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(71) Applicant: **Elematic Oy Ab**
37801 Toijala (FI)

(72) Inventor: **Eilola, Jani**
37560 Lempäälä (FI)

(74) Representative: **Kiviluoma, Markku Juhani**
Bergren Oy AB
P.O. Box 16
00101 Helsinki (FI)

(54) **Device and equipment for remolding a fresh, slipform cast concrete product**

(57) Device (1) for remolding a fresh, slipform cast concrete product, said device comprising a stationary digging jaw (4) fixedly attached to a support structure (2), and a movable digging jaw (3) that is movable with respect to the stationary digging jaw; and means (5) for operating the movable digging jaw, wherein the movable digging jaw (3) being attached to the support structure (2) by intermediation of two or several articulated joints or shafts (6, 7) for shifting the tip of the movable digging jaw towards the stationary digging jaw (4) substantially on the horizontal level. The invention also relates to equipment provided with such a device.

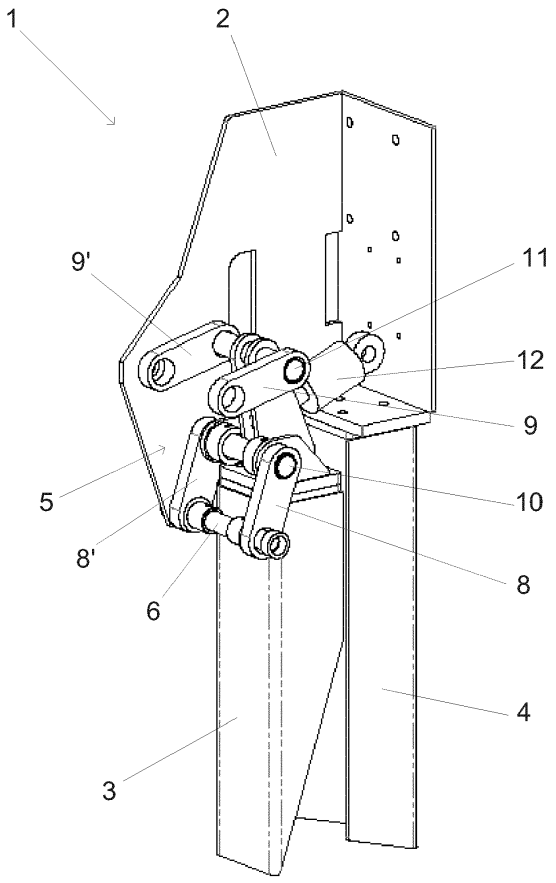

FIG. 1

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Description

[0001] The invention relates to a device for remolding a fresh, uncured concrete product, and to equipment provided with such a device. More precisely, the invention relates to a device and equipment for making apertures and holes in a fresh slipform cast concrete product.

[0002] After slipform casting, the cast concrete products must often be remolded in many different ways to be suitable in their targets of usage, because a slipform cast product is a uniform, elongate piece, where the shape of the cross-section is defined according to the slipform casting mold proceeding along with the casting process. Regular finishing operations include making various allocations and holes in a fresh slipform cast concrete product for forming necessary lead-through holes etc.

[0003] It is well known that the concrete mix used in slipform casting is fairly stiff, in order to allow the compacting means for compacting the concrete mix, provided in the slipform casting equipment, to achieve a sufficient compacting effect in the product formed in the slipform casting mold before the cast product is moved away from the effective area of the slipform casting machine, as the slipform casting process proceeds further. In slipform casting, a fresh uncured concrete product is left to be cured on the casting bed without side walls or other support structures, in which case it must be sufficiently compact in order to be able to maintain its shape on the casting bed as the slipform casting process proceeds further.

[0004] Owing to its properties and to the compacting effect caused by the slipform casting machine, the concrete mix of a slipform cast fresh concrete product is very compact, and thus fairly difficult to make holes in. Moreover, the reinforcing strands of slipform cast concrete products often obstruct the making of holes, because the reinforcing strands provided inside a concrete product should not be moved while making holes - otherwise the grip of the strands in the fresh concrete mix is weakened.

[0005] Generally the holes and lead-throughs provided in slipform cast concrete products are made either manually or by a finishing machine designed for finishing a fresh, slipform cast concrete product.

[0006] Such finishing machines are typically provided with a ladle or a digging head, by which the machine makes holes and lead-throughs at predetermined spots of the cast concrete product. Conventionally such digging heads comprise two jaws, of which the first jaw is stationary, and the second jaw is movable in relation to the stationary jaw, so that the tip of the movable jaw is in the digging process turned towards the stationary jaw for detaching compact concrete mix and for removing it from the hole to be made.

[0007] A problem with such conventional digging heads of regular finishing machines is that by using them, it is very difficult to make a lead-through in a slab so that no concrete mix is left on the bottom of the lead-through. The reason for this is that the tip of the movable jaw makes a curved motion on the cross-sectional plane with respect to its fastening point, and thus it is not able to remove all concrete mix from the bottom of the created hole, particularly not from the area of the extreme ends of the motional reach of the jaw tip.

[0008] In an arrangement according to the present invention, the two jaws of the digging head are attached to the support structure of the digging head in such a way that the movable jaw is attached to the support structure by intermediation of at least two articulated joints or shafts, in which case a lever arm structure is formed in between the movable digging jaw and the articulated joints or shafts of the support structure. By means of the described lever arm structure, the tip of the movable digging jaw can be shifted along the bottom of the created hole on the horizontal level, i.e. on the level of the hole bottom, clearly better than with solutions of the prior art.

[0009] Thus, by means of the arrangement according to the invention, the amount of concrete mix left on the bottom of the created hole can be remarkably reduced, in which case there are not needed any separate means or measures for finishing the created hole.

[0010] Moreover, the arrangement according to the invention enables the making of holes or hole allocations with flat bottoms, which has not been possible in the prior art solutions.

[0011] The arrangement according to the invention also enables the recycling of the concrete mix first cast in a slipform cast concrete product and then removed in the digging process by reusing it. The fresh concrete mix removed from the concrete product by the digging equipment is conveyed from the digging equipment either to a concrete mix tank of the slipform casting machine, or to the concrete mix manufacturing process. Consequently, both economical and ecological savings are achieved.

[0012] Moreover, the arrangement according to the invention also remarkably reduces manual labor required in the finishing process of slipform cast concrete products, which further reduces the manufacturing costs of the concrete products.

[0013] More precisely, the device according to the invention is characterized by what is set forth in the characterizing part of claim 1, and the equipment according to the invention is characterized by what is set forth in the characterizing part of claim 5.

[0014] The invention is described in more detail below, by way of example, with reference to the appended drawings, where

Figure 1 is a schematical illustration of a digging head according to the invention, seen in a three-dimensional view, without the second side plate of the support structure of the digging head, and

Figures 2A-2C are schematical illustrations of a digging head of the invention according to Figure 1, as the movable jaw is shifted towards the stationary jaw at the various stages of the shifting operation.

[0015] Figure 1 illustrates a digging head 1 according to the invention, including a support structure 2, a movable digging jaw 3, a stationary digging jaw 4 and a transfer mechanism 5 operating the movable digging jaw 3. In the drawings, the second side plate of the support structure 2 of the digging head is removed in order to better illustrate the structure of the transfer mechanism 5.

[0016] In the embodiment illustrated in the drawings, the movable digging jaw 3 is attached to the side plates of the support structure 2 of the digging head 1 by intermediation of a transfer mechanism 5. The transfer mechanism 5 includes two articulated shafts 6 and 7 (articulated shaft 7 is not illustrated in Figure 1) extending between the side plates of the support structure 2 and supported by the side plates, arms 8, 8' attached at one end to the articulated shafts 6 and 7; and at the opposite ends of the arms 8, 8' and 9, 9', articulated shafts 10 and 11 connecting the arms together and the movable digging jaw 3 to the structure. In addition, the transfer mechanism 5 includes a hydraulic cylinder 12 for generating driving power for the movable digging jaw 3.

[0017] Next, the operation of the digging head 1 according to the invention as illustrated in the drawings, is described with reference to figures 2A-2C.

[0018] When using the digging head 1, first the tips of the digging jaws 3 and 4 are immersed, in a position illustrated in Figure 2A, in a slipform cast fresh concrete product, at a desired depth, by pressing them for instance vertically downwards from the product surface level. When the digging jaws 3 and 4 are immersed at the desired depth inside the product, the immersing motion is stopped, and the movable digging jaw 3 is started to be shifted towards the stationary digging jaw 4 by the transfer mechanism 5, in accordance with Figure 2B.

[0019] In this connection it is pointed out that when the space defined by the jaws 3 and 4 of the digging head 1 is full of concrete mix, the concrete mix located between the jaws effectively hinders the motion of the jaw 3 towards the stationary jaw 4. Said concrete mix compressed between the jaws can now be removed from the concrete product by lifting the digging head 1 upwards, whereby the concrete mix compressed in between the jaws is detached from the concrete product. Fresh, compacted concrete mix is well resistant to compression, but is easily broken by tensile stress.

[0020] When the digging of a hole or aperture has proceeded for example to a defined depth, the movable digging jaw 3 can at the finishing stage of the digging process be shifted to the position illustrated in Figure 2C, where the tip of the movable digging jaw 3 and the slanted edge are in contact with the stationary digging jaw 4, or placed in the immediate vicinity thereof.

[0021] As can be seen from the illustrations of Figures 2A-2C, the tip of the movable digging jaw 3 is during the whole shifting process of the movable digging jaw placed substantially on the same level, i.e. on the horizontal level. Thus all excess concrete mix can be effectively removed from the bottom of the created hole, so that the quality of the hole or aperture made by the digging head 1 is remarkably improved in comparison with the solutions of the prior art.

[0022] In comparison with a conventional digging head provided with fastening by one articulated joint or shaft at the digging head of the movable digging jaw, the movable digging jaw according to the invention makes it possible to remarkably reduce the distance of the tip of the digging head from the bottom level of the created hole in extreme positions. For instance, in the example illustrated in the drawings, said distance of the tip of the movable digging jaw from the bottom level is at least 70-75% shorter in the extreme regions of the motional reach than in a conventional solution.

[0023] Although the solution illustrated in the examples in the drawings only includes two articulated joints and shafts, it is obvious for a person skilled in the art to use even several articulated joints and/or shafts in the fastening of the movable digging jaw, in which case the motion of the movable digging jaw, particularly in the extreme positions, can be brought nearer to the bottom level.

[0024] As regards the embodiment illustrated in the drawings, it is also pointed out that the described arrangement is only an exemplary embodiment of the invention, and it should by no means be interpreted as restrictive of the invention. The scope of the invention is restricted by the appended claims only.

Claims

1. Device (1) for remolding a fresh, slipform cast concrete product, said device comprising a stationary digging jaw (4) fixedly attached to a support structure (2), and a movable digging jaw (3) that is movable with respect to the stationary digging jaw, and means (5) for operating the movable digging jaw, **characterize in that** the movable digging jaw (3) is attached to the support structure (2) by intermediation of two or several articulated joints or shafts (6, 7) for shifting the tip of the movable digging jaw towards the stationary digging jaw (4) substantially on the horizontal level.

2. A device (1) according to claim 1, **characterize in that** the movable digging jaw (3) is connected to articulated joints or shafts (6, 7) provided in the support structure (2) by intermediation of lever arms (8, 8', 9, 9').

3. A device (1) according to claim 1 or 2, **characterized in that** the motion of the movable digging jaw (3) is generated by hydraulic or pneumatic means (12).

4. A device according to any of the claims 1-3, **characterized in that** the device (1) forms part of equipment arranged for remolding a fresh concrete prod-

uct.

5. Equipment for remolding a fresh, slipform cast concrete product, said equipment comprising means (1) for digging concrete mix from a fresh concrete product, **characterized in that** the equipment is provided with a device according to any of the claims 1-5.

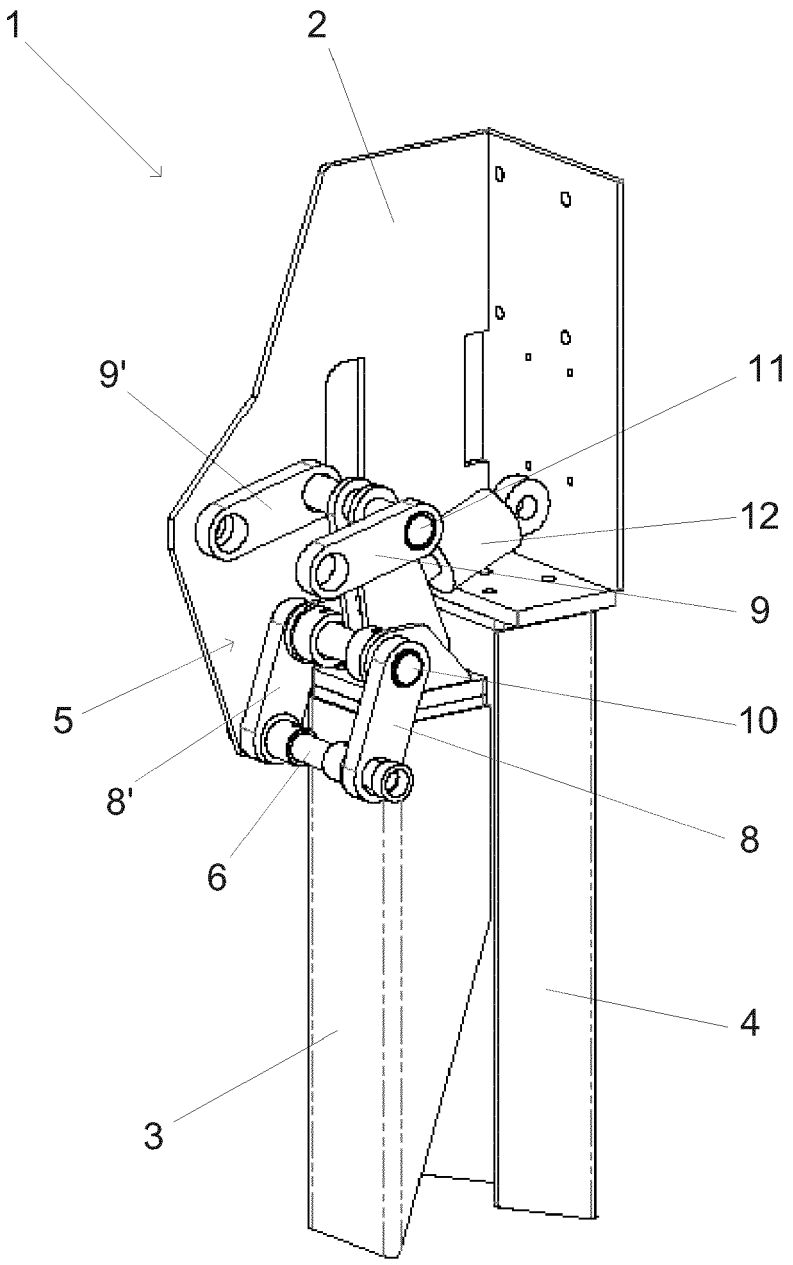

FIG. 1

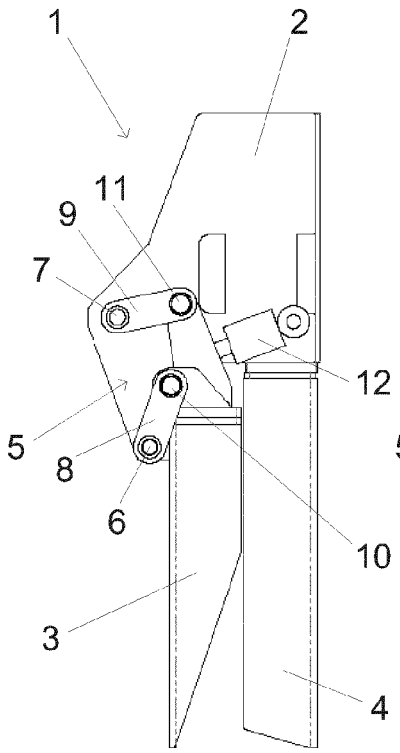

FIG. 2A

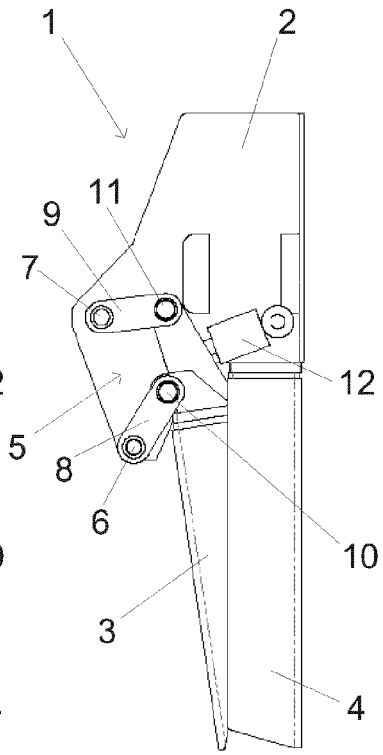

FIG. 2B

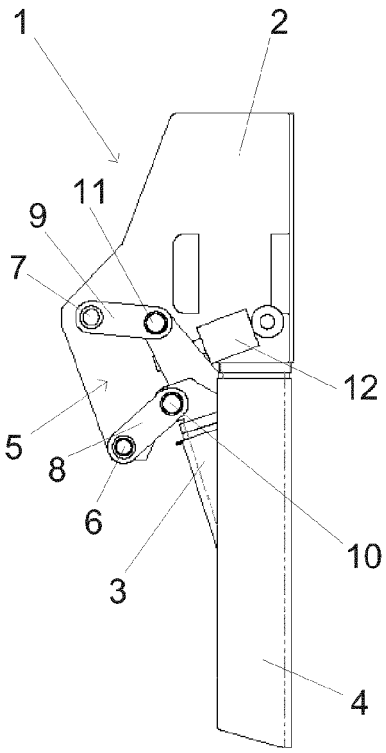

FIG. 2C