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(54) Ceramic punch of the stamp type

(57) Punch for moulding ceramic tiles, comprising a rigid body (1) provided with an active face (2) suitable for coining the fixing side of the tiles, a first sub-plane (30) formed on said active face (2) of the rigid body (1), a second sub-plane (31) that defines a plurality of projecting ribs (6, 60), a plurality of grooves (4) crossing over one another that cross said second sub-plane (31) forming a lattice and that define coplanar flat areas (5) around said projecting ribs (6, 60), said lattice of grooves (4) making a labyrinth channel that contains an incompressible fluid (10), an elastically flexible perforated plate (7) rested upon said flat areas (5), the openings of which are suitable for slotting onto said projecting ribs (6, 60) with perfect fit, and an elastically deformable membrane (8) firmly fixed to said first sub-plane (30) and to said perforated plate (7), the outer face of said membrane (8) being equipped with a lattice of grooves (9) suitable for forming support feet in the tile.

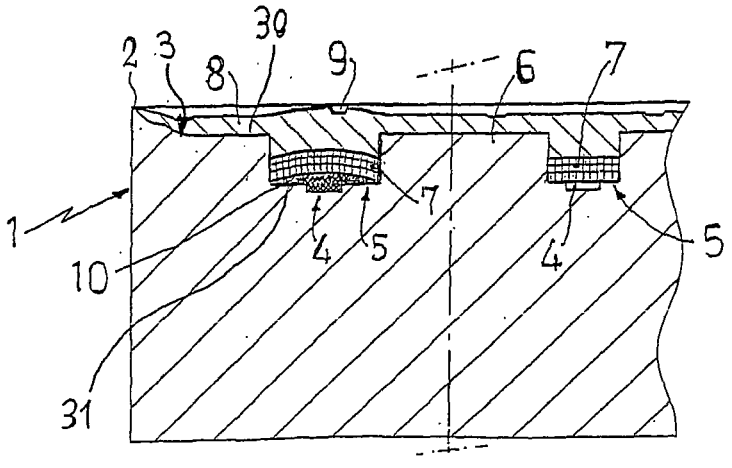

FIG. 4

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Description

[0001] The present finding refers, in a totally general sense, to moulds for forming ceramic tiles, and, more specifically, it concerns a punch intended to be associated with the forming cavities of said moulds.

[0002] As known, normal ceramic moulds comprise at least one forming cavity provided to contain the initial powdered material (or materials), in which a bottom punch is slidably received with which an overlying punch collaborates carried by the vertically mobile crossmember of the press.

[0003] More specifically, the finding refers to a punch of the stamp type, in other words intended to coin the back (or fixing) face of tiles, in the jargon the "masonry" side.

[0004] It is also known that the pressing operation often creates defects in the raw tile that can sometimes even be very serious, which depend upon various factors, the most notable of which is the irregular distribution of the powder or powders in the cavity of the mould, and the lack of homogeneity of the granule size of this powder, or powders.

[0005] Said defects generally result in a corresponding nonhomogeneous or irregular density of the raw tile, which at the end of the drying and firing cycle has defects in size, shape and flatness, and sometimes they actually break and/or crack resulting from the differentiated thermal expansions in the firing step and from the corresponding differentiated shrinkage in the cooling step.

[0006] In order to overcome, or at least mitigate, the quoted problems, for some time in this specific field so-called isostatic punches have been used.

[0007] Isostatic punches are known that comprise, in brief, a metallic body equipped with a cavity closed by an elastic membrane and filled with an incompressible fluid, generally hydraulic oil.

[0008] The active face of said membrane is equipped with impressions for the shaping of the so-called feet of the tile.

[0009] Solutions do exist in which said cavity comprises a series of communicating cells that open out onto the face of the body covered by the membrane, where they provide a lattice with flat edges to which the membrane is fixed, said edges being arranged at said feet.

[0010] This is in order to ensure the perfect flatness of the top of the feet, and to obtain a homogeneous and uniformly distributed plane on which the tile can rest during firing, otherwise it can collapse, with obvious consequences.

[0011] These isostatic punches have proven satisfactory with reference to the problem of the homogeneous pressing of the initial mass, and to that resulting from the defects of the end product.

[0012] However, with the quoted punches there is generally the undesired so-called transparency effect in the end product.

[0013] Said effect consists of the fact that a trace, even if often light, of the feet situated at the back on the fixing face of said tiles remains on the visible front face of the tiles, which is generally a consequence of the fact that the powder, at the lattice that rigidly supports the membrane behind the feet, is more compact.

[0014] Said trace, which also remains visible on polished or enamelled tiles with transparent glaze, obviously degrades the product aesthetically.

[0015] Moreover, given that said trace is generally indicative of compacting (sometimes even highly differentiated) of the different areas of the tile, in the most serious cases this can give rise to incomplete or imperfect fixing of the enamel or glaze, with the imaginable consequences.

[0016] The main purpose of the present finding is to provide a punch of the stamp type that has the typical properties of isostatic punches, and that at the same time is able to practically eliminate said transparency effect, and at the same time provide the tile with a perfectly flat support during firing.

[0017] Another purpose of the finding is to achieve said result in the context of a simple, rational, reliable, strong and cost-effective constructive solution.

[0018] Said purposes are accomplished thanks to a punch that has the characteristics indicated in claim 1.

[0019] Advantageous and preferred embodiments thereof are outlined in the subordinate claims.

[0020] The characteristics and the advantageous features of the finding shall become clear from the following detailed description, made with reference to the figures of the attached tables of drawings that illustrate, purely as a non-limiting example, a particular and preferred embodiment thereof.

FIG. 1 is a plan view of the metallic body that constitutes the base of the punch.

FIG. 2 is a part in increased scale of the previous figure, where the punch is covered by the membrane.

FIG. 3 is the section III-III of FIG. 2 in increased scale, where the left part comprises the hydraulic oil, whereas the right part is without any.

FIG. 4 is an enlarged part of the section IV-IV of FIG. 1, where the left part comprises the hydraulic oil, whereas the right part is without any.

FIG.5 is a plan view of a punch according to an alternative embodiment of the invention.

FIG. 6 is the section VI-VI of FIG. 5 in increased scale, shown without the hydraulic oil.

FIG. 7 is a plan view of the metallic body that constitutes the base of the punch of FIG.5.

FIG. 8 is the section VIII-VIII of FIG.7 in increased scale.

FIG. 9 is a plan view of the bearing for equalizing the unbalancing from pressing applied to the metallic body of FIG. 7.

FIG. 10 is the section X-X of FIG. 9 in increased scale, shown without the hydraulic oil.

[0021] From the quoted figures a ceramic punch of the stamp type can be seen, in other words intended to coin the back (or fixing) face of tiles.

[0022] The punch comprises a metallic body 1 that is intended to be fixed in a known way to a respective support element of a ceramic mould that is equally known.

[0023] In the case shown the body 1 is square-shaped in plan (see FIG. 1), but obviously said shape in plan can be whatever.

[0024] A concentric cavity 3 of differentiated depth is formed on the active face 2 of the body 1 (FIGS. 3 and 4).

[0025] In particular, said cavity 3 makes a first and a second sub-plane, 30 and 31 respectively, the second 31 of which is arranged at a lower level than the first 30 and defines a plurality of projecting ribs 6.

[0026] As well-illustrated, said second sub-plane 31 is crossed by a regular lattice of relatively narrow and generally shallow grooves 4, which cross over one another.

[0027] In the example shown said grooves 4 are orientated according to the directrix defined by the diagonals of the shape in plan of the body 1 (see FIGS. 1 and 2) . In particular, the arrangement and/or distribution of said crossed grooves 4 is such that they define an ordered plurality of identical rectangular coplanar flat areas 5 on the second sub-plane 31.

[0028] At the centre of each individual flat area 5 there is a respective projecting rib 6 that are rectangular in plan, arranged concentrically to the respective surrounding flat rectangular area 5 (FIGS. 1 and 2).

[0029] The quoted ribs 6 are the same height, and their free end, which is flat and horizontal, is obviously coplanar to the first sub-plane 30.

[0030] In the example shown in figure 1, the ribs 6 extend in a rectilinear direction, are parallel to each other, and are aligned in groups to form equally spaced rows, orientated according to the directrix defined by one of the diagonals of the shape in plan of the body 1.

[0031] In accordance with the finding, see FIGS. 3 and 4, the cavity 3 receives a plate 7 with the function of a bearing for equalizing the unbalancing caused by pressing. In particular said plate 7 has a generally constant thickness and is rested on the flat areas 5, the shape of which it matches in plan (FIGS. 2-4).

[0032] In the example shown said bearing consists of a perforated plate 7 the thickness of which is practically half the height of the ribs 6. Said perforated plate 7 is elastically flexible, and consists of generally rigid resin, or else harmonic steel.

[0033] The ports or openings of the quoted perforated plate 7 are sized so as to slot practically to exactly fit onto the respective ribs 6.

[0034] To complete the punch an elastically deformable membrane 8 of elastomeric material is foreseen that seals the cavity 3 shut. In particular, the membrane 8 is firmly fixed, for example vulcanised, to the first sub-plane 30 of the cavity 3 and to the opposite face of the plate 7; in other words, it is firmly fixed to the marginal strip of the cavity 3, to the opposite face of the plate 7, and to the top of the ribs 6 that go beyond the plate 7.

[0035] Finally, the active outer face of the membrane 8 has impressions for forming the feet of the tile, in the present case provided by a lattice of identical rectilinear crossing grooves 9 that run parallel to the edges or sides of the body 1 (FIG. 2).

[0036] In this way, see in particular FIG. 2, according to a plan view each groove 9 is oblique to the ribs 6 behind, which it crosses only in some portions, so that the defect of "transparency" is limited to just said portions.

[0037] The important thing is that the areas of overlapping between grooves 9 and ribs 6 are regularly and/or homogeneously distributed given that at the moment of pressing on them the coplanar support points for the tile are formed during firing.

[0038] Once assembled, the punch is substantially as shown on the right in FIGS. 3 and 4, where it can be seen that the membrane 8 and the plate 7 are flat and undeformed, with the second 7 resting on the bottom of the flat rectangular areas 5, where it closes the mouth of the grooves 4.

[0039] Before installing the punch on a ceramic mould, an incompressible fluid, typically hydraulic oil, indicated with 10 in FIGS. 3 and 4, which is placed at a pressure suiting the processing being carried out, is introduced into the cavity 3.

[0040] This pressure can, for example, be between 2 and 8 bar.

[0041] The pressurised oil 10 is introduced, in a *per* sé known way, through two horizontal blind holes 22 and 33 (see FIG. 1) that are equipped with respective sealing plugs 122 and 133, and that are connected to two grooves 4 through corresponding vertical holes 222 and 233, whereas the oil 10 is discharged through a vertical hole 244 that derives from a groove 4, and that communicates with a horizontal blind hole 44 equipped with a suitable sealing plug 144.

[0042] Such pressurization causes the simultaneous eversion of the portions of plate 7 and membrane 9 that are located between the ribs 6, with which the plate 7 is separated from the bottom of the cavity 3.

[0043] An example of said eversion is shown in the left part of FIGS. 3 and 4, where it can be seen that in practice it does not involve the areas of the membrane 9 that are vertically aligned with the ribs 6 behind.

[0044] Said grooves 4 make a labyrinth channel the function of which is to allow the oil to run from one area of the cavity 3 to the other.

[0045] Thanks to the described means all of the purposes of the finding are fully achieved, as it has been possible to see through specific tests conducted with ceramic moulds equipped with punches in accordance with the finding.

[0046] This is thanks to the synergy between the different properties of the punch described above.

[0047] Indeed, it generally operates in the same way as an isostatic punch, and this is due to the presence of the membrane 8 supported by the oil 10; it does not gen-

erate the harmful transparency effect, thanks to the distribution of the areas on which the feet rest and the compensation of the unbalancing due to the pressing carried out by the plate 7; and it provides the tile with a homogeneous and uniformly distributed support plane, defined by the areas in which the surface grooves 9 of the membrane 8 and the ribs 6 overlap.

[0048] Obviously, at the points that are outside of said areas of overlapping between ribs 6 and grooves 9, the feet of the tile can have a not perfectly flat extension, the defects of which are limited by the presence of the plate 7 under the membrane 8.

[0049] The shape, size and distribution of the ribs 6 and of the surface grooves 9 of the membrane 8 can be selected by discretion, provided that, as also stated previously, there are mutually overlapping areas between the two that are generally regularly distributed.

[0050] In this context, figures 5 to 10 show an alternative embodiment of the invention, in which the shape and the distribution of the ribs and of the grooves 9 allow feet to be made that effectively define a set of points of support that are coplanar, stable and very uniformly distributed.

[0051] In these figures, the elements in common with the first embodiment are indicated with the same reference numerals.

[0052] With reference to figures 7 and 8, the punch in accordance with said second embodiment comprises a metallic body 1, generally flat and square in plan, on the active face 2 of which a cavity 3 with differentiated depth is formed having a first sub-plane 30 and a second bottom sub-plane 31 that defines a plurality of projecting ribs 60.

[0053] Said second sub-plane 31 of the cavity 3 is furrowed by an ordered lattice of mutually perpendicular grooves 4, which are in communication with two horizontal holes 22 and 33 for feeding the hydraulic oil, and with a discharge hole 44, so as to make a labyrinth channel that allows the oil to run from one area of the cavity 3 to another, as described previously.

[0054] In particular, the grooves 4 are orientated according to the directrices defined by the diagonals of the square shape of the metallic body 1; however, this does not rule out the possibility of them being orientated in a different way.

[0055] As illustrated in figure 7, the lattice of grooves 4 defines a plurality of coplanar flat areas 5 on the second sub-plane 31, which are identical to each other and are square-shaped in plan; this, with the exception of the flat areas 5 that are located adjacent to the edges of the cavity 3, which are different shapes in order to help the development of said edges.

[0056] Inside each individual flat area 5 there is a respective rib 60.

[0057] In the example shown each rib 60 comprises two perpendicular elongated parts, the cross section of which is substantially smaller than the size of the relative flat area 5, so as to occupy a limited portion thereof.

[0058] Preferably said elongated parts are joined together to form a continuous rib 60 that is substantially L-shaped in plan.

[0059] The ribs 60 are orientated the same way, and are arranged so that the relative elongated parts are aligned according to a plurality of ordered rows that cross one another forming a lattice.

[0060] Preferably said rows are equally spaced apart, so that the mesh of said lattice is identical and generally square-shaped in plan.

[0061] In the example shown, the elongated parts of each rib 60 extend parallel and adjacent to two consecutive sides of the relative flat area 5, so that the rows defined by them run alongside the grooves 4, a short distance from them.

[0062] With reference to figures 9 and 10, a perforated plate 7, the characteristics and functions of which are the same as those already described for the first embodiment of the invention, is rested on the bottom of the flat areas 5.

[0063] In particular, the shape of said perforated plate 7 matches the shape in plan of the flat areas 5, and its openings are sized so as to slot substantially fitting exactly onto the respective ribs 60. Therefore, in this case, said openings are obviously substantially L-shaped in plan.

[0064] The perforated plate 8 has a thickness roughly equal to half the height of the ribs 60, and consists for example of rigid plastic resin or harmonic steel.

[0065] Finally, with reference to figures 5 and 6, the punch is completed by an elastically deformable membrane 8, of elastomeric material, which is firmly fixed to the first sub-plane 30 of the cavity 3 (thus also to the top of the ribs 60), and to the projecting face of the perforated plate 7.

[0066] The active outer face of the membrane 8 has impressions for forming the feet of the tile, which are provided by a lattice of identical rectilinear grooves 9 that cross over one another.

[0067] In the embodiment shown in figure 5, said rectilinear grooves 9 run along the directrices identified by the diagonals of the shape in plan of the metallic body 1.

[0068] In particular, each groove 9 of the membrane 8 is parallel to and overlaps a row of underlying parts belonging to the ribs 60. In practice, the lattice of grooves 9 fits together in plan with the lattice defined by the ribs 60 (see fig.5) .

[0069] In this way a complete overlapping is obtained between the grooves 9 and the ribs 60 which, being distributed in an ordered and regular way, ensure the formation in the rear face of the tile of resting points distributed in an equally ordered and regular way.

[0070] Moreover, since the ribs 60 are just arranged at the grooves 9, they only act in the parts of the tile touched by the support feet, ensuring effective isostatic behaviour of the punch in all of the other parts.

[0071] Finally, since the elongated parts of said ribs 60 are arranged along directions perpendicular to each other, they allow coplanar support areas to be made that extend according to both of the aforementioned directions, and therefore that ensure a stable support of the

tile, whatever orientation it takes up on the roller system of the firing kiln.

Claims

1. Punch for moulding ceramic tiles, comprising a rigid body (1) provided with an active face (2) suitable for coining the fixing side of the tiles, **characterised in that** it comprises:

   - a first sub-plane (30) formed on said active face (2) of the rigid body (1),
   - a second sub-plane (31) that defines a plurality of projecting ribs (6, 60),
   - a plurality of grooves (4) crossing over one another that cross said second sub-plane (31) forming a lattice and that define coplanar flat areas (5) around said projecting ribs (6, 60), said lattice of grooves (4) making a labyrinth channel that contains an incompressible fluid (10),
   - an elastically flexible perforated plate (7) rested upon said flat areas (5), the openings of which are suitable for slotting onto said projecting ribs (6, 60) with perfect fit, and
   - an elastically deformable membrane (8) firmly fixed to said first sub-plane (30) and to said perforated plate (7), the outer face of said membrane (8) being equipped with a lattice of grooves (9) suitable for forming support feet in the tile.

2. Punch according to claim 1, **characterised in that** said grooves (9) of the membrane (8) overlap the projecting ribs (6, 60) of the rigid body (1) in a plurality of discrete areas that are uniformly distributed with respect to the shape in plan of the punch.

3. Punch according to claim 1, **characterised in that** said ribs (6) extend in plan according to a rectilinear direction, and are arranged oblique with respect to the grooves (9) of the membrane (8).

4. Punch according to claim 3, **characterised in that** said ribs (6) are parallel to each other.

5. Punch according to claim 4, **characterised in that** said ribs (6) are aligned in groups to form ordered rows.

6. Punch according to claim 5, **characterised in that** said ordered rows are equally spaced apart.

7. Punch according to claim 1, **characterised in that** said ribs (60) are L-shaped in plan, with two elongated parts that extend according to rectilinear directions perpendicular to each other.

8. Punch according to claim 7, **characterised in that** said ribs (60) are orientated in the same way.

9. Punch according to claim 8, **characterised in that** said ribs (60) are arranged so that the relative elongated parts are aligned in groups to form a plurality of ordered rows that cross one another to form a lattice.

10. Punch according to claim 9, **characterised in that** said lattice formed from the elongated parts of the ribs (60) matches up in plan with the lattice of grooves (9) of the membrane (8) .

11. Punch according to claim 1, **characterised in that** the portions of perforated plate (7) and membrane (8) that are located in areas outside of the positions occupied by said projecting ribs (6, 60) have a convexity towards the outer face of the membrane (8), through the effect of the pressure with which said incompressible fluid (10) is trapped in said labyrinth channel defined by the lattice of grooves (4).

12. Punch according to claim 1, **characterised in that** said flexible plate (7) is made from rigid resin.

13. Punch according to claim 1, **characterised in that** said flexible plate (7) is made from harmonic steel.

FIG. 1

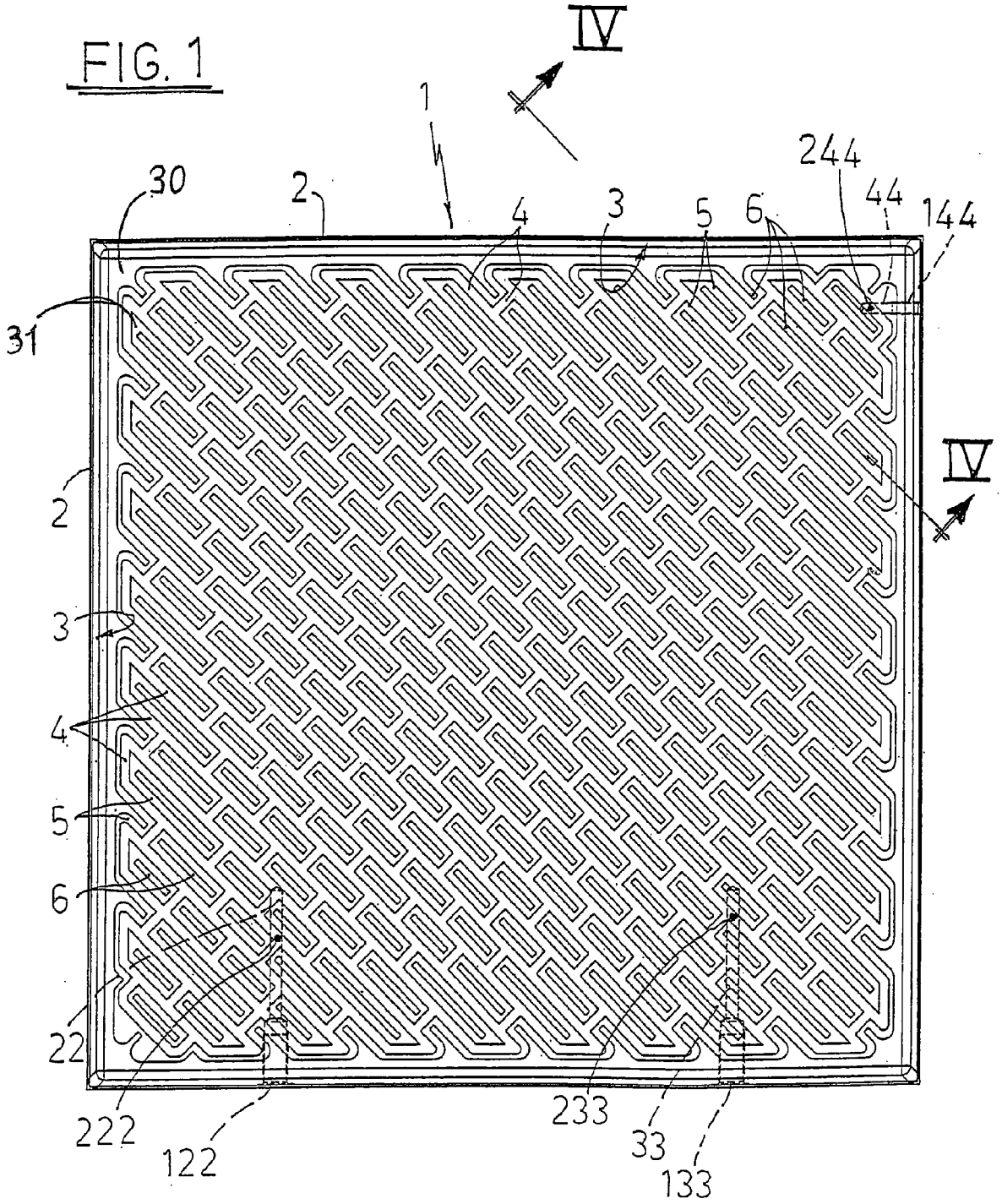
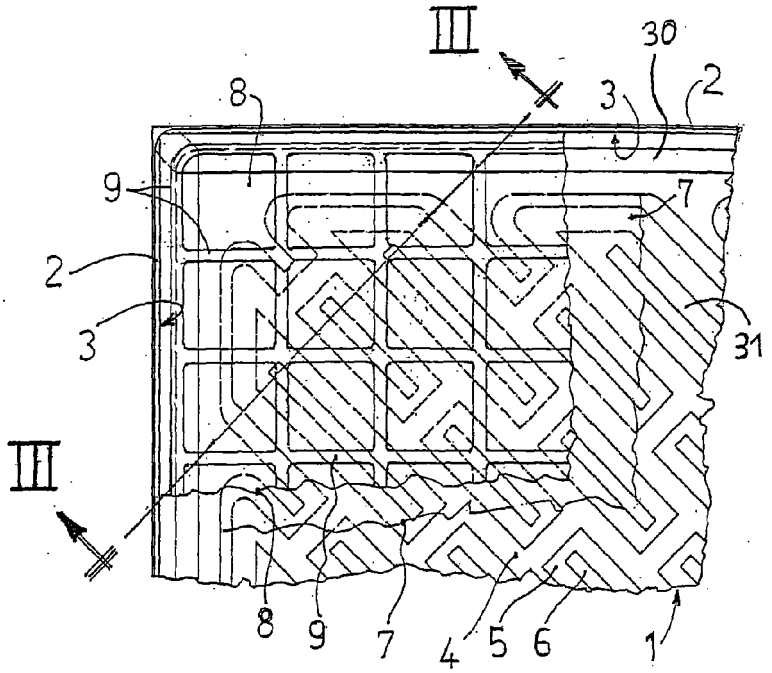


FIG. 2



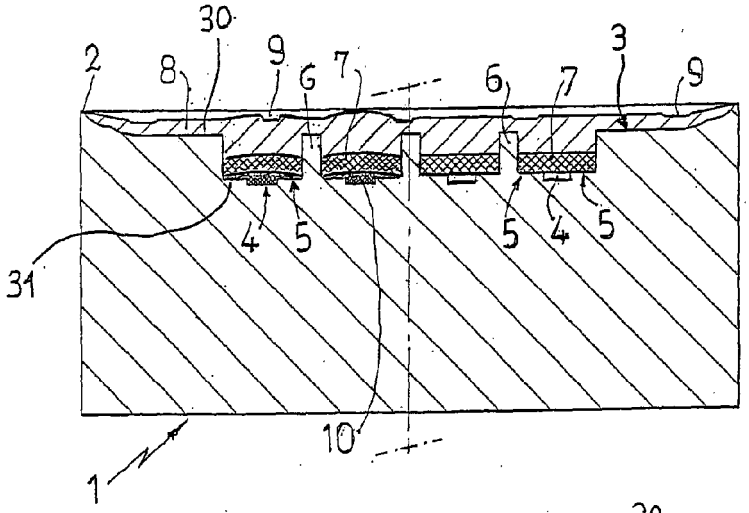


FIG. 3

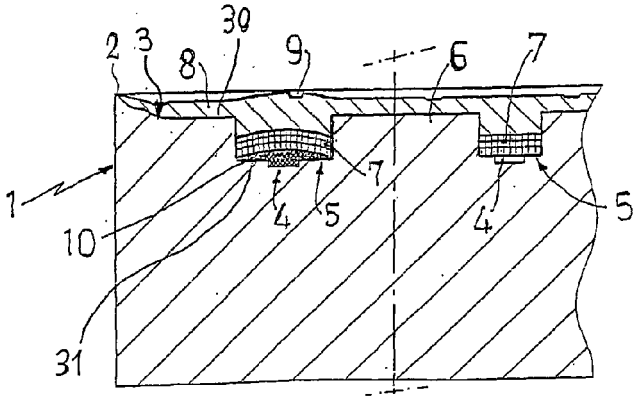


FIG. 4

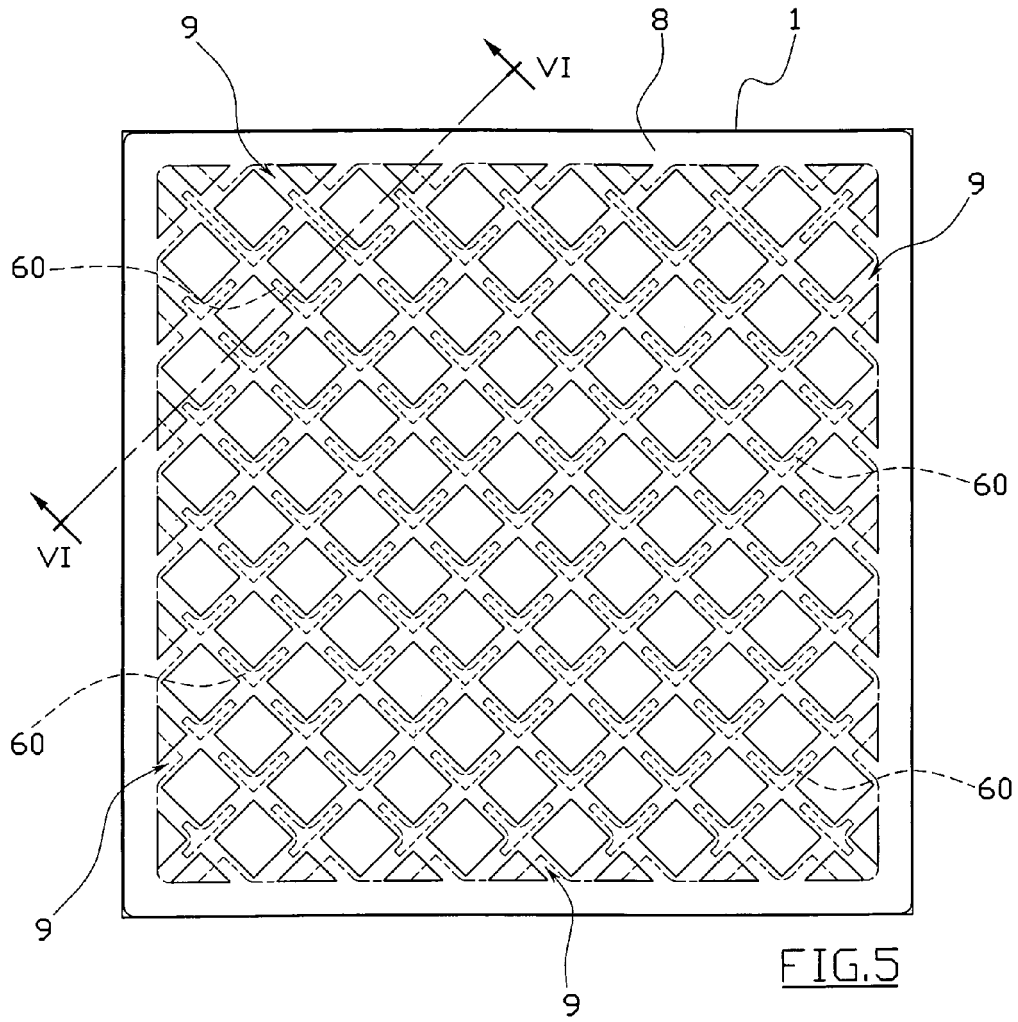


FIG.5

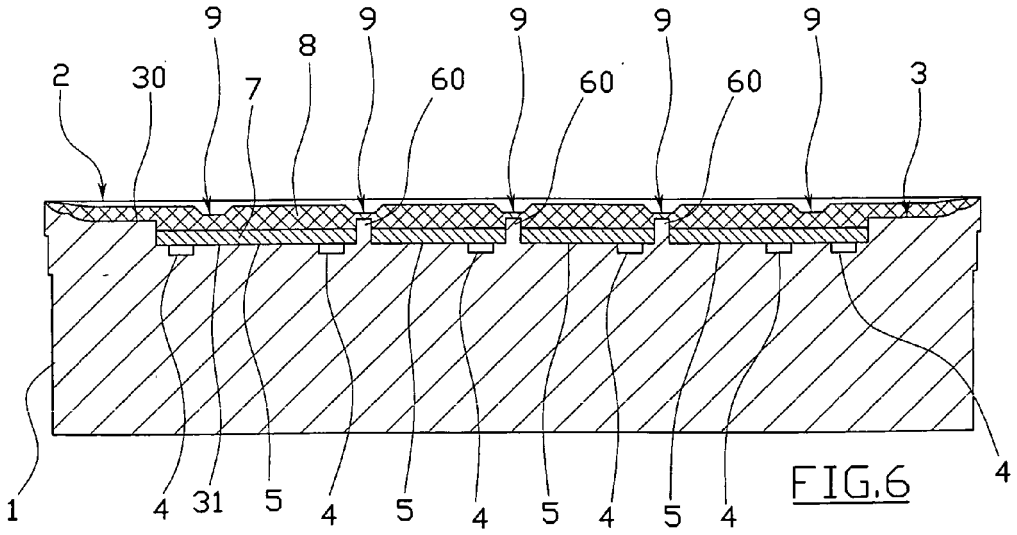
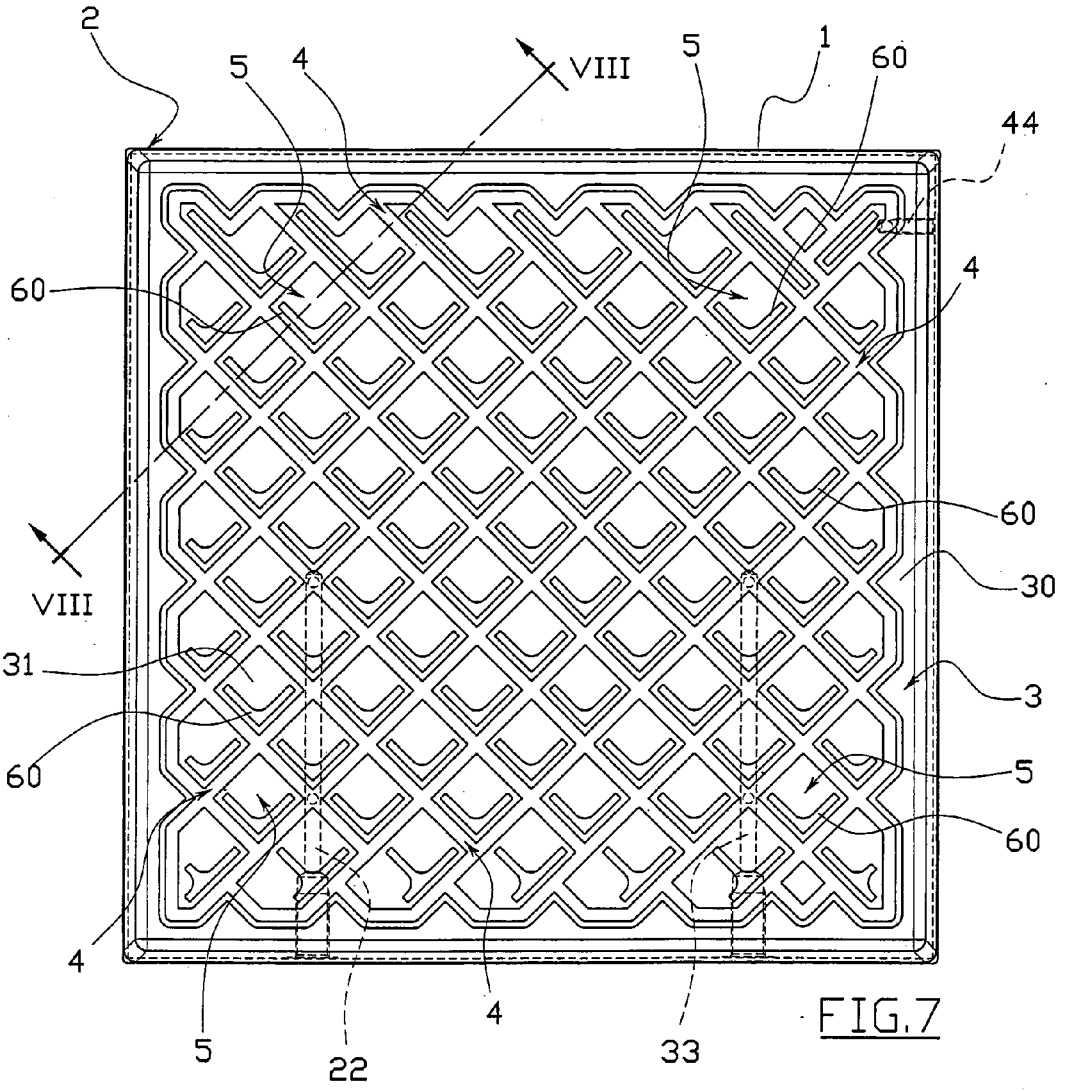


FIG.6


2
5
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VIII
5
1
60
44
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4
VIII
60
30
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5
60
4
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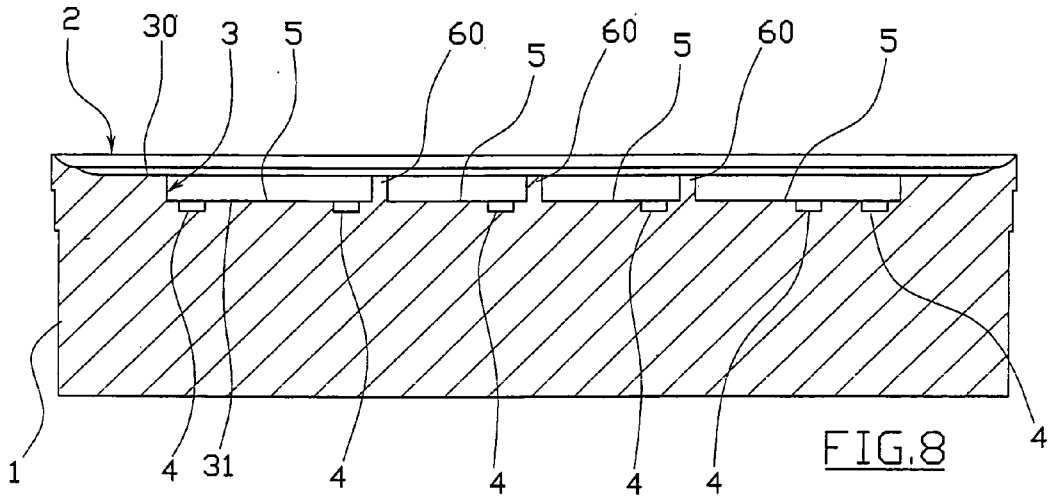
4
33

FIG.7


2
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31
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4
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4
4

FIG.8

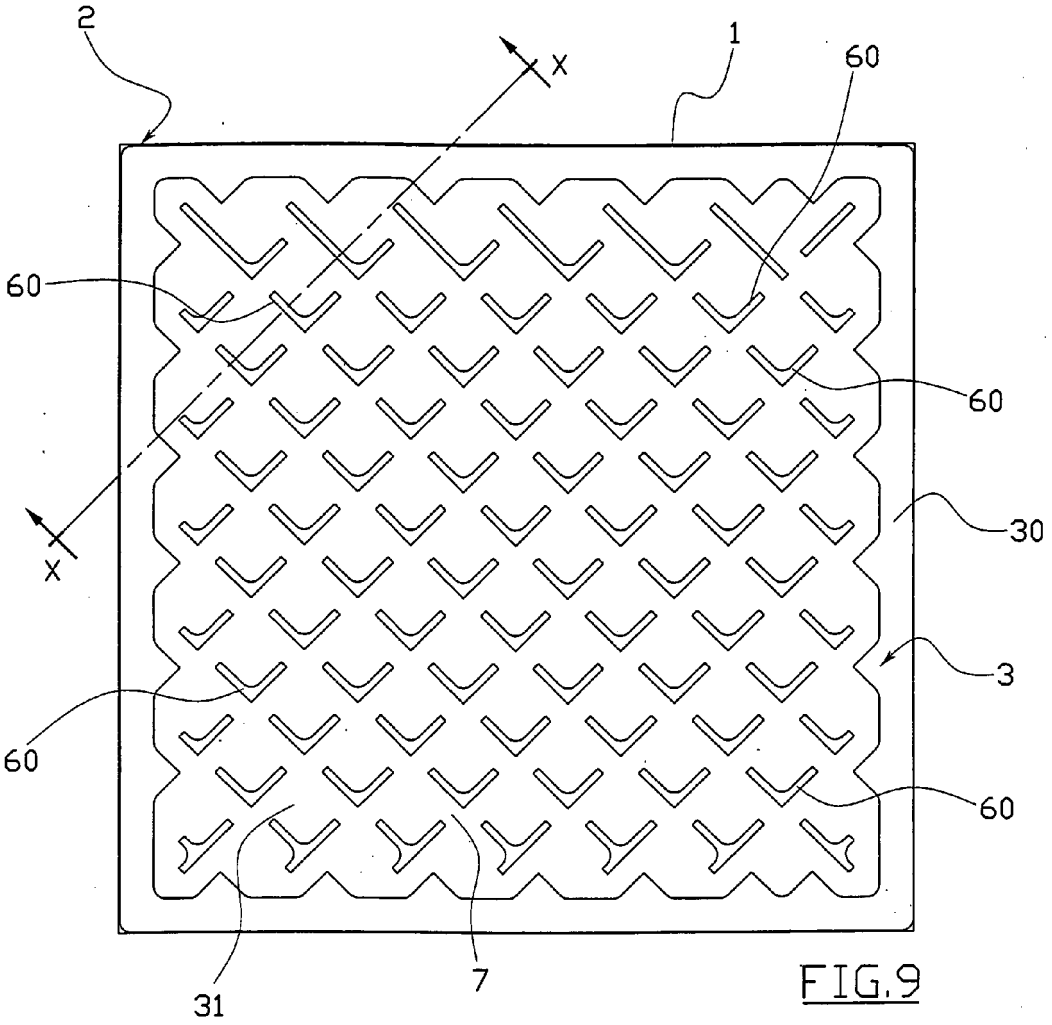

FIG.9

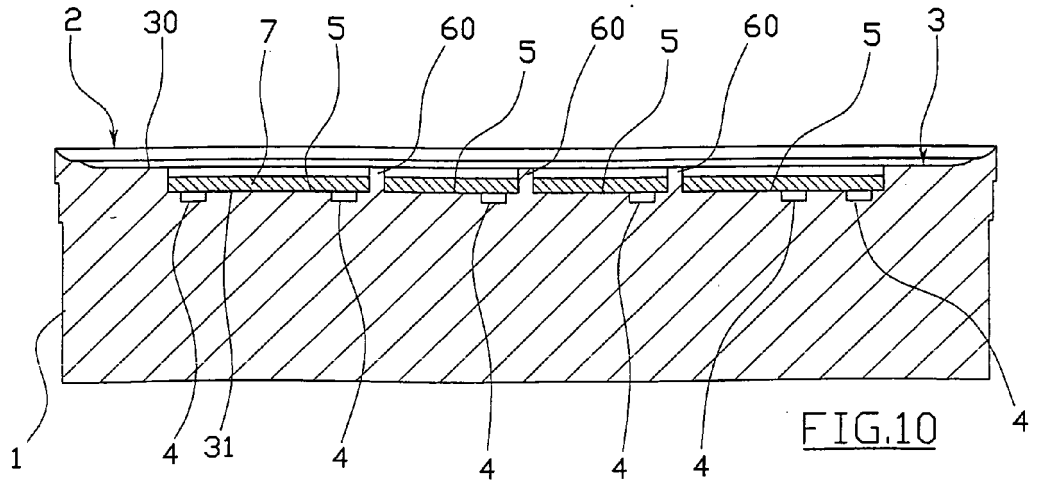

FIG.10