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(54) Isostatic die means

(57) Die means, suitable for isostatic moulding of ceramic tiles, comprising two dies, punch (P, 203) and matrix (201), at least one die having a cavity containing an incompressible fluid (11) flowable through corresponding passageways, said cavity being closed on the side facing the clay mixture (204, 232) to be pressed by means of an elastic membrane (5; 16; 17), said elastic membrane (5; 16; 17) comprising central anchoring zones and a peripheral anchoring zone (103a), said central anchoring zones (2, 3, 4, 20; 2, 20; 102, 208, 209) and peripheral anchoring zone (103a) being anchored to the body of said die (P); said passageways being defined between each central anchoring zone (2, 3, 4, 20; 2, 20; 102, 208, 209) and adjacent central (2, 3, 4, 20; 2, 20; 102, 208, 209) and/or peripheral anchoring zones (103a).

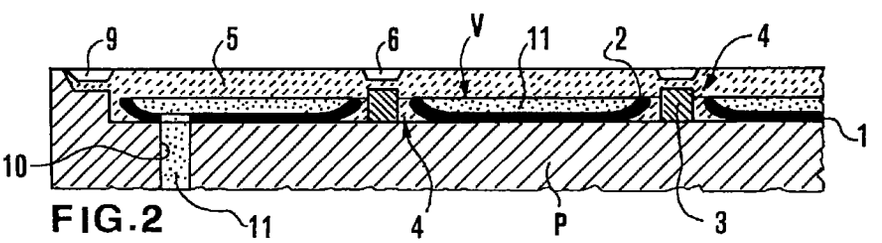

FIG.2

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Description

The invention concerns isostatic die means, suitable for moulding of ceramic tiles, according to the preamble of claim 1.

IT-A-1 104 511 relates to a method and a device for achieving uniform pressing of ceramic tiles.

The method envisages the application to the free surface of the clay mixture introduced into the opening of the die, during the action of pressing of an elastic moulding surface, or elastic membrane, held in firm contact with the clay mixture, to form one face of the tile, by means of an incompressible fluid: this, to neutralize the effects of zones of disuniform density in the body of the formed tile which would cause uneven shrinkage on firing, with consequent variations in the size, or linearity, of the sides of the tile and/or of the planarity of its surface and with the additional possibility of cracking or breakage.

The methods and the device according to IT-A-1 104 511 have introduced the fundamental concept of an incompressible fluid, for example, oil, acting on an elastic membrane and interposed between the punch and the membrane.

However, said method and device do not always enable sufficiently flat (back) surfaces, and hence sufficiently uniform tile thickness, to be readily achieved, particularly in the case of large formats.

We are aware of a die featuring an auxiliary punch base with, on its front face, a chessboard-like array of large flat squares surrounded by channels for the distribution of the liquid, communicating with the internal surface of the overlying membrane by means of large, corresponding square alveoli, forming part of an intermediate punch-plate superimposed on said auxiliary punch base; the smooth inner surface of the overlying (vulcanized) membrane is moulded to afford an array of large, flat square protruding bosses surrounded by channels corresponding exactly to the aforesaid configuration of the upper face of said base of auxiliary punch.

However this punch is of extremely complex construction; furthermore, the considerable size of the square alveoli causes a notable deformation of the membrane with consequent unacceptable defects of planarity in the pressed tile. This type of mould is also described as forming part of the prior art in IT-U-MI93000071, Fig. 1 and in IT-A-MI92002158, page 3.

EP-A-0556163, which is per se an intermediate document but concerns the same type of mould, discloses a mould having a plurality of cavities defined by a lattice to which a membrane is anchored; however the lattice cannot be provided with a membrane obtained by vulcanized elastomeric substance, such as rubber or resin, since, when the liquid elastomeric substance is poured on the lattice, the cavities become completely filled with the elastomeric substance and no room is therefore available for the incompressible fluid.

IT-U-214739 discloses a punch for uniform pressing of ceramic tiles, comprising a plurality of cavities among which a lattice is inherenty defined, said cavities containing an incompressible fluid, i. e. oil, and being closed on the side facing the clay mixture to be pressed by means of an elastic membrane, the elastic membrane comprising a central zone and a peripheral zone, those parts of the membrane not covering the cavities being anchored to the body of said punch at respective peripheral and intermediate anchoring zones, each cavity being intermediately occupied by a respective piston and serving as a guide for allowing axial movements of the piston inwardly and outwardly with respect to the cavity.

Each piston is further externally provided with a seal for the incompressible fluid peripherally engaged with the internal surface of the respective cavity in order to prevent oil from coming into contact with the membrane.

In that mould, however, the pistons deteriorate the corresponding edges of the membrane when they move into the cavities to compensate disuniform density of the clay mixture.

Furthermore, when the membrane has to be formed, particularly by vulcanization, the pistons have to be inserted into the cavities before the liquid elastomeric membrane is poured to coat the face of the punch: therefore a difficulty arises in that the pistons cannot be located at precise axial positions inside the cavity, being it essential, for proper functioning, that each piston be located at intermediate sections of the respective cavity, so that they can be moved outwardly, under the pression of the oil, and also inwardly, under the pression of the clay mixture.

Correct positioning of the pistons is also essential in order to avoid excessive variations of thickness of the membrane.

Such prior art may be subject to further improvements with a view to eliminating the said drawbacks.

The technical problem is therefore to find an isostatic die of the aforesaid type which is exrememly easy to manufacture, by providing it with a vulcanised membrane.

A further aspect of the technical problem is to eliminate the complex machining needed on the surface of the punch to create the interconnecting conduits of the alveoli.

A further aspect of the technical problem is to allow the manufacture of items, particularly tiles with more or less deep veinings, or cavities, on one face without occasioning, on the opposite face, undesirable differences of lustre due to differences of compactness: this, to reduce the use of material necessary for the manufacture of the item, thereby reducing weight and cutting the costs of manufacture and transport.

A further aspect of the technical problem is to control the thickness of the soft layer of powders to be pressed, so as to obtain uniform thickness and density in the body of the pressed tile.

The invention solves the above-mentioned technical problem by adopting die means, suitable for isostatic moulding of ceramic tiles, comprising two dies, punch and matrix, at least one die having a cavity containing an

incompressible fluid flowable through corresponding passageways, said cavity being closed on the side facing the clay mixture to be pressed by means of an elastic membrane, said elastic membrane comprising central anchoring zones and a peripheral anchoring zone, said central anchoring zones and peripheral anchoring zone being anchored to the body of said die, characterised in that, said central anchoring zones are reciprocally isolated so that said passageways are defined between each central anchoring zone and adjacent central and/or peripheral anchoring zones, and in that said membrane is anchored to said body in said zones.

In a particularly advantageous embodiment, a moulding plate is interposed between said membrane and the bottom of said cavity, said moulding plate having a plurality of through-apertures, in such a way that said membrane is anchored to said plate in the zones defining the border of said apertures.

It is to be noted that the moulding plate has the additional function of allowing the distribution of the incompressible fluid in the cavity of the relative die. It is to be noted, furthermore, that, on completion of the membrane-shaping process, the moulding plate may be eliminated, for example, by a chemical process, whereby a substance that will corrode said plate, but not the membrane, is introduced into the cavity, or by a physical process, whereby, for example, the die is heated to a temperature at which the plate melts, while the membrane remains firmly attached to the cavity.

It is to be noted, furthermore, that, in the embodiment with a plate with apertures, the surface of the plate facing the bottom of the cavity is preferably treated with an adhesive, while the opposite surface is treated with a non-stick agent to prevent the membrane from adhering to it.

In another particularly advantageous embodiment, said anchoring zones are defined by non-communicating groove-shaped zones located in the bottom of said cavity; said anchoring zones being advantageously spread with adhesive to ensure that the membrane adheres to them.

It is to be noted that the distribution of the grooves can be based on an labyrinth pattern so designed as to determine areas of membrane anchorage delimiting a formation of communicating chambers in the cavity of the semi-die, destined to receive the incompressible fluid.

It is to be noted, furthermore, that holes for the introduction and discharge of the incompressible fluid are provided in the mould, said holes protruding from the bottom of the cavity through a spot-facing that can be blocked with a plug during the moulding of the elastic membrane, the plug remaining partially incorporated in the membrane itself.

In order to prevent said membrane from adhering to the bottom of the cavity, those areas of the bottom of the cavity where the membrane should not adhere can be sheathed in plastic, or paper, with holes punched where said apertures occur.

In another particularly advantageous embodiment, the cavity communicates with a regulating device for regulating the volume of fluid in the cavity.

Said regulating device being such as to enable the ratio between the thickness of the unpressed powders and that of the powders after pressing to remain virtually constant throughout the pressed clay body.

The regulating device is operated as follows:

- during the loading of the powders, the volume of fluid is greater than the volume of the cavity to be formed on the back of the tile;
- during pressing, the excess of fluid is evacuated from said cavity in a controlled manner, to flow back into the cavity when pressing is complete.

The ratio between the initial maximum and minimum thicknesses of the layer of powders and the ratio between the maximum and minimum thicknesses of said layer remains substantially constant during the pressing cycle and corresponds to that which is to be achieved in the formed tile.

The advantages offered by this invention are: lower manufacturing costs; lower running costs; possibility of renovating the die; improved functionality; possibility of adopting various, not only square, designs; maximum stability in the areas of adhesion; possibility of transforming traditional punches, even if en bloc, into punches according to the invention by the simple application of a distributing plate to, or above, the active surface of the punch itself; possibility of more efficient moulding of the membrane; possibility of greater control over the flexing of the membrane, reduction in surface defects; ease of removal of pressed items, facilitated particularly with the adoption of the device regulating the volume of fluid.

Some embodiments of the invention are illustrated, by way of example, in the 8 sheets of drawing attached, in which:

Figure 1 is a partial interrupted view of the punch, as it is used, having a surface associated to a moulding-distributing plate is positioned, shaped so as to constitute a labyrinth tray, or liquid chamber, to enable the penetration of liquid between it and the elastic membrane above it, in the thickness between the base and the plane of the raised borders of the tray;
Figure 2 is the transverse section II-II of Figure 1;
Figure 3 is a section as in Figure 2, but relating to the preceding moulding phase of the elastic membrane;
Figure 4 is a section as in Figure 2, as set up for the forming of the tile, that highlights, with an enlarged scale, on one side, possible deformations in the membrane, on the other side, uniformly distributed coplanar areas;
Figure 5 and 6 are plan views of variations in the design of the surface of the punch and of its covering distribution plates or membranes;

Figure 7 is section VII-VII of Figure 5, in the case with the punch covered with a membrane layer of reduced thickness directly against the active face of the punch;

Figure 8 is a partial, interrupted plan view of the corner of the punch in the case of a flat plate, distanced from the surface ofthe punch;

Figure 9 is section IX-IX of Figure 8;

Figure 10 is section X-X of Figure 8;

Figure 11 is a partial, interrupted plan view of the punch of the die, in the case of the elastic membrane having a labyrinth on its lower surface and of the punch having corresponding channels, the top part showing the metallic surface and the bottom part showing the elastic membrane;

Figure 12 is the vertical transverse section XII-XII of Figure 11;

Figure 13 is the vertical transverse section XIII-XIII of Figure 11;

Figure 14 is a section as in Figure 12, in the case where a sheet is inserted between the smooth upper surface of the punch and the internal labyrinthed surface of the membrane, which is self-adhesive, or however made to adhere, made of paper or plastic, having the function of a non-stick agent: the said sheet being punched (that is interrupted) in the areas corresponding to the areas of adherence of the membrane to the said face;

Figure 15 is a vertical section of a membrane die for ceramic tiles of a type with a single imprint, with a volume regulating device according to the invention, or even centralized in the case of a number of imprints, filled with liquid or incompressible type fluid, prior to use;

Figure 16 is a section as in Figure 15, but in the final pressing phase;

Figure 17 is a section as in Figure 15, but with the position of the baffle plate inverted and during the initial compression phase: in this case the displacement of a part of the mixture occurs on contact with the bulging parts of the membrane, causing differences in compression in relation to the preceding case, which, however, can be corrected by altering the excess in depth taken on by the chambers of the punch in relation to the depth of the cavities on the back of the tiles.

The Figures show: 1, a plate, for example, having a thickness ranging from a few tenths of a millimeter to a few millimeters, depending also on the dimensions of the tiles, glued or however coupled to the active face of punch P, corresponding to the back of the tile, having through-apertures with tapered raised edges 2 - for example, of the order of a millimeter, or part thereof - for example, advantageously in the shape of a rounded slot.

The apertures, with the preferred shape of a slot, are suitably spaced to anchor the elastic material of the membrane and have lengths, by way of example, of a few centimeters and widths of a few millimeters; the said apertures being distributed in relief inside a tray V having interconnecting chambers distributed around the said raised edges.

The set of edges 2 of the said apertures lying preferably on a plane parallel to that of the said plate constituting the base of the said tray. A number of risers 3, or keys, can be fixed to the said active face of the punch, each riser being inserted in a said slot and with its extremities coupled to those of the slot itself, whereas the sides of the risers remain clear of the corresponding edges of the said slots with a clearance 4 of at least a few tenths of a millimeter, sufficient to permit the passage of the filling material - for example, vulcanized rubber - that is to constitute the elastic element, or elastic membrane 5, the membrane adapting itself to the disuniformity of the mass of mixture placed in the mould of the die to obtain a uniform compression in the mass itself, in its every point during pressing.

The presence of the said keys constituting gripping elements and reducing the thickness of the membrane in relation to the raised edges that make up the design of the base of the tile.

Elastic membrane 5 also having indentations 6, 6a formed during moulding by corresponding bosses 7 on moulding matrix 8 of membrane 5 (Figure 3).

Membrane 5 also having an indented peripheral border 9 whose base is coplanar with those of indentations 6 that, during pressing, form the so called "feet" or support ribs on the back of the tile, or their complements.

There are also a number of holes 10 for the introduction of liquid 11, for example oil, in tray V, after the membrane has been moulded, after the possible chemical disintegration and/or physical elimination of the material of the plate, for example, by making use of the same hole; hole 10 being closeable with plug 12 to prevent it from becoming filled with the material the membrane is made of when it is poured or else when it is being moulded. The plug itself - for example, cylindrical - penetrates in a corresponding hole in plate 1, when still in situ, and, together with one or more other analogous plugs, act as a reference pin for the plate.

A layer 13 of non-stick material applied to the internal surface of tray V to prevent the moulding material of membrane 5, however placed in it, from sticking to it permanently: the keys, the flat portions of the punch and the internal portions of the openings or raised holes - that is the lower uncovered surface of tray V - on the other hand, are covered with an adhesive substance.

Figure 4 shows: 14, the tile being formed; 8, the buffer plate constituting the base of the matrix of the die, whose external face corresponds to the flat top face of the tile; 15, one of the walls of a mould or cavity of the die; 16, 17 (Figures 5 and 6) elastic membranes having a different design to that of membrane 5 of the first Figures; 16a, 17a, indentations in the external face of elastic membrane 16 and 17: respectively with apertures 16b of tray V in relation to indentations 16a; 18, (Figures 8 and 9) a flat plate positioned above, distanced from, active surface 19 of punch P, which can be seen through aper-

tures 20: said plate being treated with non-stick agent; 21, a gasket for liquids in a seat obtained in the body of the punch P; 22, the base of punch P; 23, an externally conical bush inserted in hole 24 of punch P during assembly to fit tightly, with a wet seal, the lower inlet of hole 25 obtained in the lower part of tubular appendage 26 made of the same material as the elastic membrane by means of a pin with its upper extremity inserted in hole 27 in distribution plate 18 before membrane 5 is moulded; 23a, the hole of bush 23; 28, a lower layer of membrane 5 distancing distribution plate 18 from active surface 19, even in part pre-formed and inserted; 29, an advantageous alternative version of bush 23 fitted tightly into hole 25 of the lower appendage of membrane 5; said bush having base 30 with seal 31, truncated cone stem 32 with axial hole 33 having seal 34 around the end cylindrical portion. It is to be noted that the apertures 16b and 20 could be replaced with a series of holes spaced out along the same path of the aperture.

The moulding of the elastic membrane is as follows: tray V, having been obtained by blanking and drawing or by pressing, or even simply by blanking in the case of the flat plate 18, its surface facing the membrane having been treated with a non-stick agent, is placed on the upper surface of punch P, positioning it by means of suitable pins 12 (not shown in Figure 9), subsequently also acting as plugs, otherwise glueing it on or keeping it raised to permit the penetration beneath it of the elastic material during moulding that also has to be present in punch P; having inserted, where necessary, keys 3, covered in adhesive material, as with the other surfaces that can come into contact with the material as it is poured through the apertures, the elastic material making up membrane 5, or membranes 16, 17 is then poured, either cold or heated: this, in such a way so that the said material infiltrates through the clearances 4 to fill even the interstices existing between the external surface of the punch and the external surface of the tray and remaining stuck to it; the surface of the elastic membrane that moulds the back of the tile during pressing being shaped, with in situ moulding, by matrix 8 (Figure 3); plugs, or pins 12, are then extracted from holes 10 so that they may be used, entirely or in part, as feed or discharge channels for the incompressible fluid, centering them on the corresponding channels made for this purpose in the plate on which the punch is positioned: this after having possibly eliminated - either chemically or physically as described earlier - the tray-shaped or flat plate V; having introduced the liquid - for example, oil - under a modest pressure, sufficient to cause the separation of the surface of elastic membrane in contact with the surface of the tray (if it has not been eliminated), until it is full, the inlet and outlet holes for the said liquid are then closed off.

The Figures also show: 101 (Figure 11), the top face of punch P having anchorage grooves 102, even having sides diverging downwards thereby creating undercut, covered with adhesive substance, and peripheral frame 103 with internal face similarly treated: grooves 102 being filled by appendages 103a of the elastic membrane; 104, grooves on the external surface of elastic membrane 5 vulcanized in situ, reproducing in relief the design of the back of the tile to be formed; 106, a metallic tablet, partially incorporated, for vulcanizing the internal surface of membrane 5 in relation of hole 107 for the supply of liquid 11 to chambers 108, or interconnected cavities (Figure 12), protruding from the said internal surface and fitting, creating a seal against the poured material, in spot facing 109 that is the upper enlargement of the said hole: said tablet advantageously being tapered to be held with undercut in the elastic membrane to enable the instantaneous flow of the liquid as soon as it is opened; 110 (Figure 14), a sheet of non-stick material.

Operation is as follows: if, as the punch enters the matrix, whose base consists of baffle plate M that defines the front face of the tile, the mixture is not uniformly distributed and/or does not have a constant density, the membrane deforms, in as much as the mixture is compressed only in the zones that are less compacted, (see Figure 4, which highlights the zones that remain flat and coplanar): this results in the back surface of the tile possibly having slight deformations (concave or convex) in areas that do not correspond to points of support or reference 6, 9, 16a, 17a.

In the case of Figure 7, where keys 3 are missing, the elastic layer of the membrane is in points thinner and the stiffness is given by the presence of the surface of punch P rather than by the surface of key 3.

As regards the elastic membrane, it can be stiffened transversely by means of, advantageously, inextensible fibres inserted in it, during vulcanization: this prevents marked undulation, whilst conserving longitudinal elasticity.

It is to be noted that the feet or ribs on the back of the tile can be of any other convenient form, for example, even of the type having cells in the form of a honeycomb. Furthermore, the punch can perform the function of the baffle plate and vice-versa.

The Figures also show: 201 (Figure 15), the punch which is made to enter into matrix 202 to compress the mixture 204, wet or even dry, against the baffle plate 203; 5, an elastic membrane, or elastic element, to contain the body of liquid 11 interposed so as to fill interconnecting cavities between the membrane itself and the top face of baffle plate 203; 207, support ribbing on the back of the tile in relation to the corresponding protuberances 208 of the internal surface of the membrane 5.

The protuberances are anchored by vulcanization, and/or glueing, in the hollows 209 of the top face of baffle plate 203; 210, an inlet and outlet channel for the fluid communicating with above mentioned cavities, originating from tube 211 connected to chamber 212 of the cylinder 213, for example, double acting.

A piston, 214, of cylinder 213 is activated by pressurized inert gas in tank 215 that constitutes the liquid volume regulator, the tank being connected to the other chamber 216 by means of tube 217. Each chamber 212, 216, advantageously for shock absorption, being filled

with liquid; 218, 219, 220, 221 respectively, the two opposing end covers of the cylinder and corresponding stroke limiting elements for piston 214, in other words calibration devices in function of the volume of liquid to expel and to re-absorb; 222, a throttling and closing control mechanism, for example, a solenoid valve, inserted in tube 211; 223 (Figure 16) the formed tile.

Figure 17 shows: 224, a cylinder, whose piston 225, as with 213 but single acting, separates liquid chamber 226 from chamber 227 having return spring 228; 229, the punch having channel 230 for the introduction of the liquid in interconnected cavities 231, enclosed between punch 229 and membrane 5; 232, the earth or powder, dry or wet, with which the tile is formed; 233 a projection of the powder 232 above the closing line of the matrix, that is created at the beginning of the pressing due to the entry of protuberances of membrane 5 into the body of powder 232; 234, the punch.

Figures 15 and 16 show respectively: A, B the starting thicknesses, maximum and minimum, of the body of powder to be pressed and A', B' the final thicknesses.

The volume regulating device can, however, be of a different type to those indicated and in whichever way adjustable.

The invention as described is susceptible to numerous changes and variations all included in the domain of the present invention.

Furthermore, all the details of execution may be replaced by others that are technically equivalent.

In practice the materials employed, as well as the forms and dimensions, can be varied as required without departing from the giuridical domain of the following claims.

Claims

1. Die means comprising two dies, punch and matrix, at least one die (P) having a cavity (108) containing an incompressible fluid (11) flowable through corresponding passageways, said cavity being closed on the side facing the clay mixture (204, 232) to be pressed by means of an elastic membrane (5; 16; 17), said elastic membrane (5; 16; 17) comprising central anchoring zones (2, 3, 4, 20; 2, 20; 102, 208, 209) and a peripheral anchoring zone (103a), said central anchoring zones (2, 3, 4, 20; 2, 20; 102, 208, 209) and peripheral anchoring zone (103a) being anchored to the body of said die (P), characterised in that, said central anchoring zones (2, 3, 4, 20; 2, 20; 102, 208, 209) are reciprocally isolated so that said passageways are defined between each central anchoring zone (2, 3, 4, 20; 2, 20; 102, 208, 209) and adjacent central (2, 3, 4, 20; 2, 20; 102, 208, 209) and/or peripheral anchoring zones (103a), and in that said membrane (5; 16; 17) is anchored to said body in said zones (2, 3, 4; 2, 4; 102, 208, 209; 103a).

2. Die means according to claim 1, wherein said central anchoring zones (2, 3, 4, 20; 2, 20; 102, 208, 209) are reciprocally isolated.

3. Die means according to claim 1, or 2, wherein said central anchoring zones are defined by a plurality of grooves (102, 208) in which appendages (103a, 209) of the membrane (5; 16; 17) are received.

4. Die means according to claim 2, or 3, wherein said central anchoring zones are defined by apertures (2) obtained in a plate (V) fixed to the bottom of said cavity.

5. Die means according to claim 4, wherein said apertures have edges (2) distanced apart from said bottom and projecting towards said membrane (5; 16; 17).

6. Die means according to claim 4, or 5, wherein said apertures (2) encircle corresponding raisers (3) fixedly interposed between the bottom of said cavity and said membrane (5; 16; 17).

7. Die means according to claim 4, wherein said plate (V) is distanced apart from said bottom and is fixed to said bottom by the same material from which the membrane (5; 16; 17) is made.

8. Die means according to claim 1, or 2, or 3, wherein said central anchoring zones (2, 3, 4, 20; 2, 20; 102, 208, 209) are oriented in at least two different directions.

9. Die means according to claim 1, wherein said cavity communicates with piston-operated controlling means (212-218, 225) for controlling the quantity of said incompressible fluid (11) into said cavity during pressing.

10. Die means according to claim 9, wherein said piston (214, 225) is connected with a tank (215) of pressurized compressible fluid.

11. Die means according to claim 10, wherein said piston (225) cooperates with a spring (228).

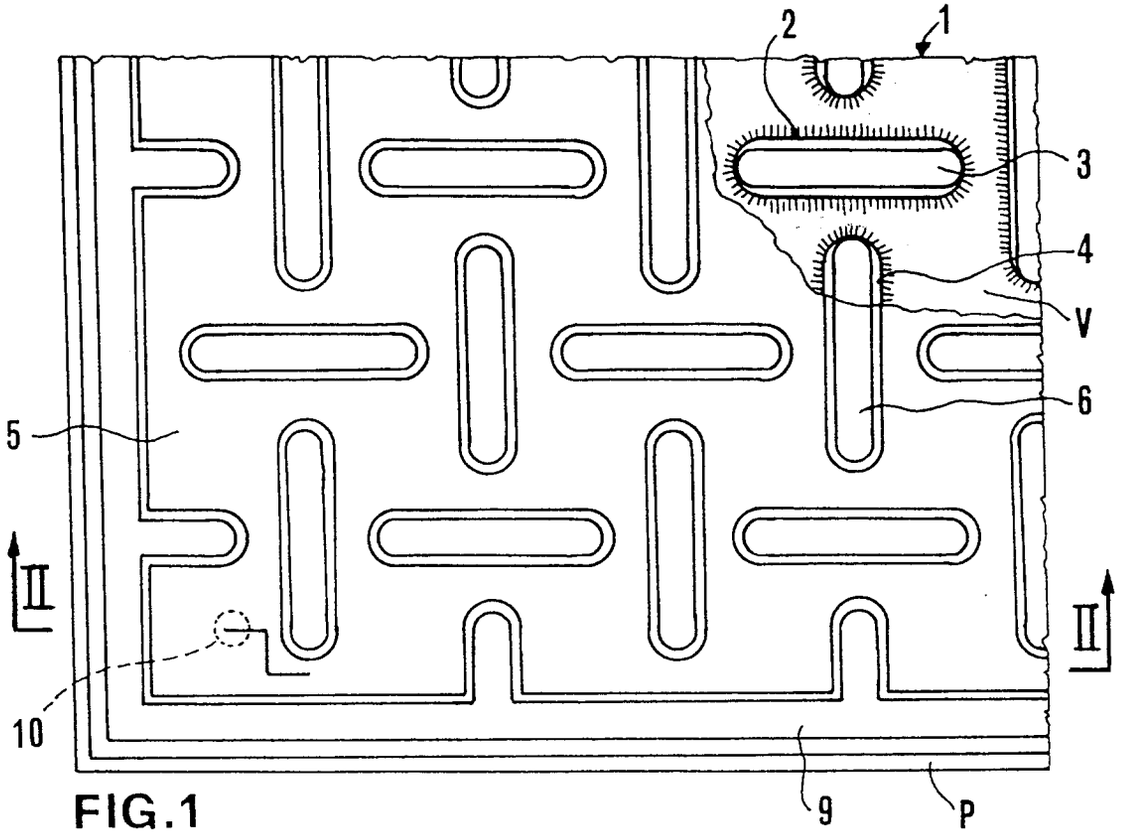


FIG.1

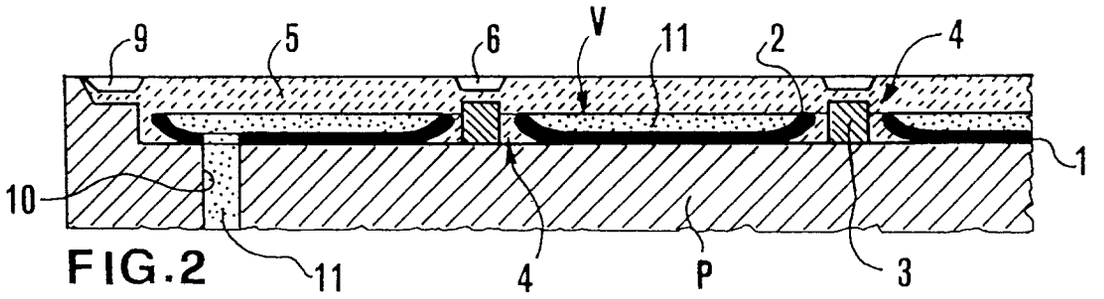


FIG.2

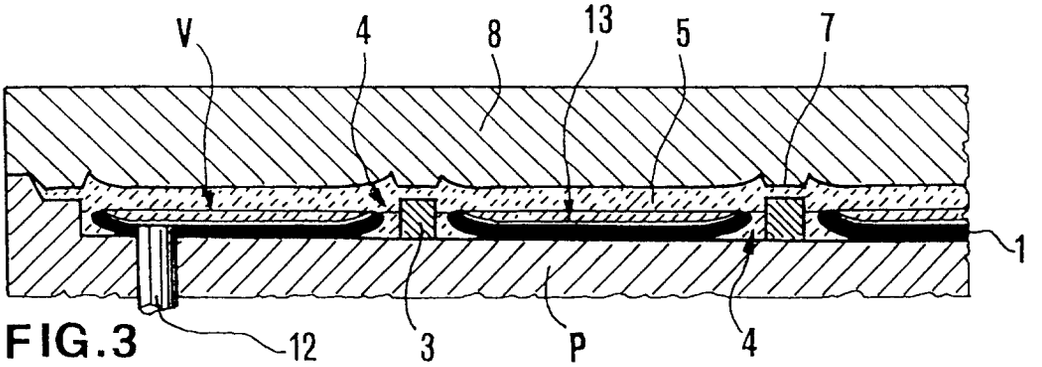


FIG.3

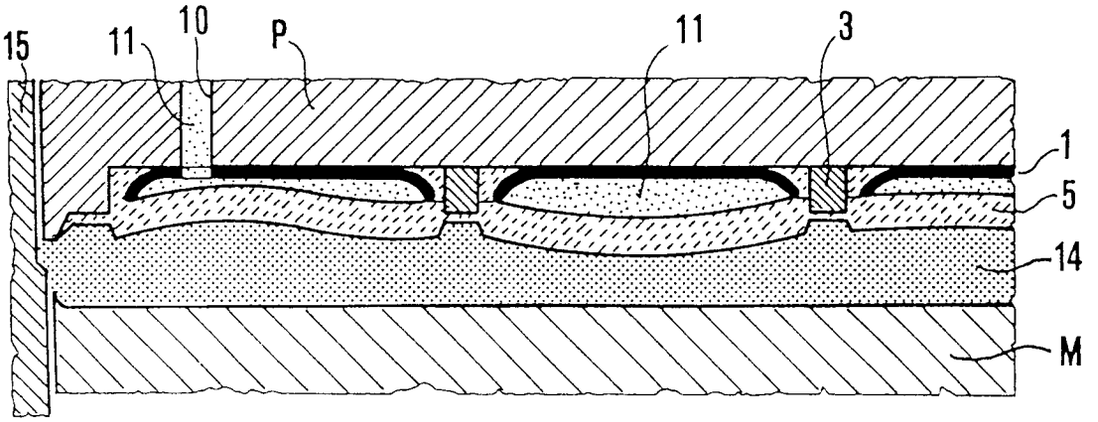


FIG.4

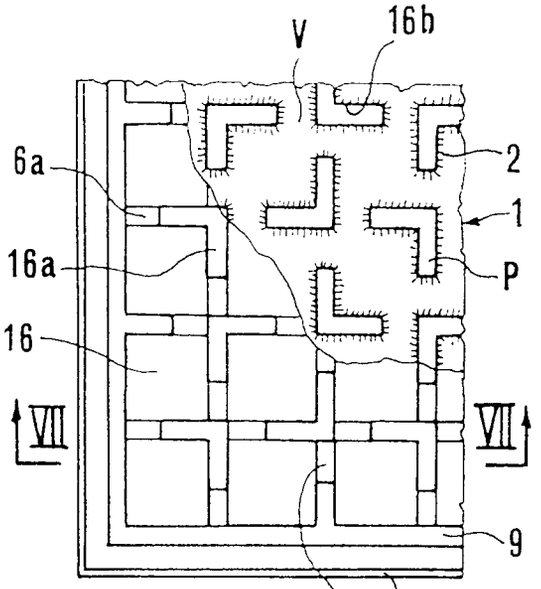


FIG.5

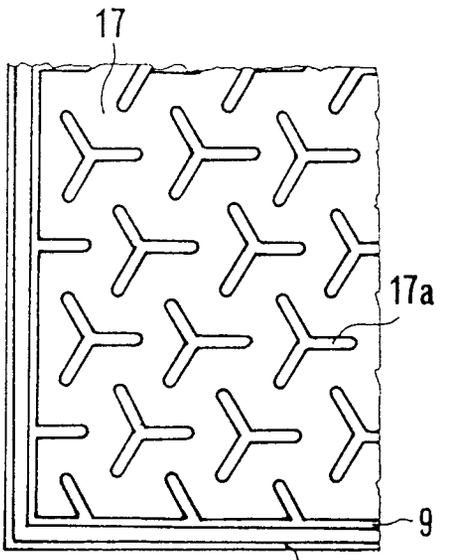


FIG.6

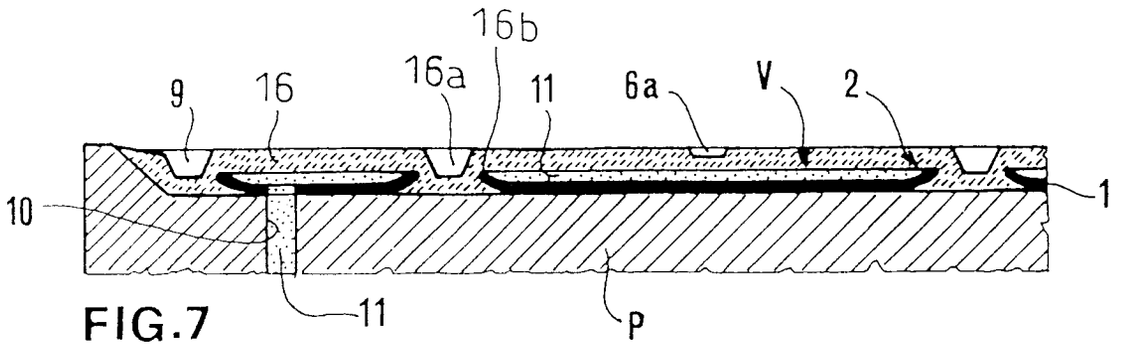


FIG.7

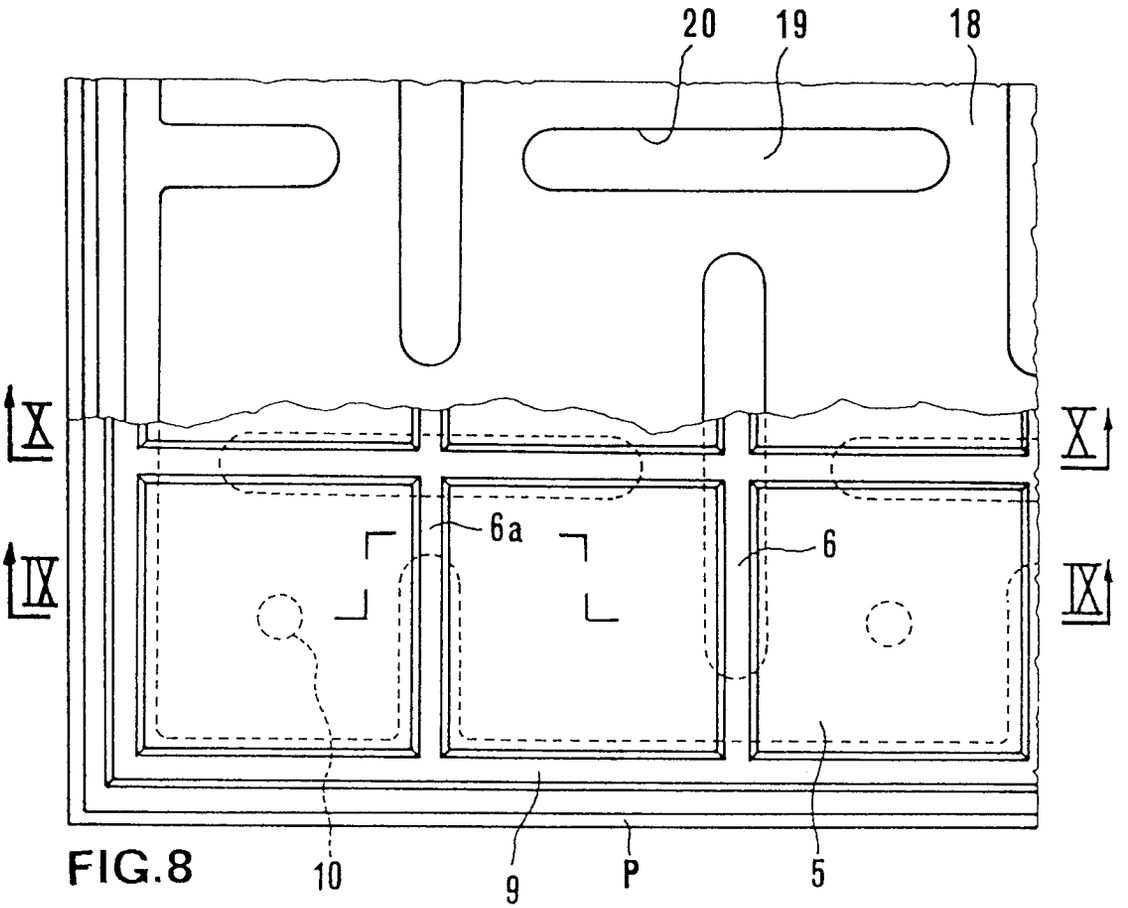


FIG.8

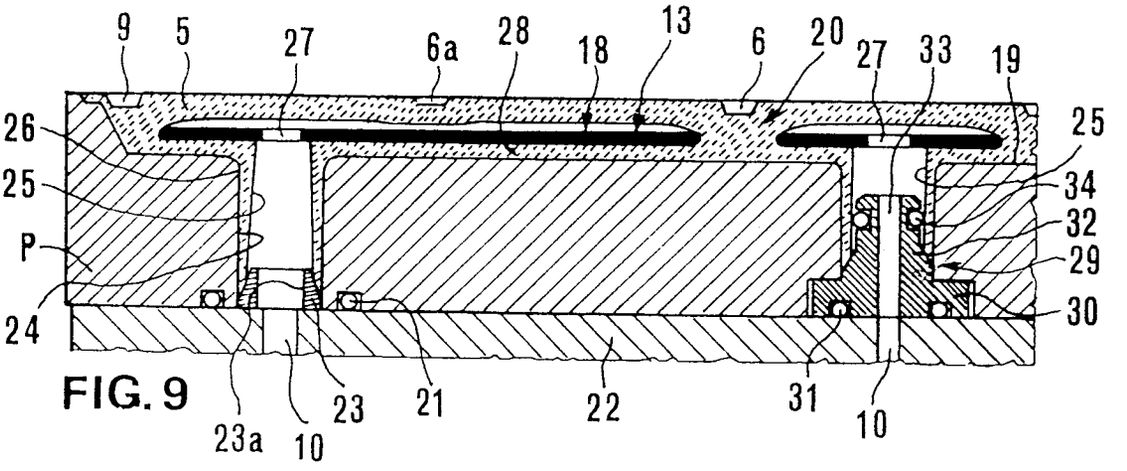


FIG. 9

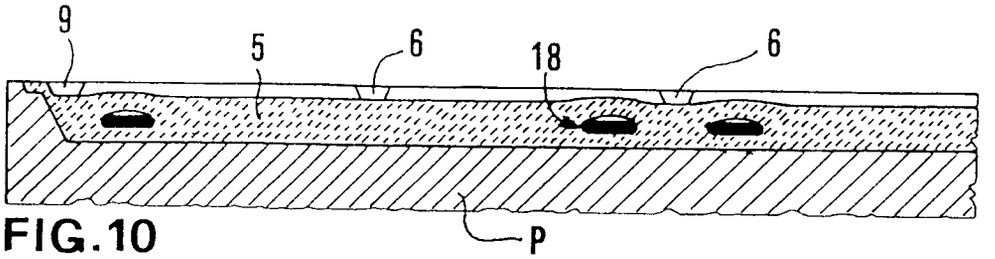


FIG.10

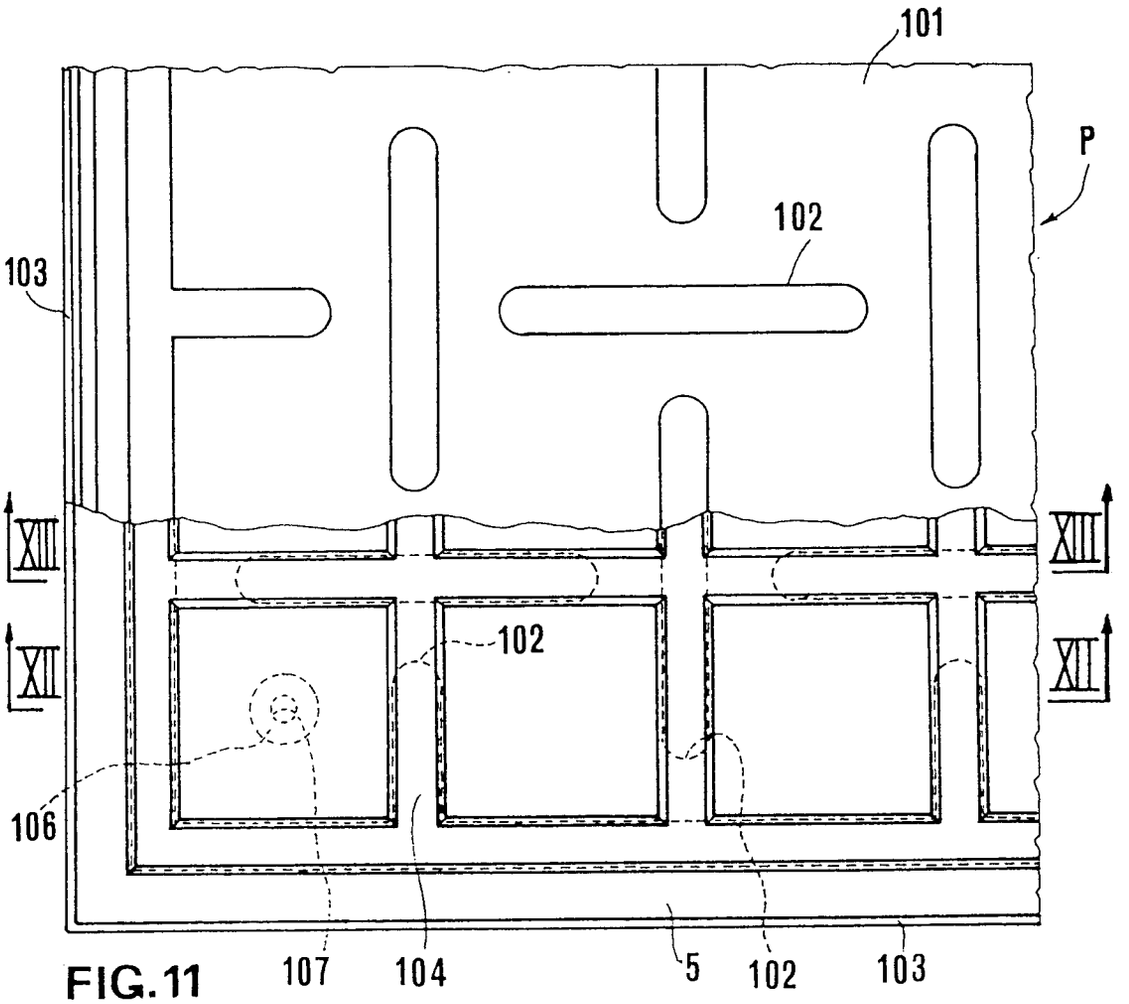

101
P
102
103
XIII
XII
XIII
XII
102
106
107
104
5
102
103

FIG. 11

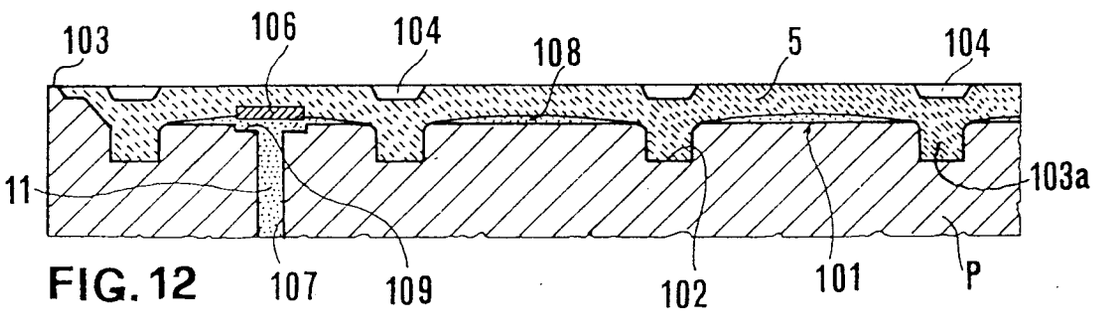

103
106
104
108
5
104
11
103a
107
109
102
101
P

FIG. 12

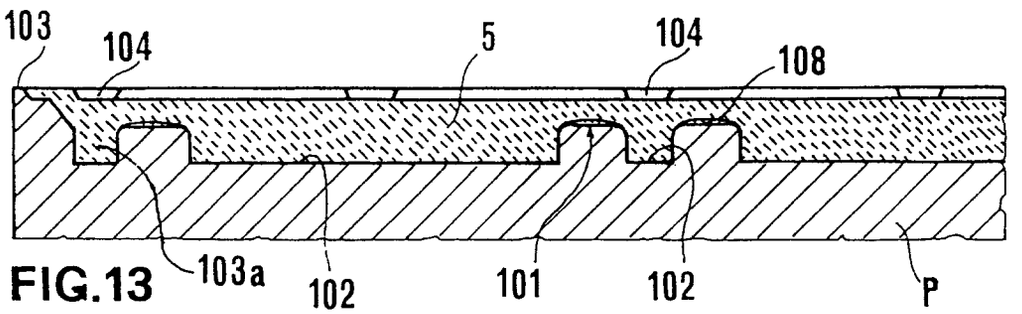

103
104
5
104
108
103a
102
101
102
P

FIG.13

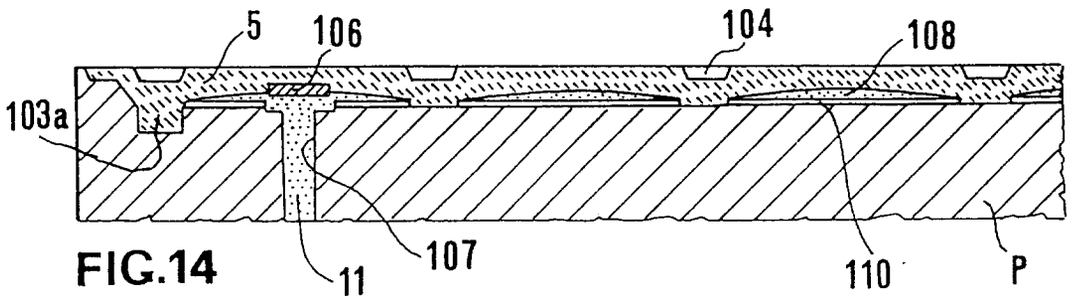
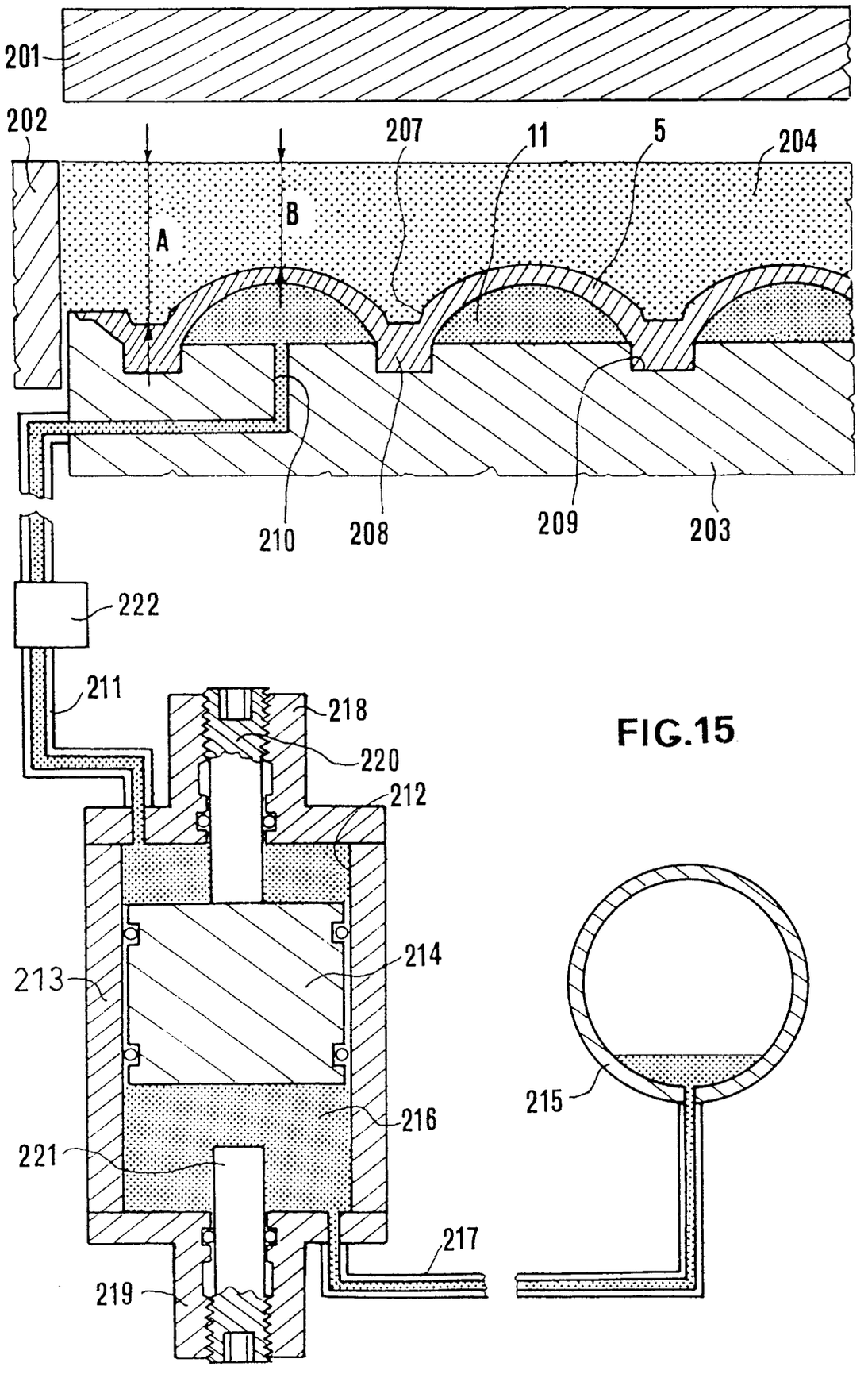

5
106
104
108
103a
107
11
110
P

FIG.14


201
202
207
11
5
204
A
B
210
208
209
203
222
211
218
220
212
214
213
216
221
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219
215

FIG.15

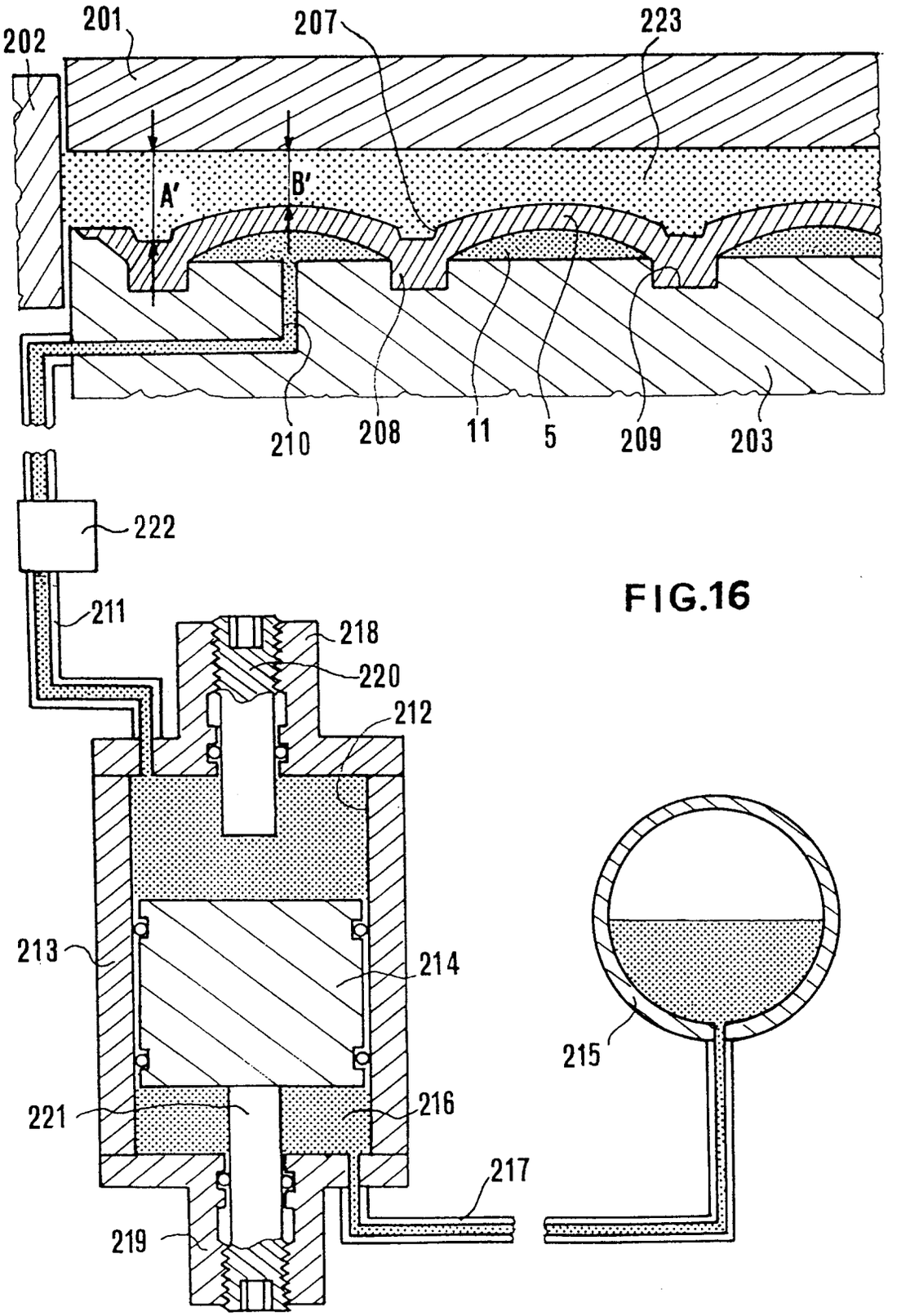
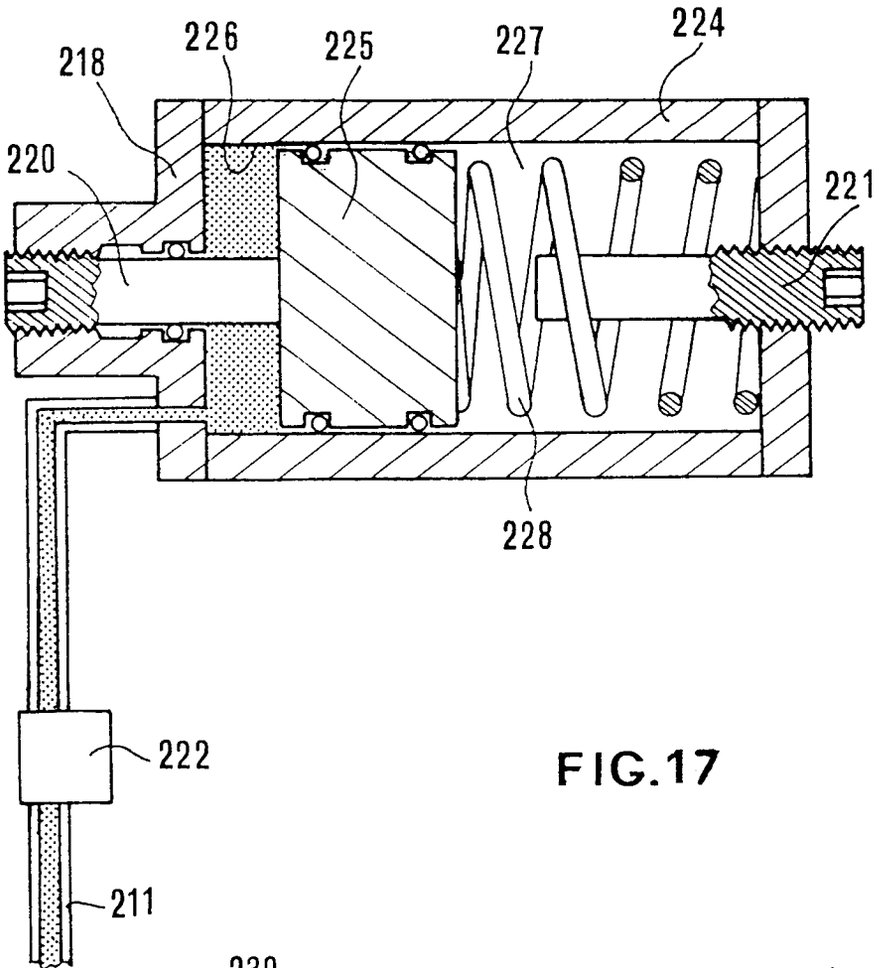

202
201
207
223
A'
B'
210
208
11
5
209
203
222
211
218
220
212
213
214
215
221
216
217
219

FIG.16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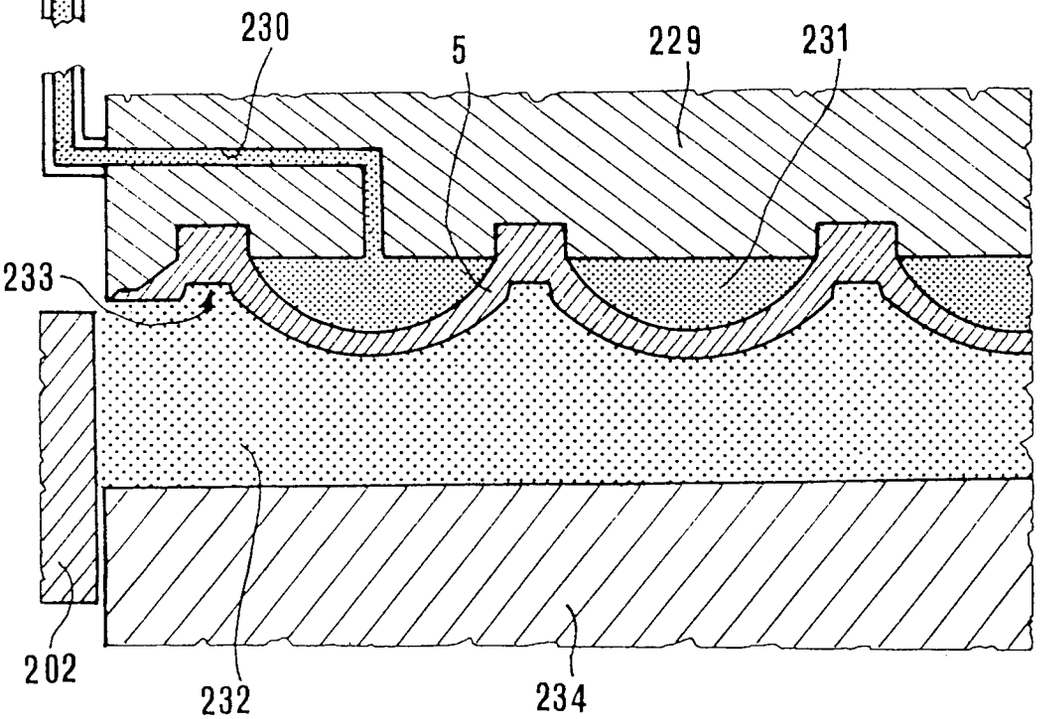
211

FIG.17


230
5
229
231
233
202
232
234

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 20 0762

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	US-A-4 937 025 (R. D. FOSTER) * the whole document * ---	1	B28B3/02 B28B3/00
A	US-A-4 370 120 (R. D. FOSTER) * the whole document * -----	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B28B
B30B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	13 May 1996	Gourier, P

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L : document cited for other reasons

& : member of the same patent family, corresponding document

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