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(54) A method and device for casting concrete products.

(57) Method and device for the production of elongated concrete products by feeding the concrete material first in a compaction tank (3), whereafter the concrete is fed by means of a pump (2) into the mould (1) as a continuous flow in such a way that the concrete moves on in the mould in the longitudinal direction of the mould.

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A method and a device for casting concrete products

This invention relates to a method of casting concrete products by filling a mould with flowing concrete material and compacting the concrete material. The invention is also concerned with a device for casting concrete products.

Prior art techniques for the production of elongated concrete products, such as columns and beams, include slip casting in which a casting machine feeds concrete into a mould while moving on rails along the mould from its one end to the other. The casting machine is positioned above the mould, so that the concrete flows into the mould under the influence of the force of gravity. The concrete fed into the mould is compacted by means of vibrators to remove air bubbles from it. The vibrators may be connected to the casting machine or they may be mounted fixedly in the mould.

This prior art technique has a few drawbacks, which become particularly apparent in the production of high-strength concrete products. One drawback is that the final degree of compaction and homogeneity of the concrete cannot be fully known, because it is not known accurately how much air is mixed with the concrete while it falls from the casting machine into the mould and because compacted concrete cannot be sampled for homogeneity measurement without damaging the product. As a result, the strength properties of a concrete product at its different points cannot be known accurately. Another drawback of the technique is that it is very slow because the casting machine to be moved is heavy and because it is necessary to allow the concrete to flow slowly to minimize the amount of air mixed with it. The compaction of con crete by means of vibrators is also time-consuming. In addition, it is to be noted that the compaction process is difficult to carry out and requires complicated machinery when the casting is carried out by means of a closed mould.

The object of the present invention is to provide a method of casting concrete products, which method is rapid and provides high-quality products with good strength properties. The method according to the invention is characterized in that the compaction of the concrete material is carried out before the concrete is fed into the mould, and that to fill up the mould the concrete material is fed into it as a continuous flow.

The casting method of the invention is more rapid than prior art methods due to the fact that the compaction of the concrete to be cast into the mould is carried out before the casting step. In addition, the products produced by means of the method are of excellent quality. This is partly due to the fact that the concrete compaction is carried out before the casting as a separate step, wherefore the compaction takes place under controlled conditions, which, in turn, enables sampling, for instance. The quality of the products is also affected by the way in which the concrete is fed into the mould. In the invention the concrete is fed in such a way that gas bubbles and boundaries will not be formed within it. The method of the invention is especially suited for the production of long, prestressed concrete products, such as concrete rods containing prestressed irons, disclosed in FI 881843.

With an elongated mould, a simple way of providing a continuous flow is to create a counterpressure in the mould and feed the concrete longitudinally of the mould.

Boundaries and gas bubbles will not be formed in the concrete during casting when the concrete is fed into the mould through its one end.

To ensure that the product will not contain gas bubbles, it is important that the concrete does not move during the casting, that is, into the mould and in the mould, in the direction of the force of gravity; otherwise the mass flow may be interrupted. According to one embodiment of the invention, the mould is kept in a vertical or slanted position during the casting, the concrete being fed into the mould through its lower end and moved on the mould against the force of gravity. Since the concrete is moved on against the force of gravity, it remains compact throughout the casting process, and no interruptions occur in the flow.

For the workability of the method of the invention it is to be preferred that the concrete is pumped from the compaction means into the mould.

The invention is also concerned with a device for casting concrete products, comprising a mould, means for feeding flowing concrete material into the mould, and means for compacting the concrete material.

The device according to the invention is characterized in that the concrete compaction means are connected before the concrete feeding means, and that the concrete feeding means are arranged to feed concrete into the mould as a continuous flow.

According to one embodiment of the device of the invention, the concrete compaction means are formed by a tank, and a vibrator and means for creating an overpressure and/or underpressure in the tank are connected to the tank. By compacting the concrete material in the separate tank in place of the mould an advantage is obtained in that the

compaction can be carried out under controlled conditions. If desired, samples can be taken from the concrete, and the required vibrating effect and time can be easily defined through experience. In view of the compaction of the concrete material, it is to be preferred that the tank comprises means for creating an underpressure in the tank. The concrete material can be advantageously fed from the tank into the mould with means creating an overpressure in the tank, the concrete material being forced into the mould by means of this overpressure. Another alternative suited for the method of the invention is to pass the concrete material from the tank to the mould by means of a pump.

In order to ensure that the concrete material fed into the mould remains compacted, it is important to position the mould horizontally, vertically or in a slanted position. In the two last-mentioned cases, the mould is closed, the concrete inlet being positioned at the lower end of the mould.

In the following the invention will be described in greater detail with reference to the attached drawing, wherein

Figure 1 is a general view of a preferred embodiment of the device according to the invention;

Figure 2 is a top view of a portion of another embodiment of the device; and

Figure 3 is a sectional view of the device of Figure 2 along the line III-III of Figure 2.

Figure 1 shows the principal parts of a casting device, viz, a mould 1; means 2 for feeding concrete material into the mould; and means 3 for compacting the concrete material. The parts 1 to 3 communicate with each other by means of conduits 4 and 5. In this particular embodiment, the concrete feeding means comprise a pump 2, and the compaction means comprise a compaction tank 3.

According to the invention the compaction tank 3 is connected by means of the conduit 4 before the pump 2 in the direction of movement of the concrete, and the pump 2 is connected by means of the conduit 5 to one end of the mould 1. In this embodiment, the mould is elongated, closed and vertically positioned, and the conduit 5 is connected to its lower end.

A filling opening is provided at the top of the compaction tank 3. The opening can be closed by means of a lid 6. Furthermore, a gas removal connection 7 is provided at the top of the tank. At least one vibrator 8 is provided in the bottom portion of the tank, and a closing connection 9 connected to the conduit 4 is provided in the bottom of the tank. A connection between the conduit 4 and the pump is indicated with the reference numeral 10, and a pump feed pipe connected to the conduit 5 is indicated with the reference 11.

According to the invention, the casting of the concrete product is carried out by first compacting the concrete in the tank 3 and subsequently pumping it into the mould 1 so that it moves on in the mould as a continuous flow.

To compact the concrete it is fed in the direction of the arrow A into the compaction tank 3, in which it is vibrated while sucking gas out of the tank through the gas removal connection 7 in the direction of the arrow B. After the compaction has been completed, the closing connection 9 is opened and the pump 2 is started, whereby the concrete flows from the compaction tank through the pump to the lower end of the mould 1 and within the mould further upward along the mould until the mould is full or the concrete flow is cut off. The casting method of the invention is considerably more rapid than prior art production techniques, because instead of moving the casting device itself the concrete flows from the tank into the mould. The method of the invention can be used both in connection with a closed and open mould.

Figures 2 and 3 show another embodiment of the device, in which the mould 1 is, for instance, rectangular, horizontal and open at the top, being intended for the production of a concrete slab, for instance. In this case, the conduit 5 feeds concrete from above into the mould. In order that the concrete would form a continuous flow, a counterpressure has to be created in the mould. In this particular embodiment, the counterpressure is created by means of a horizontal plate 12 surrounding the opening of the conduit 5. The plate 12 and the bottom and sides of the mould define a substantially closed space which prevents the concrete from falling freely into the mould. The conduit 5 and the plate 12 are displaced horizontally along the mould along parallel paths so that the slab is formed by concrete zones 13 positioned side by side. To provide the slab with a smooth surface, it is to be preferred that the plate 12 rotates or oscillates.

Alternatively, the invention can be realized without the pump 2. The compaction tank is thereby provided with a connection through which pressurized gas can be introduced into the tank to feed compacted concrete directly into the mould.

In the embodiment shown in Figure 1, the mould is elongated and vertically positioned, and the con duit 5 opens in the lower end of the mould. Alternatively, the mould can be slanted or horizontally positioned, whereby the concrete inlet need not necessarily be positioned at the end of the mould. It is essential for maintaining the degree of compaction of the concrete unchanged that the feeding force of the pump or the like is the only force acting on the concrete in its direction of movement. A force resisting the feeding of the

concrete can be alternatively effected by forming an overpressure in a closed mould before the filling of the mould. The simplest way, however, is to utilize the force of gravity as a counter force. If regarded necessary, the concrete can, of course, be subjected to additional compaction in a conventional manner after having been cast into the mould.

Additional compaction can be alternatively effected by exposing the concrete to a pressure by creating an overpressure in the mould.

Claims

1. A method of casting concrete products by filling a mould (1) with flowing concrete material and compacting the concrete material, **characterized** in that the compaction of the concrete material is carried out before the concrete is fed into the mould, and that to fill up the mould (1) the concrete is fed into it as a continuous flow.

2. A method according to claim 1, **characterized** in that a counterpressure is created in the mould to achieve a continuous flow.

3. A method according to claim 1 or 2, when using an elongated mould, **characterized** in that the concrete material is fed into the mould in such a way that it moves on in the mould (1) in its longitudinal direction.

4. A method according to claim 3, **characterized** in that the concrete material is fed into the mould (1) through its one end.

5. A method according to claim 3, **characterized** in that the mould (1) is kept in a slanted or vertical position during the casting, the concrete material being fed into the mould through its lower end and moved on in the mould against the force of gravity.

6. A method according to anyone of claims 1 to 5, **characterized** in that the concrete material is pumped from compaction means (3) into the mould (1).

7. A method according to claim 1 or 2 when the mould is open, **characterized** in that the concrete inlet point in the mould is kept substantially closed by means of a plate positioned at the inlet point.

8. A method according to anyone of claims 1 to 6 **charac terized** in that an overpressure is created in the mould to compact the concrete material (1) contained in the mould (1).

9. A device for casting concrete products, comprising a mould (1); means (2) for feeding flowing concrete material into the mould; and means (3, 7, 8) for compacting the concrete material, **characterized** in that the concrete compaction means (3, 7, 8) are connected before the concrete feeding means (2), and that the concrete feeding means (2) are arranged to feed concrete into the mould (1) as a continuous flow.

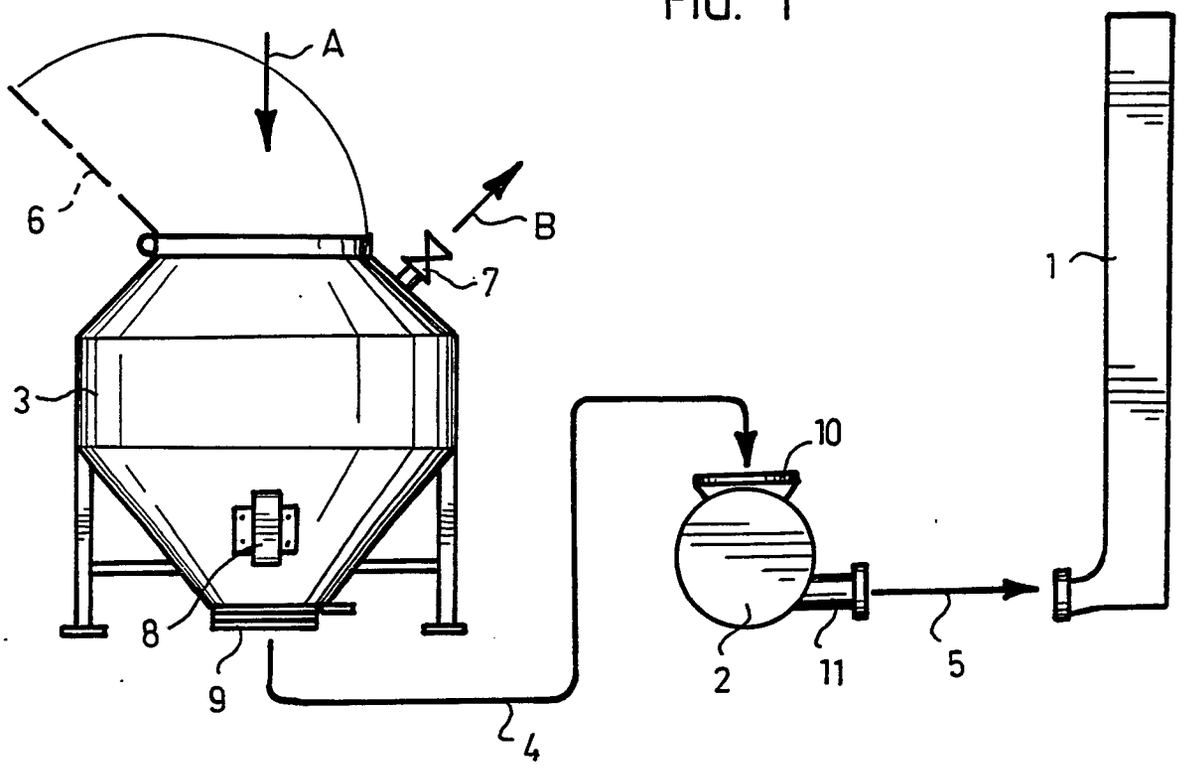
10. A device according to claim 9, **characterized** in that the concrete compaction means comprise a tank (3), a vibrator (8) and means (7) for creating underpressure and/or overpressure in the tank being connected to the tank (3).

11. A device according to claim 9 or 10 **characterized** in that the concrete feeding means (2) are arranged to feed concrete into the mould through its one end.

12. A device according to anyone of claims 9 to 10, **characterized** in that the mould (1) is positioned horizontally, vertically or in a slanted position, the mould being closed and the concrete inlet being positioned at the lower end of the mould in the two last-mentioned cases.

13. A device according to claim 9, **characterized** in that a movable plate (12) surrounds the concrete inlet which opens in the mould.

FIG. 1



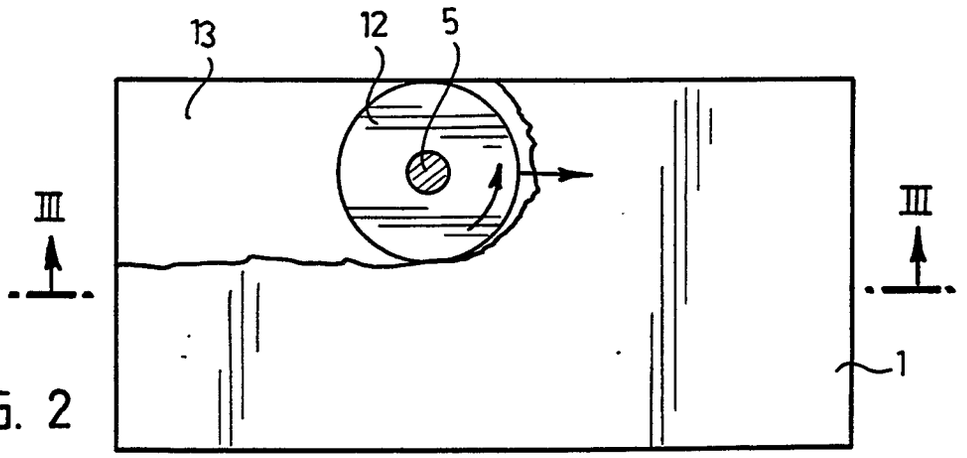


FIG. 2

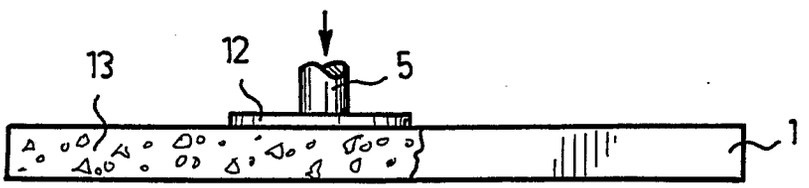


FIG. 3

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EUROPEAN SEARCH REPORT

Application number

EP 89124153.1

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int Cl⁵)
X	FR - A1 - 2 405 796 (SIMMERING-GRAZ-PAUKER) * Page 8, lines 32-37; claim 3 *	1	B 28 C 5/48 B 28 B 15/00
Y		2,3,4, 5,6,9, 10,11	
Y	US - A - 2 429 012 (ZIGENBEIN) * Column 2, lines 42-43 *	1,2,3, 4,5,6, 9,10, 11	
A	CH - A - 153 368 (RUML) * Page 2, column 1, lines 14-17 *	5,6	

TECHNICAL FIELDS SEARCHED (Int Cl⁵)

B 28 B
B 28 C
E 02 D
E 04 G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	17-03-1990	GLAUNACH

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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