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(54) **A PRESS FOR THE PRODUCTION OF CERAMIC PRODUCTS**

PRESSE ZUR HERSTELLUNG VON KERAMIKPRODUKTEN

PRESSE POUR LA PRODUCTION DE PRODUITS CÉRAMIQUES

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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention generally regards the technical field of presses for the dry production of ceramic products, in particular tiles or plates, even of large size, in which the ceramic material to be pressed is fed by a conveyor belt.

STATE OF THE ART

[0002] At the state of the art, the making of ceramic tiles or plates can occur under dry conditions, by means of the compaction of a mass of ceramic material in the form of a mixture of ceramic powders and possible other additives.

[0003] The dry compaction of one such mixture of powder ceramic material occurs in a press, more particularly at a forming seat thereof into which the mass of powder ceramic material to be compacted is fed, e.g. arranging it directly in a forming seat or transporting it by means of suitable feeding means, for example a conveyor belt.

[0004] The forming seat remains delimited between two opposite plane surfaces which are substantially non-deformable and parallel to each other, mutually movable away from and towards the other. More particularly, the forming seat comprises a first pressing plane surface, lower during use, having mold function and intended to receive the mass of powder ceramic material to be compacted and a second plane surface, upper during use, having the function of punch or counter-mold. When the two plane surfaces are moved towards each other, the mass of powder material to be compacted comprised between the two plane surfaces is subjected to high process pressures, by means of suitable power members suitably connected to one or both pressing plane surfaces, in accordance with the type of press.

[0005] If the material to be compacted is fed by means of the above feeding means, e.g. a conveyor belt which traverses the forming seat between the two opposite plane surfaces, the powder ceramic material to be compacted is directly compressed on the conveyor belt and then conveyed to the outlet by the belt itself, at the end of the process.

[0006] The mass of powder ceramic material to be compacted has a high air content, even 50%, which during the pressing step must exit outward from the material in a uniform manner, in order to ensure a good quality of the final product.

[0007] This is difficult, above all in the case of tiles or plates of large size, since the only air escape route from the mass of powder ceramic material is represented by the perimeter edge of the mass itself, when the latter is compressed between the two plane surfaces.

[0008] Hence, in order to allow the air the possibility to entirely and uniformly exit outward from the mass of ceramic material, at the state of the art the pressing can

occur in multiple successive steps, and in each of these the pressure applied to the mass of powder ceramic material is different. Alternatively, the pressing times can be lengthened.

[0009] In the first case, the pressing process is complicated since the operation in successive steps of the press must be suitably controlled and coordinated with the other components of the press itself, for example the starting members and the conveyor belt. In the second case, the pressing times of rather long duration can compromise the efficiency of the production.

[0010] In addition, since the powder ceramic material is directly compressed on the conveyor belt, there is also the problem of adequate supporting the conveyor belt, since the same has a limit rigidity.

[0011] There is therefore the need to improve the dry production technique for ceramic products, in particular tiles or plates also of large size, starting from a mass of ceramic material in the form of a mixture of ceramic powders.

[0012] The documents EP0793565A1, US2014141961A1, EP2364830A1, EP2384870A1 teach solutions according to the state of the prior art.

[0013] WO2014/101993 discloses a conveyor belt designed for transporting plate-shaped items in a processing machine, comprising a belt body, having longitudinal edges, connecting edges, and a support face, shaped to support the items, and at least one assembling member, arranged so as to join the connecting edges, and extending in an assembling direction that is oblique relative to the longitudinal direction; the belt body has a plurality of perforations that make it possible to obtain a vacuum on the support face, so as to immobilise the items.

[0014] ITMO20100268 discloses an apparatus for forming substantially slab-shaped products according to the preamble of claim 1, comprising a conveyor belt provided with an inlet side at which material to be formed is fed, an outlet side in correspondence of which formed articles are removed, and pressing means of said material to be formed, provided with at least one half-mold positioned above the upper branch of the conveyor belt, and alternatively mobile approaching and moving away from it according to a pressing direction.

[0015] The conveyor belt is made of porous material, permeable to at least one fluid medium; the pressing means comprise at least one abutment body of the half-mold during pressing, which is positioned below the upper branch of the conveyor belt in correspondence with the half-mold, and which defines a bearing surface of the upper branch of the conveyor belt itself, during the pressing stage; the supporting surface is provided with at least one opening in communication with a chamber, defined internally to the abutment body, for collecting the fluid medium evacuated from the material during pressing through the pores of the conveyor belt.

OBJECTS OF THE INVENTION

[0016] Therefore, the main object of the present invention is to improve the state of the art of presses for the dry production of ceramic products, in particular tiles or plates of large size.

[0017] In the scope of such task, one object of the present invention is to provide a press for making ceramic products which allows obtaining products of high quality in relatively limited times with respect to the pressing times of the conventional presses.

[0018] Another object of the present invention is to provide a press for making ceramic products that is easy to make, also at competitive costs.

[0019] These and still other objects of the present invention are attained by a press according to claim 1.

[0020] The dependent claims refer to preferred and advantageous embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] Further characteristics and advantages of the present invention will be clearer from the detailed description of a particularly preferred non-exclusive embodiment of a press according to the present invention, given as a non-limiting example, in the set of drawing tables in which:

figure 1 is a perspective and schematic view, in reduced scale, of a press according to the present invention, in which the mass of powder ceramic material to be compacted is fed into the forming seat of the press, by means of a conveyor belt;

figure 2 illustrates a perspective view, taken from above, of a pressing plane surface of the forming seat of the press of figure 1;

figure 3 shows, in a plan view of the plane surface of figure 2, a first face of such plane surface;

figure 3a is a cross section view, in enlarged scale, of a detail of the plane surface of figure 3, taken along the section line IIIa-IIIa;

figure 4 illustrates, in a bottom view of the plane surface of figure 2, a third face of such plane surface, opposite the first face;

figure 5 shows, in a front view of the plane surface of figure 2, a second face of such plane surface, in slightly enlarged scale;

figure 6 is a side view of the plane surface of figure 2, in further enlarged scale and taken from the left;

figure 7 illustrates a cross section view of the plane surface of figure 3, taken along the section line VII-VII;

figure 7a shows, in enlarged scale, a first detail of figure 7;

figure 7b is a view, in enlarged scale, of a second detail of figure 7;

figure 8 illustrates a side view, with parts in section, of the plane surface of figure 2;

figures 9 and 10 are respectively a plan view and a lateral view of a conveyor belt or of a section of a conveyor belt of a press according to the present invention; figure 11 is a slightly top perspective view of another pressing plane surface for a press according to the present invention;

figure 12 is a side view of the plate of figure 11 with a detail in cross section; figure 13 is a sectional view along the trace XIII-XIII of figure 12;

figure 14 illustrates a detail in enlarged scale of figure 13;

figure 15 illustrates a detail in enlarged scale of figure 13;

figure 16 is a sectional view along the trace XVI-XVI of figure 15;

figure 17 illustrates a detail in enlarged scale of figure 11.

EMBODIMENTS OF THE INVENTION

[0022] With reference to the enclosed figures, the press for the dry production of a ceramic product according to the present invention is generically indicated with the reference number 1 and comprises at least one first pressing plane surface 2 and one second pressing plane surface 3, arranged substantially parallel to each other. In the enclosed figures, the first pressing plane surface 2 is arranged below the second pressing plane surface 3 and lies on a substantially horizontal plane. During use, the pressing plane surfaces 2 and 3 are mutually movable towards and away from each other by means of suitable power means, not illustrated in the figures, so that the plane surfaces can approach or move away from each other. Between the two plane surfaces of the press 2 and 3, during the process of making a ceramic product, a mass 4 of ceramic material to be compacted is arranged, in the form of a mixture of ceramic powders and possible other additives. According to one version of the invention, at least one between the first pressing plane surface 2 and the second pressing plane surface 3 (in the illustrated figures, only the first pressing plane surface 2) comprises a first face 5 facing towards the mass 4 of ceramic material to be compacted and a second face 6, connectable with suitable suction means, not visible in the drawings, e.g. a vacuum pump.

[0023] In such pressing plane surface (the plane surface 2 in the enclosed figures), a manifold circuit 7 for gas is obtained, comprising a plurality of ducts 70 as well as first openings 8, obtained at the first face 5, facing towards the powder material to be compacted, and second openings 9, obtained at the second face 6. As will be seen hereinbelow, the first and the second openings 8, 9 are in fluid communication with each other by means of the plurality of ducts 70.

[0024] In the enclosed figures, the second face 6 of the pressing plane surface 2 is a lateral face of the plane surface itself. Nevertheless, such face could be the face opposite the first face 5, or directed opposite the mass 4

of powder ceramic material to be compacted.

[0025] The plurality of ducts 70 leads, on one side, onto the first face 5, at the first openings 8 and, on the other side, onto the second face 6, at the second openings 9, for the connection with the abovementioned suction means.

[0026] According to one version of the present invention, the first face 5 of the pressing plane surface affected by the manifold circuit 7, in the illustrated case the first pressing plane surface 2, is made of compact material (i.e. non-porous) that is impermeable to gas, e.g. metal or metal alloy, preferably high-tensile steel capable of supporting the specific required pressing pressure (up to 500 kg/cm²), e.g. C45. The first openings 8, obtained in the first face 5 of the pressing plane surface 2, are uniformly distributed on such first face and have a diameter less than or equal to 1 mm. A diameter thus reduced prevents the powder ceramic material from entering into the plurality of ducts 70, while ensuring, as will be seen hereinbelow, the fluid communication with the suction means connectable with such ducts. According to one embodiment, the first openings 8 are obtained in the first face 5 of the pressing plane surface 2 according to a grid configuration.

[0027] With particular reference to figures 3a, 7 and 7a, it will be observed that the plurality of ducts 70 comprises at least one main duct 71 and a plurality of secondary ducts 72 in fluid communication with each other, each secondary duct 72 leading, on one side, through a respective first opening 8, onto the first face 5 of the plane surface 2 and on the other side, into the main duct 71 and each main duct 71, in turn, leading on one side, into respective secondary ducts 72 and, on the other side, through a second opening 9, onto second face 6.

[0028] The secondary ducts 72 are arranged substantially orthogonal to the main duct 71. In any case, other configurations of the plurality of ducts 70 can be provided for, so long as they allow the fluid communication between the first face 5 of the pressing plane surface 2 and the second face 6 thereof.

[0029] According to one embodiment, each secondary duct 72 comprises a first portion 721, at the respective first opening 8, and a second portion 722, facing towards the respective main duct 71, as well as an intermediate portion 723 for the connection between the first portion 721 and the second portion 722. The first portion 721 and the second portion 722 each have substantially circular cross section with different diameter from each other, while the intermediate connection portion 723 has a frustoconical configuration.

[0030] In order to ensure the fluid connection between the first and the second face of the pressing plane surface 2, simultaneously preventing the mixture of ceramic powder to be compacted from flowing into the plurality of ducts, the diameter of the first portion 721 of each secondary duct is reduced, for example less than or equal to 1 mm and less than the diameter of the second portion 722.

[0031] According to one embodiment, the main ducts 71 of the plurality of ducts 70 have a cross section that is substantially circular or semicircular or with a straight base portion, connected at its own ends with a portion having an inverted "U" or curved or rounded shape.

[0032] The pressing plane surface 2 provided with the plurality of ducts 70 can be formed in a single piece, or it can comprises multiple layers, as illustrated in the enclosed figures (figures 2, 6, 7 and 8).

[0033] In this case, the pressing plane surface comprises a first layer 21, in which the secondary ducts 72 and at least part of the main ducts 71 are obtained, and a second layer 22 with substantially constant thickness.

[0034] According to this version, the press comprises suitable tightening means 10, for tightening together the layers 21 and 22 of the pressing plane surface 2. According to one embodiment, such tightening means 10, e.g. screws or bolts with configuration adapted for such purpose, are applied to the layers 21 and 22 in proximity to the plurality of ducts 70, arranged on opposite sides with respect to each secondary duct 72, in respective openings obtained if necessary, in order to allow the fluid-tight seal of the ducts themselves and of the main duct 71.

[0035] The press according to one embodiment also comprises fluid-tight sealing means 11 between the first layer 21 and the second layer 22, for example a gasket or a layer 111 made of silicone or any other suitable material, applied externally with respect to the layers 21 and 22 at the junction thereof.

[0036] According to one embodiment, the press comprises at least one connecting block 12, fastened to the second face 6 of the pressing plane surface 2 for connection to the suction means of the press. Such block 12 comprises at least one support 121 in which a through portion 122 is obtained for each second opening 9 made in the second face 6 of the pressing plane surface 2. Each through portion 122, once the block has been fastened to the plane pressing surface 2, is aligned with a respective second opening 9.

[0037] The connecting block 12 also comprises a connecting sleeve 123 for each through portion 122. Each connecting sleeve 123 is inserted in the respective through portion 122 and serves as a component of connection with the suction means. The connecting block 12 is fastened, e.g. bolted to the second face 6 of the pressing plane surface 2, by means of suitable fastening means 13. Also in this case, in order to facilitate the fluid-tight seal, it is provided that such fastening means 13 are applied in proximity to the through sections 122, arranged on opposite sides with respect to each of these.

[0038] The press also comprises fluid-tight sealing means 14, for example a gasket of a type suitable for this purpose, between the connecting block 12 and the second face 6 of the pressing plane surface 2, in particular around the mouth of each through portion 122 and the second opening 9.

[0039] The press comprises feeding means 15, provided to feed the mass 4 of powder ceramic material to

be compacted between the two pressing plane surfaces 2 and 3. The feeding means 15 are comprised between the first pressing plane surface 2 and the second pressing plane surface 3, they are positioned on the first pressing plane surface 2, and cross through the forming seat of the press.

[0040] Such feeding means 15, according to the present invention, comprise a conveyor belt made of material permeable to gas, e.g. a conveyor belt made of porous fabric.

[0041] In an embodiment not covered by the claimed invention, the feeding means 15 serve as first filtering element for the powder material to be compacted, since they retain the ceramic powder fraction of larger size, while the finer powder fraction is conveyed towards the pressing plane surface 2, and hence they prevent the manifold circuit from being obstructed.

[0042] One such belt 15 is perforated or micro-perforated, with through holes or micro-holes, so as to be permeable to gas, but impermeable to the powders of materials to be pressed, e.g. to the powders of ceramic materials.

[0043] In addition, the belt 15 comprises a distribution or percentage or density of the perforations or micro-perforations with respect to the surface of the belt itself that varies in passing from the center or center line or longitudinal symmetry axis x-x of the belt 15 to the sides S1, S2 thereof and more particularly which decreases in passing from the center or center line or longitudinal symmetry axis x-x of the belt 15 to the sides S1, S2 thereof.

[0044] More particularly, the belt 15 could have a first zone or central zone or zone 15a developing side to side with respect to the center line x-x of the belt with a first percentage or density of perforations greater than the other zones.

[0045] Still more particularly, the belt 15 could have two second zones or intermediate zones 15b, each with a second percentage or density of perforations, and such intermediate zones 15b are side-by-side the central zone 15a and placed on opposite sides from each other with respect to the central zone 15 along with, if desired, two third zones or lateral zones 15c each with a third percentage or density of perforations, and such lateral zones 15c each define a respective side S1, S2 of the belt 15 and are distal from the central zone 15a and each are also side-by-side a respective intermediate zone 15b.

[0046] The first percentage of perforations can be higher than the second percentage of perforations and the second percentage of perforations can be higher than the third percentage of perforations, so that the micro-perforations have denser distribution in the pressing zones that are more internal or further away from the sides S1, S2 of the belt and progressively lower density in approaching the sides S1, S2 of the belt 15.

[0047] As will be understood, by percentage of perforations it is intended the number of holes or micro-holes per unit of surface area, considering that in each zone 15a, 15b and (if provided) 15c the holes or micro-holes

are substantially uniformly distributed over the entire extension (longitudinal and transverse) of the zone itself.

[0048] More particularly, the distance between the holes or micro-holes in the central zone 15a could be between about one-fourth and about three-fourths, e.g. between about one-third and about two-thirds the distance of the holes or micro-holes in the intermediate zones 15b, if desired substantially equal to half the distance of the holes or micro-holes in the intermediate zones 15b. If desired, the distance between the holes or micro-holes in the intermediate zones 15b could be between about one-fourth and about three-fourths, e.g. between about one-third and about two-thirds the distance of the holes or micro-holes in the lateral zones 15c, if desired substantially equal to half the distance of the holes or micro-holes in the lateral zones 15c.

[0049] If desired, the holes in the central zone 15a could be spaced from each other by about 2-8 mm, e.g. 3-7 mm, if desired about 5 mm, the holes in the intermediate zones 15b could be spaced from each other by about 5-15 mm, e.g. 8-12 mm, if desired about 10 mm and the holes in the lateral zones 15c could be spaced from each other by about 15-25 mm, e.g. 18-22 mm, if desired about 20 mm.

[0050] The central zone 15a has extension transverse or orthogonal to the longitudinal symmetry axis x-x between 0.5 and 2 times, e.g. substantially equal to, the transverse extension of the intermediate zones 15b and, if provided, of the lateral zones 15c.

[0051] Naturally, the holes are substantially distributed along the entire longitudinal extension (parallel to the axis or center line x-x) and transverse extension (orthogonal to the axis x-x) of the zones 15a, 15b and (if provided) 15c of the belt 15.

[0052] As will be understood, the pressing occurs in a more intense manner at the center line or at the central zone of the belt, while the intensity or power of the pressing decreases in moving away from the center line x-x and in approaching the sides of the belt 15. The decrease of percentage of the perforations as indicated above ensures that the suction of the gases from the pressing zone is more greatly ensured where the pressing is greater, simultaneously reducing the costs of perforation or micro-perforation of the belt 15.

[0053] Clearly but not forming part of the invention, there could also be the same distribution or percentage of perforations or micro-perforations over the entire extension of the belt 15.

[0054] The belt 15 can be obtained by perforating, e.g. by means of water jet, a belt lacking holes, e.g. made of rubber or of a similar material. Such perforation can be made by means of a punch or a group of punches.

[0055] In an embodiment not covered by the claimed invention, the holes or micro-holes delimited by the or on the belt 15 could have a diameter of about 0.5-3 mm; in an embodiment of the invention, the holes or micro-holes delimited by the, or on, the belt 15 could have a diameter between 0.5 and 1 mm, if desired 0.8 mm.

[0056] In addition, the belt 15 can be made of multiple layers, for example with a layer, lower during use, reinforced with canvas 15d and an upper layer 15e made of PVC, polyurethane, rubber or a similar material packed with the lower layer 15d. The lower layer 15d can be such to facilitate the evacuation of the gases from the pressing zone and to improve the flow on the first pressing plane surface 2.

[0057] The surface of the belt can also have reliefs, and not be smooth.

[0058] The belt 15 could then have terminal connector components 15f, each connected to the lower layer 15d and to the upper layer 15e.

[0059] According to the non-limiting embodiment illustrated in the figures, the belt or a section thereof has two terminal connector components 15f, each at a respective end of the belt section, and such terminal connector components 15f delimit a seat 15g, which if desired is extended transverse or orthogonal to the axis x-x, set to house a hinge or junction with another belt section or with a component for the connection (not illustrated in the figures) with another connector component.

[0060] In addition, the connector components 15f could have a width greater than the lower layers 15d and upper layers 15e, so as to project laterally with respect thereto. The connector components 15f could also have sectioned or smoothed edges 15f1. Such expedient ensures an improved evacuation of air during the pressing.

[0061] With reference now to figures 11 to 17, another pressing plane surface 2, 3 for a press according to the present invention is illustrated. This comprises a base or top plate 16 on which a plurality of side-by-side packed strips 17 are arranged and fastened, in particular removably, so as to define the first face 5 or the second face 6.

[0062] In addition, one or more slits or grooves or micro-slits 18 connectable with suitable suction means is/are delimited between at least two adjacent strips 17, preferably between all the pairs of adjacent strips, or in at least one strip 17, preferably in all the strips 17, and such slits or grooves are actually in substitution of the openings 8.

[0063] The strips 17 define the first face 5 facing towards the mass 4 of ceramic material to be compacted or the second face 6.

[0064] In addition, the strips 17 can have a first lateral wall 17a with a plurality of notches such to delimit the slits or grooves or micro-slits 18 with the second lateral wall 17b of an adjacent strip, clearly once the strips 17 are packed. Alternatively, the slits or grooves or micro-slits 18 can be made within the body of the strips 17.

[0065] The slits or grooves or micro-slits 18 lead, in particular below if they are part of a first pressing plane surface 2 or above if they are part of a second pressing plane surface 2, into one or more suction manifolds or channels 19 in fluid communication with the suction plant, e.g. a vacuum pump. The or each suction manifold or channel 19 can be made in the base plate 16 or in the strips 17. The manifold(s) 19 can be extended in a direc-

tion orthogonal to the front F - rear R direction.

[0066] According to the non-limiting embodiment illustrated in the figure, each strip 17 comprises two lateral walls 17a, 17b, e.g. substantially extended in the front F - rear R direction, an upper wall 17c, a lower wall 17d, a front wall or wall facing towards the front F of the pressing plane surface 2, 3 and a rear wall or wall facing towards the rear R of the pressing plane surface 2, 3.

[0067] The plurality of side-by-side upper walls 17c defines the first face 5, while the plurality of side-by-side lower walls 17d defines the second face 6.

[0068] One of the lateral walls 17a, 17b can be configured substantially as an L in cross section, i.e. in a plane surface orthogonal to the direction from the front F to the rear R of the pressing plane surface 2, 3, so that each strip 17 has a part, lower 17h during use or upper during use of smaller width and a part, upper 17g during use or lower during use of greater width and with a portion 17n projecting with respect to the underlying lower part 17h or overlying upper part. With one such structure, below the projecting portion 17n of the upper part 17g or above the projecting portion of the lower part, a connector chamber 17m is defined between two adjacent strips 17 that is set to place the slits or grooves or micro-slits 18 in fluid communication with a respective suction manifold or channel 19.

[0069] The projecting portion 17n of a strip can have a curved or substantially curved surface 17p delimiting the connector chamber 17m with a portion of lateral wall 17b of an adjacent strip.

[0070] The slits or grooves 18 can be constituted by means of through notches defined at one of the lateral walls 17a, 17b, and additionally the slits or grooves or micro-slits 18 can be extended from the upper face of the first pressing plane surface 2 or lower face of the second pressing plane surface 3 to a suction manifold 19 or, if provided, to a connector chamber 17m leading into a suction manifold 19.

[0071] If desired, each strip 17 has a plurality of slits or grooves 18 spaced from each other and, if desired, extended in a direction substantially parallel to the front F - rear R direction. More particularly, each strip has slits or grooves 18 over the entire longitudinal extension thereof or in front F - rear R direction.

[0072] The strips 17 can be fastened, in particular removably, to the base plate 16 by means of fastening means, such as screws, bolts or stops or lateral stop plates 20a and possibly one or more stops or central stop plates 20b, in particular if the pressing plane surface 2, 3 is very long.

[0073] For such purpose, the stops 20a can include a bracket or bar, for example delimiting a through hole, and in such case once the strips 17 are arranged substantially aligned and packed on a base plate 16, a first bracket or bar 20a is arranged above or below the front ends of the strips 17 and a second bracket or bar 20b is arranged above or below the rear ends of the strips 17 and the brackets 20a, 20b are constrained to the base plate by

means of screws 20c or the like.

[0074] If the pressing plane surface 2, 3 is very long, then two series of strips 17 can be provided, connected to each other by means of a central stop 20b.

[0075] According to such embodiment, each manifold circuit 7 is defined by a slit or groove 17 and, if provided, by a connector chamber 17m.

[0076] In one such pressing plane surface, there is no need to make micro-holes in large plates and moreover the entire suction plane surface can be easily disassembled and serviced in case of need, ensuring a solution that is inexpensive and easy to maintain.

[0077] The above-described invention attains numerous advantages.

[0078] With a press according to the invention, the air present in the powder material to be compacted can in fact escape outward from the material itself during the pressing process, i.e. when this material is placed under pressure by the pressing plane surfaces 2 and 3 suitably controlled by the power members, according to three preferred pathways.

[0079] As in conventional presses, the air exits outward from the perimeter edge of the mass of powder ceramic material to be compacted. It exits outward from the conveyor belt, which is permeable to gas, both laterally and through the thickness of the belt towards the underlying pressing plane surface 2, and it also exits outward from the pressing plane surface (2 in the drawings) in fluid connection, by means of the plurality of ducts obtained therein, with suitable suction means. The particular configuration of the plurality of ducts 70 facilitates the outward exit of air from the mass of powder material to be compacted, in a manner that is entirely uniform with respect to the mass itself, reducing the risk of stagnation of air in the product, and in a rather reduced time with respect to the time required by the conventional presses. There is therefore an increase of the quality of the obtained products and a reduction of the production times, with increased production efficiency of the press.

[0080] The above-described press is susceptible of numerous modifications and variants within the protective scope of the following claims.

[0081] Hence, for example, the present invention is applied to presses where only one pressing plane surface is movable with respect to the other (e.g. the one that is lower during use or that upper during use - the latter case is illustrated in the enclosed figures) or to the case in which both pressing plane surfaces are movable.

[0082] In the description, the pressing plane surface 2, lower during use, is described; here the plurality of ducts 70 is attained but it remains intended that also or only pressing plane surface 3, upper during use, can have the same configuration and be connectable to suitable suction means.

[0083] In addition, other configurations of the distribution of the first openings 8 and other arrangements and configurations of the plurality of ducts 70 can be provided, so long as the fluid connection is ensured between the

face of the pressing plane surface facing towards the powder ceramic material to be compacted and the suction means and simultaneously the quantity of material entering into the plurality of ducts is reduced to the minimum.

[0084] Hence, for example, all three sections 721, 722 and 723 could have substantially circular cross section of equal diameter.

Claims

1. A press for the dry production of ceramic products starting from a mass (4) of powder ceramic material to be compacted, comprising:

- at least one first pressing plane surface (2) and one second pressing plane surface (3), said first pressing plane surface (2) and said second pressing plane surface (3) being arranged parallel to each other and being mutually movable away from and towards the other;

- feeding means (15) provided to feed said mass (4) of powder ceramic material to be compacted, said feeding means (15) being positioned on said first pressing plane surface (2), so that said mass (4) of powder ceramic material to be compacted is delimited between said first pressing plane surface (2) and said second pressing plane surface (3);

wherein

at least one from between said first pressing plane surface (2) and said second pressing plane surface (3) comprises:

- a first face (5) facing towards said mass (4) of powder ceramic material;
- a second face (6), connectable with suitable suction means; and
- a manifold circuit (7) for gas, obtained between said first face (5) and said second face (6),

said first face (5) being made of compact material impermeable to gas, said feeding means (15) comprising at least one conveyor belt made of material permeable to gas,

characterized in that said at least one conveyor belt (15) is perforated or micro-perforated so as to be permeable to gas, but impermeable to the powders of materials to be pressed, **and in that** said at least one conveyor belt (15) comprises a percentage or density of the perforations or micro-perforations, i.e. the number of holes or micro-holes per unit of surface area that varies in passing from the center or center line or longitudinal symmetry axis (x-x) of the belt (15) to the sides (S 1, S2) thereof.

2. Press according to claim 1, wherein said manifold circuit (7) for gas comprises a plurality of ducts (70) as well as first openings (8), at said first face (5) and second openings (9) at said second face (6), said first and said second openings (8, 9) being in fluid communication with each other by means of said plurality of ducts (70).
3. Press according to claim 2, wherein said first openings (8) are uniformly distributed on said at least one first face (5) of said plane surface (2).
4. Press according to claim 1, wherein said at least one conveyor belt (15) comprises a percentage or density of the perforations or micro-perforations which decreases in passing from the center or center line or longitudinal symmetry axis (x-x) of the belt (15) to the sides thereof.
5. Press according to claim 1 or 4, wherein said belt (15) has a first zone or central zone (15a) or zone developing side to side with respect to the center line (x-x) of the belt with a first percentage of perforations and two second zones or intermediate zones (15b) each with a second percentage of perforations, and such second zones (15b) are side-by-side the central zone (15a) and placed on opposite sides from each other with respect to the central zone (15), wherein in each zone (15a, 15b) the holes or micro-holes are substantially uniformly distributed for the entire longitudinal and transverse extension thereof, and wherein the first percentage of perforations is greater than the second percentage of perforations.
6. Press according to claim 5, wherein said belt (15) comprises two lateral zones (15c), each with a third percentage of perforations, and such lateral zones (15c) each define a respective side (S1, S2) of the belt (15) and are distal from the central zone (15a), and each are also side-by-side a respective intermediate zone (15b), wherein in the third zone (15c) the holes or micro-holes are substantially uniformly distributed for the entire longitudinal and transverse extension of the third zone (15c) itself, and wherein the second percentage of perforations is greater than the third percentage of perforations.
7. Press according to any one of the preceding claims 1 and 4 to 6, wherein at least one from among said first (2) and said second (3) pressing plane surface comprises a base or top plate (16) as well as a plurality of strips (17) removably arranged and fastened on said base or top plate (16) and side-by-side each other and packed so as to define said first face (5) or said second face (6), at least one slit or groove (18) connectable with suction means being delimited between at least two adjacent strips (17) or in at least one strip (17).

8. Press according to claim 7, wherein said at least one slit or groove (18) leads into at least one suction manifold or channel (19) obtained in said base plate (16) or in said strips (17) and in fluid communication with suction means.

Patentansprüche

1. Presse für die Trockenherstellung von keramischen Produkten, ausgehend von einer Masse (4) aus zu verdichtendem pulverförmigem keramischem Material, umfassend:
- mindestens eine erste ebene Pressoberfläche (2) und eine zweite ebene Pressoberfläche (3), wobei die besagte erste ebene Pressoberfläche (2) und die besagte zweite ebene Pressoberfläche (3) parallel zueinander angeordnet sind und gegenseitig voneinander weg und aufeinander zu bewegbar sind;
 - Zuführungsmittel (15), die vorgesehen sind, um die besagte Masse (4) des zu verdichtenden pulverförmigen keramischen Materials zuzuführen, wobei die besagten Zuführungsmittel (15) auf der besagten ersten ebenen Pressoberfläche (2) positioniert sind, sodass die besagte Masse (4) des zu verdichtenden pulverförmigen keramischen Materials zwischen der besagten ersten ebenen Pressoberfläche (2) und der besagten zweiten ebenen Pressoberfläche (3) begrenzt ist; worin mindestens eine zwischen der besagten ersten ebenen Pressoberfläche (2) und der besagten zweiten ebenen Pressoberfläche (3) umfasst:
 - eine erste Fläche (5), die der besagten Masse (4) aus pulverförmigem keramischem Material zugewandt ist;
 - eine zweite Fläche (6), die mit geeigneten Saugmitteln verbindbar ist; und
 - einen Verteilerkreis (7) für Gas, der zwischen der besagten ersten Fläche (5) und der besagten zweiten Fläche (6) erhalten wird, wobei die besagte erste Fläche (5) aus einem kompakten gasundurchlässigen Material besteht, wobei die besagten Zuführungsmittel (15) mindestens ein Förderband aus gasdurchlässigem Material umfassen,
- dadurch gekennzeichnet, dass** das mindestens eine Förderband (15) perforiert oder mikroperforiert ist, sodass es für Gas durchlässig, aber für die Pulver der zu pressenden Materialien undurchlässig ist, und dadurch, dass das mindestens eine Förderband (15) einen Prozentsatz oder eine Dichte der Perforationen oder Mikroperforationen umfasst, d.h. die Anzahl von Löchern oder Mikrolöchern pro Flächeneinheit, die

beim Übergang von der Mitte oder Mittellinie oder Längssymmetrieachse (x-x) des Bandes (15) zu dessen Seiten (S1, S2) variiert.

2. Presse nach Anspruch 1, worin der besagte Verteilerkreis (7) für Gas eine Vielzahl von Kanälen (70) sowie erste Öffnungen (8) an der besagten ersten Fläche (5) und zweite Öffnungen (9) an der besagten zweiten Fläche (6) umfasst, wobei die besagten ersten und zweiten Öffnungen (8, 9) durch die besagte Vielzahl von Kanälen (70) in Fluidverbindung miteinander stehen. 5
3. Presse nach Anspruch 2, worin die besagten ersten Öffnungen (8) gleichmäßig auf der besagten mindestens einen ersten Fläche (5) der besagten ebenen Oberfläche (2) verteilt sind. 10
4. Presse nach Anspruch 1, worin das besagte mindestens eine Förderband (15) einen Prozentsatz oder eine Dichte der Perforationen oder Mikroperforationen umfasst, der/die beim Übergang von der Mitte oder Mittellinie oder Längssymmetrieachse (x-x) des Bandes (15) zu dessen Seiten hin abnimmt. 20
5. Presse nach Anspruch 1 oder 4, worin das besagte Band (15) eine erste Zone oder mittlere Zone (15a) oder sich von Seite zu Seite in Bezug auf die Mittellinie (x-x) entwickelnde Zone des Bandes mit einem ersten Prozentsatz an Perforationen und zwei zweite Zonen oder Zwischenzonen (15b), jede mit einem zweiten Prozentsatz an Perforationen, aufweist, und solche zweiten Zonen (15b) neben der mittleren Zone (15a) liegen und auf einander gegenüberliegenden Seiten in Bezug auf die mittlere Zone (15) angeordnet sind, worin in jeder Zone (15a, 15b) die Löcher oder Mikrolöcher im Wesentlichen gleichmäßig über die gesamte Längs- und Quererstreckung derselben verteilt sind, und worin der erste Prozentsatz an Perforationen größer ist als der zweite Prozentsatz an Perforationen. 30
6. Presse nach Anspruch 5, worin das besagte Band (15) zwei seitliche Zonen (15c), jeweils mit einem dritten Prozentsatz an Perforationen, und solche seitlichen Zonen (15c), die jeweils eine jeweilige Seite (S1, S2) des Bandes (15) definieren und von der mittleren Zone (15a) distal sind und die jeweils ebenfalls Seite an Seite an einer jeweiligen Zwischenzone (15b) liegen, umfasst, worin in der dritten Zone (15c) die Löcher oder Mikrolöcher im Wesentlichen gleichmäßig über die gesamte Längs- und Quererstreckung der dritten Zone (15c) selbst verteilt sind, und worin der zweite Prozentsatz an Perforationen größer ist als der dritte Prozentsatz an Perforationen. 35
7. Presse nach irgendeinem der vorangegangenen Ansprüche 1 und 4 bis 6, worin mindestens eine unter 40

der besagten ersten (2) und der besagten zweiten (3) ebenen Pressoberfläche eine Basis- oder Deckplatte (16) sowie eine Vielzahl von Streifen (17) umfasst, die entfernbar auf der besagten Basis- oder Deckplatte (16) und Seite an Seite angeordnet und befestigt sind und so zusammengedrängt sind, dass sie die besagte erste Fläche (5) oder die besagte zweite Fläche (6) definieren, wobei mindestens ein Schlitz oder eine Nut (18), der/die mit Saugmitteln verbindbar ist, zwischen mindestens zwei benachbarten Streifen (17) oder in mindestens einem Streifen (17) begrenzt ist.

8. Presse nach Anspruch 7, worin der besagte mindestens eine Schlitz oder die besagte mindestens eine Nut (18) in mindestens einen Saugverteiler oder -kanal (19) führt, der in der besagten Basisplatte (16) oder in den besagten Streifen (17) erhalten wird und in Fluidverbindung mit Saugmitteln steht. 50

Revendications

1. Presse pour la production sèche de produits en céramique à partir d'une masse (4) de matière céramique en poudre qui doit être compactée, comprenant : 25

- au moins une première surface plane de pression (2) et une deuxième surface plane de pression (3), ladite première surface plane de pression (2) et ladite deuxième surface plane de pression (3) étant disposées parallèlement l'une à l'autre et étant mobiles mutuellement en éloignement et en rapprochement ;

- des moyens d'alimentation (15) prévus pour alimenter ladite masse (4) de matière céramique en poudre qui doit être compactée, lesdits moyens d'alimentation (15) étant positionnés sur ladite première surface plane de pression (2), de telle sorte que ladite masse (4) de matière céramique en poudre qui doit être compactée soit délimitée entre ladite première surface plane de pression (2) et ladite deuxième surface plane de pression (3) ; 35

dans laquelle

au moins l'une de ladite première surface plane de pression (2) et de ladite deuxième surface plane de pression (3) comprend :

- une première face (5) orientée vers ladite masse (4) de matière céramique en poudre ;
- une deuxième face (6) pouvant être raccordée avec des moyens d'aspiration appropriés ; et
- un circuit de collecteur (7) pour gaz, obtenu entre ladite première face (5) et ladite deuxième face (6), ladite première face (5) étant constituée de matière compacte imperméable au gaz, les- 50

- dits moyens d'alimentation (15) comprenant au moins une bande transporteuse constituée de matière perméable au gaz, **caractérisée en ce que** ladite au moins une bande transporteuse (15) est perforée ou microperforée pour être perméable au gaz, mais imperméable aux poudres de matières qui doivent être pressées, et **en ce que** ladite au moins une bande transporteuse (15) comprend un pourcentage ou une densité de perforations ou microperforations, c'est-à-dire le nombre de trous ou de micro-trous par unité de surface qui varie en allant du centre ou de la ligne médiane ou de l'axe de symétrie longitudinal (x-x) de la bande (15) vers les côtés (S1, S2) de celle-ci.
2. Presse selon la revendication 1, dans laquelle ledit circuit de collecteur (7) pour gaz comprend une pluralité de conduits (70) ainsi que des premières ouvertures (8), sur ladite première face (5) et des deuxièmes ouvertures (9) sur ladite deuxième face (6), lesdites premières et lesdites deuxièmes ouvertures (8, 9) étant en communication fluïdique les unes avec les autres grâce à ladite pluralité de conduits (70).
 3. Presse selon la revendication 2, dans laquelle lesdites premières ouvertures (8) sont réparties uniformément sur ladite au moins une première face (5) de ladite surface plane (2).
 4. Presse selon la revendication 1, dans laquelle ladite au moins une bande transporteuse (15) comprend un pourcentage ou une densité de perforations ou microperforations qui diminue en allant du centre ou de la ligne médiane ou de l'axe de symétrie longitudinal (x-x) de la bande (15) vers les côtés de celle-ci.
 5. Presse selon la revendication 1 ou 4, dans laquelle ladite bande (15) comporte une première zone ou zone centrale (15a) ou zone qui s'étend d'un côté à l'autre par rapport à la ligne médiane (x-x) de la bande avec un premier pourcentage de perforations et deux deuxièmes zones ou zones intermédiaires (15b) ayant chacune un deuxième pourcentage de perforations, ces deuxièmes zones (15b) étant côte-à-côte de la zone centrale (15a) et placées sur des côtés opposés l'un de l'autre par rapport à la zone centrale (15), dans laquelle dans chaque zone (15a, 15b), les trous ou micro-trous sont sensiblement répartis uniformément sur la totalité de l'extension longitudinale et transversale de celle-ci, et dans laquelle le premier pourcentage de perforations est supérieur au deuxième pourcentage de perforations.
 6. Presse selon la revendication 5, dans laquelle ladite bande (15) comprend deux zones latérales (15c), chacune ayant un troisième pourcentage de perforations, et ces zones latérales (15c) définissant cha-
- cune un côté (S1, S2) respectif de la bande (15) et étant distales de la zone centrale (15a), et chacune étant également côte-à-côte d'une zone intermédiaire (15b) respective, dans laquelle dans la troisième zone (15c), les trous ou micro-trous sont sensiblement répartis uniformément sur la totalité de l'extension longitudinale et transversale de la troisième zone (15c), et dans laquelle le deuxième pourcentage de perforations est supérieur au troisième pourcentage de perforations.
7. Presse selon l'une quelconque des revendications 1 et 4 à 6 qui précèdent, dans laquelle au moins l'une parmi ladite première (2) et ladite deuxième (3) surface plane de pression comprend une base ou plaque supérieure (16) ainsi qu'une pluralité de bandes (17) disposées et fixées de manière amovible sur ladite base ou plaque supérieure (16) et côte-à-côte l'une de l'autre et regroupées de manière à définir ladite première face (5) ou ladite deuxième face (6), au moins une fente ou une rainure (18) pouvant être raccordée avec des moyens d'aspiration étant délimitée entre au moins deux bandes adjacentes (17) ou dans au moins une bande (17).
 8. Presse selon la revendication 7, dans laquelle ladite au moins une fente ou rainure (18) amène dans au moins un collecteur ou canal d'aspiration (19) obtenu dans ladite plaque de base (16) ou dans lesdites bandes (17) et en communication fluïdique avec des moyens d'aspiration.

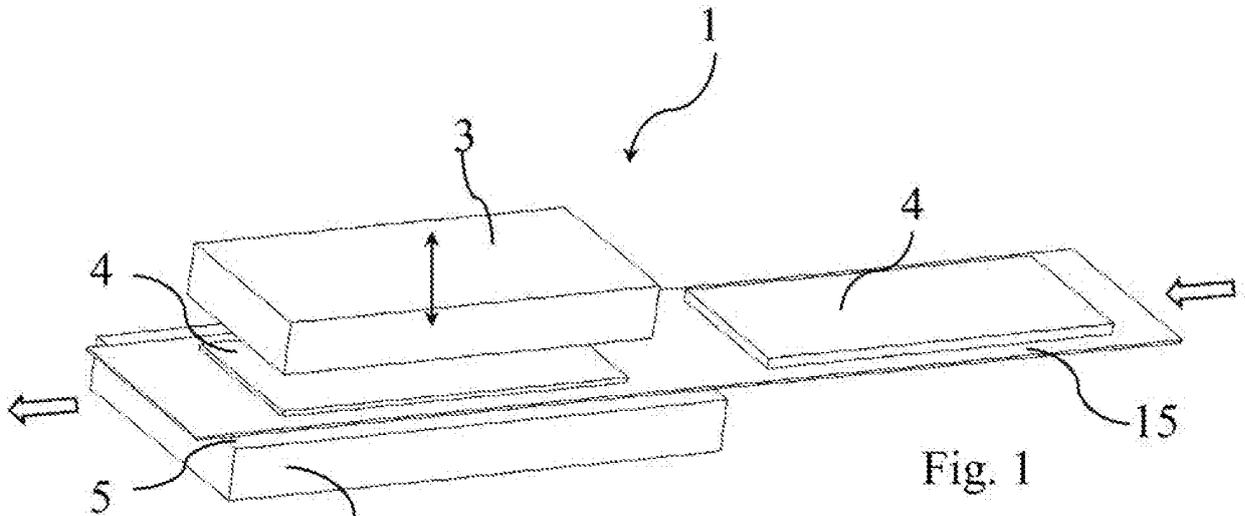


Fig. 1

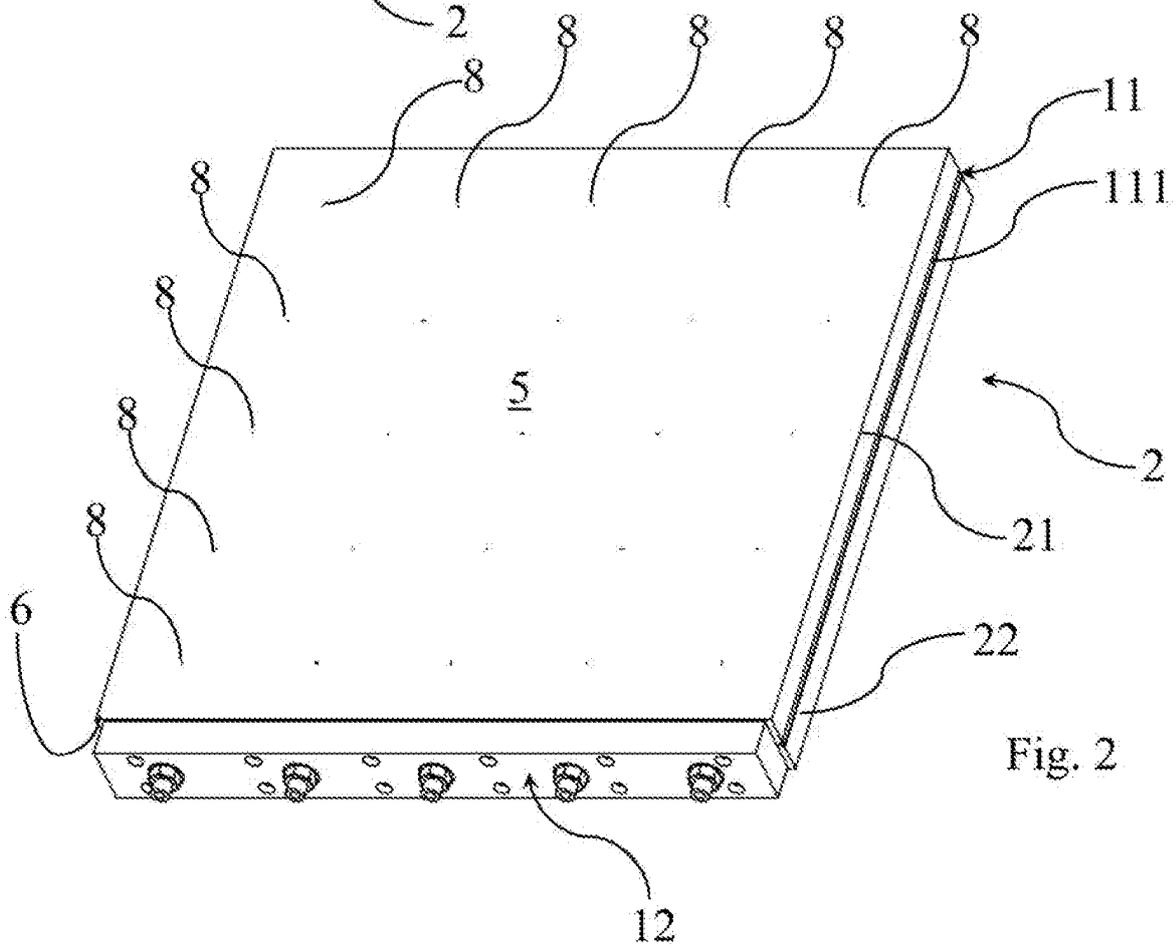


Fig. 2

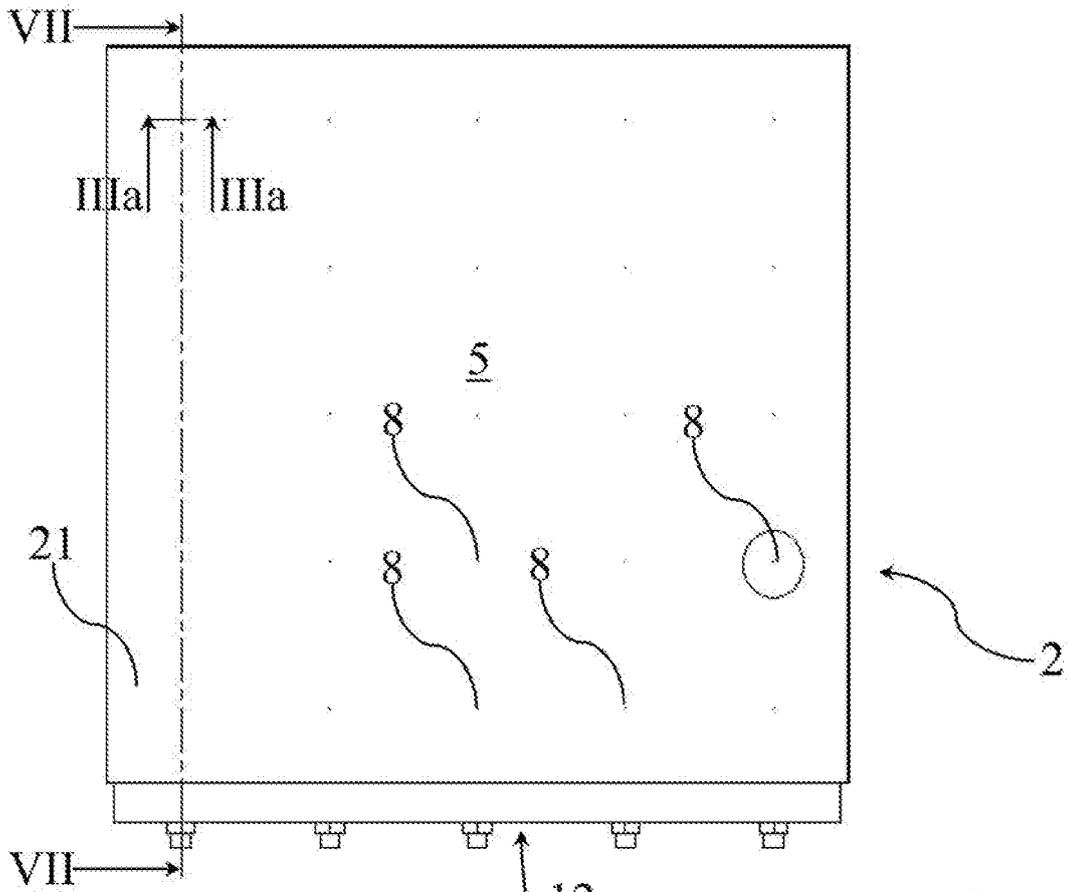


Fig. 3

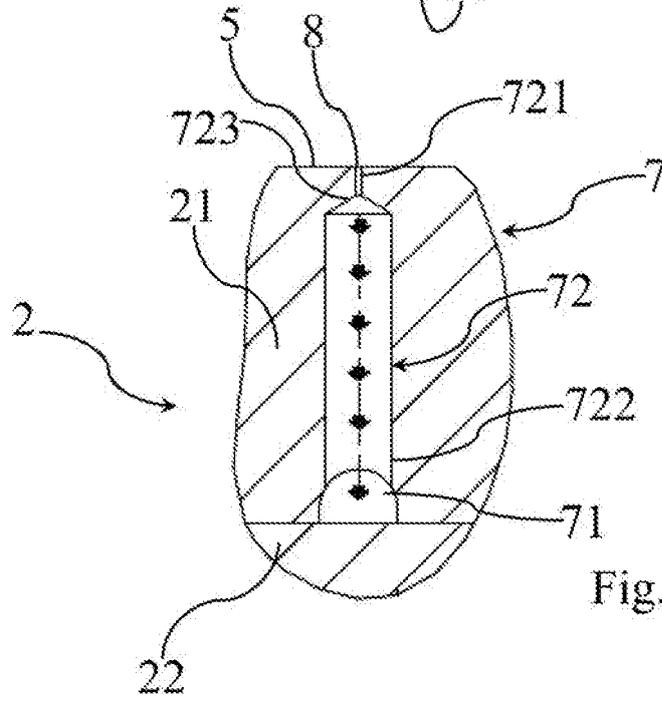


Fig. 3a

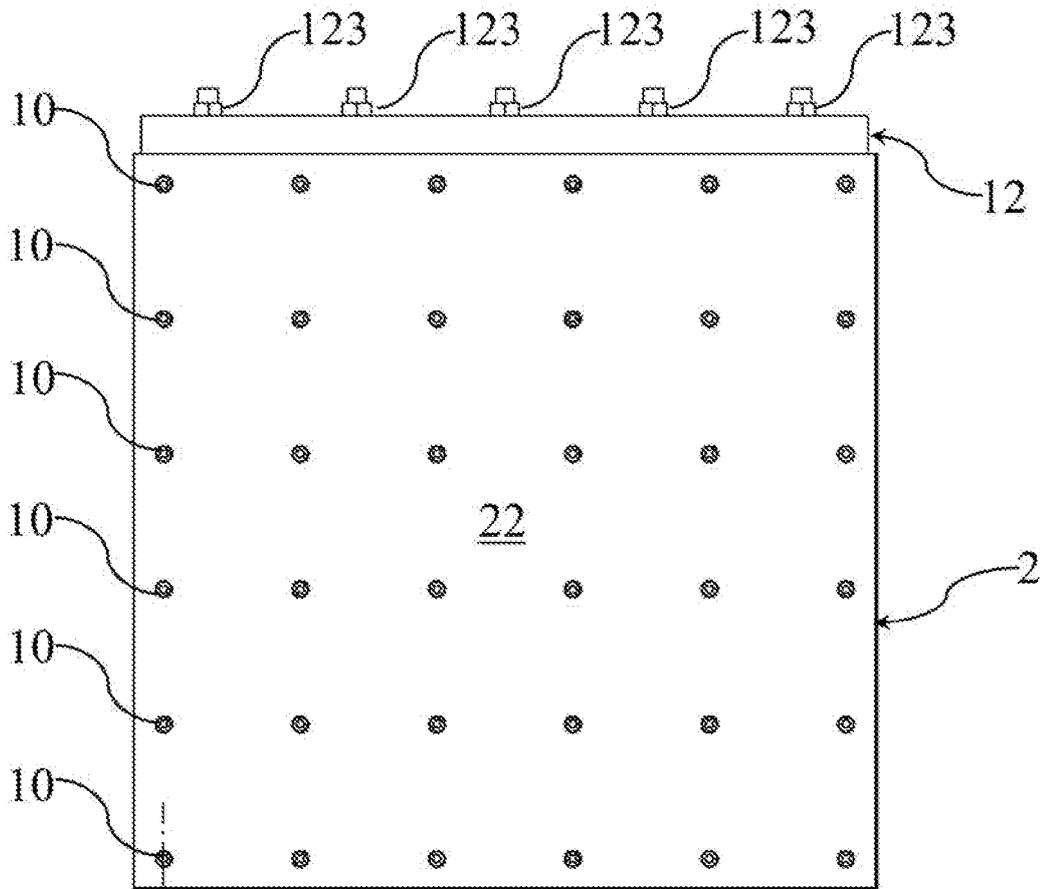


Fig. 4

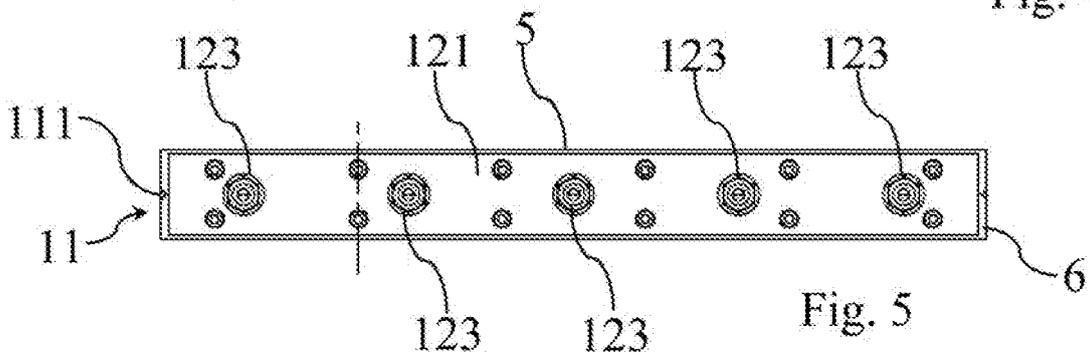


Fig. 5

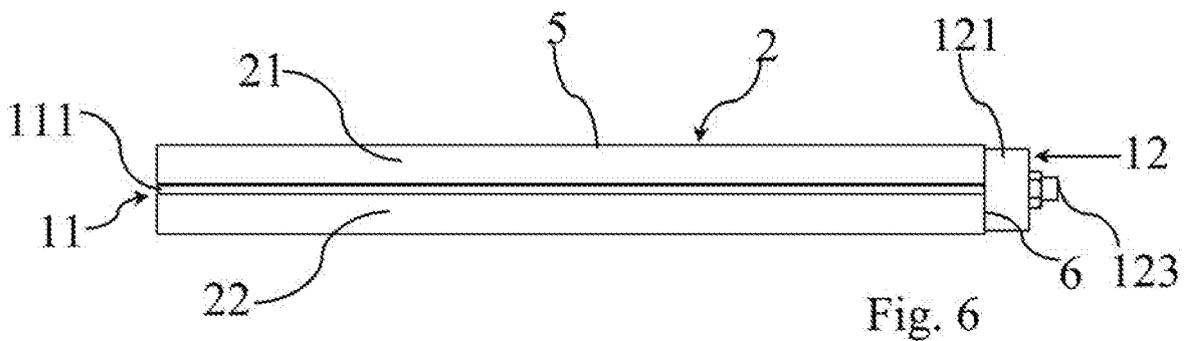
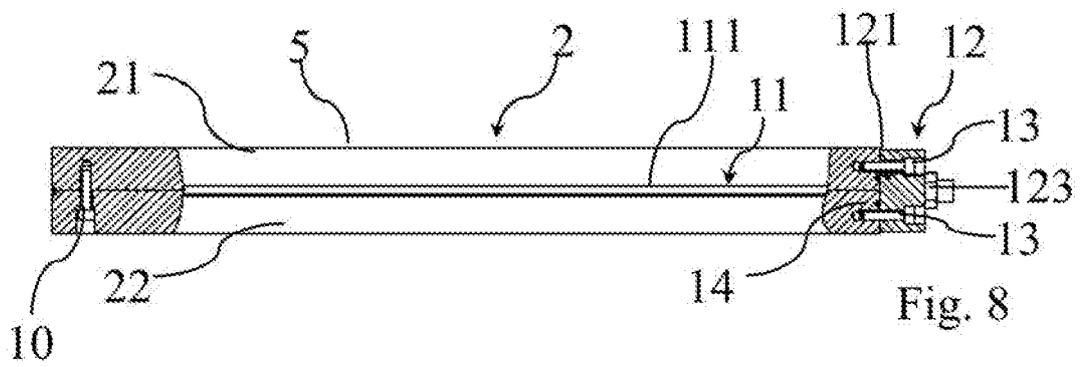
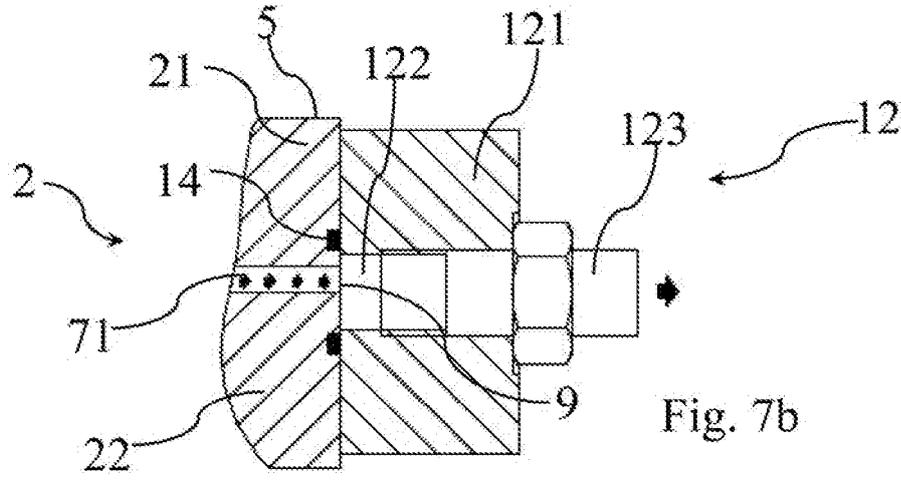
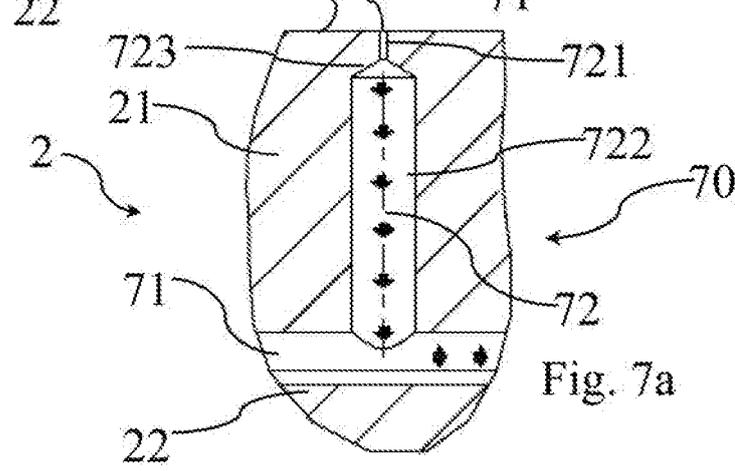
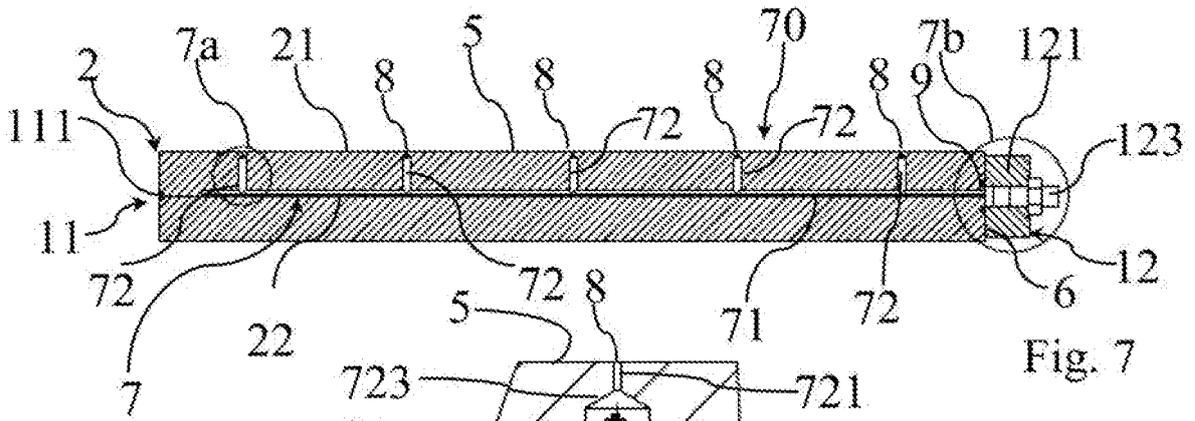
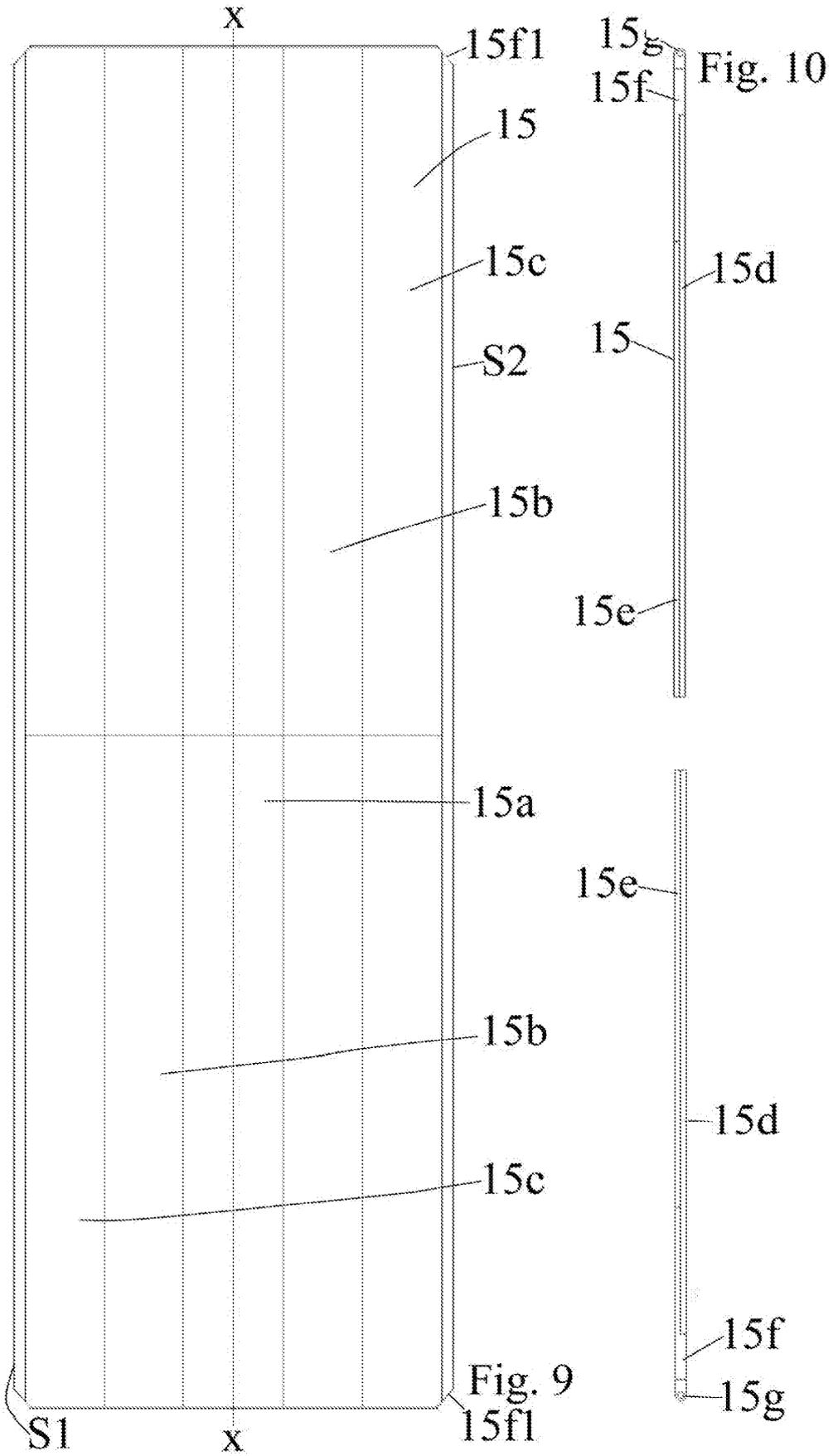
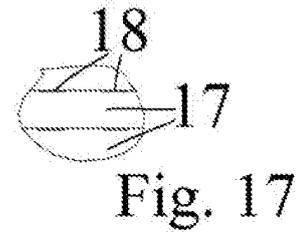
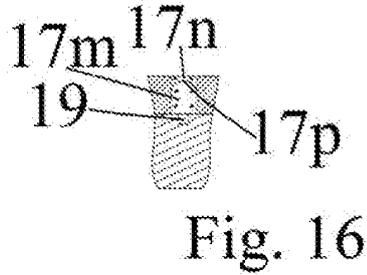
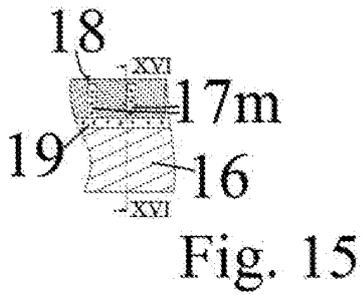
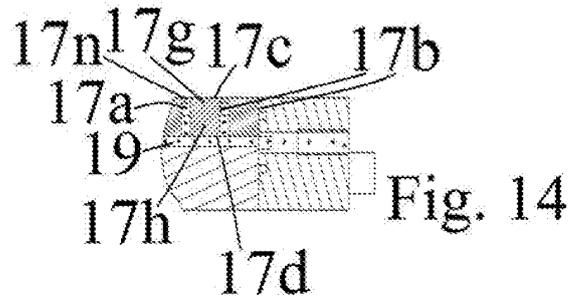
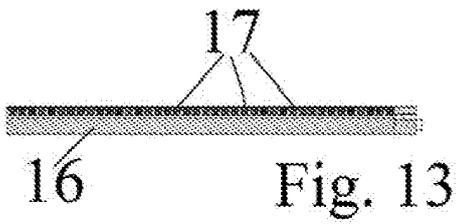
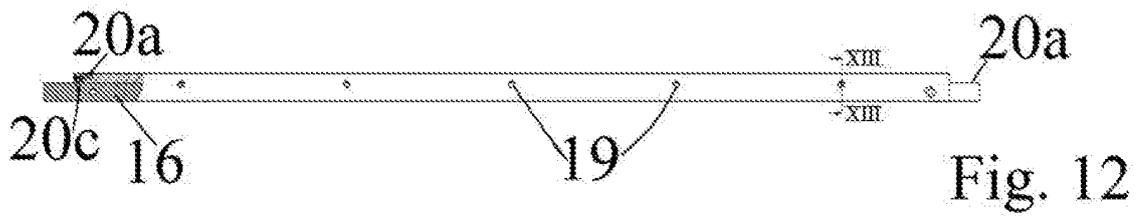
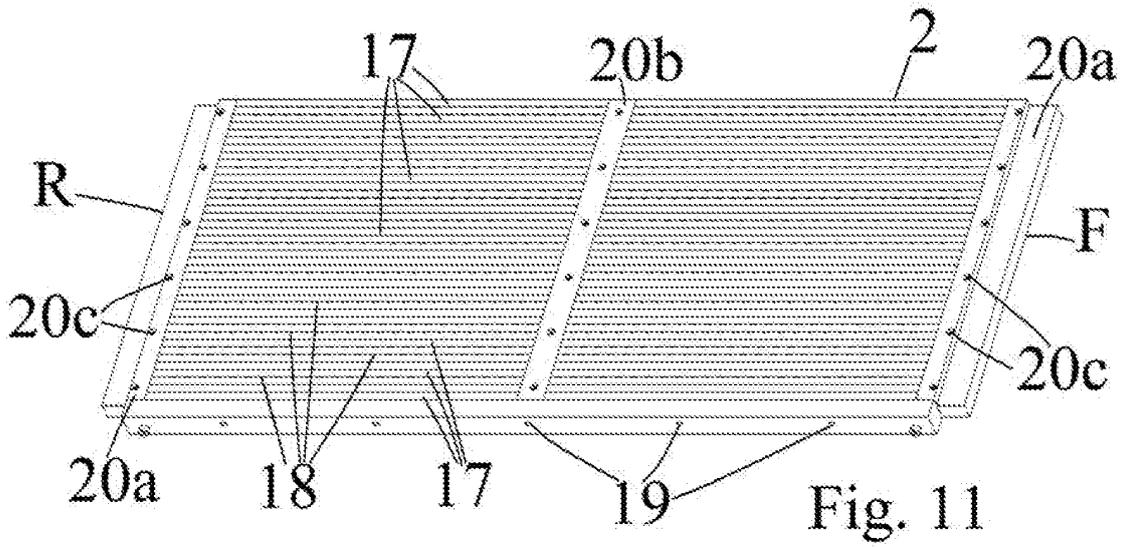


Fig. 6







REFERENCES CITED IN THE DESCRIPTION

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