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(54) **Method and apparatus for attaching a tag to slipform cast prefabricated concrete product**

(57) Method and equipment for attaching a tag to a slipform cast prefabricated concrete product (2), in which method a tag including the identification data of the concrete product is produced, which tag is fastened to the

concrete product, wherein the tag is produced and fastened to the concrete product (2) by intermediation of a device producing said concrete product, or a device (1) finishing said concrete product.

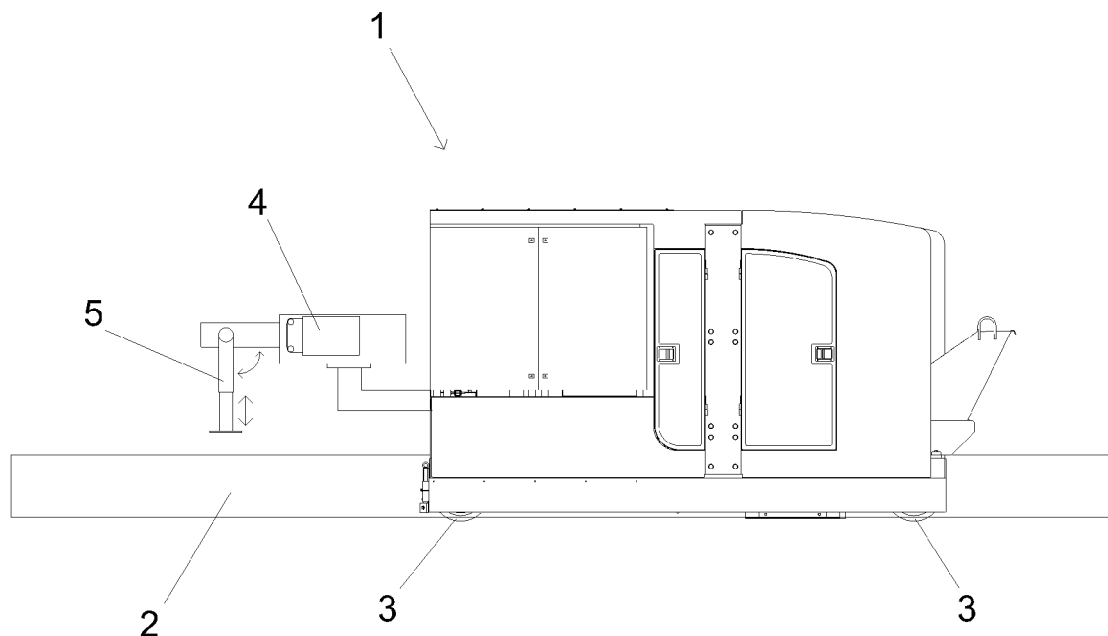


FIG. 1

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Description

[0001] The invention relates to attaching a tag to a slipform cast prefabricated concrete product. More precisely, the invention relates to an arrangement for attaching a tag to a concrete product by intermediation of a device for manufacturing or finishing said concrete product.

[0002] Prefabricated concrete elements, such as hollow-core slabs and solid concrete slabs, are conventionally cast as slipform casting on elongate casting beds in a continuous process. The length of said continuous casting process is defined either on the basis of the combined length of the elements to be cast, or on the basis of the maximum length of the casting bed. The length of casting beds used in slipform casting can be even 150-200 m, depending on the size of the element factory. After the slipform casting equipment has cast a continuous slab on the casting bed, the cast concrete mix is allowed to be cured on the casting bed. When the concrete mix is cured, the uniform cast concrete slab is sawed in predetermined lengths on the basis of the targets of usage of the final elements, and the sawn concrete elements are lifted off the casting bed to storage, to wait for transportation to their respective locations of usage.

[0003] In slipform casting devices, concrete mix is fed either in one or several stages to a casting mold moving along with the casting device, said mold being formed by side walls of the mold and vibrating beam defining the top surface of the mold, together with the casting bed. The side walls and vibrating beam of the casting mold perform a vibrating and/or trowelling compacting motion for compacting the concrete product. When casting hollow-core slabs, the slipform casting device is provided with means for forming the cavities. Generally a slipform casting device is a casting machine moving on a stationary casting bed along with the casting process, but a slipform casting device can also be realized as a stationary casting station, in which case the casting bed moves along with the casting process with respect to the casting station.

[0004] The most general types of slipform casting devices are Extruder and Slipformer. In an Extruder-type slipform casting device, the concrete mix is fed on feed screws that extrude the concrete mix to the slipform casting mold. Thus, in an Extruder-type casting device, the feeding of the concrete mix to a slipform casting mold is carried out in one single feed step. When casting hollow-core slabs, at the end of the feed screws are attached hollow-core forming members, such as hollow-core mandrels.

[0005] In a Slipformer-type casting device, the concrete mix is in the first feed step fed only to the bottom part of the space defined by the side walls of the slipform casting mold, and when casting hollow-core slabs, in said bottom part of the space, there are formed, by means of vibrator shoes and following tubes, grooves forming the lower part of the cavity. In the second feed step of the concrete mix, the rest of the concrete mix is fed in the

slipform casting mold, in the case of hollow-core slabs on top of the following tubes, whereafter, as the casting process proceeds, the vibrating beam defining the top surface of the cast product compacts and finishes the top surface of the product to be cast.

[0006] Generally concrete products made by slipform casting, in other words concrete elements, are prestressed, i.e. they are provided with reinforcing strands. In addition, after slipform casting, slipform cast concrete products can also be provided with various different holes or apertures, for instance for lead-throughs or other fittings to be added in the product after casting. Apart from conventional concrete mix, for instance fiber-reinforced concrete mix can be used as the casting material for slipform cast concrete products.

[0007] The apertures and holes made in a fresh, i.e. green concrete product can be made in the concrete product either manually or by a machine. The machines used in this kind of finishing treatment of fresh concrete products typically include means for digging concrete mix from the fresh concrete slab and means for measuring the cast product and marking the points for sawing, according to the obtained measurement results. Moreover, a finishing machine often is also provided with means for drilling water holes in concrete products provided with cavities.

[0008] According to the current standards and requirements, it must be possible to track all prefabricated components and elements used in the building industry down to their place of manufacture and even down to their specific batch of production. This also applies to slipform cast concrete products. The standard EM 13369:2004 sets forth the requirements stipulated for marking elements.

[0009] Conventionally said marking of prefabricated, slipform cast concrete products has been realized by providing the concrete product with a separate identification tag. Typically said tag is a piece of paper or plastic, in which the identifying data of the concrete product is marked, and/or the tag is provided with a bar code. Generally this tag is attached on the surface of a fresh slipform cast concrete product, for example by nails, before the concrete mix is cured.

[0010] The tag can also be a RFID tag.

[0011] The fastening of the tag on the surface of a slipform cast concrete product is carried out as manual work, in which case the tag is first printed, whereafter it is fastened to concrete products. In practice, the fastening of the tag on the product surface is realized by nailing or gluing.

[0012] The problem with said conventional fastening of the tags is that the printed tags are easily mixed during the fastening process, and the concrete product can be easily provided with a wrong tag. This results in that on the basis of the identification data, a wrong product is delivered to the building site, in which case it does not fit in the reserved place, for example. The returning of a wrong product and the delivery of the correct one to the

building site ties up transport equipment, delays the building work and causes other economical losses.

[0013] In the arrangement according to the present invention, the making and fastening of the tag to the pre-fabricated slipform cast concrete product is realized so that either the slipform casting machine casting the concrete product, or the finishing machine finishing said product, is provided with means for producing the tag and for connecting it in the cast concrete product.

[0014] With the arrangement according to the invention, the production and fastening of the tag to the cast concrete product can be mechanized, which eliminates the problems of manual fastening, and it can be ensured that the correct tag is attached to each concrete product. This improves for instance the flexibility of the production process.

[0015] Advantageously the means for producing and fastening the tag form part of the finishing machine of a slipform cast product, which machine marks the points for sawing in the slipform cast concrete product, and performs other remolding operations with a fresh concrete product.

[0016] Advantageously the arrangement according to the invention can be realized by means of a tag printing unit connected to either the concrete product slipform casting machine or to the finishing machine of a fresh concrete product, and by means of a robot gripper that attaches the tag to the concrete product.

[0017] The tag printing unit can be for example a regular printer that prints the identification data of a concrete product on a plastic tag slip. The printer unit is preferably connected to the control system of the machine, so that the tag data is transmitted through the control system to the printer unit.

[0018] The robot gripper fastening the tag to a concrete product can be provided with means for nailing the tag to the concrete product. As an alternative, the tag slip can be attached to the concrete product by means of an adhesive surface provided in the tag.

[0019] When using RFID tags, the slipform casting machine or the concrete product finishing machine is provided with means for adding the concrete product identification data to the RFID tag, said means being preferably integrated in the control system of the machine.

[0020] An RFID tag can be attached to a concrete product by a robot gripper either on the surface of the concrete product, as a normal tag slip, or it can be embedded, by the robot gripper, inside the concrete product, in the vicinity of the surface thereof, in order to make it easier to read the tag information.

[0021] More precisely, the method according to the invention is characterized by what is set forth in the characterizing part of claim 1, and the apparatus according to the invention is characterized by what is set forth in the characterizing part of claim 5.

[0022] The invention is described in more detail below, by way of example, with reference to the appended drawing, where

Figure 1 is a schematical illustration of a finishing machine of slipform cast concrete products according to the invention.

[0023] The finishing machine 1 of slipform cast concrete products illustrated in Figure 1 moves above a fresh, green concrete product 2 placed on the casting bed. The finishing machine 1 is placed above the cast concrete product 2 so, that the machine wheels 3 are set on the rails provided at the edges of the casting bed.

[0024] Typically the task of the finishing machine 1 is to dig holes and allocations, as well as to mark sawing points in the fresh concrete product 2.

[0025] For making the tag, the finishing machine 1 is provided with a tag printer unit 4, which prints the identification data of the cast product for example on a plastic tag slip.

[0026] For fastening the tag in the concrete product 2 after making the tag, a robot gripper 5 is arranged in connection with the printer unit 4. In the example of the drawing, the robot gripper 5 is realized as a shaft with an adjustable length, one end of said shaft being fastened to the vicinity of the printer unit 4, and the other end of said shaft being provided with the gripper unit.

[0027] By turning the shaft element of the robot gripper 5 to the horizontal level, and by shifting the grip unit to the immediate vicinity of the printer unit 4, the grip unit of the robot gripper has access to grip the printed tag and to remove it from the printer unit. When the shaft of the robot gripper 5 is thereafter turned to the vertical position, and the grip unit of the robot gripper is shifted to the immediate vicinity of the concrete product 2, the grip unit has access to attach the tag to the concrete product.

[0028] In the example of the drawing, the tag fastened by the robot gripper 5 is attached to the concrete product by intermediation of an adhesive surface provided in the tag. As an alternative, or in addition to this, the grip unit of the robot gripper 5 can be provided with means for nailing the tag slip to the concrete product 2.

[0029] When using RFID tags, the printer unit 4 is replaced by a suitable RFID tag programming unit. In that case the RFID tag is embedded in the surface of the concrete product by the robot gripper 5.

[0030] In the arrangement according to the invention, the tag can be attached to the horizontal top surface of the concrete product 2, or to the vertical side surfaces of said concrete product.

[0031] The finishing machine 1 is typically controlled by a control system, in which system there is fed data of the finishing operations required by the concrete product 2, and of the sawing points of the concrete product. Said control system of the finishing machine 1 is advantageously made use of for transmitting identification data to the printer unit 4 in order to produce tags.

[0032] The printer unit 4 illustrated in the drawing in connection with the finishing machine 1, as well as the robot gripper 5, can also be connected to the rear part of the slipform casting machine in ways obvious for a

person skilled in the art, in which case a separate finishing machine is not needed for fastening the tag to the concrete product 2.

[0033] As regards the above described examples and embodiments, it is pointed out that the arrangement according to the invention is not restricted to said described embodiments, but it can be changed and modified in ways obvious for a person skilled in the art, within the scope defined in the appended claims.

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Claims

1. A method for attaching a tag to a slipform cast pre-fabricated concrete product (2), in which method a tag including the identification data of the concrete product is produced, and said tag is attached to said concrete product, **characterized in that** the tag is produced and fastened to the concrete product (2) by intermediation of a device producing said concrete product, or a device (1) finishing said concrete product. 15
2. A method according to claim 1, **characterized in that** the device producing and fastening the tag is a slipform casting machine or a concrete product finishing machine (1). 25
3. A method according to claim 1 or 2, **characterized in that** the tag is produced on a plastic slip by printing or by recording the identification data in an RFID tag. 30
4. A method according to any of the claims 1-3, **characterized in that** the tag is attached to the concrete product (2) by intermediation of a robot gripper (5). 35
5. An apparatus for attaching a tag to slipform cast pre-fabricated concrete product (2), **characterized in that** the equipment includes means (4) for producing the tag and means (5) for fastening the tag to a concrete product (2), and **in that** the equipment is a slipform casting machine or a concrete product finishing machine (1). 40
6. An apparatus according to claim 5, **characterized in that** the means for producing the tag comprise a printer unit (4) or means for recording data in an RFID tag. 45
7. An apparatus according to claim 5 or 6, **characterized in that** the means for fastening the tag to a concrete product (2) comprise a robot gripper (5). 50

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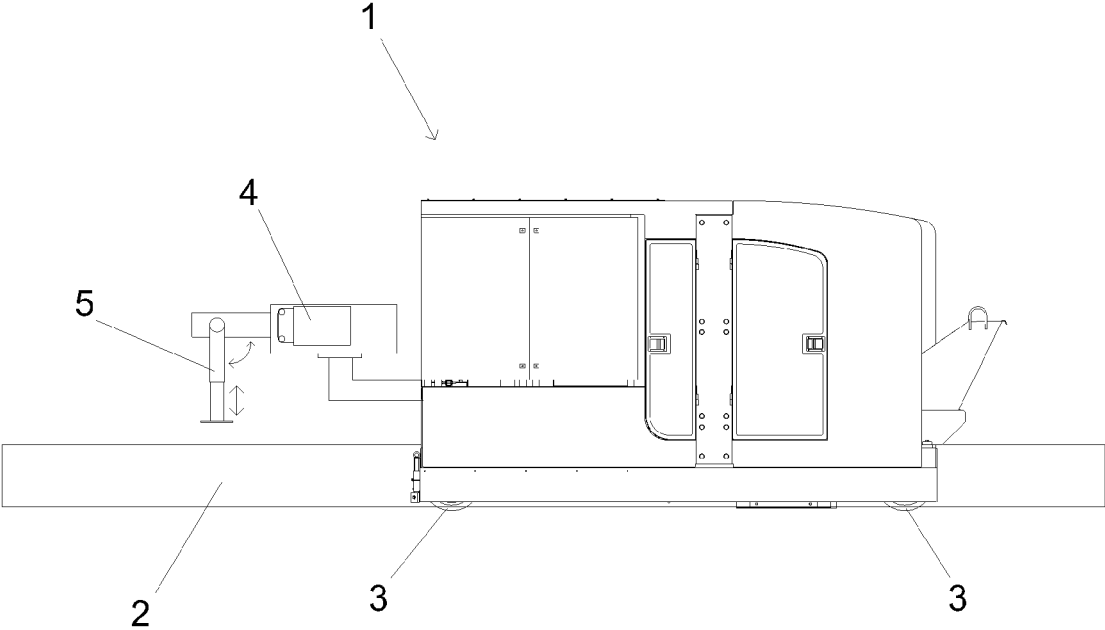


FIG. 1