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

(11) **EP 1 952 961 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
06.08.2008 Bulletin 2008/32

(51) Int Cl.:
B28B 1/08 *(2006.01)* ***B28B 3/20*** *(2006.01)*

(21) Application number: **08397001.2**

(22) Date of filing: **15.01.2008**

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

(30) Priority: **05.02.2007 FI 20070099**

(71) Applicant: **Elematic Oy Ab**
37800 Toijala (FI)

(72) Inventor: **Seppänen, Aimo**
37700 Sääksmäki (FI)

(74) Representative: **Langenskiöld, Tord Karl Walter et al**
Oy Jalo Ant-Wuorinen Ab,
Iso-Roobertinkatu 4-6 A
00120 Helsinki (FI)

(54) **Method and apparatus for casting concrete products**

(57) A method and an apparatus for casting concrete products with a substantially horizontal slipforming process, the concrete mass in said method being fed by means of at least one feed element (2) through a limited cross section (11, 7, 8) for forming the concrete product, whereby the feed elements (2) are brought to a dual-frequency longitudinal reciprocal motion for compacting the concrete mass.

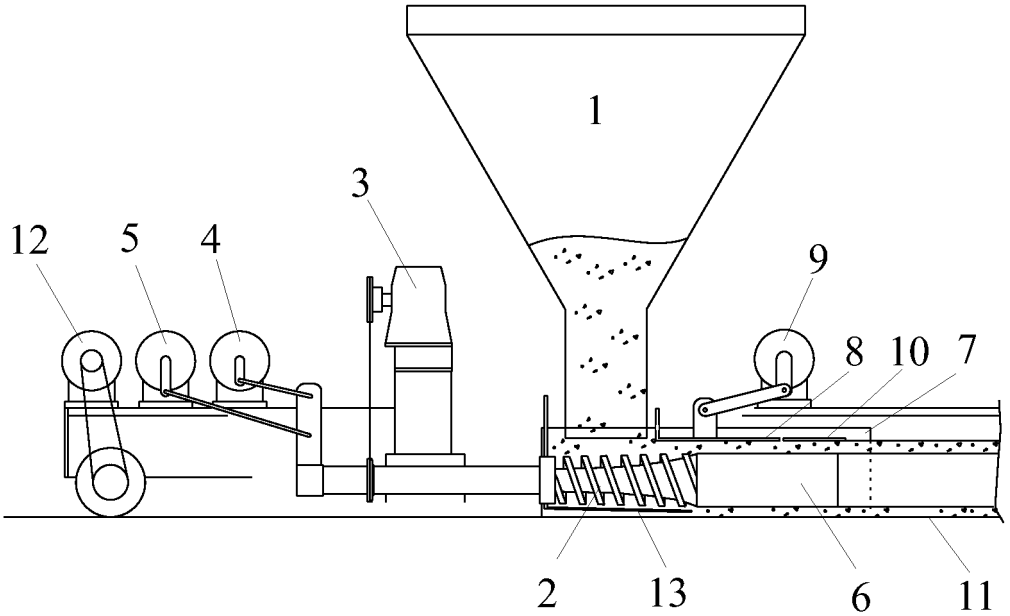

FIG. 1

EP 1 952 961 A2

Description

[0001] The present invention relates to casting of concrete products by means of a substantially horizontal slipforming process, wherein the concrete mass is pressurized at least by means of one feeding screw. More precisely, the invention relates to the motion of the feed screw and/or the element forming the hollow core during the casting process.

[0002] When casting with traditional extruder and slipformer casting machines, the casting mold is formed by a casting bed and side walls and upper surface moving along with the casting machine and forming the cross section of the product to be cast to the desired shape and size. When the casting machine proceeds, the side walls and the upper surface, and if necessary, the elements forming one or a plurality of hollow cores to the product to be cast, perform motion compacting the concrete mass. The ready-cast product remains on the casting bed to harden. Because the cast fresh slab remains lying on the casting bed in its final form, a high stiffness is required from the concrete mass to be used in the solutions of prior art.

[0003] The stiff concrete mass used in the solutions of prior art causes strong wear of the wear parts of the slipforming machine, like the feed screws and the hollow-core forming elements, whereby these wear parts must be changed relatively often. In connection with the chance of the wear parts, also the casting process of the production plant must be interrupted for the duration of the change. The stiff concrete mass also causes mechanical burden on the processing devices, like the trowelling devices of the upper surface, side walls and the hollow-core mandrels, and the rotating devices of the screws, and degradation of the compacting efficiency caused by the fast wear.

[0004] The slipforming technique for manufacturing hollow-core slabs and massive slabs is well known in the art. For example Patent publication PI 80845 discloses a method and an apparatus for casting a hollow-core slab. The compacting method described therein is based on reciprocal swinging of the hollow-core mandrel simultaneously with the reciprocal longitudinal motion. Nowadays, the heights of the slabs are increasing, whereby also the heights of the hollow cores are increased. In case of high hollow cores, with the described swinging of the hollow-core mandrel the adequate compacting of the hollow core is not achieved.

[0005] Patent publication FI 85350 discloses a compacting method, wherein wedge surfaces are moved in the casting direction in opposite directions with respect to each other in a reciprocal, opposite phase. The effect of the wedge surfaces, however, remains quite small, because the wedge surfaces must be quite low from the point of view of the flow of the concrete mix, which decreases their properties decreasing or increasing the compacting area. With deep wedge surfaces the flow of the concrete mix is prevented.

[0006] With slipforming machines of extruder type known in the art, the length of the reciprocal motion of the feed screw and the hollow-core mandrels ranges from 5 to 50 mm with a frequency from 1 to 10 Hz.

[0007] By means of the present invention, a slipforming machine having a simple construction is provided for the slipforming process, comprising a dual-frequency compacting arrangement, whereby a better compacting result with less wear of the components can be provided than with prior art machines.

[0008] Dual-frequency compacting method in this connection refers to a compacting method, wherein the mass is compacted simultaneously with two different frequencies.

[0009] More precisely, the method in accordance with the present invention is characterized by what is stated in the characterizing part of Claim 1, and the apparatus in accordance with the present invention is characterized by what is stated in the characterizing part of Claim 4.

[0010] The invention will be described in more detail in the following, with reference to the enclosed drawing, wherein

Figure 1 shows a schematic view of one slipforming machine in accordance with the present invention.

[0011] Essential parts of the slipforming machine shown in Figure 1 are the mass container 1, feed screw 2, driving devices 3, 4, 5 of the feed screw, hollow-core mandrel 6, side walls 7, trowelling beam 8, driving devices 9 of the trowelling beam, surface leveling plate 10, casting bed 11, drive motor 12 and the chute 13 of the feed screw. The apparatus shown in the figure is meant for casting hollow-core slabs or beams.

[0012] When using the casting machine shown in Figure 1, stiff concrete mass is fed from the mass container 1 to one or a plurality of feed screws 2. Each of the feed screws 2 is located in a chute 13 guiding the concrete mass to the feed screw at the forward end of the feed screw. The feed screws 2 extrude the concrete mass under pressure to the cross section defined by the casting bed 11, side walls 7 and trowelling beam 8 defining the outer dimensions of the product to be cast. The rotating motion caused by the extrusion of the concrete mass by the feed screws 2 is effected by means of the driving device 3 of the rotating motion. When casting products with hollow cores, there are hollow core mandrels 6 mounted after the feed screw, forming the hollow cores to the product to be cast.

[0013] The casting machine moves supported by wheels along the casting bed driven by the reaction force of the feed screws 2, said force moving the casting machine forward being accelerated or decelerated by means of a drive motor 12 connected to the casting machine.

[0014] The product to be cast is compacted by means of the reciprocal motion of the feed screws 2 and the hollow-core mandrels 6, as well as by the compacting

trowelling motion of the side walls 7 and the trowelling beam 8, which in case of the trowelling beam is effected by the driving devices 9 of the trowelling beam. The surface leveling plate 10 following the trowelling beam 8 levels the upper surface of the final product.

[0015] The reciprocal motion of the feed screws 2 and the hollow-core mandrels 6 is a dual-frequency motion effected by means of a long-motion driving means 5 and a short-motion driving means 4. Thereby the driving means 4 performs several reciprocal motions during one long reciprocal motion of the driving means 5. Thus, the compacting assembly formed by the feed screws 2 and the hollow-core mandrels 6 performs several short reciprocal motions at the same time when said compacting assembly performs one long reciprocal motion.

[0016] In the solution in accordance with the invention, the length of the short reciprocal motion preferably ranges from 0,2 to 4 mm having preferably a frequency from 15 to 50 Hz. The length and frequency of the long reciprocal motion of the solution in accordance with the invention essentially corresponds to the corresponding motion of the solutions known in the art, in other words the length ranging from 5 to 40 mm with a frequency from 1 to 10 Hz.

[0017] This kind of a dual-frequency compacting motion in accordance with the invention provides for the part of the short motion:

- efficient working of the concrete mass, whereby the concrete mass will be partly compacted already over the length of the feed screw,
- pumping of the cement paste against the surface of the moving components, which decreases the friction and the wear of the components,
- loosening the hollow-core mandrel from the compacted concrete, whereby the separate loosening movement can be omitted,

and for the part of the long motion:

- provides the compacting effect over the total length of the hollow-core mandrel, and

- intensifies the feed of the concrete mass to the area of the limited cross section having the biggest pressure.

[0018] By connecting the long and short motion, in addition, a more coarse thread of the feed screw can be used, due to the intensified feed and compacting of the concrete mass, which provides bigger casting speed of the casting machine, and at the same time less relative wear of the feed screw.

[0019] The solution in accordance with the invention is not limited to the method and apparatus for casting concrete products with hollow cores, only, like shown in the example of the figure, but it is also applicable to casting of for example massive slabs without hollow cores. Thereby the hollow-core forming elements are removed from the casting apparatus, and only the feed screw/screws is/are moved reciprocally with the dual-frequency compacting motion.

[0020] The solution in accordance with the invention can also be implemented with a fixed casting station, whereby the casting apparatus is located in the fixed casting station, but the casting bed moves with respect to the casting station. Thereby the movable casting bed moves the finished product out of the fixed casting station, and the ready-cast product remains on the casting bed.

Claims

1. A method for casting concrete products with a substantially horizontal slipforming process, the concrete mass in said method being fed at least by means of one feed element (2) through a limited cross section (11, 7, 8) for forming a concrete product, **characterized in that** the feed elements (2) are brought to a dual-frequency longitudinal reciprocal motion for compacting the concrete mass.

2. A method in accordance with Claim 1, **characterized in that** the product to be cast is a concrete product equipped with at least one hollow core, whereby in addition to the feed elements (2), also the hollow-core forming elements (6) are brought to the dual-frequency longitudinal reciprocal motion.

3. A method in accordance with Claim 1 or 2, **characterized in that** the length of the short reciprocal motion of the dual-frequency motion ranges from 0,2 to 4 mm with a frequency from 15 to 50 Hz, and that the length of the long reciprocal motion ranges from 5 to 40 mm with a frequency form 1 to 10 Hz.

4. An apparatus for casting concrete products with a substantially horizontal slipforming process, said apparatus comprising at least one feed element (2) for feeding the concrete mass through a limited cross section (11, 7, 8) for forming a concrete product, **characterized in that** the apparatus comprises means (4, 5) for bringing the feed elements (2) to a dual-frequency longitudinal reciprocal motion for compacting the concrete mass.

5. An apparatus in accordance with Claim 4, **characterized in that** the apparatus comprises means (6) for forming at least one hollow core to the concrete product to be cast, said means (6) being brought to the dual-frequency longitudinal reciprocal motion together with the feed elements (2).

6. An apparatus in accordance with Claim 4 or 5, **characterized in that** the length of the short reciprocal motion of the dual-frequency motion ranges from 0,2 to 4 mm with a frequency from 15 to 50 Hz, and that

the length of the long reciprocal motion ranges from 5 to 40 mm with a frequency form 1 to 10 Hz.

7. An apparatus in accordance with any of the Claims from 4 to 6, **characterized in that** the feed element is a feed screw (2).

8. An apparatus in accordance with any of the Claims from 4 to 7, **characterized in that** the apparatus comprises means (12) for moving the apparatus along the casting bed (11) during the cast.

9. An apparatus in accordance with any of the Claims from 4 to 7, **characterized in that** the apparatus comprises a fixed casting station and movable casting beds.

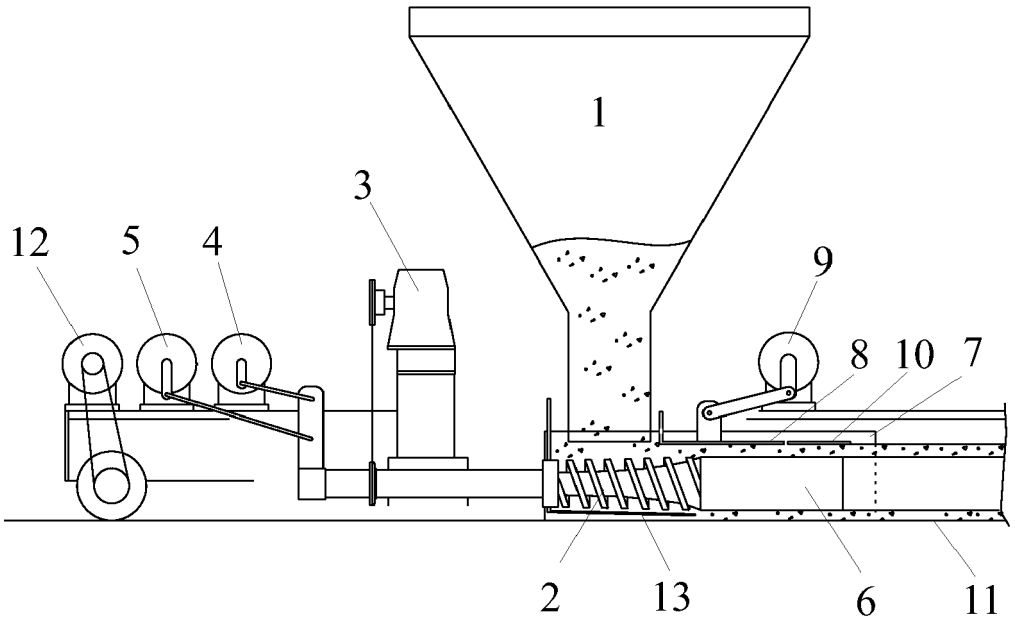

FIG. 1

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- FI 85350 **[0005]**