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(54) **Method and apparatus for fabricating an elongate foundation element, and foundation element obtained therewith**

(57) Using a method and apparatus for fabricating an elongate foundation element of the type comprising a floor plate (1) with a first cross sectional width and a rib (2) with a second smaller cross sectional width positioned on top of the floor plate, the floor plate is cast from concrete within an appropriately shaped first mould (4) with a substantially open top, and the rib is cast from concrete on top of the floor plate within an appropriately shaped second mould (6) with a substantially open bottom and substantially open top when the concrete floor plate has hardened to such a degree that its concrete does not flow anymore. A nose (3) with an even smaller third cross sectional width may be provided on top of the rib in a corresponding manner.

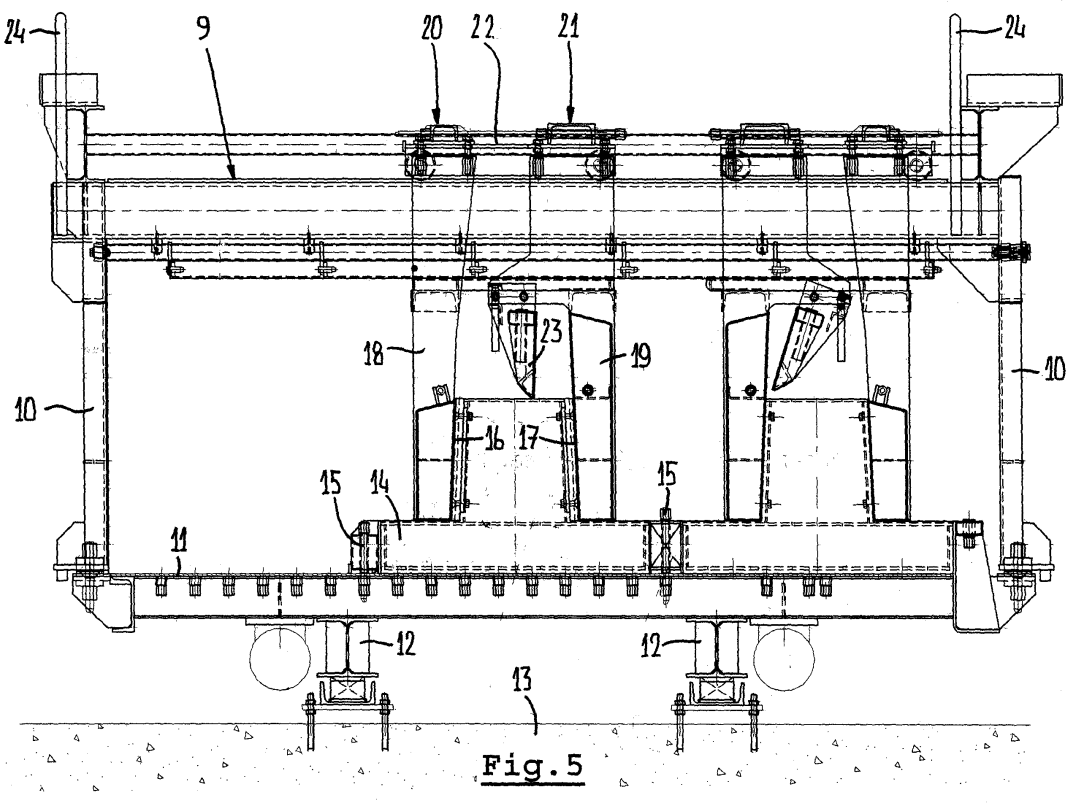

Fig.5

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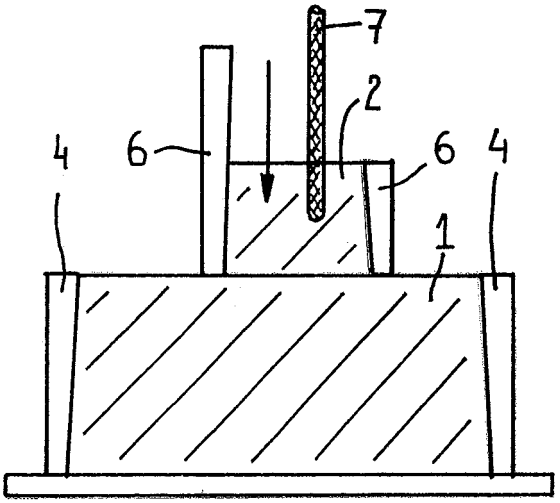

Fig.2

Description

[0001] The invention firstly relates to a method for fabricating an elongate foundation element of the type comprising a floor plate with a first cross sectional width and a rib with a second smaller cross sectional width positioned on top of the floor plate.

[0002] Conventionally, such an elongate foundation element is fabricated such, that firstly a concrete floor plate is positioned on top of an appropriate support (which, for example, may be piles or a sand bed) and that next building blocks (for example sandlime bricks) are positioned on top of the concrete floor plate. The building blocks will define a support for the floor and outer wall of the erected building. Such a fabrication, however, is rather labor intensive and time consuming. The weight of the building blocks is high (e.g. 13,5 kg each) which makes the labor also difficult and unhealthy.

[0003] Thus it is an object of the present invention to provide an improved method of the type referred to above.

[0004] In accordance with the present invention said method is characterized by the following steps:

- casting the floor plate from concrete within an appropriately shaped first mould with a substantially open top, and
- casting the rib from concrete on top of the floor plate within an appropriately shaped second mould with a substantially open bottom and substantially open top when the concrete floor plate has hardened to such a degree that its concrete does not flow anymore.

  As a result of this procedure a completed elongate foundation element is obtained in which the floor plate and rib are integrally made of concrete, thus defining a single part which may be positioned on top of an appropriate support (piles, sand bed or alike) and which then is ready for use (especially for positioning thereon a floor and outer wall of a building) without the need for any additional activities.

  The moment at which the rib is cast on top of the floor plate is such, that it is not too early (preventing the concrete of the rib from 'sinking' into the floor plate) but also not too late (preventing an insufficient coherence between the concrete of the floor plate and the concrete of the rib), and can be determined by experiments. Of course the lapse of time between casting the floor plate and casting the rib will depend on a number of parameters, such as for example the type of concrete used, the shape and dimensions of the moulds and the temperature around the moulds.

  The fact that the floor plate is cast first, followed by casting the rib, results in the completed foundation element already having the correct spatial position (floor plate below and rib thereabove), eliminating the need for rotating the foundation element (which would need extremely complicated and heavy equipment because of the high weight of the foundation element). The difficulty of rotating such a heavy completed foundation element makes it impractical to cast a foundation element in a classical manner, i.e. with its rib facing downwards and with the floor plate on top.

  The method according to the present invention also may be devised for fabricating an elongate foundation element as stated before, but of the type further comprising a nose with a third even smaller cross sectional width positioned on top of the rib.

  In such a case the method is characterized by the additional step of

  - casting the nose from concrete on top of the rib within an appropriately shaped third mould with a substantially open bottom and substantially open top when the rib has hardened to such a degree that its concrete does not flow anymore.

[0005] The advantages stated with respect to the first embodiment of the method apply even stronger with respect to this embodiment.

[0006] It will be clear, that in either case the moulds will be removed when the cast concrete has hardened sufficiently.

[0007] According to another preferred embodiment of the method according to the present invention, during casting the concrete a vibrating action is exerted onto the concrete. Such a vibrating action helps gas (e.g. air) to escape from the cast concrete at the open top of the mould.

[0008] For example, during casting the concrete floor plate the first mould may be vibrated, such as with vibrating motors (or any other appropriate means).

[0009] As another example, during casting the rib and/or nose the respective concrete may be vibrated using vibrating needles inserted into the concrete.

[0010] For improving the final strength of the completed elongate foundation element, in selected parts of the foundation element reinforcing members may be provided which are cast into the concrete. Such reinforcing members, for example, may comprise steel bars or a steel grid.

[0011] Of course the moulds used with the present invention may be provided with special shapes, for example for defining connecting members on the floor plate for interconnecting adjacent foundation members at a building location.

[0012] The invention secondly relates to an apparatus for fabricating an elongate foundation element of the type comprising a floor plate with a first cross sectional width and a rib with a second smaller cross sectional width positioned on top of the floor plate.

[0013] In accordance with a first embodiment such an apparatus is characterized by a first mould having a substantially open top for casting concrete therein for the fabrication of the floor plate and a second mould having a substantially open bottom and a substantially open top for casting concrete therein for the fabrication of the rib,

which second mould is movable between an operative position on top of the first mould and an inoperative position removed from the first mould.

[0014] When the floor plate is cast, the second mould may be positioned in its inoperative position for allowing an easy access to the first mould (but not strictly needs to be). At an appropriate moment (when the floor plate has hardened sufficiently) the second mould is moved towards the operative position and the rib is cast. After the rib has hardened sufficiently the second mould may be removed again, and the completed foundation element may be taken out of the first mould with its floor plate.

[0015] In a preferred embodiment of the apparatus according to the invention, the relative position between the second mould in its operative position and the first mould is settable. This offers a first possibility to manufacture a foundation element tailored to specific demands.

[0016] Although such a setting operation of the relative position between the moulds may be caused by mechanical (electrical, pneumatic, hydraulic or other) means, it may be preferred to realise it manually such as to prevent damaging parts of the apparatus.

[0017] The apparatus according to the invention also may be devised for fabricating an elongate foundation element as stated before, but further comprising a nose with a third even smaller cross sectional width positioned on top of the rib.

[0018] In such a case the apparatus is characterized by a third mould having a substantially open bottom and a substantially open top for casting concrete therein for the fabrication of the nose, which third mould is movable between an operative position on top of the second mould and an inoperative position removed from the second mould.

[0019] What has been stated above with respect to the first and second moulds applies mutatis mutandis for the second and third moulds of this embodiment of the apparatus.

[0020] Also, in such an embodiment, the relative position between the third mould in its operative position and the second mould may be settable (again preferably by hand).

[0021] In a special embodiment of the apparatus, the second and third mould share at least one mould wall. Thus this mould wall extends along the rib as well as the nose. The opposite walls of the moulds, however, are defined by separate, different walls.

[0022] When, in accordance with yet another preferred embodiment of the apparatus according to the present invention, at least some of the moulds have two opposite mould walls of which the distance is settable, another possibility is offered to manufacture foundation element tailored to the demands or needs of a customer.

[0023] Preferably at least some of the moulds are suspended from or supported by a common frame. This makes it relatively easy to manufacture foundation elements with the required dimensional precision.

[0024] The frame could be provided with a multiplicity of moulds for manufacturing a number of foundation elements simultaneously. For example two elongate foundation elements could be manufactured alongside each other.

[0025] For handling the frame (and thus the moulds) it can be handy when it is provided with hoisting means, such as hoisting eyes (which then may cooperate with a crane or alike).

[0026] The invention thirdly relates to an elongate foundation element, comprising a concrete floor plate with a first cross sectional width and a concrete rib with a second smaller cross sectional width positioned on top of the floor plate, wherein the rib is integrally connected to the floor plate by a concrete casting procedure.

[0027] In an alternative embodiment of such an elongate foundation element, it further comprises a nose with a third even smaller cross sectional width positioned on top of the rib, wherein the nose is integrally connected to the rib by a concrete casting procedure.

[0028] Hereinafter the invention will be elucidated while referring to the drawing, in which:

Figures 1-4 show four successive stages during the fabrication of an elongate foundation element according to an embodiment of the invention, and
Figure 5 shows a transversal cross section through an apparatus according to the invention.

[0029] Firstly referring to figures 1-4, an example of a method for fabricating an elongate foundation element is illustrated in four successive stages. Referring to figure 4, the elongate foundation element (which in figure 1 extends perpendicularly to the plane of the drawing) is of the type comprising a floor plate 1 with a first cross sectional width, a rib 2 with a second smaller cross sectional width positioned on top of the floor plate 1 and a nose 3 with a third even smaller cross sectional width positioned on top of the rib 2.

[0030] The method for fabricating such a foundation element starts (according to figure 1) with casting the floor plate 1 from concrete within an appropriately shaped first mould 4 with a substantially open top.

[0031] During casting the concrete of the floor plate 1 a vibrating action is exerted onto the concrete. In the represented embodiment the first mould 1 is vibrated by vibrating motors 5.

[0032] The next step (figure 2) comprises casting the rib 2 from concrete on top of the floor plate 1. This casting of the rib 2 occurs within an appropriately shaped second mould 6 with a substantially open bottom and substantially open top when the concrete floor plate 1 has hardened to such a degree that its concrete does not flow anymore (basically, the concrete of the rib 2 should not 'sink' into the floor plate, but there still has to be coherence between the concrete of the floor plate 1 and the concrete of the rib 2). Also here, during casting the concrete of the rib 2 a vibrating action is exerted onto the

concrete, for example by vibrating needles 7 inserted into the concrete.

[0033] Figure 3 shows the next step of the method according to the invention. The nose 3 is cast from concrete on top of the rib 2 within an appropriately shaped third mould 8 with a substantially open bottom and substantially open top when the rib has hardened to such a degree that its concrete does not flow anymore. In the illustrated embodiment one wall (left wall) of the third mould 8 is defined by an upper extension of a corresponding wall of the second mould 6.

[0034] Figure 3 also shows a vibrating needle 7 for vibrating the concrete of the nose 3 during (or after) casting.

[0035] In figure 4 the completed foundation element is shown after removal of, or from the moulds 4, 6 and 8.

[0036] It has not been illustrated that in selected parts of the foundation element reinforcing members (for example steel rods) can be provided which are cast into the concrete.

[0037] In figure 5 a transversal cross section through an embodiment of an apparatus for simultaneously fabricating two elongate foundation elements of the type shown in figure 4 (each comprising a floor plate 1 with a first cross sectional width, a rib 2 with a second smaller cross sectional width positioned on top of the floor plate 1, and a nose 3 with a third even smaller cross sectional width positioned on top of the rib 2) is illustrated. Because this apparatus comprises two parts which basically are each others mirror image, only one of these parts will be discussed in detail here. It is noted, however, that both parts do not need to be mirror images but also could be exact copies of each other.

[0038] The apparatus comprises a frame with bridge members 9 supported by vertical columns 10. The columns 10 are connected to a bottom part 11 supported by feet 12 resting on the floor 13. A first mould 14 having a substantially open top for casting concrete therein for the fabrication of the floor plate is attached to the bottom part 11, for example by fixing means 15.

[0039] It is possible that the position of the first mould 14 relative to the bottom part is settable. It even is possible that the first mould comprises two opposite walls which have a variable, settable distance. Such walls could each end at frontal end walls (not shown) extending in parallel to the plane of the drawing.

[0040] A second mould comprises opposite walls 16 and 17 attached to respective arms 18 and 19 supported by carriages 20 and 21 which can move along a bridge member 9. The second mould also has a substantially open bottom and a substantially open top for casting concrete therein for the fabrication of the rib.

[0041] For example by means of the carriages 20 and 21 the second mould is movable between an operative position on top of the first mould 14 and an inoperative position removed from the first mould.

[0042] The carriages 20 and 21 are connected by a setting mechanism 22 which can change the distance between the walls 16 and 17. Such setting mechanism may be operated manually (although an automated operation also could be provided).

[0043] It is noted that the illustrated ways of movement of the parts of the apparatus only represent examples, and that many other ways are possible within the context of the present invention.

[0044] Thus, such movement also could be used for setting the relative position between the second mould 16,17 in its operative position and the first mould 14.

[0045] The apparatus further comprises a third mould having a substantially open bottom and a substantially open top for casting concrete therein for the fabrication of the nose 3 of the foundation element. Said third mould is defined by a first wall 23 and an opposite wall which, in the illustrated embodiment, is defined by (an upper extension of) the wall 17 of the second mould. This third mould also is (at least partially) movable between an operative position on top of the second mould and an inoperative position removed from the second mould.

[0046] In the illustrated embodiment the wall 23 of the third mould is hingeably connected to arm 19 and thus the relative position between the third mould in its operative position and the second mould is settable.

[0047] The frame is provided with hoisting means, such as hoisting eyes 24.

[0048] The apparatus may be provided with any appropriate means for varying its configuration, and especially for changing relative positions between parts thereof (i.e. the relative position between the moulds or parts of a mould). Such means are, however, not illustrated in detail here.

[0049] Of course, the apparatus also can be devised for manufacturing only one foundation element; also, more than two foundation elements could be manufactured at the same time. When more than one element is manufactured at the same time, these elements also may have differing shapes or dimensions.

[0050] The invention is not limited to the embodiments described before which may be varied widely within the scope of the invention as defined by the appending claims.

Claims

1. Method for fabricating an elongate foundation element of the type comprising a floor plate with a first cross sectional width and a rib with a second smaller cross sectional width positioned on top of the floor plate, **characterized by** the following steps:

   - casting the floor plate from concrete within an appropriately shaped first mould with a substantially open top, and
   - casting the rib from concrete on top of the floor plate within an appropriately shaped second mould with a substantially open bottom and sub-

stantially open top when the concrete floor plate has hardened to such a degree that its concrete does not flow anymore.

2. Method according to claim 1, for fabricating an elongate foundation element of the type further comprising a nose with a third even smaller cross sectional width positioned on top of the rib, **characterized by** the additional step of

- casting the nose from concrete on top of the rib within an appropriately shaped third mould with a substantially open bottom and substantially open top when the rib has hardened to such a degree that its concrete does not flow anymore.

3. Method according to claim 1 or 2, wherein during casting the concrete a vibrating action is exerted onto the concrete.

4. Method according to claim 3, wherein during casting the concrete floor plate the first mould is vibrated.

5. Method according to claim 4, wherein the first mould is vibrated by vibrating motors.

6. Method according to any of the claims 3-5, wherein during casting the rib and/or nose the respective concrete is vibrated using vibrating needles inserted into the concrete.

7. Method according to any of the previous claims, wherein in selected parts of the foundation element reinforcing members are provided which are cast into the concrete.

8. Apparatus for fabricating an elongate foundation element of the type comprising a floor plate with a first cross sectional width and a rib with a second smaller cross sectional width positioned on top of the floor plate, **characterized by** a first mould having a substantially open top for casting concrete therein for the fabrication of the floor plate and a second mould having a substantially open bottom and a substantially open top for casting concrete therein for the fabrication of the rib, which second mould is movable between an operative position on top of the first mould and an inoperative position removed from the first mould.

9. Apparatus according to claim 8, wherein the relative position between the second mould in its operative position and the first mould is settable.

10. Apparatus according to claim 8 or 9 for fabricating an elongate foundation element of the type further comprising a nose with a third even smaller cross sectional width positioned on top of the rib, **characterized by** a third mould having a substantially open bottom and a substantially open top for casting concrete therein for the fabrication of the nose, which third mould is movable between an operative position on top of the second mould and an inoperative position removed from the second mould.

11. Apparatus according to claim 10, wherein the relative position between the third mould in its operative position and the second mould is settable.

12. Apparatus according to claim 10 or 11, wherein the second and third mould share at least one mould wall.

13. Apparatus according to any of the claims 8-12, wherein at least some of the moulds have two opposite mould walls of which the distance is settable.

14. Apparatus according to any of the claims 8-13, wherein at least some of the moulds are suspended from or supported by a common frame.

15. Apparatus according to claim 14, wherein the frame is provided with a multiplicity of moulds for manufacturing a number of foundation elements simultaneously.

16. Apparatus according to claim 14 or 15, wherein the frame is provided with hoisting means, such as hoisting eyes.

17. Elongate foundation element, comprising a concrete floor plate with a first cross sectional width and a concrete rib with a second smaller cross sectional width positioned on top of the floor plate, wherein the rib is integrally connected to the floor plate by a concrete casting procedure.

18. Elongate foundation element according to claim 17, further comprising a nose with a third even smaller cross sectional width positioned on top of the rib, wherein the nose is integrally connected to the rib by a concrete casting procedure.

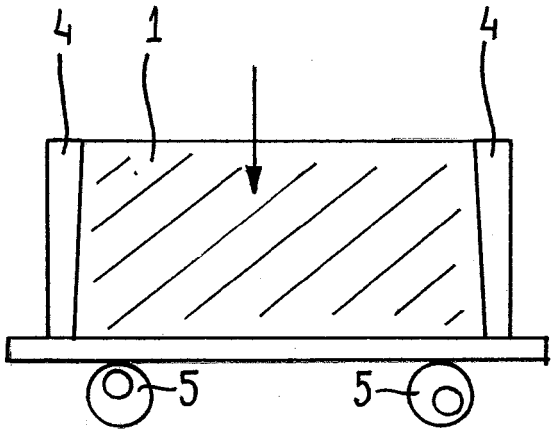

Fig.1

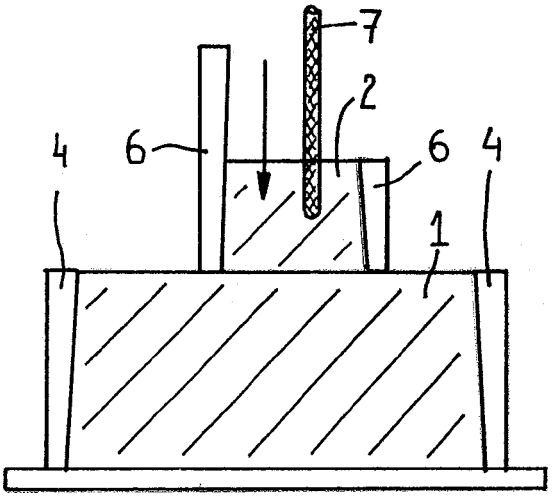

Fig.2

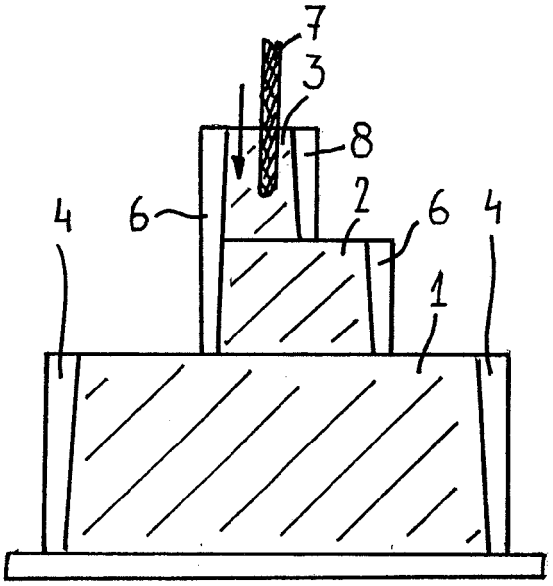

Fig.3

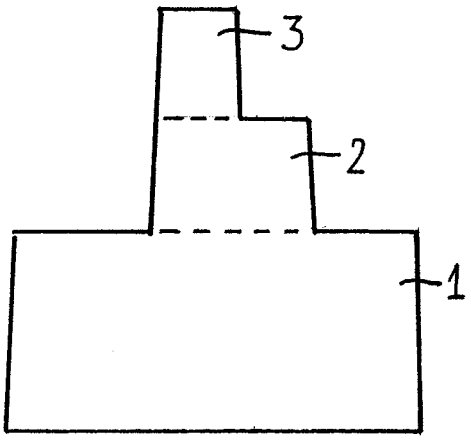

Fig.4

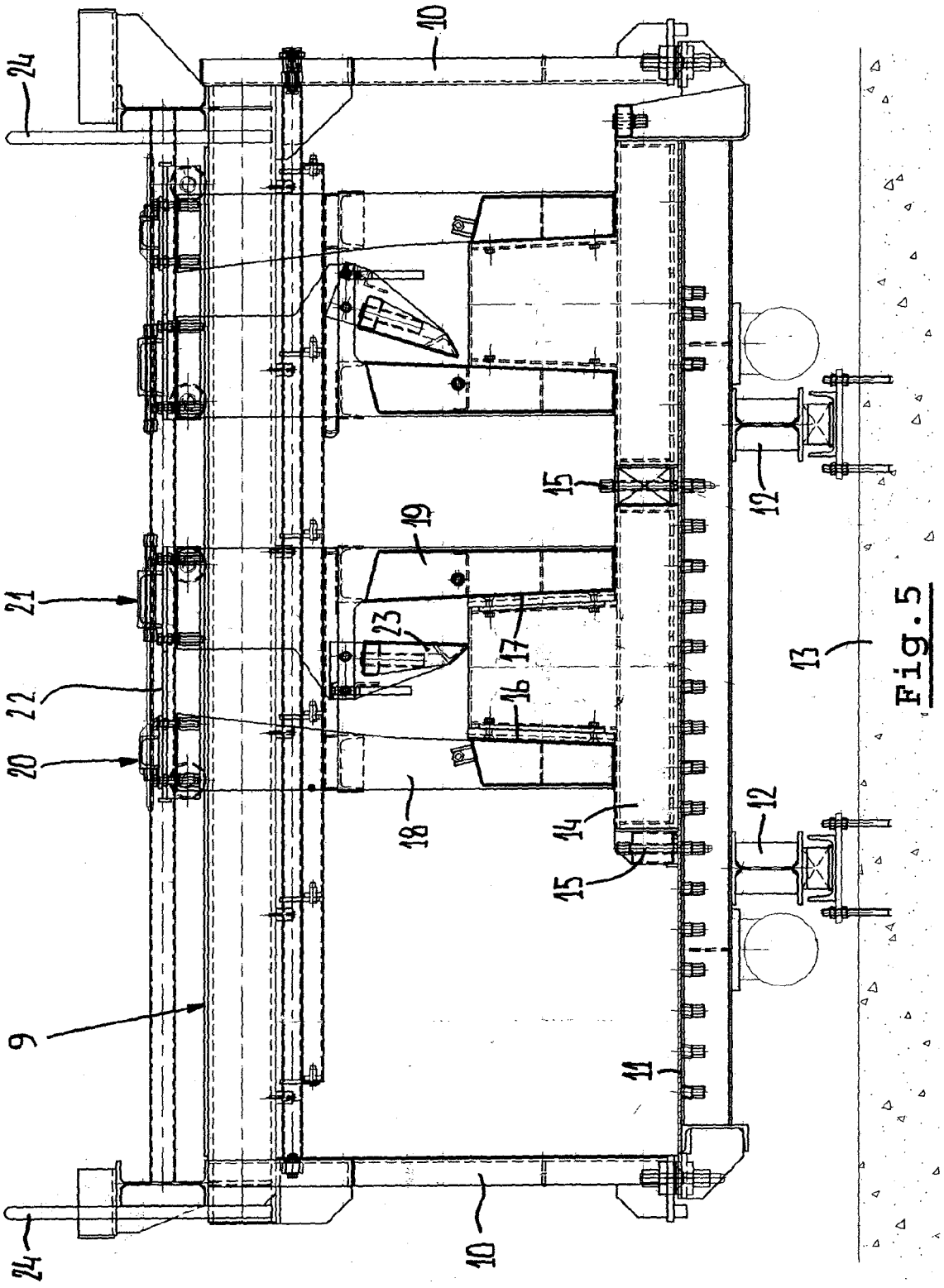

Fig.5

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EUROPEAN SEARCH REPORT

Application Number
EP 06 11 7122

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TECHNICAL FIELDS SEARCHED (IPC)
E04B E02D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	26 January 2007	Khera, Daljit

CATEGORY OF CITED DOCUMENTS

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