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(54) Installation device for manufacturing vent holes in concrete elements

(57) An installation device for implementing a vent hole in a concrete element having a concrete outer shell and inner shell, a thermal insulation between them, as well as a vent hole between the outer shell and the thermal insulation substantially along the entire area of the concrete element. According to the invention, the installation device comprises a distribution frame (2) to be connected to a pneumatic post (1), as well as a set of parallel, elongated and elastic tube elements (3, 4) that are separate from each other and extend from the distribution frame towards a particular direction, the tube elements being in a pneumatic post connection to the distribution frame.

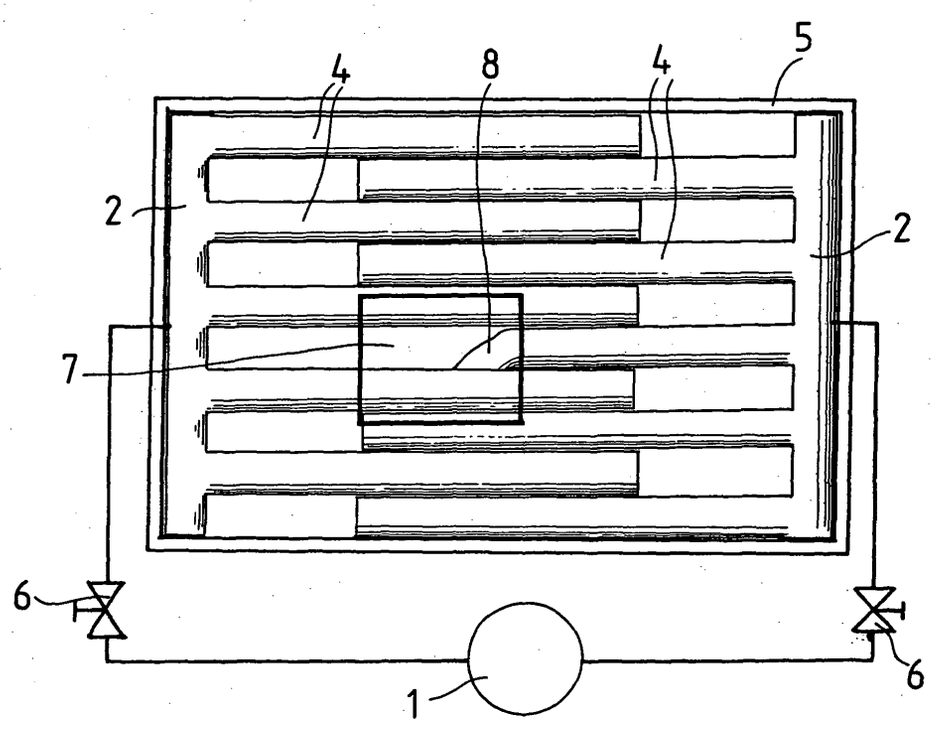

FIG 2

EP 1 435 282 A2

Description

[0001] The invention relates to an installation device as defined in the preamble of claim 1 for implementing a vent hole in concrete elements.

[0002] The closest prior art in the field of the invention represents international patent publication WO 01/96686. It discloses a manufacturing method of a concrete element provided with a vent hole, in which method the concrete element consists of an outer shell, a vent hole, a thermal insulation and an inner shell. The vent hole is implemented by means of a sheet-like slotted sheathing of flexible material, which as being extended, is placed on top of the outer shell between the reinforcements. After the setting of the concrete, the carpet-like sheathings are exhausted out of pressurised air and withdrawn from inside the hardened element, thus forming a uniform vent hole inside the element.

[0003] Known carpet-like slotted sheathings have proven to be very good and functional per se, and by means of them, several functional elements with vent holes have been manufactured. However, they have some disadvantages that make their use somewhat cumbersome. Slotted sheathings are fixed in terms of width and length, so it is difficult to use the same slotted sheathings in elements having various widths, heights or reinforcement widths. A second disadvantage is associated with the detachment of the slotted sheathing after the element has dried. Although the slotted sheathing is usually reduced when emptying it, removing it usually is difficult as some parts of it are stuck in the concrete casting. A third disadvantage is associated with the various discontinuities in the element to be manufactured. Usually, the element includes windows, doors or other various through-holes which have no standard wall structures or reinforcement spacers. Installing a sheet-like slotted sheathing in such an area is out of the question, so there is a need for slotted sheathings having different lengths and widths, which would be used, for each case specifically, on different sides of the element.

[0004] The objective of the invention is to eliminate the drawbacks referred to above. One specific objective of the invention is to disclose a new type of installation device allowing flexible manufacturing of vent holes of concrete elements regardless of the element dimensions and other characteristics.

[0005] As for the features characteristic of the invention, reference is made to them in the claims.

[0006] The installation device in accordance with the invention is designed to implement a vent hole in a concrete element which has a concrete outer shell and inner shell, a thermal insulation between them, as well as a uniform vent hole between the outer shell and the thermal insulation substantially along the entire area of the concrete element. According to the invention, the installation device comprises a distribution frame to be connected to a pneumatic post, as well as a set of parallel, elongated and elastic tube elements that are separate from each other and extend from the distribution frame towards a particular direction in a plane, the tube elements being in a pneumatic post connection to the distribution frame and via the distribution frame to the pneumatic post.

[0007] In one embodiment of the invention, the tube elements have a substantially round cross section. Advantageously though, the tube elements have a substantially oval cross section and are so placed that the flatter and wider area of the sheathing of the tube element is disposed against the concrete and insulation. In this manner, the pressure of the tube elements against the insulation and the damp concrete is achieved more uniform and planar, thus producing a substantially smooth finish. When the tube elements are non-pressurised, they are relatively flat, having a thickness of about 10mm. When full-blown, the thickness can be e.g. about 50mm. Thus, the installation device can be used to advantageously manufacture for concrete elements vent holes with various thicknesses ranging from 20 to 50mm just by suitably selecting the pressure to be used.

[0008] Although it is possible to consider an embodiment in which the distribution frame is a rigid tube or case, it is, however, of the same elastic material as the tube elements, whereby the distribution frame and the tube elements extending from it together form an elastic whole whose thickness can be regulated using pressured air.

[0009] The number of the tube elements extending from the distribution frame can vary according to the dimensions of the elements to be manufactured and to those of the vent holes to be made in them. Advantageously, there are 2-20, e.g. 5-10 tube elements, which makes the installation device easy to handle as it is relatively light. In manufacturing big elements, it is possible to use several adjacent installation devices together.

[0010] In manufacturing a big number of elements with the same size, the tube elements of the installation device can be so dimensioned that they extend from one end to another of the concrete element to be manufactured. In that case, at one end of the casting mould, the distribution frame of the installation device is mounted, and the tube elements are arranged next to each other to extend to the opposite end of the mould. In this embodiment, the tube elements can be disposed almost side by side in the distribution frame, though the installation device does not have any functional difference, even though there would be a distinct spacing between the tube elements.

[0011] In most of the cases, however, concrete elements are manufactured with varying sizes, in which case it is preferable to use an installation device in which the tube elements are spaced at a distance from each other in the distribution frame. This distance preferably is about the lateral-direction thickness of the tube elements. In that case, the installation device uses two separate distribution frames with their tube elements in such

a manner that in the manufacture of the concrete element, from the distribution frames that are mounted on the opposite flanks of the mould, the tube elements extend in the central area of the element substantially in a staggered manner. When the length of the tube elements to be used is more than a half of the width or height of the element to be manufactured, the tube elements extend at least partially crosswise. In the crosswise area, the tube elements constitute a nearly uniform mould, but in the fringe areas, a slot is formed that is somewhat wavy in respect of its thickness. However, it does not impede the functions of the slot that ventilate and dry the element.

[0012] The installation device of the invention has considerable advantages compared to prior art. Due to the elastic tube elements, the installation device can be easily installed and fitted into casting moulds of different shapes. Also the places of the different through-holes possibly disposed in the casting moulds can be easily circumvented. In addition, as far as the dimensioning is concerned, the same installation device can be fitted into casting moulds of various widths without any further functions. In the same way, the installation device makes it possible to manufacture in a wide area vent holes having various thicknesses just by changing the pressure.

[0013] In the following, the invention will be described in more detail with reference to the accompanying drawings, in which

Fig. 1 represents one installation device in accordance with the invention, and
Fig. 2 represents another installation device in accordance with the invention.

[0014] Fig. 1 shows one installation device in accordance with the invention comprising a tubular, hollow distribution frame 2, made of a rubber sheathing and connected to a pneumatic post 1 via a valve 6. Connected to the distribution frame, along the entire length thereof, are side by side a set of separate tube elements 3, made of flexible rubber and extending into one direction, the tube elements being in a pressurised air connection to the distribution frame 2. The tube elements together form a relatively uniform, planar sheathinq adjustable by means of pressurised air in respect of its thickness, which sheathing can be used when manufacturing vent holes in concrete elements. The rubber tubes 3 are attached, side by side, to the hollow distribution frame at the one end thereof, but otherwise they are separate from each other and detached, i.e. they are discrete from each other along the entire length and at their outer end. As they are in completely straight, parallel and non-pressurised state, as shown in Fig. 1, little slots are formed between the tube elements.

[0015] Fig. 2 shows a more versatile embodiment of the invention, from which the advantages of the invention over prior art are apparent in more detail. The installation device as shown in Fig. 2 comprises two separate, flexible distribution frames 2 made of rubber, both of which have a set of tube elements 4 whose thickness can be adjusted by means of pressurised air. The tube elements 4 are disposed in the distribution frame at a distance from each other, this distance substantially corresponding to the thickness of the tube element in the direction of the plane. The tube elements are only attached to the common distribution frame at the one end, extending from here as being parallel, separate and detached from each other into the same direction at a distance from each other. In this way, the tube elements extending from the distribution frames 2 that have been installed on the opposite edges of the casting mould 5 can be installed in a staggered manner in the central area of the casting mould, i.e. the element to be manufactured.

[0016] Often the wall elements to be manufactured are of standard height but varying in width. In that case, as the distribution frames correspond to the height of the element in terms of length, the same installation device can be used in the manufacture of elements with various widths with the tube elements 4 that extend from the opposite distribution frames 2 towards each other being staggered in each other's spaces to different lengths in elements of various widths.

[0017] When an installation device in accordance with the invention consisting of tube elements 4 is used, it is possible, e.g. near the window openings 7, to leave the end 8 of the tube element hanging, as shown in the figure, in case it does not sufficiently extend over the opening. In the same manner, the reinforcements between the concrete parts of the element as well as other possible through-holes can be easily circumvented, when in the installation phase, the non-pressurised tube elements 4 that are separate from each other are just fitted in the spaces of these.

[0018] After this, by letting the pressurised air from the pneumatic post 1 via the valves 6 into the distribution frames 2 and via them into the tube elements 4, both the distribution frames and the tube elements expand, thus forming in the casting mould 5, on top of the concrete outer shell, a sufficient support and space that inhibits a direct contact between the thermal insulation placed on top of it and the concrete outer shell. When casting an inner shell of the element on top of the thermal insulation, the installation device keeps the insulation and the outer shell separate from each other. After the concrete has sufficiently dried, the air pressure can be let out of the installation device, whereby the distribution frames and the tube elements are reduced, are detached from the rest of the structure and can be withdrawn from the vent hole thus formed. The installation device can be immediately re-used at the following casting step.

[0019] It must be noted that usually the outer shell of an element is cast in a mould of its own, and on top of this, the installation device and the insulation are placed.

Supported on top of the insulation is then the mould of the inner shell, into which the inner shell is cast. In this manner, the distribution frames of the installation device need not be disposed within the area defined by the moulds, as shown in the figure. The moulds are separate ones also near the window openings and the like, respectively, so that the tube elements 4 can go straight also in these places, as shown in Fig. 2. In this manner, in between the tube elements, just the reinforcements between the outer shell and the inner shell and the possible through-holes are left.

[0020] In the foregoing, the invention has been described by way of examples with reference to the accompanying drawing while various embodiments of the invention are possible within the scope of the inventive idea defined by the claims.

Claims

1. An installation device for implementing a vent hole in a concrete element having a concrete outer shell and inner shell, a thermal insulation between them, as well as a vent hole between the outer shell and the thermal insulation substantially along the entire area of the concrete element, **characterised in that** the installation device comprises a distribution frame (2) to be connected to a pneumatic post (1), as well as a set of parallel, elongated and elastic tube elements (3, 4)that are separate from each other and extend from the distribution frame towards a particular direction, the tube elements being in a pneumatic post connection to the distribution frame.

2. The installation device as defined in claim 1, **characterised in that** the tube elements (3,4) are substantially round in cross section.

3. The installation device as defined in claim 1, **characterised in that** the tube elements (3,4) are substantially oval in cross section.

4. The installation device as defined in claim 1, **characterised in that** the distribution frame (2) is substantially of the same elastic material as the tube elements.

5. The installation device as defined in claim 1, **characterised in that** connected to the distribution frame (2) are 2-20, preferably 5-10 tube elements.

6. The installation device as defined in any one of claims 1-5, **characterised in that** the tube elements (3) extend from one end to another of the concrete element to be manufactured.

7. The installation device as defined in any one of claims 1-5, **characterised in that** the tube elements (4) are disposed in the distribution frame at a distance from each other.

8. The installation device as defined in claim 7, **characterised in that** the installation device comprises two separate distribution frames (2) with its tube elements (4), so that from the distribution frames that are mounted on the opposite flanks of the mould, the tube elements extend in the central area of the element in a substantially staggered manner.

9. The installation device as defined in claim 7 or 8, **characterised in that** the length of the tube element (4) is more than a half of the width or height of the element being manufactured.

10. The installation device as defined in any one of claims 1-9, **characterised in that** the tube elements (4) are rubber tubes that are detached and separate from each other and extend forwards from a common distribution frame at a distance from each other.

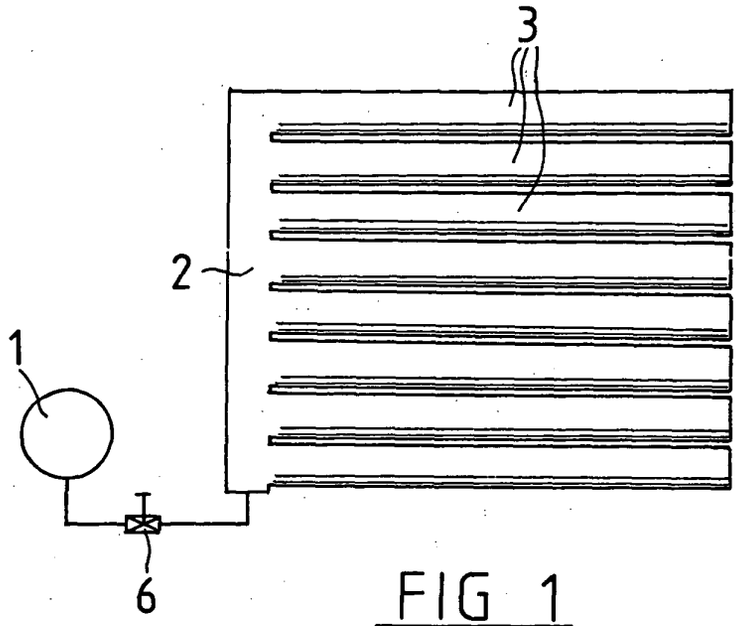

FIG 1

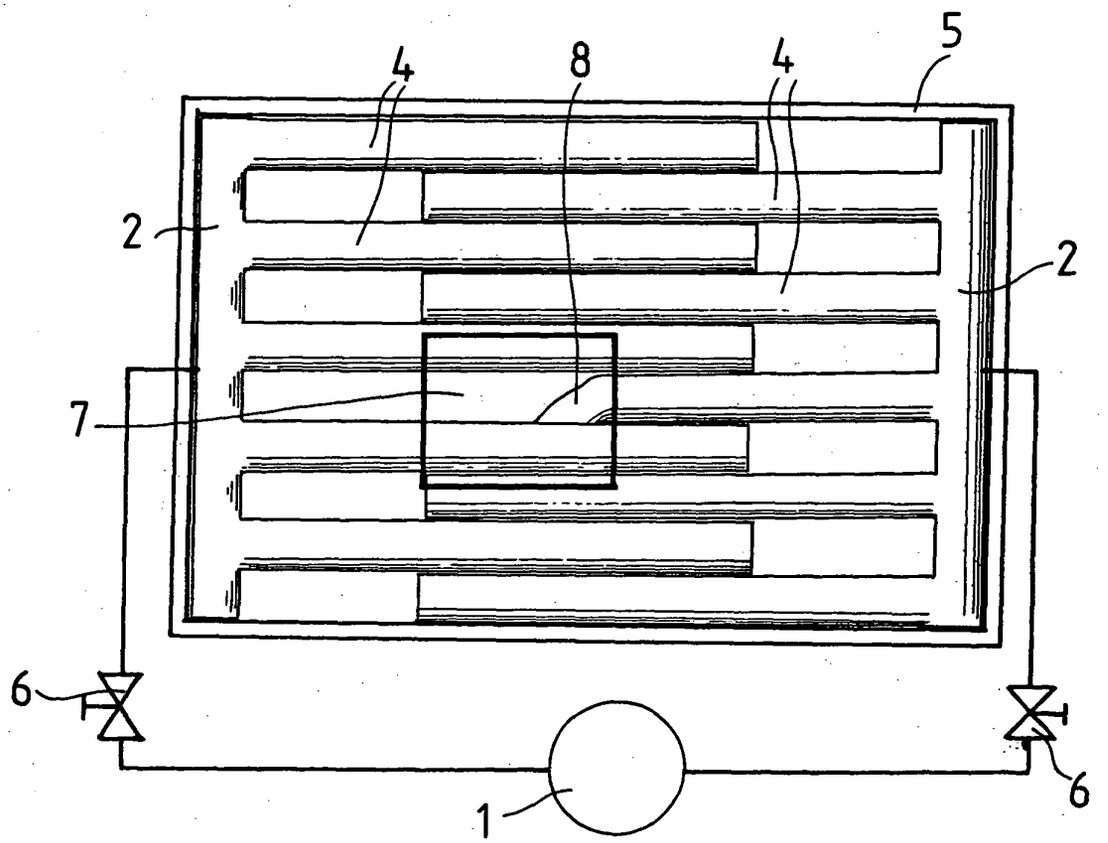

FIG 2