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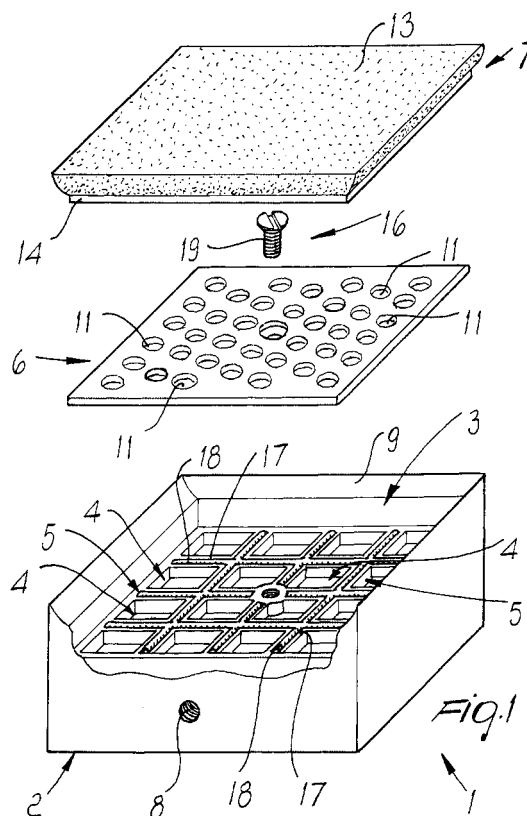
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(54) **Mold part for pressing ceramic items**

(57) An improved mold part for pressing ceramic items comprises: a concave rigid support (2), which forms a cavity (3) open in an upward region; a plurality of open cells (4), which are formed proximate to the bottom of the cavity (3); a perforated plate (6), which can be inserted in the cavity (3) so as to rest on the surface formed by the cells (4); a membrane (7) for closing the cavity (3) in an upward region, which is made of a material of the elastically deformable type and can be fixed perimetrically to the edge (9) of the support (2); and at least one hole (8), which is formed in the support (2) and is connected to the cavity (3), for feeding an incompressible fluid so as to form a continuous cushion (10) which is interposed between the perforated plate (6) and the membrane (7) and is adapted to allow uniform distribution of the pressing loads of the ceramic items.



Description

[0001] The present invention relates to an improved mold part for pressing ceramic articles such as tiles.

[0002] Molds used in the pressing of ceramic articles, such as tiles, being constituted by two complementary mold parts, one of which is rigid and the other one is of the so-called isostatic type, are known.

[0003] The latter mold part acts on the bottom surface of the tile, the so-called "scoring" or "facing", shaped so as to form a supporting grid, takes advantage of the property of an incompressible fluid to transmit pressure uniformly in all directions, and is used in order to compensate for the different values assumed locally by the density of the ceramic material loaded for pressing, arising from inherent lack of homogeneity of the material itself or from anomalies occurring during feeding and loading.

[0004] In particular, conventional isostatic mold parts are constituted by a rigid support, on one surface of which there is provided a cavity which is open outward and is closed, in an upward region, by a membrane made of a material such as rubber or resin, on the upper outward-facing surface of which there is provided the complementary impression of the bottom surface of the tile to be formed.

[0005] A chamber remains between the cavity and the membrane and is divided by a rigid grid into a plurality of individual cells, the membrane being firmly anchored to the outer edge of the support and to the upper surface of the grid so as to close and separate the cells in an upward region.

[0006] The cells are connected one another, in a downward region, by a plurality of connecting holes and channels for feeding a pressurized fluid which are formed in the bottom of the cells and in the body of the support.

[0007] In this manner, the portions of the membrane that close the individual cells in an upward region are supported by the corresponding cushions of pressurized fluid that form between the cells and said portions, and are thus free to undergo deformations and/or move under the action of the fluid.

[0008] During the pressing of the tile, due to the holes and channels that connect the cells in a downward region, fluid is transferred from one cell to another depending on whether the specific pressure generated thereat is higher or lower than the theoretical average pressing value.

[0009] Conventional isostatic mold parts are not free from drawbacks, including the fact that they do not allow to uniformly compensate and correct the different density values assumed by the ceramic material loaded into the mold; the rubber or resin membrane is in fact anchored to the rigid grid and is free to undergo deformation only at the cell closure portions.

[0010] This generates unevenness, tensions and unwanted deformations of the pressed tile body which be-

come evident especially after the firing step.

[0011] Further drawbacks of conventional isostatic mold parts consist in that they are difficult and complicated to manufacture and entail long times and high costs for production; it is in fact necessary to provide, in the body of the rigid support, said channels for connecting the individual cells and for feeding the incompressible fluid, which require several accurate machining operations.

[0012] The aim of the present invention is to eliminate the above-mentioned drawbacks of conventional isostatic mold parts by providing an improved mold part for pressing ceramic items which allows to uniformly compensate and correct the different density values assumed by the ceramic material to be pressed, avoiding the formation of unevenness, tensions and deformations in the body of the molded item and does not require the execution of complicated machining steps and long production times.

[0013] Within the scope of this aim, an object of the present invention is to provide a structure which is simple, relatively easy to provide in practice, safe in use, effective in operation, and of relatively low cost.

[0014] This aim and this and other objects are achieved by the present improved mold part for pressing ceramic items, characterized in that it comprises: a concave rigid support, which forms a cavity open in an upward region; a plurality of open cells, formed proximate to the bottom of the cavity; a perforated plate, which can be inserted in the cavity so as to rest on the surface formed by said cells; a membrane for closing the cavity in an upward region, which is made of a material of the elastically deformable type and can be fixed perimetrically to the edge of the support; and at least one hole, which is formed in said support and is connected to the cavity, for feeding an incompressible fluid so as to form a continuous cushion which is interposed between the perforated plate and the membrane and is adapted to allow uniform distribution of the pressing loads of the ceramic items.

[0015] Further characteristics and advantages of the present invention will become better apparent from the detailed description of a preferred but not exclusive embodiment of an improved mold part for pressing ceramic items, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is an exploded perspective view of a first embodiment of an improved mold part for pressing ceramic items, according to the invention;

Figure 2 is a schematic sectional view of the support and of the perforated plate of the mold part of Figure 1;

Figure 3 is a schematic sectional view of the mold part of Figure 1 in the inactive configuration;

Figure 4 is a schematic sectional view of the mold part of Figure 1 in the active configuration;

Figure 5 is an exploded perspective view of a sec-

ond embodiment of the mold part according to the invention;

Figure 6 is a schematic sectional view of the support and of the perforated plate of the mold part of Figure 5;

Figure 7 is a schematic sectional view of the support, of the perforated plate and of the membrane of the mold part of Figure 5 during assembly;

Figure 8 is a schematic sectional view of the mold part of Figure 5 in the inactive configuration;

Figure 9 is a schematic sectional view of the mold part of Figure 5 in the active configuration.

[0016] With reference to the figures, reference numeral 1 generally designates an improved mold part for pressing ceramic items, such as tiles.

[0017] The mold part 1 is associable with the structure of a press for coupling to a complementary mold part, both of which are not shown because of a conventional type.

[0018] The mold part 1 is constituted by a rigid and concave support 2, which forms a cavity 3 open in an upward region and on the bottom of which there are provided a plurality of open cells 4 which are mutually distinct and separated by corresponding separation edges 5.

[0019] The mold part 1 further comprises a perforated plate 6 which can be inserted in the cavity 3 and rests on the surface formed by the cells 4, a membrane 7 which closes the cavity 3 in an upward region, and a hole 8 for feeding an incompressible pressurized fluid for filling the empty spaces inside the cavity 3.

[0020] The membrane 7 is made of elastically deformable material and is fixed perimetrically to the edge 9 of the support 2 that forms the cavity 3.

[0021] A continuous cushion 10 of fluid having a predefinable thickness, such as to allow uniform distribution of the pressing loads, is thus formed between the membrane 7 and the plate 6.

[0022] The plate 6 is provided with a plurality of mutually staggered through holes 11 which constitute corresponding channels 12 for connecting the cells 4 and the cushion 10, the individual cells 4 being thus mutually connected in an upward region.

[0023] The membrane 7 is constituted by a wall 13, made of a material of the elastomeric type such as rubber, resins or the like, which is fixed perimetrically to the edge 9, and by a sheet 14, which is made of flexible elastic material, such as spring steel or the like.

[0024] The lower surface of the wall 13, being directed towards the inside of the cavity 3, is rigidly anchored to the upper surface of the sheet 14 so as to form a monolithic body.

[0025] As a whole, the membrane 7 can undergo deformations of the elastic type and the sheet 14 stiffens the wall 13 and together with the presence of the continuous cushion 10 of fluid allows uniform distribution of the pressing loads.

[0026] The mold part 1 further comprises means 15 for adjusting the level of the plate 6 with respect to the membrane 7, which are associated with the support 2 and allow to provide the membrane 7 and determine the thickness of the cushion 10, and means 16 for stabilizing the plate 6 with respect to the support 2, which are adapted to keep said plate fixed in the active configuration, i.e. during pressing to form the ceramic items.

[0027] In the embodiment shown in Figures 1 to 4, the edges 5 that separate the cells 4 are constituted by channels 17 for containing tubular elements 18 which are inserted therein so as to protrude partially in order to support the plate 6, while the stabilization means 16 are constituted by screw-type fixing means 19 which are flush-fitted proximate to the central region of the plate 6 and can be inserted in the support 2.

[0028] Conveniently, the tubular elements 18 are made of a plastically deformable material and are constituted by metallic wires, for example made of steel or the like, which also act as adjustment means 15, allowing, thanks to their deformability, the self-calibration of the thickness of the cushion 10 during pressing loads.

[0029] Instead of being provided on the edges 5, the tubular elements 18 can be inserted in the cells 4, so long as they are thicker than said cells; in this case it is no longer necessary to provide the containment channels 17.

[0030] In the further embodiment shown in Figures 5 to 9, the adjustment means 15 comprise a plurality of actuation screws 20 which are arranged substantially at right angles to the plane of the plate 6 and can be inserted in corresponding threaded through holes 21 formed in the bottom of the support 2 at the cells 4.

[0031] The screws 20 have a first end 22 which can be inserted in the cavity 3 for lifting and lowering the plate 6 and a second end 23 which can be actuated from outside.

[0032] The stabilization means 16 are instead constituted by a pin 24 which is perpendicular and rigidly coupled to the lower surface of the plate 6 proximate to its central region and whose free end can be inserted in a corresponding through hole 25 being formed in the support 2 and protruding from it in order to be associated with a locking element constituted by a nut 26.

[0033] It is observed that at the different holes formed in the mold part 1 there are provided fluid sealing elements which are not shown since of a conventional type.

[0034] The mold part 1 further comprises a fluid discharge hole 27, which is also connected to the cavity 3, and elements 28 for closing hermetically the intake hole 8 and the discharge hole 27.

[0035] The incompressible fluid is, for example, oil and is fed at a pressure on the same order of magnitude as the average value of the molding pressure of the ceramic items.

[0036] Advantageously, the mold part 1 comprises at least one duct for connecting the cavity 3 to a similar cavity of at least one adjacent mold part, which is asso-

ciated with the press for the balanced distribution of the fluid among the several mold parts that are present therein.

[0037] The method for the first embodiment of the mold part 1 (Figures 2, 3 and 4) consists in inserting the plate 6 in the cavity 3 of the support 2 so as to rest on the protruding portion of the tubular elements 18, in inserting with a flush fit the screw-type means 19 for fixing the plate 6 to the support 2, in resting the sheet 14 on the plate 6, in arranging the wall 13 on the sheet 14 and on the edge 9 of the support 2, in feeding the cavity 3 with the incompressible fluid (oil) so as to occupy the empty spaces provided inside it, and in inserting hermetically the closure elements 28 in the intake hole 8 and in the discharge hole 27, respectively.

[0038] As a consequence of the pressing of the ceramic items, the tubular elements 18 undergo plastic deformation by compression, moving the plate 6 into a lowered configuration with respect to the sheet 14 so as to form the continuous cushion 10 of fluid which becomes interposed between the membrane 7 and the plate 6.

[0039] As mentioned, the means 15 for adjusting the level of the plate 6 are formed, in this case, by the tubular elements 18, which allow self-calibration of the thickness of the cushion 10.

[0040] As an alternative, the method for the second embodiment of the mold part 1 (Figures 6, 7, 8 and 9) consists in inserting the plate 6 in the cavity 3 of the support 2 so that it rests on the edges 5 that separate the cells 4; in inserting the screw-type actuation means 20 in the cavity 3, in order to lift and support the plate 6 in a raised configuration with respect to the edges 5; in resting the sheet 14 on the plate 6; in arranging the elastic wall 13 on the sheet 14 and on the edge 9 of the support 2 that forms the cavity 3, so as to constitute the membrane 7 monolithically; in disengaging the screw-type actuation means 20 from the cavity 3, with consequent lowering of the plate 6, which is thus returned to rest on the edges 5.

[0041] The lowering of the plate 6 allows to define the thickness of the cushion 10 interposed between the membrane 7 and said plate 6, which is then fixed by locking the pin 24 with the nut 26.

[0042] This is followed by a step of feeding the incompressible fluid until the empty spaces inside the cavity 3 are filled and by a step of hermetically inserting the closure elements 28 in the intake hole 8 and the discharge hole 27.

[0043] In both of the illustrated embodiments, the placement of the wall 13 on the sheet 14 so as to form the membrane 7 provides for applying an adhesive to the upper surface of the sheet 14 and of the edge 9, depositing the rubber or resin at a specific temperature and applying to the wall 13 a pressure which ensures its adhesion and rigid anchoring to the sheet 14 and its perimetric fixing to the edge 9 so as to constitute a monolithic body.

[0044] In practice it has been found that the described

invention achieves the intended aim and objects and in particular allows uniform distribution of the pressing loads on the entire molded item both thanks to the presence of the continuous cushion of fluid and of the stiffening lamina.

[0045] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept.

[0046] All the details may further be replaced with other technically equivalent ones.

[0047] In practice, the materials used, as well as the shapes and the dimensions, may be any according to requirements without thereby abandoning the scope of the protection of the appended claims.

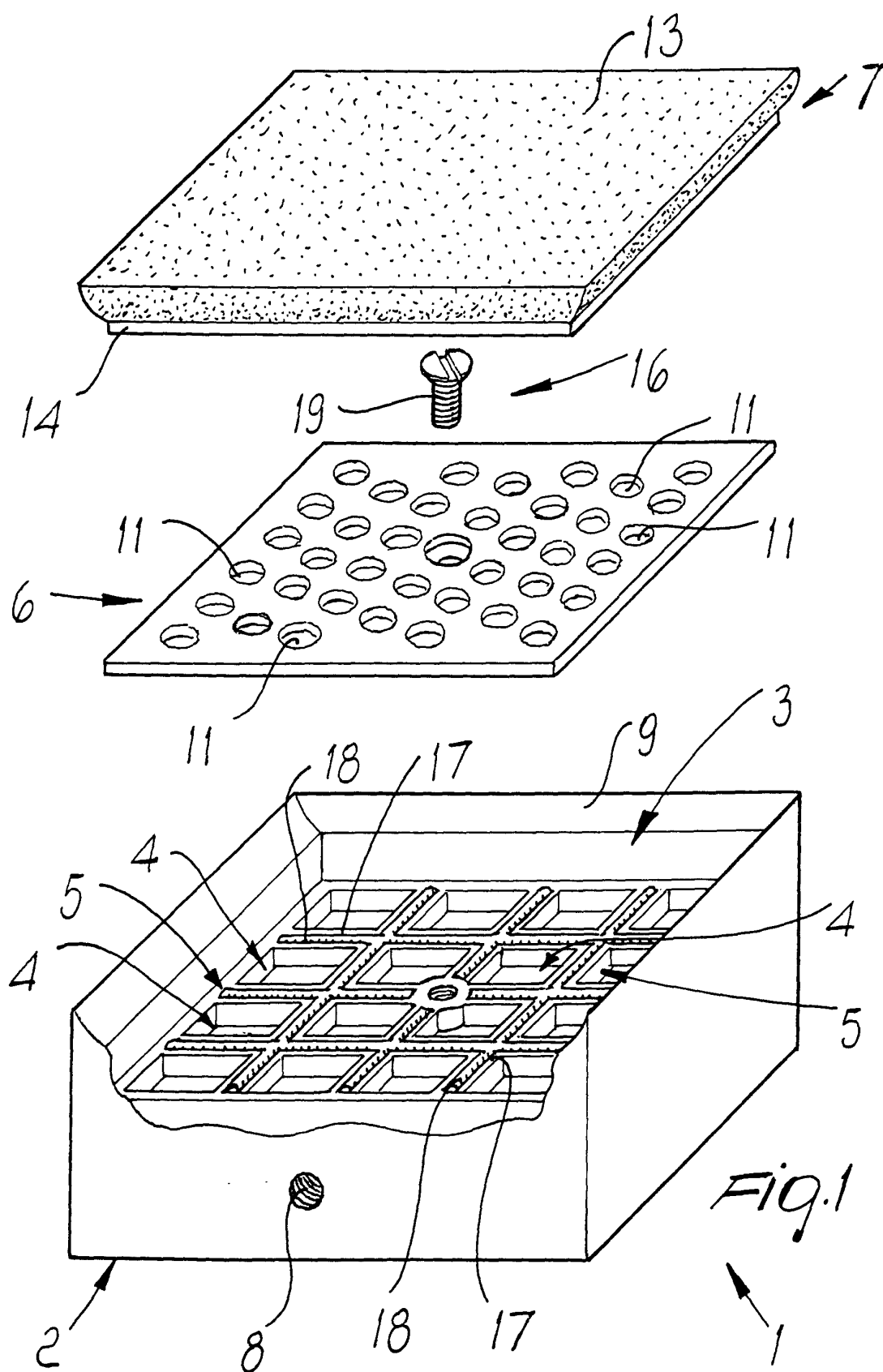
[0048] The disclosures in Italian Patent Application No. M02000A000035 from which this application claims priority are incorporated herein by reference.

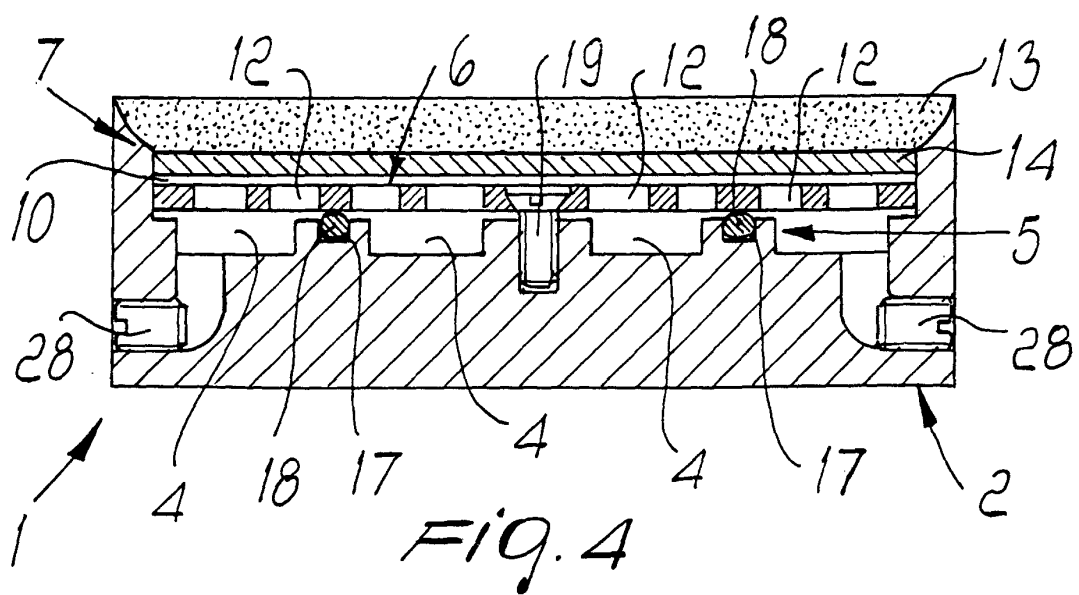
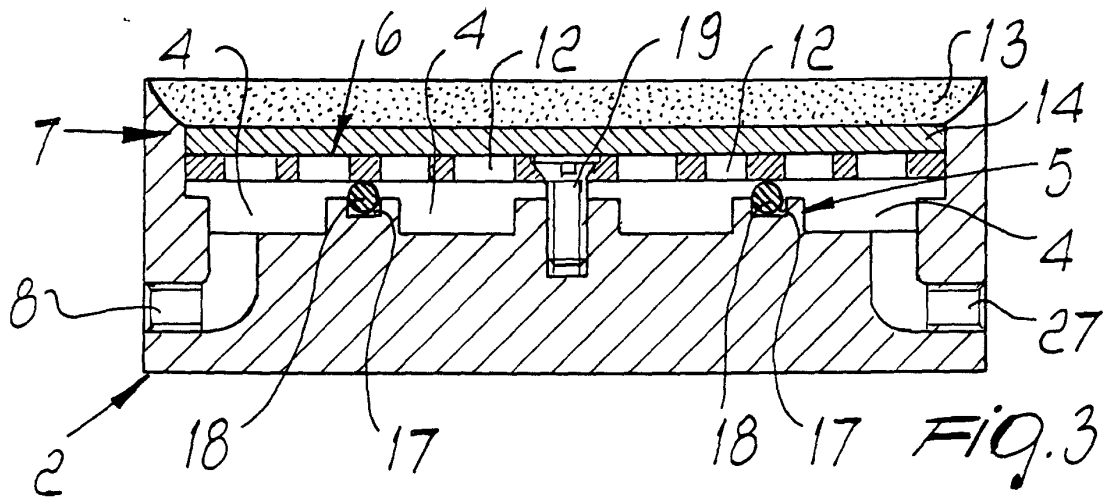
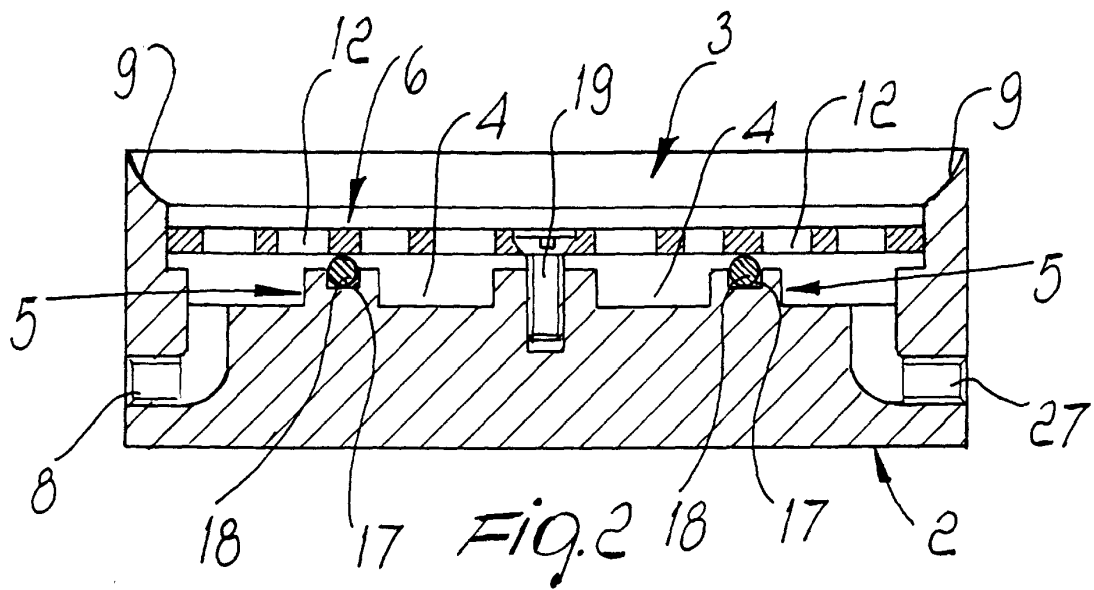
[0049] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

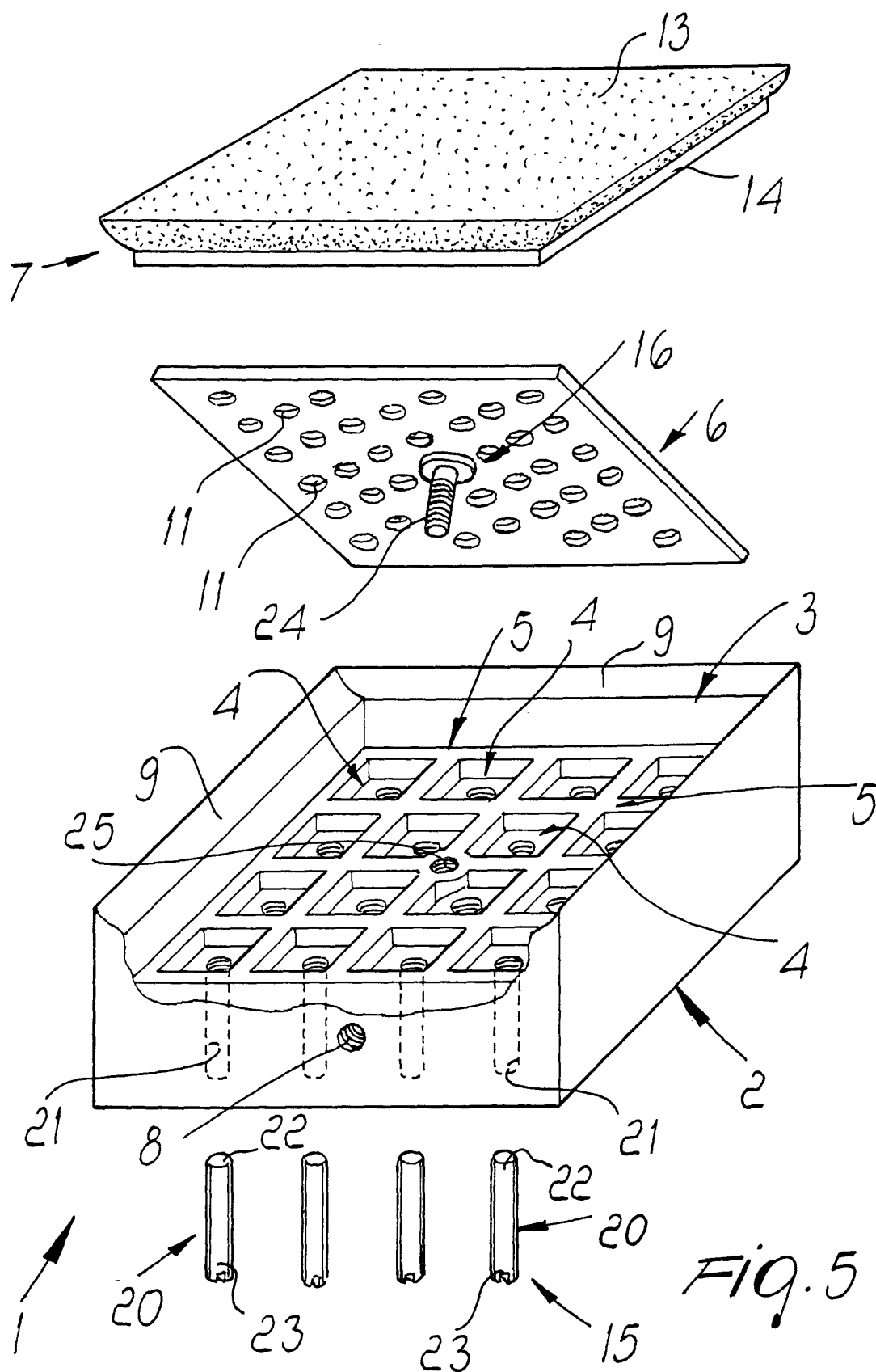
Claims

1. An improved mold part for pressing ceramic items, **characterized in that** it comprises: a concave rigid support (2), which forms a cavity (3) open in an upward region; a plurality of open cells (4), formed proximate to the bottom of the cavity (3); a perforated plate (6), which can be inserted in the cavity (3) so as to rest on the surface formed by said cells (4); a membrane (7) for closing the cavity (3) in an upward region, which is made of a material of the elastically deformable type and can be fixed perimetrically to the edge (9) of said support (2); and at least one hole (8), which is formed in said support (2) and is connected to said cavity (3), for feeding an incompressible fluid so as to form a continuous cushion (10) which is interposed between said perforated plate (6) and said membrane (7) and is adapted to allow uniform distribution of the pressing loads of said ceramic articles.
2. The mold part according to claim 1, **characterized in that** said membrane (7) comprises a wall (13) which is made of a material of the elastomeric type and is perimetrically fixed to said edge (9) of the support (2), its lower surface being firmly anchored to a sheet (14) made of an elastically flexible material.
3. The mold part according to one or more of the preceding claims, **characterized in that** said wall (13) is made of rubber, resins, or the like.

4. The mold part according to one or more of the preceding claims, **characterized in that** said sheet (14) is made of spring steel or the like.
5. The mold part according to one or more of the preceding claims, **characterized in that** it comprises means (15) for adjusting the height of the perforated plate (6) with respect to the membrane (7), said means (15) being associated with the support (2) and being adapted to define the thickness of said cushion (10) of fluid.
6. The mold part according to one or more of the preceding claims, **characterized in that** it comprises means (16) for stabilizing said perforated plate (6) with respect to said support (2).
7. The mold part according to one or more of the preceding claims, **characterized in that** said perforated plate (6) comprises a plurality of through holes (11) which are mutually offset so as to form corresponding channels (12) for connection between said cells (4) and said cushion (10).
8. The mold part according to one or more of the preceding claims, **characterized in that** said plate (6) rests on a plurality of tubular elements (18) made of a plastically deformable material and are inserted so as to protrude partially into said cells (4).
9. The mold part according to one or more of the preceding claims, **characterized in that** said tubular elements (18) are inserted so as to protrude partially in the edges (5) of the cells (4) in order to support said perforated plate (6).
10. The mold part according to claim 8, **characterized in that** said tubular elements (18) are constituted by wires made of a material such as steel or the like.
11. The mold part according to one or more of the preceding claims, **characterized in that** said adjustment means (15) comprise a plurality of screw-type actuation means (20) which can be inserted in corresponding through holes (21) of the bottom of the support (2), with a longitudinal axis substantially perpendicular to the plane formed by said plate (6), and can be actuated from outside in order to lift and/or lower said plate (6).
12. The mold part according to one or more of the preceding claims, **characterized in that** said stabilization means (16) comprise screw-type means (19) for fixing said perforated plate (6) with respect to said support (2).
13. The mold part according to one or more of the preceding claims, **characterized in that** said stabilization means (16) are constituted by at least one pin (24) which is substantially perpendicular and rigidly coupled to the lower surface of said plate (6), can be inserted in a corresponding through hole (25) of said support (2), protrudes from it and is associable with a locking element (26).
14. The mold part according to one or more of the preceding claims, **characterized in that** it comprises at least one duct for connecting said cavity (3) to the cavity (3) of at least one other mold part (1) which is associated with a press for the balanced distribution of said fluid.
15. A method for manufacturing the mold part according to one or more of the preceding claims, comprising the steps of: inserting said perforated plate in the cavity of said rigid support so that it rests on said tubular elements; positioning said sheet so that it rests on said plate; depositing said elastic wall in order to anchor its lower surface to said sheet and fix it perimetrically to the edge of the support, so as to constitute said membrane; and feeding said cavity with said incompressible fluid so as to fill the empty spaces that are present therein, during the pressing of the ceramic items said tubular elements being adapted to undergo deformation by compression and to bring the plate to a lowered configuration with respect to the plate, so as to form said continuous cushion of fluid between the membrane and the plate in order to uniformly distribute the loads.
16. The method for manufacturing the mold part according to one or more of the preceding claims, comprising the steps of: inserting said plate in the cavity of said rigid support so that it rests on the separation edges of said cells; inserting said screw-type actuation means in the corresponding holes of the bottom of the support in order to lift and support said plate in a raised configuration with respect to said edges; positioning said sheet on said plate; depositing said elastic wall in order to anchor its lower surface to said plate and fix it perimetrically to the edge of the support, so as to constitute said membrane; disengaging said actuation screw means for the movement of the plate into a lowered configuration for resting on said cell separation edges; stably locking the lowered plate and feeding said cavity with said incompressible fluid so as to fill the empty spaces inside it and form said continuous cushion of fluid which is equal in thickness to said movement of the plate, in order to uniformly distribute the loads.







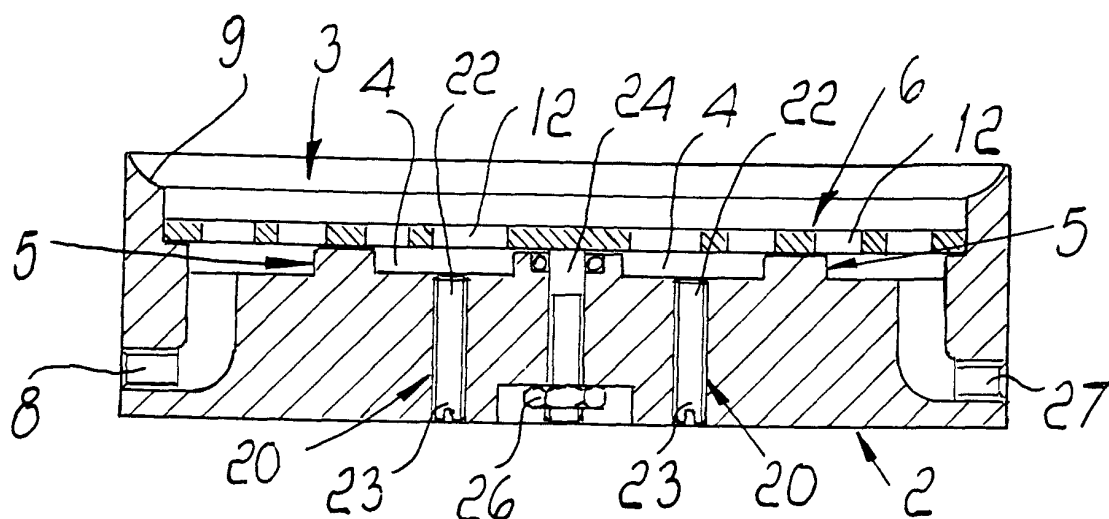


Fig. 6

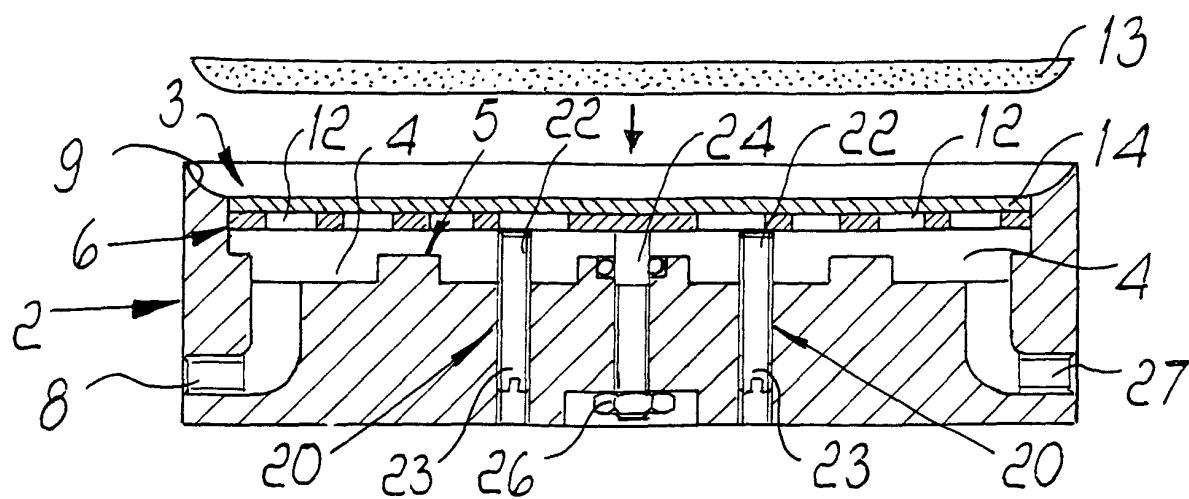


Fig. 7

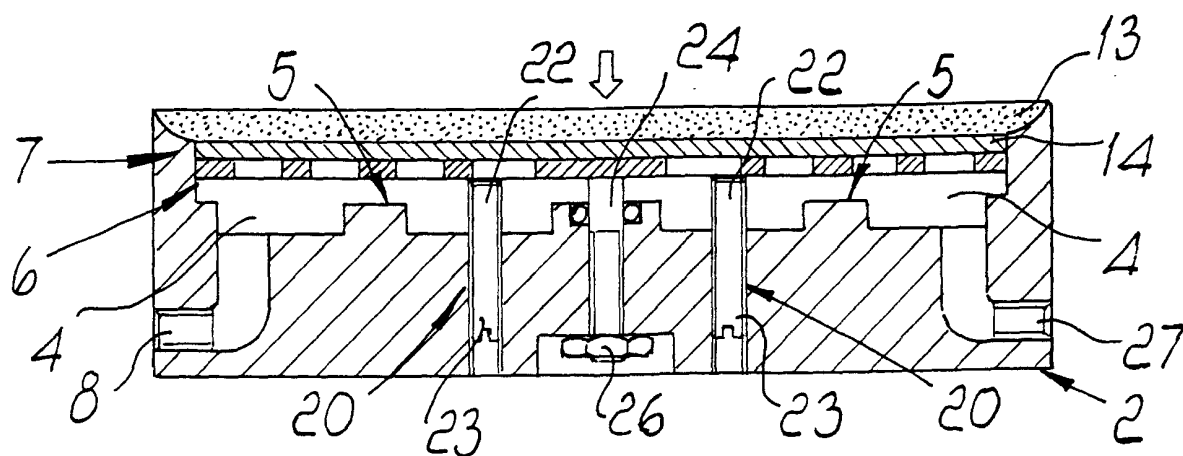


Fig. 8

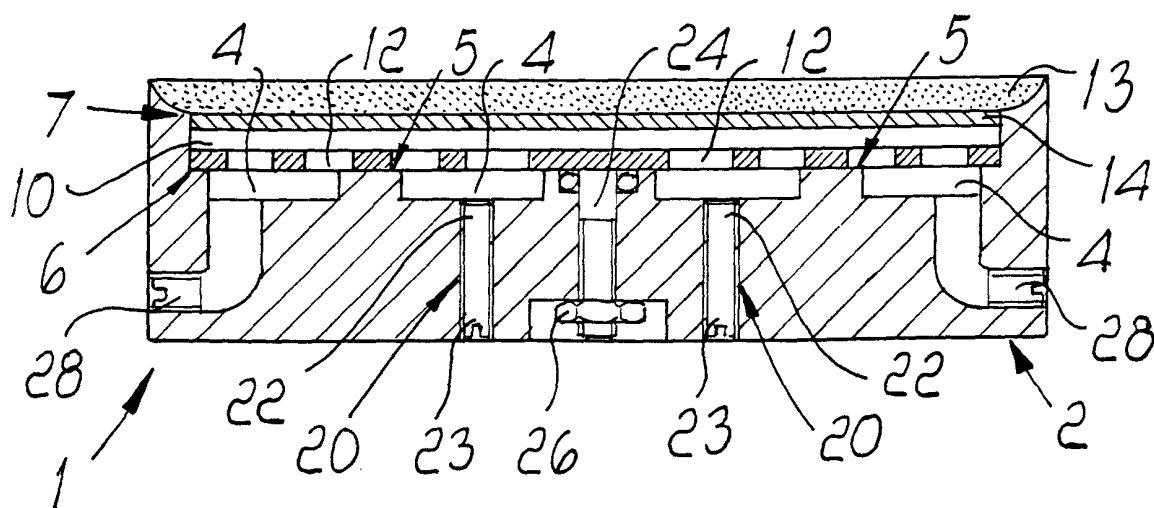


Fig. 9