concrete-like material via the passage to the channel in the part of the channel located at least near the passage.

12. A method according to any one of claims 1-10, **characterized in that** the passage to the channel is formed in the prefabricated concrete element when the concrete element is still uncured.

13. A method according to claim 12, **characterized in that** the passage is formed using a means for making recesses in an uncured concrete element.

14. A method according to claim 13, **characterized in that** the means comprises a piston.

15. A method according to claim 13, **characterized in that** the means comprises a ram.

16. A method according to claim 15, **characterized in that** loose uncured concrete material produced for the purpose of making the passage is compacted in the channel using vibrations.

17. A method according to claim 16, **characterized in that** the vibrations are carried out using the ram which has been caused to vibrate.

18. A method according to any one of the preceding claims, **characterized in that** the method comprises:

- fitting a constructional hoisting hook.

19. A method according to any one of the preceding claims, **characterized in that** the method further comprises:

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- fitting the hoisting hook in the prefabricated concrete element, such that the hoisting hook is situated wholly within the outer surfaces of the concrete element.

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20. A method according to any one of the preceding claims, **characterized in that** the prefabricated concrete element comprises a hollow-core slab floor.

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21. A method according to any one of claims 1-19, **characterized in that** the prefabricated concrete element is formed as a wing slab floor.

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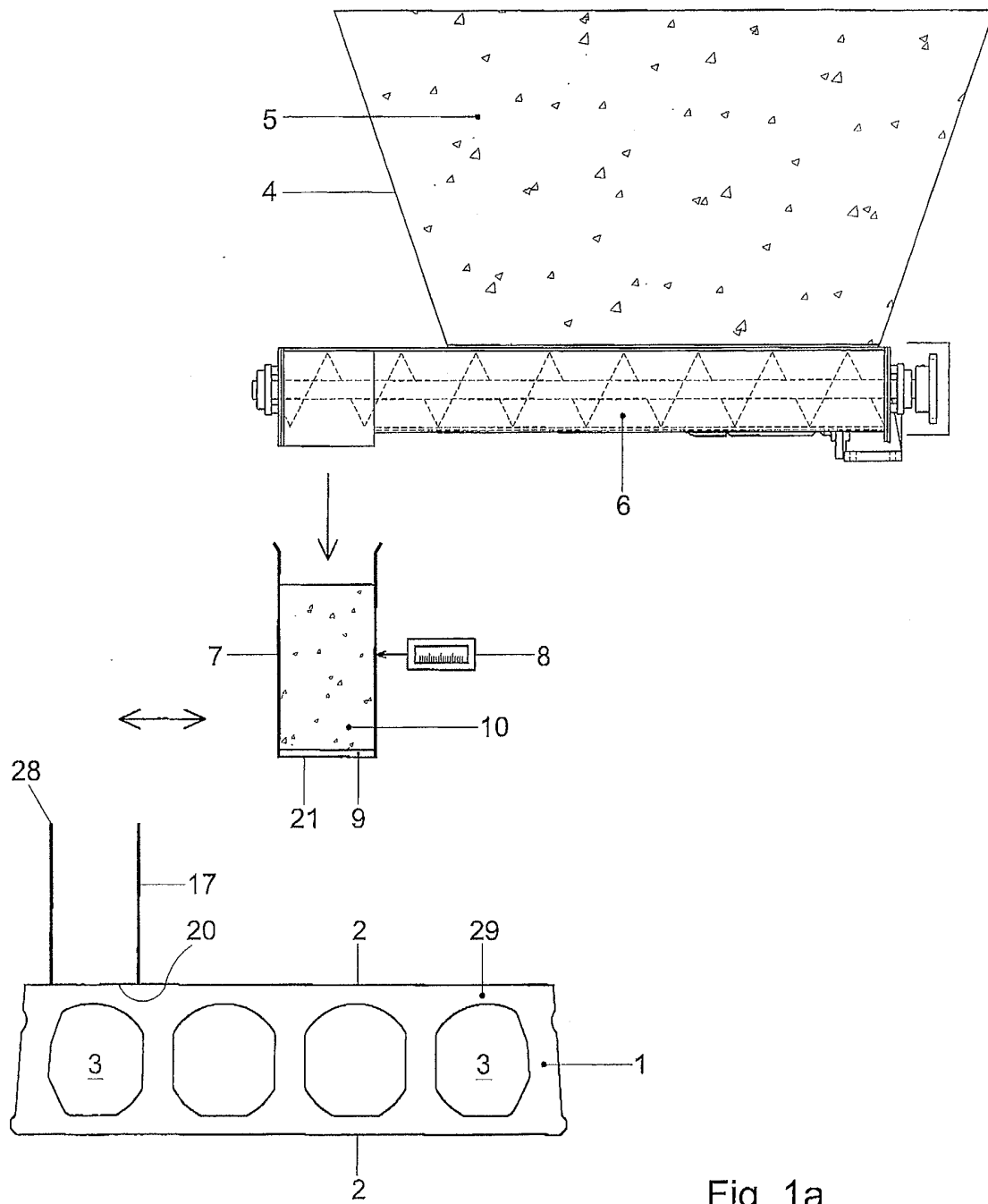


Fig. 1a

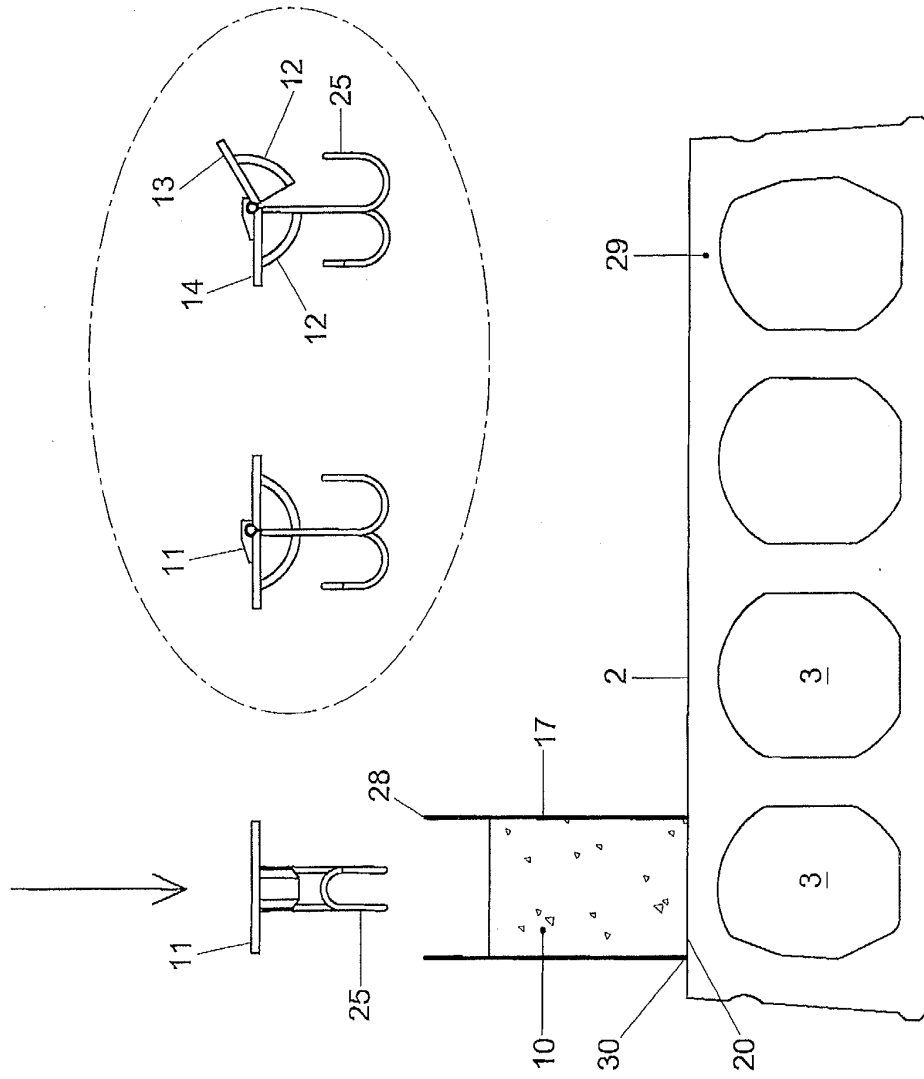
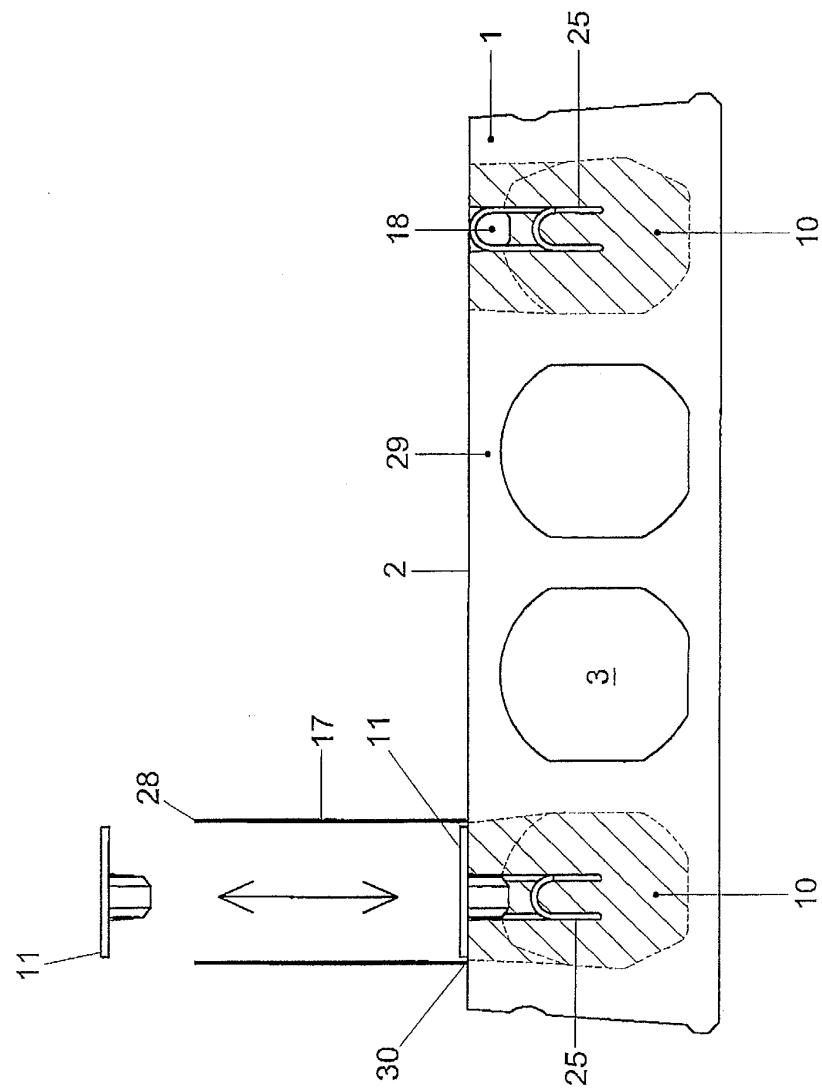
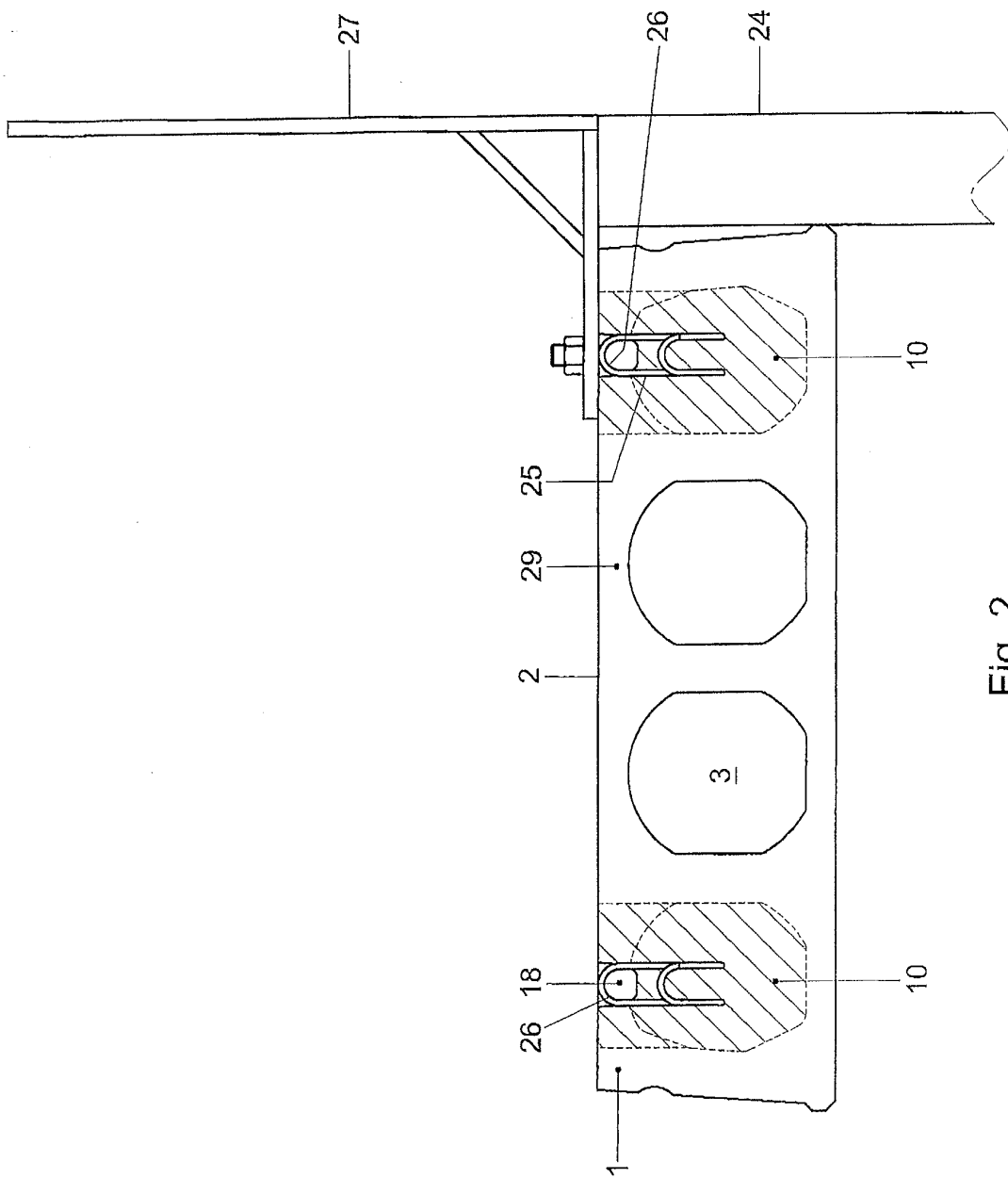


Fig. 1b





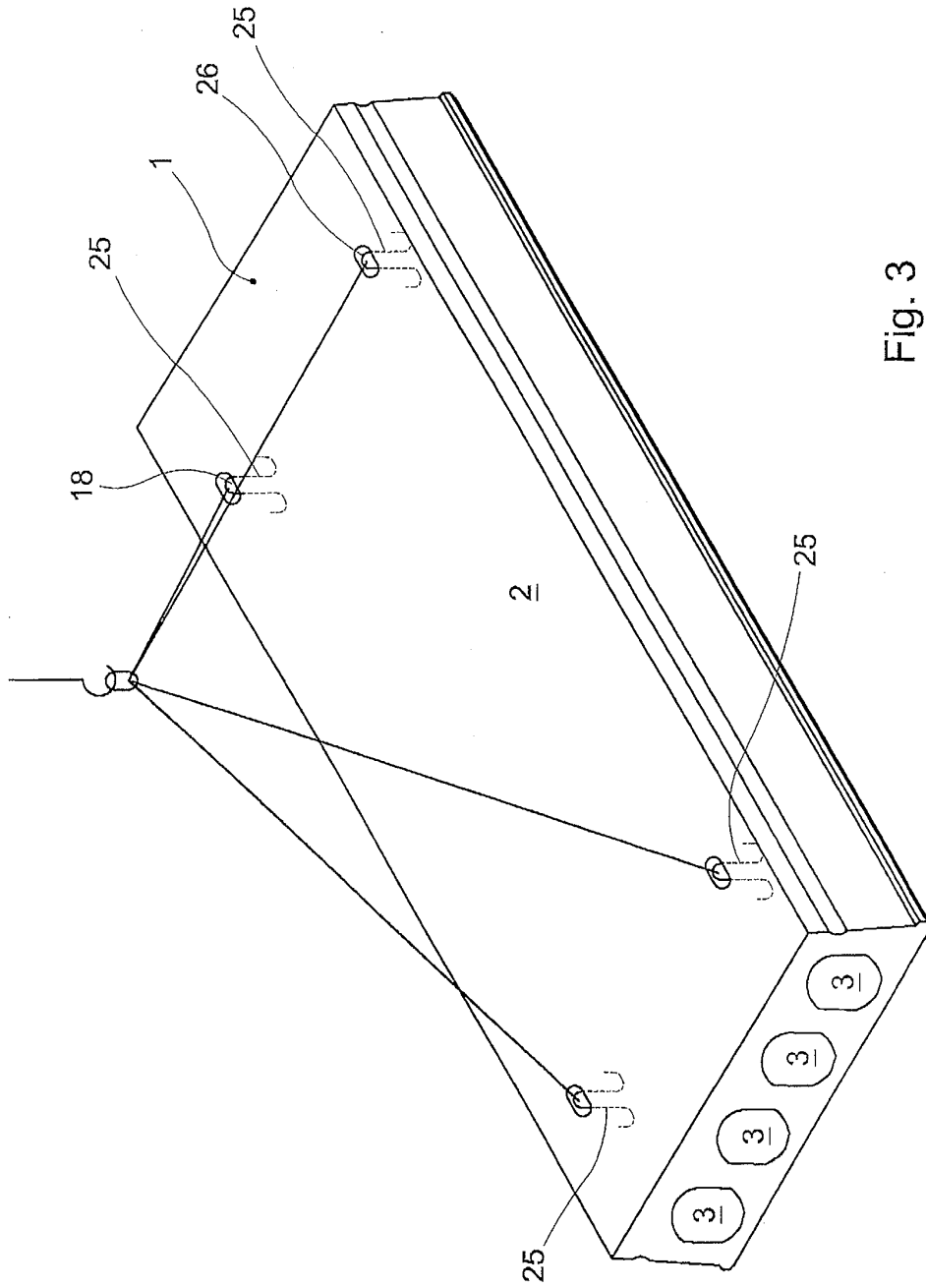


Fig. 3

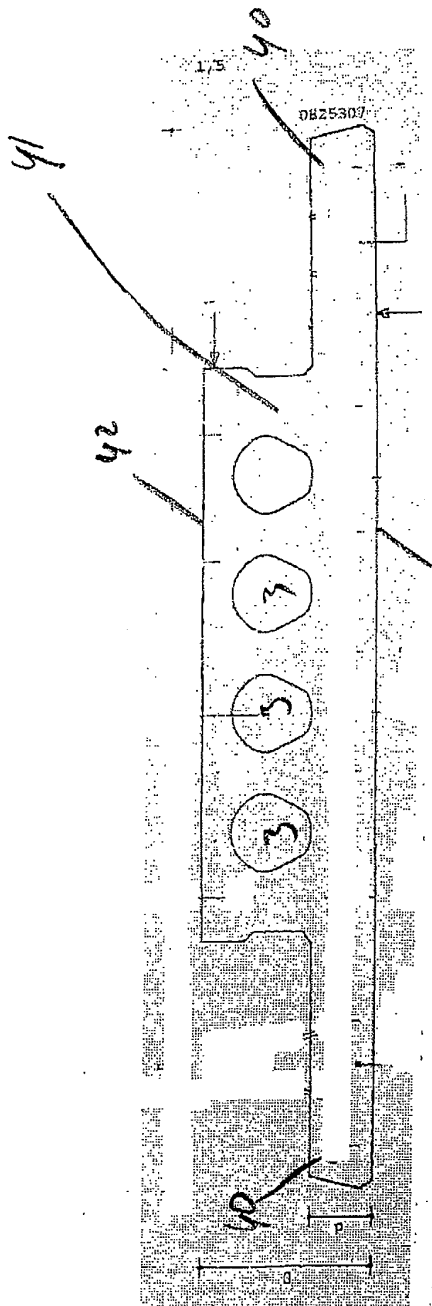


Fig. 94

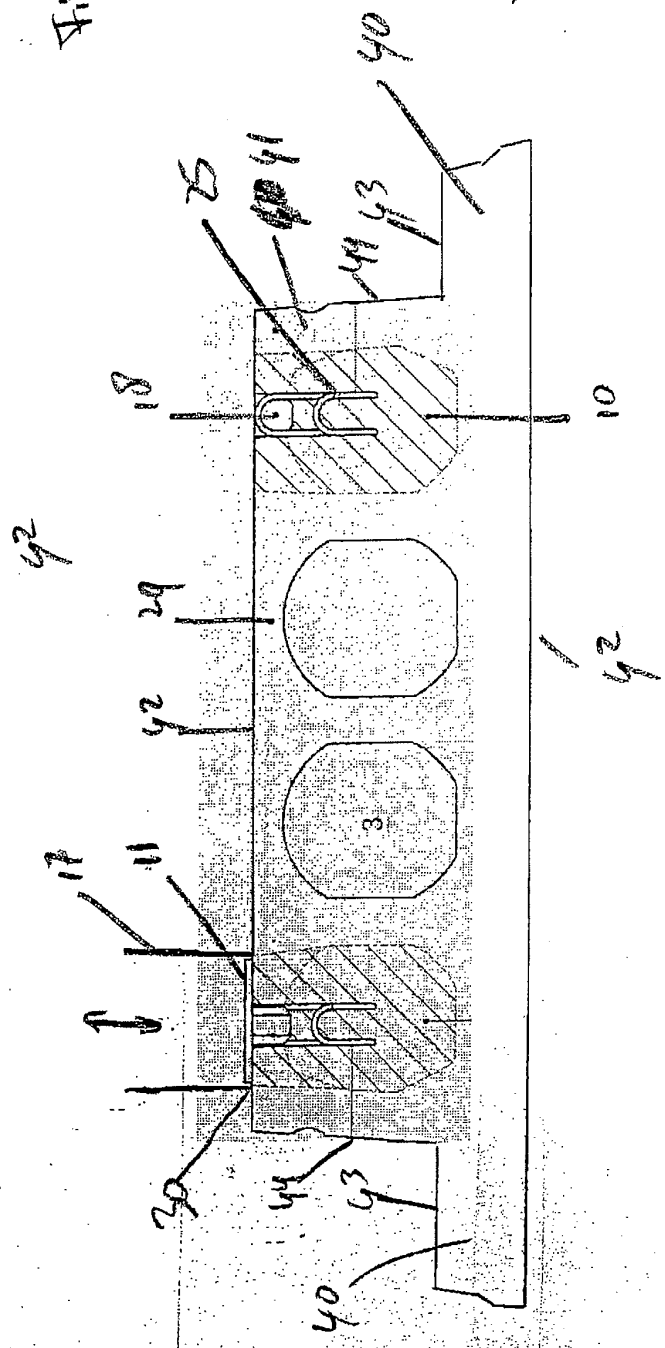


Fig. 95



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 03 07 5766

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)
X	DE 29 11 224 A (KIND KARL) 2 October 1980 (1980-10-02) * claim 1 * * figures *	1, 18	E04G21/14 B28B23/00
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 30 June 2003	Examiner Andlauer, D.
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