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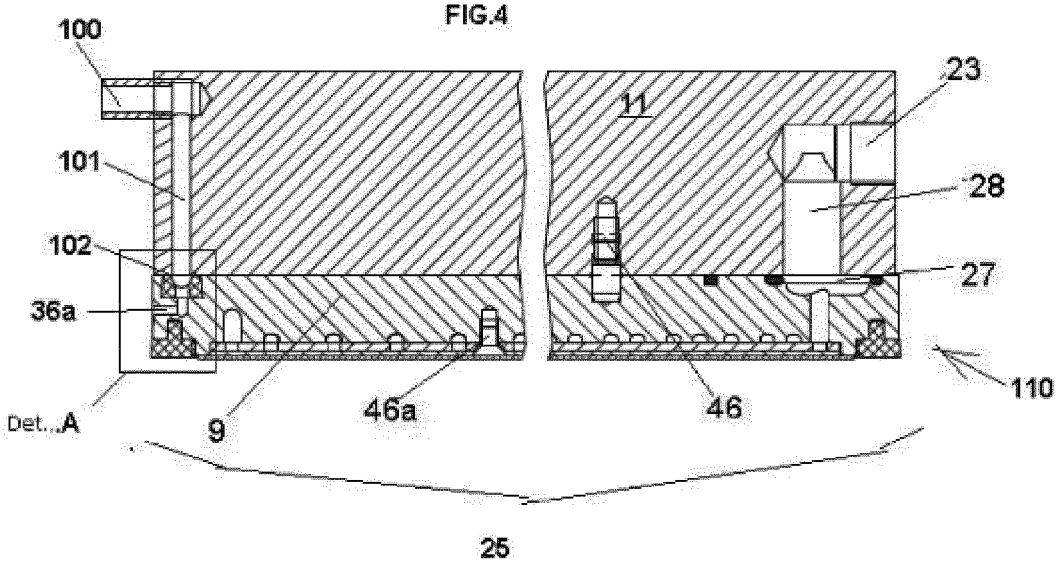
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(54) **APPARATUS AND METHOD FOR MANUFACTURING OF SINGLE-LAYER TILES**

(57) Pressing system (1) for presses (P) intended for the production of single-layer tiles starting from a water-based mixture (2) contained in a mold (3), comprising a pressing unit (110) with a filter (6) applied next to the pressing surface (25), wherein said unit (110) comprises a lower surface (24) equipped with first ducts (32, 34, 35) distributed along the pressing surface (25) and the lateral surfaces (106) provided with second ducts (36a) connected to said second pipes (109, 101, 100) for the sucking of water and sediment gathering in an interspace (72) between the unit (110) and the mold (3), and it further comprises control means (103, 108) for pneumatically separating said first and second pipes (27, 28, 23; 109, 101, 100).

FIG.4



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Description

Field of the Invention

[0001] The invention refers to an apparatus intended to perform the pressing and water suction steps during the manufacturing process of tiles, namely single-layer tiles.

STATE OF THE ART

[0002] For the same purpose, there are known apparatus of the type disclosed for example in the international patent application WO2012160583, said units envisaging a frame comprising a mold in which it is possible to introduce a water-based mixture and, during operation, is pressed by a plate which is movable relative to the frame and equipped with suction ducts distributed next to the lower pressing surface, where at least one filter applied to the lower face of the plate is also envisaged.

[0003] In the systems of a known type, a suction source is envisaged and it is intended simultaneously to sucks centrally the water through the filter below the pressing plate, and the water and the unfiltered sediment that settle in the perimeter movement gap between the frame and the plate.

[0004] The known solutions, however, have some drawbacks due to the simultaneous performance of the central and peripheral suction steps.

[0005] It has been verified that during the molding step, the presence of perimetral suction open holes involves a considerable reduction of the applied pressure and therefore the suction capacity. This vacuum reduction indicates an increase in the time needed to suck the exceeding water out of the mixture until the desired ratio water/mixture is reached. Another, not negligible, disadvantage of the suction steps simultaneity can be observed on to the pressed tile and it is due to the fact that the suction through the lateral holes excessively dries the upper perimeter of the tile and this causing, at the end of the process, this part to be the most friable area of the tile, since concrete suffered from lack of moisture in this area during the hardening phase. However, turning down the perimetral suction would result in a presence of exceeding water in the perimetral area, and therefore part of this water would pour back on the tile and on the mold during the releasing step of the tile from the mold. These are both negative effects. In the first case, the freshly molded tile shows still fresh concrete and water pouring on the tile tends to locally soften it; in the second case, the quantity of water pouring back on the ring nut tends to pool there and increases the possibility of dirt accumulating and thus causing - over time - difficulties to close the mold over the bed.

Object of the invention

[0006] It is therefore needed a piece of equipment able to solve the drawbacks of the known systems, thus obtaining - at the same time - a better efficiency of the pressing system during the pressing step of the tile.

Summary of the Invention

[0007] These objects have been achieved by developing a device according to one or more of the appended claims.

[0008] A first advantage is that the flow rate of the vacuum pump is used to the maximum of its possibilities during the first suction step and with relatively low pressing values, whereas only during the final pressing step, suction is activated in the perimeter movement gap between plate and mold.

[0009] A further advantage is that the upper perimeter of the tile is not excessively dried.

LIST OF DRAWINGS

[0010] These and other advantages will be better understood by anyone skilled in the art from the following description and the accompanying drawings, given as a non-limiting example, wherein:

- Figure 1 shows a front view of a generic press for the production of tiles;
- Figures 2a, 2b show details "A" and "B" respectively of the press shown in figure 1;
- Figure 3 shows an exploded view of a pressing and suction apparatus according to the invention;
- Figure 4 shows the unit shown in figure 3 in its assembled configuration;
- Figure 5 shows a detail of a first angular area of the apparatus shown in figure 4.
- Figure 6 shows a portion of the unit shown in figure 4 next to the upper suction manifold;
- Figure 6a shows the detail "B" of figure 6 in which the lower manifold of the plate is highlighted;
- Figure 6b shows a preferred embodiment of a lower manifold according to the invention;
- Figure 7 shows schematically an example of a pneumatic unit for implementing a separate suction according to the invention;
- Figure 8 shows a top view of the upper monolithic plate of the unit;
- Figure 8a shows an exploded view of an elastomer chamber housed in the plate shown in figure 8;
- Figure 9 shows a view from below of the plate shown in figure 8;
- Figure 10 shows the detail "C" of the angular suction area of the plate shown in figure 9;

Detailed description

[0011] With reference to the accompanying drawings, it is disclosed a preferred embodiment of a unit 1 according to the invention intended for presses of the type used

for manufacturing single-layer tiles starting from an underlying water-based mixture 2 contained into a pressing mold 3.

[0012] The unit 1, starting from the contact area with the mixture 2, substantially comprises:

A pressing unit 110 movable with respect to the mold 3 and a filter 6 applied to the pressing unit next to a pressing surface 25.

[0013] In the shown non-limiting example, the pressing unit comprises in greater detail:

a perimeter frame 5,
a filter 6 hold by the frame and in contact with the mixture so as to allow the suction of the liquid phase from the top,
a first lower manifold 7 which is preferably a metal mesh or a pack of overlapping metal meshes 78,
a second manifold 8 which is preferably a perforated plate in contact with the upper face of the first manifold 7,
a suction plate 9, which is preferably mounted by means of magnets 10 on a vertically movable pressing pad 11.

[0014] The mounting of the manifolds 7 and 8 to the plate 9 is achieved by using screws 46A into the holes 22 of the plate 9, in such a way that the manifolds remain adherent to the plate 9 when only the filter needs replacing or they can also be removed occasionally when they need to be disassembled for a more thorough cleaning.

[0015] Preferably, the second manifold 8 is obtained by a thin stainless steel sheet, having a fully perforated surface.

[0016] Alternatively, and with reference to figure 6b, the collectors 7 and 8 are replaced by a sub-filter structure 78 created by the superposition of three or more, preferably four, mesh manifolds 7 suitably mounted in a pack and staggered by half a pitch so that they fit above one another, thus obtaining a substantially flat and compact structure.

[0017] With this solution, structure 78 directly channels water to the various diagonal ducts 32, perimetral ducts 35 and to the four openings 34 of the corners.

[0018] In particular (figure 10), two diagonal ducts 32 located on the right and on the left with respect to the geometric diagonals "d" of the plate can be extended with sections 37 beyond the opening 34 towards the corners of the mold.

[0019] The direct passage of water takes place, therefore, from the filter 6 to the overlapping mesh sub-filter 78 and to the various steps 32-34-35 for their usable surface and no longer through the more or less thick holes of the plate 8. Advantageously, the draining function of the plate 9 is facilitated over the entire molding or pressing surface 25. In addition, the overlapping of the four above-described meshes creates a structure capable of withstanding without flexing in those wide water passage areas, next to the channels 34 and 35. With special reference to the figures from 4 to 9, the lower surface of plate 9 was processed by using a centring slot 43 to house the two manifolds 7, 8 so as to form a pressing surface 25 which is substantially flat and devoid of roughness or discontinuities, which will contact the liquid mixture 2 during the pressing procedure. During the necessary processing 43 to house the two manifolds, and more precisely on the surface where the second manifold 8 lies, a number of intersecting diagonal ducts 32 have been created, the holes 33 on the second manifold 8 are also diagonally positioned, so as to let the water/air flow pass directly from the holes to the ducts.

[0020] On the upper surface 24 of plate 9 there are:

at the ends of the diagonals, four housings 27 having a generally oval shape surrounded by O-ring gaskets. In the housings 27 vacuum comes from the four holes 28 positioned on the pressing pad 11;
a channel 29 to house an O-ring gasket protecting the magnetic element 10 housed on the pad 11;
supply air ducts 31 with O-ring to pneumatically extract the frame, when the latter is mounted together with the buffer. Said ducts or holes 31 are also useful if the frame needs to be removed manually from the plate when it is detached from the buffer;
holes 47 to apply the locking and removal brackets of the plate when it lies on the bottom of the mold;
holes 46 to refer to the centring pins between the buffer and the plaque.

[0021] The connection for the air/water passage between the upper and lower sides of the plate 9 is realized next to the upper housings 27. In these four areas, through openings 34 generally having an L shape, have been created and connect the bottom surface and the top surface of the plate, into which the ducts 32 of the bottom surface of the plate (e.g. four), centered on the diagonals, directly flow. The extension of all other ducts 32 is delimited by four perimetral ducts 35. Preferably, the perimetral ducts 35 are deeper than the diagonal ducts 32 and flow into the L-shaped openings 34.

[0022] In figures 4, 5 the detail of the ducts flowing into the lateral sides 106 of the plate used for the suction of water and of the unfiltered sediment found in the interspace 72 between the plate 9 and the mold 3.

[0023] In particular, with reference to figure 4, the buffer 11 is shown and equipped with first holes 23, 28 connected respectively to the suction system and the cavities 27 to allow the vacuum to get to the corners of the plate from where the filtered water is sucked, and additional holes 100 and 101, preferably four, in communication respectively to the suction system and with elastomer perimetral cavities 102 to send vacuum to the chambers into which the water and the sediment, pooled in the perimeter gap between the plate 9 and the mold during the pressing-squeezing step, flow.

[0024] In a preferred embodiment, shown in figure 8a, the elastomer chamber 102 has an upper part having a semi-toroidal shape on both sides A and operating with respect to the buffer as a seal shaped as a loop. The bag B of the chamber 102 forms a pooling area for the water and the sediment flowing into its end holes D through the holes of the plate 36A.

[0025] The housing B guarantees the closing between plaque and buffer, even when the sediment is stuck to the buffer surface in the area between the two toroidal parts A. The entire perimeter profile of the chamber 102 has also preferably a diverging inclination C having an angle of approximately seven degrees with respect to the surface of the plate 9, in such a way that after inserting it into the plate, it is locked into place.

[0026] According to the invention, and with particular reference to figure 7, the suction system of the equipment comprises a pneumatic unit having a manifold 103 equipped with a coupling device 107, which receives the vacuum generated by the vacuum pump.

[0027] The manifold 103 has four outlets B1-B2-B3-B4, which are connected to four coupling points 23 of the buffer respectively, and which lead the vacuum in the pressing surface for sucking out the through filtered water through filter 6. In the end part of the manifold 103, it can be found a valve 104, which is normally shut, for example a valve equipped with a pneumatically actuated plate 109, which, if activated by means of a suitable pneumatic control 108, allows the communication of the vacuum 107 with the ducts A1, A2 , A3, A4 connected to the four connections 100 of the buffer that are, in turn, in communication through the seals 102 and the perimetral holes 36a to the side edges of the plate 9 for the suction of water and unfiltered sediment. During its use, the mixture 2 is measured out and poured into the mold 3, such molds have a cylindrical shape and the mixture is poured from a height. In order to level out the poured mixture in the mold, what needs to be done is having the mold vibrate, according to a well-known technique. After pouring the mixture into the mold, the pressing buffer is lowered so that plate 9 comes into contact with the mixture and perform the suction and squeezing steps aimed at obtaining the correct water stoichiometric ratio and the desired compactness.

[0028] For example, in a preferred embodiment of the suction and pressing steps, the applied pressure will vary proportionally and progressively, and will have a lower pressure on the mixture in its initial step and a higher pressure during the final compaction step.

[0029] With the adopted solution, during the pressing and squeezing steps of the mixture, the operator may decide to trigger the vacuum in the manifold 103, and consequently under the filter 6, before the filter comes into contact with the mixture 2, or at the beginning of the squeezing step, by keeping the vacuum until the end of the pressing process.

[0030] According to the invention, the valve 104 is controlled upon opening 1-2 seconds before the end time of the pressing process, since the exceeding water in the mixture is sucked out when the specific molding pressure is low and thus the light specific pressure together with the high pneumatic vacuum facilitate the ascent of the water from the entire mixture and get to filter 6 and to the lower manifolds of the plate.

[0031] Advantageously, since during this step no pressure drop is registered because of the opening of the lateral holes 36A of the plate, the vacuum pump is exploited to the maximum and only for this function.

[0032] In the final phase of the pressing process, for example from 75 to 100% of the final set specific pressure, the compaction of the various components of the mixture is almost exclusively due to the strong specific molding pressure. For this reason, it is possible and advantageous to use only at this stage, even for a few seconds, part of the vacuum and the of flow rate of the pump via the valve 104 to trigger also the water and the sediment suction in the interspace between the plate and the mold via the holes 100.

[0033] In a possible preferred embodiment, the suction system is provided with two pumps with different functional characteristics that can be selectively associated to the central suction phase or to the side suction phase, for example a liquid ring pump for extracting water from the filter and a side blower pump for the side suction of water and sediment.

[0034] The present invention has been disclosed according to preferred embodiments, but equivalent variants can be designed without departing from the scope of the invention.

Claims

1. Pressing apparatus (1) for presses (P) intended for the production of single-layer tiles starting from a water-based mixture (2) contained in a mold (3), comprising
   a pressing unit (110) movable with respect to the mold (3), provided on the top with first and second pipes (27, 28, 23; 109, 101, 100) in fluid communication with a suction source (107),
   a filter (6) applied next to a pressing surface (25),
   characterized in that said unit (110) comprises a lower surface (24) equipped with first ducts (32, 34, 35) distributed along the pressing surface (25) and in communication with said first pipes (27, 28, 23) for the sucking of water flowing through the filter (6) and side surfaces (106) equipped with second ducts (36a) in communication with said second pipes (109, 101, 100) for the sucking of water and sediment gathered in an interspace (72) between the unit (110) and the mold (3) and **in that** it comprises control means (103, 108) to pneumatically separate said first and second pipes (27, 28, 23; 109, 101, 100).

2. Apparatus according to claim 1, wherein said control

and suction separation means (103, 108) comprise a common pneumatic manifold (103) in communication by respective connections (B1, B2, B3, B4, A1, A2, A3, A4) to said first and second pipes (27, 28, 23; 109, 101, 100) and a control valve (104, 108) to selectively allow the communication of said first and second pipes (27, 28, 23; 109, 101, 100) with said vacuum source (107).

3. Apparatus according to one of the preceding claims, comprising a suction system provided with at least two pumps with different functional characteristics, which can be selectively associated to said first and second pipes (27, 28, 23; 109, 101, 100).

4. Apparatus according to one of the preceding claims, comprising at least one overlapping manifold (7, 8, 78) and in fluid communication with the ducts of the lower surface of the unit (110), equipped with a plurality of holes or passages (33) distributed along the pressing surface.

5. Unit according to claim 4, wherein said manifold (78) is made of many overlapping metallic meshes.

6. Method for pressing single-layer tiles starting from a water-based mixture (2) contained in a mold (3), comprising a step during which the mixture is pressed thanks to a pressing apparatus (1) of the type including
a pressing unit (110) movable with respect to the mold (3) and equipped with first and second pipes (27, 28, 23; 109, 101, 100) in fluid communication with the suction source (107), the unit (110) also comprising a pressing plate (9) having a lower surface (24) equipped with first ducts (32, 34, 35), distributed along a pressing surface (25), communicating with said first pipes (27, 28, 23), and side surfaces (106) provided with second ducts (36a) communicating with said second pipes (109, 101, 100).
a filter (6) applied to the lower part of said group (110) in correspondence of the pressing surface (25),
characterized in that it is provided with temporally separate suction phases of filtered water, such water is sucked out of the pressing surface through the first pipes (27, 28, 23) and the non-filtered water and sediments are laterally sucked out of the plate (9) through the second pipes (109, 101, 100).

7. Method according to claim 6, comprising an initial pressing phase **characterized by** reduced pressure during which only said suction phase from the pressing surface is performed and further comprising a second pressing phase and final compaction of the mixture during which the side suction phase is triggered.

8. Method according to claim 7, wherein during said second pressing and compaction phase, both said suction phase from the pressing surface and said side suction phase are performed.

9. Method according to one of the claims 6 to 8, wherein said suction phase from the pressing surface and side suction phase are performed in different moments by means of control means (103, 108) that pneumatically separate said first and second pipes (27, 28, 23; 109, 101, 100).

10. Method according to one of the claims 6 to 9, wherein said control means comprise a common pneumatic manifold (103) in communication by the respective connections (B1-B4; A1-A4) to said first and second pipes (27, 28, 23; 109, 101, 100) and a control valve (104, 108) to selectively allow the communication of said first and second pipes (27, 28, 23; 109, 101, 100) with said vacuum source (107).

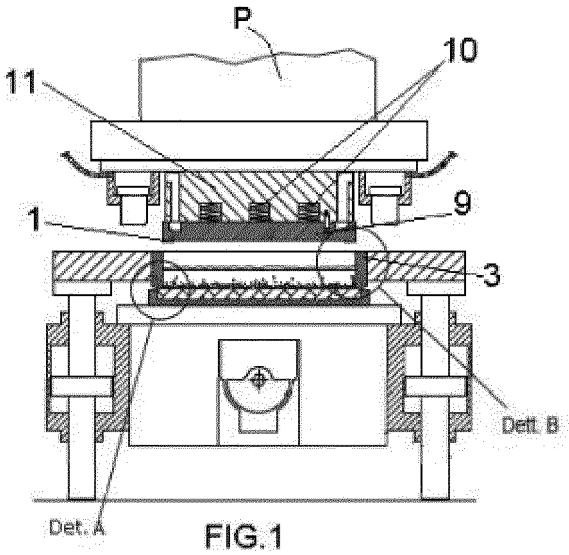


FIG.1

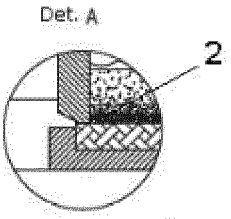


FIG.2A

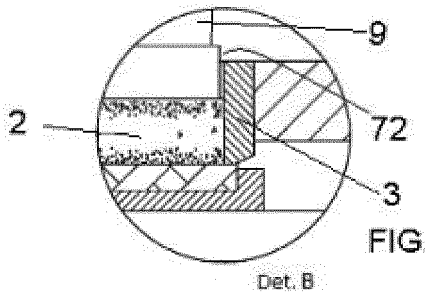


FIG.2B

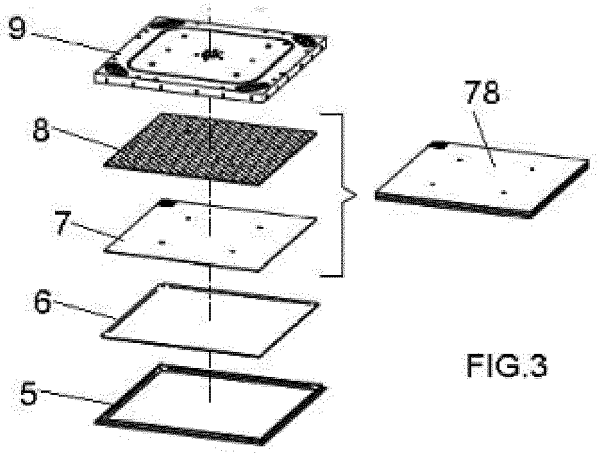
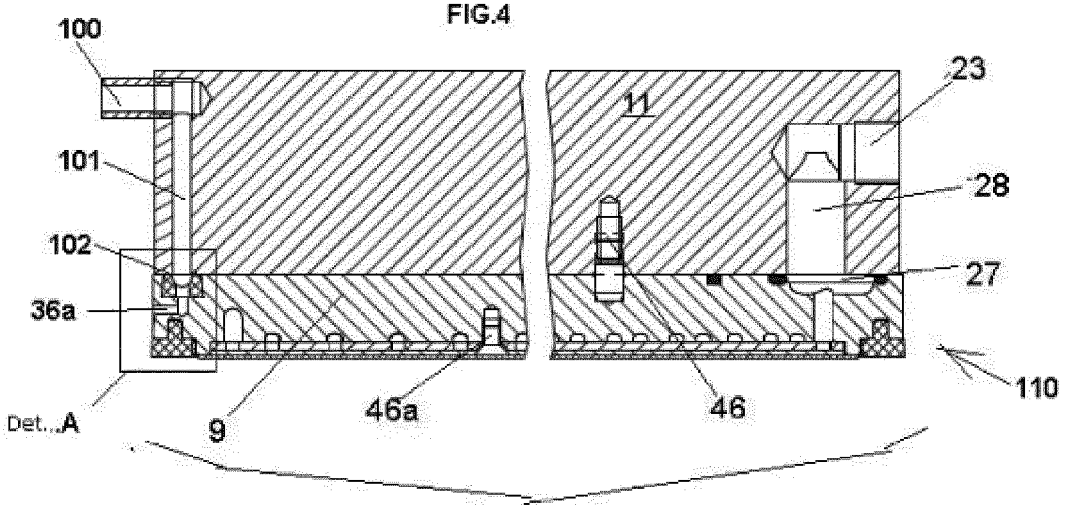


FIG.3

FIG.4



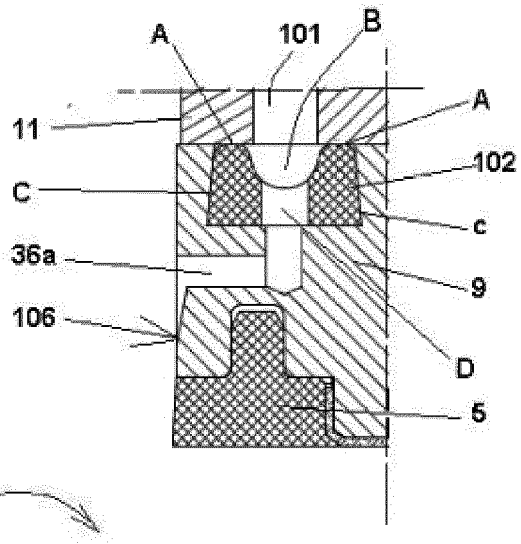


FIG.5

Det. A

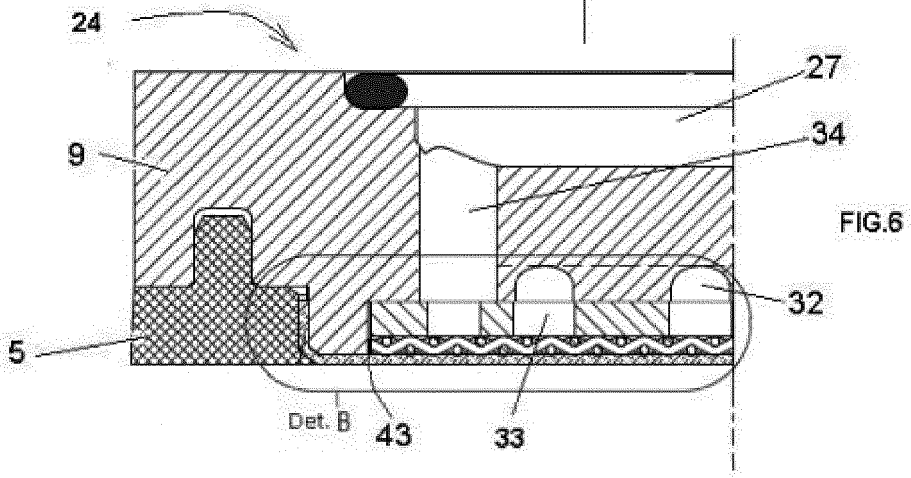


FIG.6

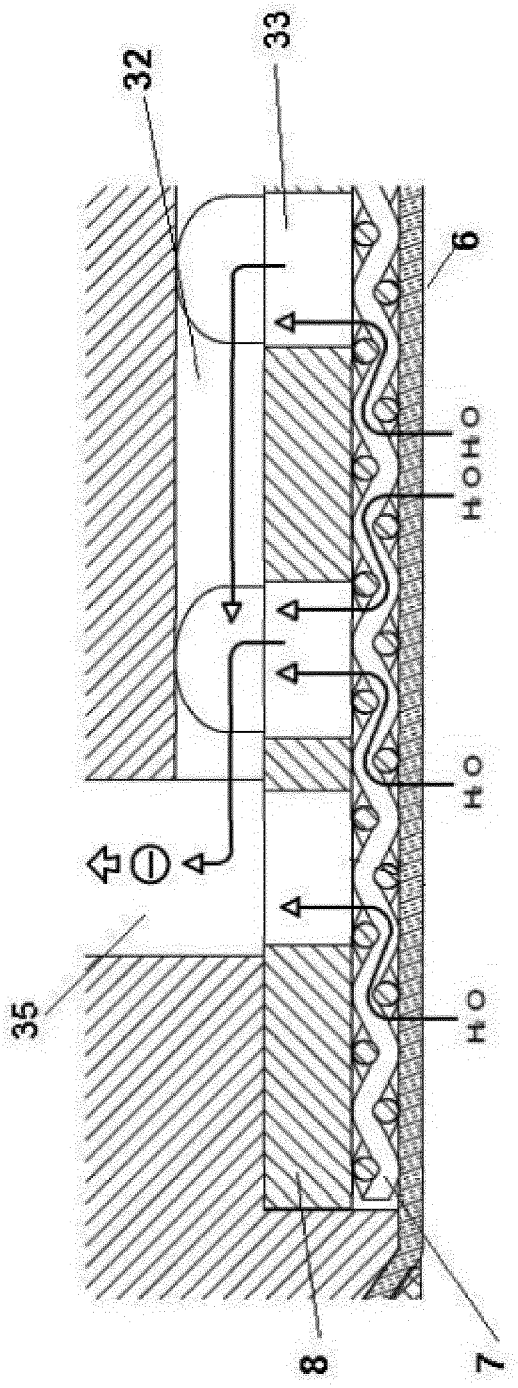


FIG.6a Det. B

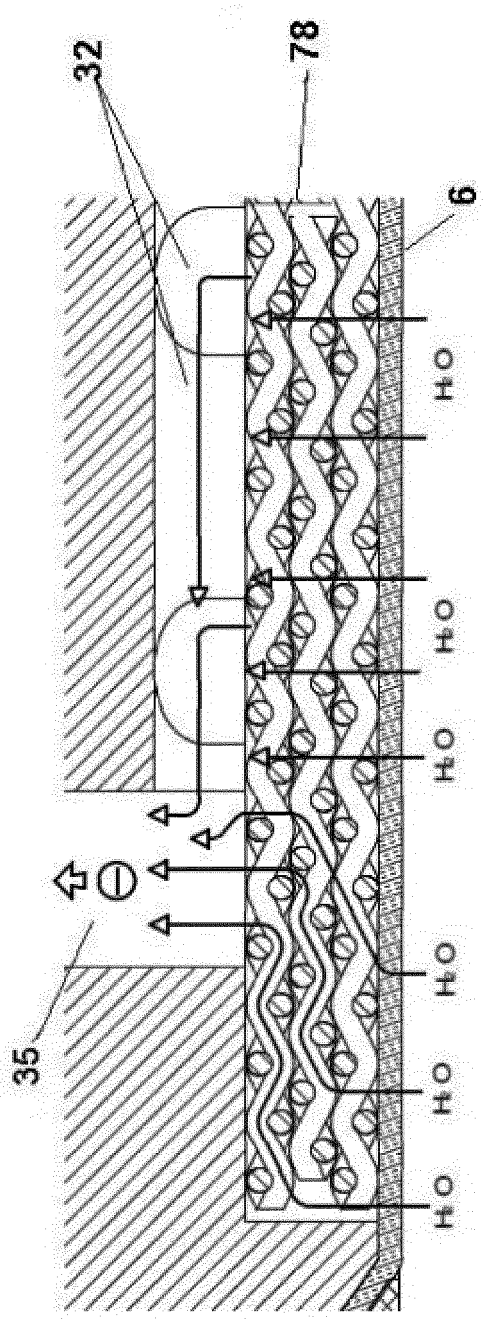


FIG.6b

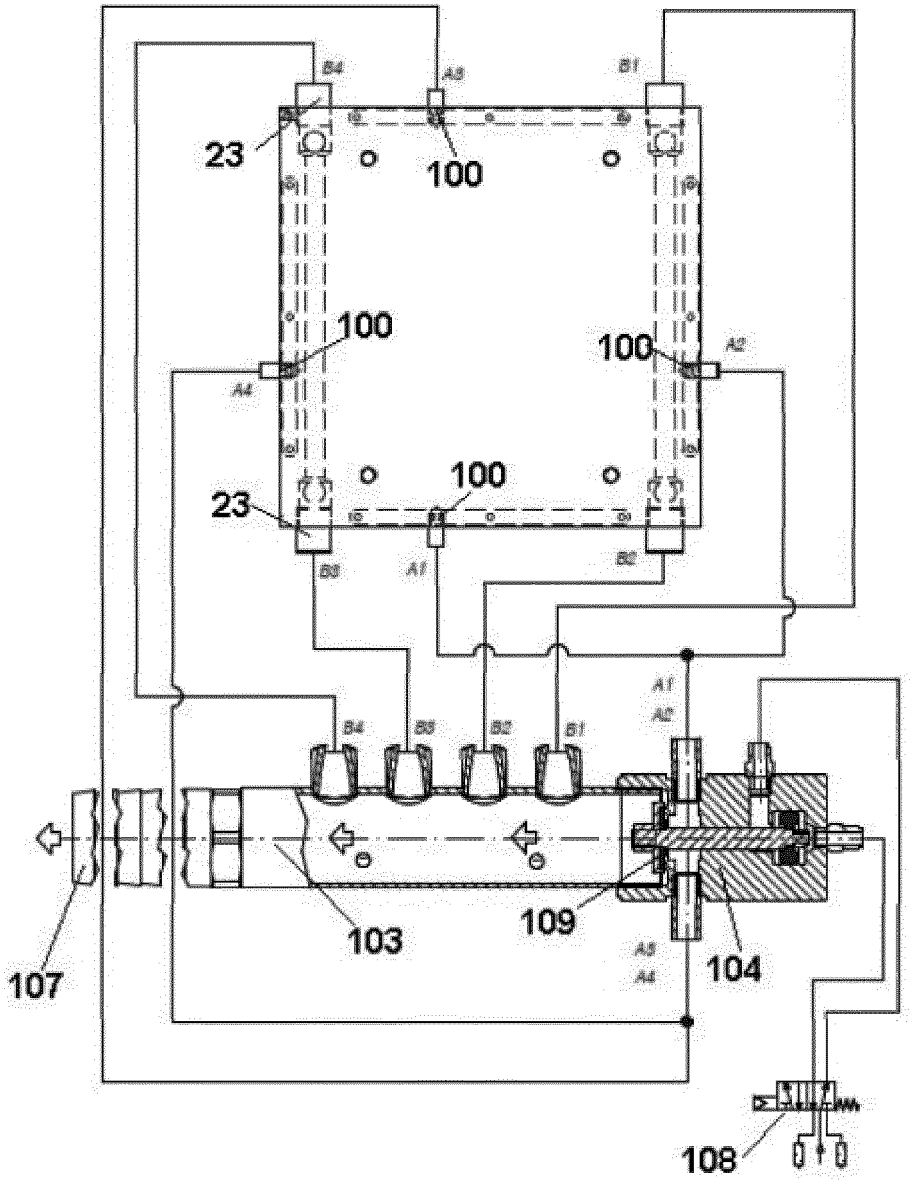


FIG.7

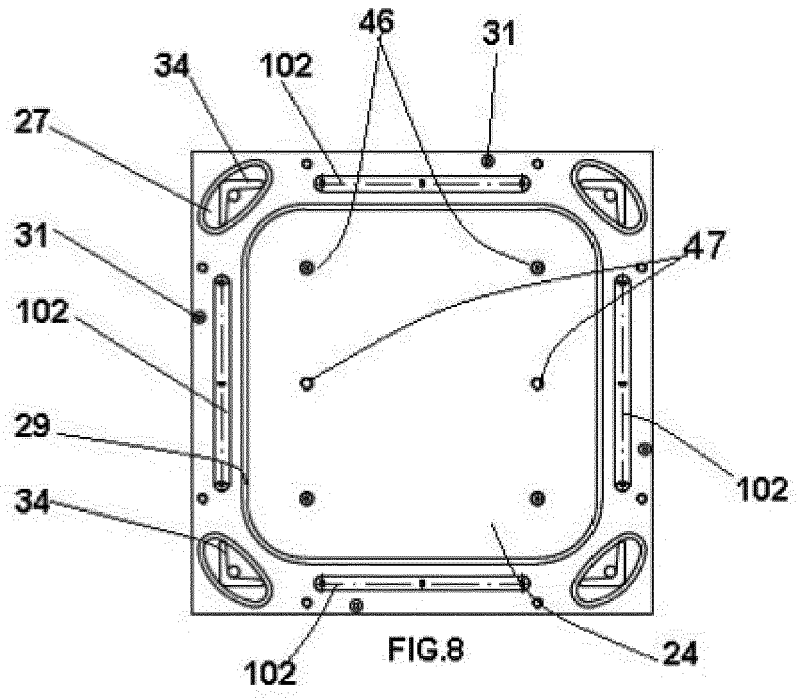


FIG.8

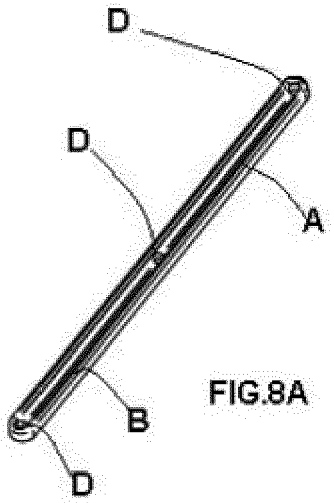


FIG.8A

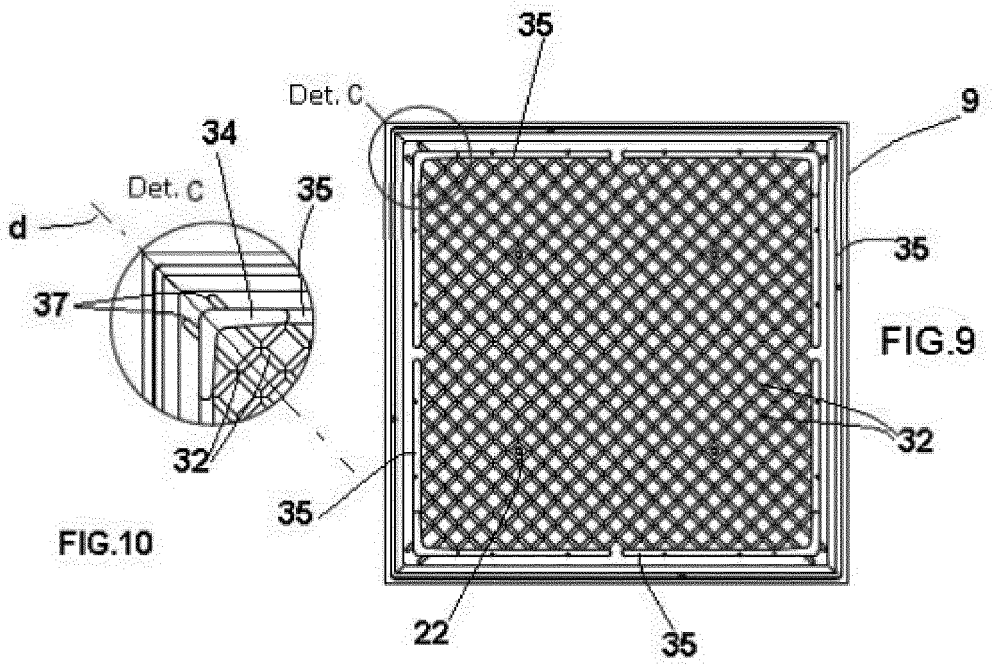


FIG.10

FIG.9

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EUROPEAN SEARCH REPORT

Application Number
EP 17 16 6604

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 1 262 296 A2 (LONGINOTTI MECCANICA S R L [IT]) 4 December 2002 (2002-12-04) * paragraph [0019] - paragraph [0067]; figures *	1-10	INV. B28B7/46
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TECHNICAL FIELDS SEARCHED (IPC)

B28B
B30B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	17 August 2017	Orij, Jack

CATEGORY OF CITED DOCUMENTS

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17-08-2017

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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