(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 569 070 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **93201036.6**

(22) Date of filing: **08.04.93**

(51) Int. Cl.5: **B28B 13/02**, B28B 3/02, B28B 23/00

(30) Priority: **07.05.92 IT RE920036**

(43) Date of publication of application:
10.11.93 Bulletin 93/45

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IE IT LI LU MC NL PT SE

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(54) Mold for forming ceramic products, tipically pressure-glazed tiles, and the relative loading means.

(57) In a ceramic mold comprising an upper plate (300) supported by the mobile cross-member (11) of a ceramic press, a lower plate (3) located on the press bed (2), and an intermediate plate (30) or die-plate mounted on damper devices (9) and having at least one through forming cavity, with said plates (3) and (300) there being associated at least one lower die (5) for forming the laying face of the tiles and at least one upper die (15) for forming their exposed face, the active surface of said at least one upper die (15) is provided with a plurality of small incisions or slits (155; 162) which are connected, via at least one rear system of channels (25, 24), to at least one suction unit (19, 20) which puts said incisions under vacuum when the upper die (15) is raised so that this latter becomes at least partly covered with at least one pulverulent material drawn from at least one corresponding service trolley, and breaks the vacuum in the incisions when the die (15) is lowered, with simultaneous release of said at least one material.

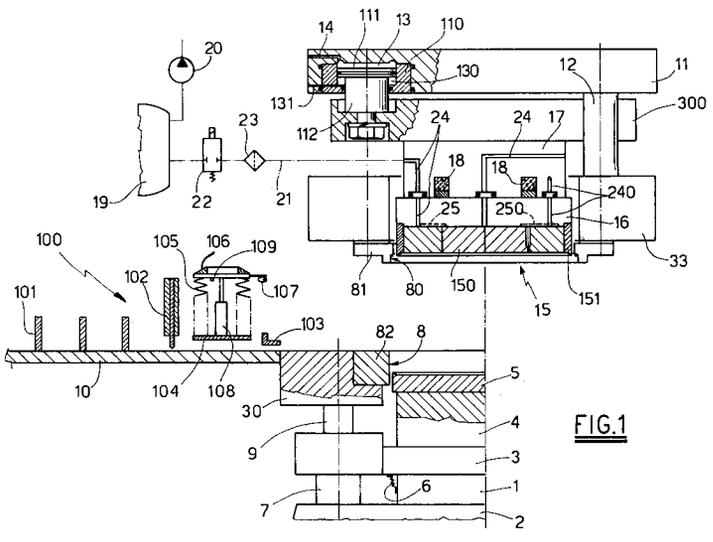

FIG.1

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This invention relates generally to a ceramic mold for tile formation, and in particular to a ceramic mold of the movable die-plate type, and to the relative loading means.

In tile manufacture it is known to use molds comprising an upper plate provided lowerly with at least one pressing die, an intermediate plate or die-plate with a corresponding through forming cavity into which at least one material to be compacted, such as atomized clay, is loaded, and a lower plate provided upperly with a pressing die which defines the base of said cavity.

In such ceramic molds the upper plate is supported by the vertically movable cross-member of the press which supports and operates the mold, the die-plate is positioned on the press base and the lower plate moves vertically to allow said at least one material to be loaded into the cavity, to allow the plate itself to rest on the press base at each individual "pressing", and to allow the tile to be extracted from said cavity.

In certain types of mold the die-plate is stationary in height relative to the press base, whereas in other types of mold, to which the present invention relates in particular, the die-plate is mounted on yieldable supports (such as springs or hydraulic dampers), so that during pressing it is pushed downwards by the upper plate.

The advantages of this latter pressing technique are well known to the expert of the art, and therefore no description will be given thereof.

Certain molds of moving die-plate type have their forming dies for the tile laying face and exposed fixed to the upper and lower mold plates respectively, whereas other molds of moving die-plate type have their forming dies for said laying and exposed faces arranged in the reverse manner.

The invention relates particularly to this latter type of moving die-plate mold, in which the forming dies for the tile exposed face, which as stated are associated with the upper plate, have their active (lower) surface formed either of a particularly hard material such as metal, or of a relatively soft material such as vulcanized rubber.

The need for this clarification will be apparent hereinafter, the features which differentiate said two types of upper die active surface being well known to the expert of the art.

The aforesaid known molds can be used to produce products of various types, for example:

- tiles commonly known as "biscuits" or "supports", which can either be glazed after firing or not,
- tiles which do not require glazing after firing, such as "fine porcelainized ceramic stone",
- tiles of two or more components, such as so-called "grained" tiles, and
- so-called pressure-glazed tiles, which are produced by pressing together two superposed layers of different materials, typically atomized clay for the lower layer and powdered ceramic glaze for the upper.

A complete pressure-glazing cycle takes place as follows:

- on completion of one "pressing", the lower die or dies are moved to the level of the upper face of the die-plate, to enable the clay loading trolley to remove the tile or tiles which have just been formed,
- said lower die is then lowered to a predetermined height corresponding to the desired layer of clay to be loaded into the forming cavity,
- the lower die is then further lowered to free a small upper part of the forming cavity into which to deposit powdered ceramic glaze,
- the lower die is then moved to its lower end-of-travel position, in which the respective thrust plate rests on the press bed,
- the upper die is now lowered to form the tile,
- finally the upper die is raised, followed by the lower die, which expels the tile from the cavity, after which a further operating cycle commences.

The widespread use of this pressure-glazing technique has brought to light the following problems.

These problems derive mainly from the fact that clay and glaze particles often remain on the upper face of the die-plate, even if the corresponding loaders are provided with respective members, for example in the form of blades, which both level the layers of clay and glaze previously deposited into the forming cavity, and also clean the upper face of the die-plate.

Basically, it often happens that small quantities of clay become mixed with the powdered ceramic glaze layer deposited on the clay, with consequent degrading of the quality or appearance and ornamental features of the finished product.

Moreover, as this pressure-glazing technique is becoming increasingly widespread due to the fact that it enables two operations (pressing + glazing) to be performed in one step with obvious advantages, there has been a long felt need in this sector to use pressure-glazing to obtain other products, such as pressure-glazed tiles already provided with a decorative motif on termination of pressing.

Attempts already made in this direction have however not given positive or satisfactory results.

The main object of the present invention is to provide a ceramic mold and relative loading means which overcome the initially stated problems and satisfy the latter requirements.

Said object is attained by a mold as defined in the accompanying claims.

In it, the active surface of each upper die is provided with a plurality of small incisions or slits which are connected by at least one rear channel system to at least one suction unit which puts said slits under vacuum when the upper die is raised and breaks the vacuum in the slits when said die is lowered, so that when in said raised position the die is at least partly covered with at least one pulverulent material drawn from a corresponding service loader, whereas when in said lowered position the said die releases said at least one material.

With particular reference to the formation of pressure-glazed tiles, according to the invention a part of the mold can be loaded (with atomized clay) from the bottom, ie above the lower die, and the remaining part can be loaded from the top, ie below the upper die. It should be noted that said incisions or slits have a width less than the particle size of the powder materials being worked.

The aforesaid arrangement achieves all the objects of the invention.

In this respect, a mold according to the invention can be used to produce pressure-glazed tiles with aesthetic features never before achieved, in that this double loading totally eliminates the contamination of the powdered ceramic glaze with clay, as happens in the initially described known art.

This has been verified by tests carried out with a mold prototype in accordance with the invention, these having shown that by suitably controlling the vacuum induced into said slits a ceramic glaze layer of uniform thickness can be drawn against the active surface of the upper die, which thickness can be chosen according to requirements if the upper die or the corresponding enclosing die-plate is enabled to move relative to the mobile crossmember of the press.

The same tests have shown that a mold according to the invention can produce new types of product, such as support tiles already provided with a decorative motif on termination of pressing, decorated pressure-glazed tiles, and further products as will be apparent hereinafter.

For example by suitably controlling the vacuum induced in the slits of the upper die and arranging these slits in accordance with a particular scheme or pattern, during the loading of the mold small lines of pulverulent ceramic material can be retained at these slits during mold loading, to be then brought, during pressing, into contact with the clay mass pressed in the forming cavity.

In a further embodiment of the invention, different groups of said plurality of slits can be subjected at different times to the same or different vacuum to form groups of lines of differently coloured glazes.

This means that decorated support tiles are obtained after pressing which can either be used as such after firing or be glazed with transparent vitreous material, and other products can also be obtained such as decorated fine porcelainized ceramic stone.

Again, if said plurality of slits is divided into groups as stated, and said groups are subjected to different vacuum at different times, lines of glaze defining a single or multi-colour decoration can be formed on a part of said slits, and the remaining slits be used to cover the entire active face of the upper die, and hence also said lines, with a basic glaze enabling decorated pressure-glazed tiles to be obtained.

From the aforegoing it is apparent that the invention is suitable for the manufacture of a relatively large number of products, even of unusual type.

For example a fine porcelainized ceramic stone tile can be decorated during its molding by allowing a sort of transfer in the form of a thin sheet of thermolabile material (such as paper) carrying the desired ceramic glaze figure or pattern to adhere to the upper die by vacuum.

The application of said sort of transfer can be combined with the application of the powdered glaze, and likewise it is possible, on loading the mold, to associate with the upper die at least one insert (of clay or glaze) prepared separately and being sufficiently compacted to ensure its integrity during loading, this compaction being less than that after pressing.

The aforesaid represent only some examples of the possibilities offered by the invention, as will be apparent to the expert of the art from the aforegoing.

Finally it should be noted that with the mold of the invention there are associated the necessary means for feeding said glazes, transfers or inserts to the upper die, said means being or able to be independently moved relative to the ceramic mold or being supported by the trolley for depositing the clay into the mold forming cavity.

As described hereinafter, the complete loading of the mold is achieved via only its upper part, ie below the upper die, this enabling both flat products such as the aforestated to be obtained, as well as ceramic products of particular shape such as right angled pieces or pieces in the form of a sector of a cylindrical surface.

The features and constructional merits of the invention and its method of operation will be apparent from the detailed description given hereinafter with reference to the figures of the accompanying drawings, which show some preferred embodiments thereof by way of non-limiting example.

Figure 1 is a partial vertical section through the invention in the open position.

Figure 2 is a partial view from below, to an enlarged scale, of the upper metal die shown in Figure 1, the component blocks being omitted on the right side to show the rear channelling.

Figure 3 is a section on the line III-III of Figure 1.

Figures 4, 5, 6 and 7 show to an enlarged scale the details indicated respectively by IV, V, VI and VII in Figure 3.

Figures 8, 9 and 10 are a front, side and rear view respectively of constituent blocks of the die of Figures 1 to 7.

Figure 11 is similar to Figure 2 but shows a die with its active surface lined with rubber, to the right of which there are shown the various layers of the lining.

Figure 12 shows to an enlarged scale part of the section on the line XII-XII of Figure 11.

Figures 13, 14, 15 and 16 are schematic vertical sections showing the most significant operating stages of a mold according to the invention.

Figures 17, 18, 19 and 20 are schematic sections showing some particular types of ceramic product obtainable with the invention.

Said figures, and in particular Figure 1, show a platform 1 positioned on the bed 2 of a usual ceramic press (not shown). On said platform 1 there is the ceramic mold lower plate 3 provided upperly with a series of blocks 4 which carry fixed to their upper surface corresponding dies 5 for molding the laying face of the tiles (not shown).

Said lower plate 3, blocks 4 and dies 5 can be locked together by any known system, and the active surface of the dies 5 can be of metal or rubber.

A perimetral dust-protection bellows is positioned between the platform 1 and the lower plate 3, said plate 3 being supported height-adjustable by a perimetral series of support devices 7, for example four in number, of which only one is visible in Figure 1. Said devices can be for example of the type described in Italian Invention Patent Application No. RE 92 A 00009 filed in the name of the present Applicant.

The dies 5 are inserted from below into the forming cavities 8 of the ceramic mold intermediate plate or die-plate 30 which is supported by a perimetral series of dampers 9, for example of hydraulic type and four in number, of which only one is visible in Figure 1.

No further details of the aforedescribed members will be given as they are of usual type and do not form a characterizing part of the invention.

It should merely be noted that to the side of the die-plate 30 (to the left in Figure 1) there is a table 10 with which there is upperly associated a trolley 100 for loading for example atomized clay into the forming cavity 8. Said trolley is described hereinafter.

As can be seen, above the die-plate 30 there is a counter die-plate 33, beyond which there is the upper plate 300 of the ceramic mold. Said counter die-plate 33 is fixed to the vertically mobile cross-member of the ceramic press by a series of vertical cylindrical bars 12, the counter die-plate being provided with a series of cavities 80 aligned with those 8 of the die-plate 30.

The active region of each cavity 80 is defined by a perimetral series of strips 81 fixed below the counter die-plate 33, and intended to rest (during the lowering of the cross-member 11) against the corresponding strips 82 defining the underlying cavity 8 of the die-plate 30.

With regard to the mold upper plate 300, as shown in Figure 1 it is slidingly mounted on said vertical cylindrical bars 12 and is supported by the cross-member 11 in the following manner.

The cross-member is provided for this purpose with a perimetral series of cylindrical recesses, for example four in number, with their mouth facing downwards, in each of them there being inserted, and suitable locked, a cup-shaped body 110 with a holed base.

Within this body there slides under sealed conditions a piston 111, the rod 112 of which extends beyond the body 110, where it carries the plate 300 fixed to it.

The piston 111 lies between an upper chamber 13 and a lower chamber 130, of which the chamber 13 is connected via a duct 14, and by way of convenient timed valve means (not shown), to a pressurized hydraulic liquid source, such as the hydraulic circuit of the press.

The lower chamber 130 is directly connected via a respective duct 131 to the base of a pressurized hydraulic vessel (not shown) in which the pressure is maintained by an atmosphere of inert gas. It should be noted that instead of said pistons 111, devices can be provided conforming to the said Patent Application No. RE 92 A 000009. It should also be noted that the plate 300 can be directly fixed to the cross-member 11, and said pistons 111 or devices can be interposed between the plate 300 and the counter die-plate 33.

A die 15 for forming the laying face of the tiles, and which can have a metal or rubber active surface as explained hereinafter, is slidingly inserted from above into each cavity 80 of the counter die-plate.

The die 15 is fixed to an overlying plate 16, this being fixed to a block 17 which is fixed to the upper plate of the mold.

Specifically, the connection between said plate 16 and block 17 is made by electromagnetic means 18 arranged to provide automatic centering

between the die 15 and cavity 80 if as normally happens some small mutual horizontal slippage occurs between the mutually acting members.

According to the invention, in a first embodiment said block 17, plate 16 and die 15 are traversed by a system of channels which at one end open into the active (lower) face of the die 15, and at their other end are connected to a suction unit.

This latter comprises a vessel 19 with which a vacuum pump 20 is associated, and from which there extends a pipe 21 in which a solenoid valve 22 and a filter 23 are connected.

The pipe 21 is connected to a series of ducts 24 which traverse both the block 17 and the plate 16, between the facing surfaces of this latter and the die 15 there being provided grooves 25 the purpose of which is stated hereinafter.

Said grooves 25 communicate with the active face of the die 15 as described hereinafter with reference to Figures 1 to 10 in the case of a completely metal die 15, and with reference to Figures 11 and 12 in the case of a rubber lined die 15.

From Figures 1 to 3 it can be seen that the die 15 consists of a plurality of mutually adjacent coplanar blocks 150 contained within an enclosing perimetral frame 151.

The blocks 150 are fixed to the plate 16 at 27, the frame 151 being fixed to the blocks 150 at 28.

As can be seen from Figures 8 to 10, on each side of each block 150 there is a series of vertical ribs 152, of two in number in the illustrated example, alternating with a series of sunken portions 153.

These latter have a height less than the thickness of the block 150, and terminate at a short distance, for example of the order of 2 mm, from the active (lower) face of the block 150. In addition along the perimetral edge of said active face there is a perimetral recess 154.

In this manner the blocks 150 are in mutual contact via said ribs 152 and rest against the frame 151, and because of said recesses 154 the active surface of the die 15 is covered with a network of narrow slots 155 or incisions (Figures 2 to 7) which communicate with each other and are connected to the rear grooving 24-25.

In the illustrated example (Figures 2, 8 and 10), the blocks 150 are square in shape, but they can be of any plan configuration, for the reasons given hereinafter. Again, two or more portions of said network of slots 155 can be connected together by small surface grooves formed in one or more blocks 150, as indicated schematically in Figure 2 by 225 (with dashed and dotted lines).

By way of example, in the illustrated embodiment:

- the depth of the sunken portions 153 is of the order of 1 mm,
- the width of the ribs 152 is about 2 mm, and
- the depth of the recesses 154 is between 0.04 and 0.2 mm.

As will be apparent hereinafter, this latter dimension is strictly related to the characteristics, in particular the particle size, of the materials used for forming ceramic objects such as pressure-glazed ties.

In the embodiment shown in Figures 11 and 12, the die 15 comprises a plate 16 fixed to the overlying block 17 (see Figure 1), and a perimetrally enclosing frame 151.

Said plate 16 has a lower surface network of grooves 25 which on one side communicate with the aforesaid channels 24 and on the other side open into the active surface of the die 15.

The following are provided below said plate 16, one following the other starting from the top (with reference to the effective working position of the die 15):

- a densely perforated metal sheet 159, for example of stainless steel, which is fixed to said plate 16 by a convenient number of spot welds,
- a sheet 160 of air-permeable flexible material, such as a fabric sheet formed from natural or synthetic heat-resistant filaments, which is fixed to the sheet 159 by small regions of gluing, and
- a layer 161 of vulcanized rubber which grips said sheet 160 and is peripherally glued to the arched inner edge of the frame 151.

Said sheets 159 and 160 and said layer 161 have for example a thickness of 2.0, 1.0 and 0.7 mm respectively.

In addition, from Figures 11 and 12 it can be seen that on the rubber layer 161 there is a plurality of cuts 162 as deep as the thickness of said layer 161, they being slightly flared towards their outer mouth and inclined to the vertical.

Specifically, said cuts 162 are inclined transversely to the horizontal, as can be seen in Figure 12.

The width of the outer (lower) mouth of said cuts 162 is between 0.04 and 0.4 mm, this dimension being selected on the basis of the materials being worked as stated heretofore, and for the reasons given hereinafter. The purpose of the transverse inclination of the cuts 162, in combination with said flared shape and transverse dimension, is to prevent the cuts 162 becoming clogged. Again, for certain types of ceramic material said cuts will have the same shape and extension as the rear grooves 25, whereas for other types of material they will have a particular determined configuration, such as that indicated by 157 in Figure

11 (by dashed and dotted lines).

A loading device is also provided, not shown in the figures, arranged to travel relative to the mold such as to occupy a first position to the side of the mold (to the right with reference to Figure 1), and a second position between the die-plate 30 and the counter die-plate 33.

Said device can be a trolley similar to, but separate from, the trolley 100 of Figure 1, and provided with at least one loader to feed the die 15 with at least one material, such as powdered ceramic glaze as described hereinafter.

In a preferred embodiment, said loader is associated with the trolley 100 for loading clay into the forming cavity.

As is usual, said trolley 100 comprises a clay (or other material) loader 101 of the type comprising horizontal slats positioned transversely to the trolley travel direction (from left to right and vice versa with reference to Figure 1). In front of said loader 101 there is a blade 102 for levelling the clay deposited into the cavity 8, and a pusher 103 for removing the formed tiles.

Between said blade 102 and pusher 103 there is a loader containing powdered ceramic glaze (or other material).

The loader consists of a relatively narrow upperly open container with a flat horizontal base 104, a lateral surface defined by a bellows 105, and an annular upper frame 106 the front and rear edges of which are conveniently bevelled.

Said frame 106 is supported by the trolley 100 by way of two cam devices 107, of which only one is shown in the figure, said base 104 being connected to the frame 106 by at least one cylinder-piston unit 108.

At the annular frame 106 there is a probe 109, and possibly a scraper (not shown) for levelling the material drawn into the cavity 80.

With reference to the aforesaid structure, the invention operates as follows.

Reference will firstly be made to the formation of a pressure-glazed tile (or more generally to a two-component tile).

On termination of a pressing, the active face of the die 5 is moved to the level of the upper face of the die-plate 30 (raised), where it supports the tile, the cross-member 11 is raised as in Figure 1, and the upper die 15 is in the position shown therein.

At this point the trolley 100 is made to advance, by which the pusher 103 removes the tile which has just been formed, then the die 5 is lowered into the loading position, by which the mold assumes the configuration shown in Figure 13.

Just before the frame 106 (Figure 1) reaches the cavity 80 of the counter die-plate 33, the cams 107 are enabled, for example by an electromagnetic proximity switch or the like, to raise the frame 106 substantially to the level of the mouth of said cavity 80.

Virtually at the same time, the cylinder-piston unit 108 raises the base 104 and hence also the overlying layer of powdered glaze, the cylinder-piston unit 108 (or the like) then halting under the control of the probe 109.

Simultaneously the solenoid valve 22 opens and the vacuum present in the vessel 19, for example of the order of - 0.6 bar, propagates as far as the incisions 155 (see Figure 2) or the cuts 162 (see Figure 12).

Basically, with reference to Figure 15, during the outward stroke (to the right in Figure 1) of the trolley 100, a layer of clay 44 (or other material) is deposited in the cavity 8 (by falling), whereas in the cavity 80 a layer of powdered ceramic glaze 55 (or other material) is collected (by suction).

After this the trolley 100 withdraws to return to the position of Figure 1, and at the same time the cams 107 and possibly the cylinder-piston unit 108 operate in the reverse manner to that stated.

If necessary, a convenient hopper, not shown, now refills the container with the glaze (or other material). It will be apparent that the upper die 15 can be covered (by suction) during the return travel of the trolley 100.

It should be noted that said double loading (Figure 15) is substantially the same if the glaze (or other material) loader moves independently of the clay loader 101.

In such a case, the loader 101 operates first, seeing that the previously formed tile has to be removed, after which the glaze (or other material) loader operates.

On termination of said double loading, the two mold plates 3 and 300 withdraw (see Figure 16), with the first plate 3 resting on the platform 1, and the second resting against the cross-member 11 (Figure 1).

Pressing then takes place in the usual manner, after which the described cycle is repeated identically.

It should be noted that during pressing, the vacuum along the pipe 21 is interrupted to allow all the glaze covering the die 15 to be removed. This also results in perfect cleaning of the slots 155 (Figure 2) or cuts 162 (Figure 12) in the active face of the die 15. The cuts 162 are cleaned by the effect of their inclination and flaring in that during pressing, these cause the cuts 162 to contract, so totally expelling the glaze particles or granules.

In addition to the advantage of eliminating any contamination of the glaze, it should be noted that the double loading effected by the invention has the further advantage of not requiring intermediate lowering of the lower die 5, as is necessary in the

initially described prior art in order to be able to deposit the glaze on the clay previously loaded into the cavity 8.

The upper part of the mold, with the exception of the dies formed in accordance with the invention, can be of usual type, ie having both the upper plate 300 and the counter die-plate 33 stably fixed to the cross-member 11. However the facility for moving the dies 15 (or counter die-plate 33) relative to the cross-member 11 on the one hand ensures expulsion of the tiles from the cavity 80, and on the other hand enables the thickness of the glaze (or other material) deposited on pressure-glazed tiles (or multi-component tiles) to be controlled as desired.

In an alternative embodiment, decorated pressure-glazed tiles can be obtained with the mold of the invention.

For this purpose, the channel system associated with the die 15 is divided into two parts, for example the two parts indicated by 25, 24 and by 250, 240 in Figure 1, of which the first 25, 24 is connected to the vessel 19 as stated, while the second 250, 240 is connected to another vessel (not shown).

For example, a vacuum of - 0.7 bar is maintained in the first vessel 19 and a vacuum of - 0.2 bar in the second vessel.

In addition, on the trolley 100 in front of the described gaze loader there is provided a further powdered glaze loader identical to this latter and containing a different coloured glaze. Alternatively said second glaze loader is positioned on the said opposite trolley to the trolley 100.

With this described alternative embodiment, during a complete molding cycle the channels 240, 250 are put under vacuum so that at the respective incisions 155 or 162 small lines of glaze 66 are created (see Figure 14), to be then covered with the glaze 55 (Figure 15) by the effect of the vacuum in the channels 24, 25. The fact that in the case of the incisions 155 or 162 associated with the channels 240, 250 the amount of covering is limited to the incisions alone is because these have a lower suction capacity than the channels 24, 25.

From tests carried out it has been found that in this manner extremely accurate decorations, figures and/or patterns can be obtained on the pressure-glazed tile, with very clear outlines.

For this purpose said two vacuums can be adjusted as required, for example on the basis of the average particle size of the glazes 55 and 66, and the respective two suction stages can be assisted by suitably selecting the position of the die 15 relative to the cavity 80.

Multi-colour decorations can be obtained if two or more glaze containers such as 66 are associated with the trolley 100, and if the network of incisions 155 or 162 is divided into the corresponding number of parts, each connected to its own suction vessel such as 19.

Said division does not present particular problems if a metal die 15 of the type shown in Figures 1 to 10 is used. In this case, with reference to Figure 2 the decoration to be added to the pressure-glazed tile can be defined either by suitable surface shaping of the blocks 150, or by connecting two or more incisions 155 to small surface grooves 255, or by interrupting said grooves 25 in regions such as 158.

In the case of a rubber-lined die, then with reference to Figure 11 the network of incisions or cuts 162 is divided by:

- providing diaphragms (such as 88) to interrupt the grooves 25,
- providing weld lines (such as 99) connecting the perforated sheet 159 to the plate 16, and
- runs of mastic (such as 260) which impregnate the fabric sheet 160 and glue it above to the vulcanized rubber and below to the perforated sheet 159.

In addition to the aforesaid ceramic products, other products can also be obtained with a mold according to the invention.

For example, decorated tiles of biscuit type can be produced by applying to them small portions of glaze (such as 66, Figure 14) of one or more colours, without covering the die 15 with the glaze 55 (Figure 15).

After firing, such biscuit-type tiles can either be used as such or glazed with transparent glazes.

Decorated tiles of high quality such as fine porcelainized ceramic stone tiles can be decorated in the same manner.

Again, with the mold of the invention, the decoration of said biscuit and quality tiles can be achieved by laying a sort of transfer on the atomized clay 44 (see Figure 15).

According to the invention said sort of transfer is in the form of a thin sheet of thermolabile or heat-dispersing material (such as paper) carrying the desired pattern in single or multi-colour ceramic glaze.

According to the invention, said sort of transfer is placed within a suitable tray positioned either in front of the clay loader 101 or on an opposite trolley to the trolley 100 (Figure 1). The tray can be stationary in height or vertically movable as required.

The dimensions of the transfer or rather of its support sheet can be the same as or less than the dimensions of the cavity 80, and the support sheet can be either solid or finely perforated.

By this means, and utilizing the self-loading facility of the die 15 according to the invention, decorated pressure-glazed tiles can be obtained.

In this respect, during a complete forming cycle the die 15 firstly sucks the transfer from the underlying tray (while in transit or temporarily at rest), and then sucks the glaze, such as 55 (Figure 15), which covers the whole, part or none of the transfer, as will be apparent from the aforegoing.

By means of the invention, tiles can also be obtained provided with inserts of various sizes, shapes and colours, these being securely bonded to the surrounding base material (atomized clay, etc).

Said inserts are of ceramic glaze, clay mixed with glaze, or another similar mixture, and are prepared separately by compacting them to an extent which ensures that they can be handled, but which is less than their extent of compacting after pressing.

For loading said inserts, a vertically slidable horizontal table is provided on the trolley 100 or on a trolley separate from and opposite this latter.

From the aforegoing it is apparent that the loading of at least one insert below the upper die 15 can be combined with the loading of glaze, such as 55 or 66, or with the loading of a transfer of dimensions less or not less than the dimensions of the cavity 80, or with both.

It will be well apparent that other loading combinations can be implemented and hence other types of product obtained, even considerably different from the aforesaid.

For example, using at least one of said inserts, a multi-component tile such as a so-called "grained" tile can be provided with an insert in a material different from the surrounding material, or in a material substantially equal to the surrounding material but of a different colour.

A ceramic product of this type is suitable for use in its crude state after firing, or it can be smoothed to better emphasize the incorporation of said insert.

Tests carried out with a mold according to the invention have totally confirmed the aforegoing, and in addition it has been found that the mold can be completely loaded via the cavity 80 of the counter die-plate 33, ie without any loading of the cavity 8 of the die-plate 30. In this respect, in the case for example of a pressure-glazed tile, the glaze 66 and the atomized clay 44 (see Figure 15) can both be sucked against the upper die 15 and into the corresponding cavity 80, after which pressing proceeds. In this case the height of the lower die 5 need not be adjusted, this then moving vertically between a lower tile forming position and a raised tile support position, ready for the tile to be removed. In addition, this facility for completely loading the mold immediately below the upper die 15 makes it possible, very advantageously, to obtain unusual ceramic products not obtainable with the usual molds in which the cavity 8 is loaded from above. Essentially, with the invention ceramic products can be manufactured, including of pressure-glazed type and possibly already decorated on pressing, having a shape different from the flat shape of usual ceramic tiles.

For example, ceramic products 900 (see Figure 17) of constant thickness with undulations can be obtained, as can right-angled ceramic elements 901 (see Figure 18) or those in the form of a sector of a cylindrical surface 902 subtending an angle of 90° (see Figure 19), or ceramic bodies with a right "omega" section 903 (see Figure 20), of which for example the first 900 can be used for floors (especially external paving) and facings, the second 901 and the third 902 to cover edges and corners of rooms and the corners of columns, and the fourth 903 for forming for example ducting for collecting and removing liquids in general.

It will be apparent that to obtain the products 900 to 903 shown in Figures 17 to 20, it is only necessary to correspondingly shape:

- the upper die 15,
- the lower face of the respective die-plate 33,
- the loader or loaders serving said upper die 15, and - the die-plate 30 and the respective lower die 5.

It should be noted that the generators for the active shaped parts of these latter mold members must lie parallel to the outward and return travel of the trolley for feeding the upper die 15 with at least one material, typically atomized clay.

The invention is not limited to that illustrated and described, but comprises all technical equivalents of the stated means and their combinations, if implemented within the concept of the following claims.

Claims

1. A mold for forming ceramic products, typically tiles, of the type comprising an upper plate (300) to be positioned below the vertically mobile cross-member of a ceramic press and lowerly provided with at least one die (15) for pressing the exposed face of the tile, an intermediate plate (30) or die-plate having at least one through forming cavity (8) and mounted on damper devices (9), and a vertically slidable lower plate (3) upperly provided with at least one die (5) for pressing the laying face of the tiles, characterized in that the active surface of said at least one upper die (15) is provided with a plurality of small incisions or slits (155; 162) which are connected, via at least one rear system of channels (25, 24), to at least one suction unit (19, 20) which puts said incisions under vacuum when the upper die (15) is

raised so that this latter becomes at least partly covered with at least one pulverulent material drawn from at least one corresponding service trolley, and breaks the vacuum in the incisions when the die (15) is lowered, with simultaneous release of said at least one material.

2. A mold as claimed in claim 1, characterized in that said incisions or slits (155; 162) have a width less than the particle size of the pulverulent materials used in forming the tiles.

3. A mold as claimed in the preceding claims, of the type in which the active surface of said at least one upper die (15) is formed of a particularly hard material such as metal, characterized in that said plurality of incisions (155) is formed by fixing a plurality of metal blocks (150) side by side on a rear plate (16) and enclosing them by a surrounding frame (151), each side of each block being provided with small ribs (152) acting as spacers between which there are sunken portions (153) which at one end communicate with said system of channels (25, 24) and at their other end open into said incisions (155), as recesses formed along the peripheral edge of the active face of each block (150).

4. A mold as claimed in the preceding claims, characterized in that at least a part of said plurality of incisions (155) is connected together by a series of small surface grooves (255) provided in the respective blocks.

5. A mold as claimed in claim 1, of the type in which the active surface of said at least one die (15) is formed of a relatively soft material such as vulcanized rubber, characterized in that said plurality of incisions consists of a multiplicity of cuts (162), (157) passing completely through the rubber layer, this latter gripping a rear sheet of porous fabric material which is glued to a rear perforated metal sheet (159), said rear metal sheet (159) being fixed to a rear plate having a network of surface grooves (25) communicating with said at least one system of channels (25, 24).

6. A mold as claimed in claims 1 and 5, characterized in that said cuts are transversely inclined to the horizontal, the lateral walls of said cuts slightly diverging towards the active surface of the die (15).

7. A mold as claimed in claim 1, characterized in that said at least one suction unit (19, 20) comprises a vacuum vessel (19) which at one end is connected to a vacuum pump (20) and at the other end is connected to said at least one system of channels (24, 25) via valve means (22) and filtering means (23).

8. A mold as claimed in claims 1 and 7, characterized in that vacuum adjustment means are associated with said at least one suction unit (19, 20).

9. A mold as claimed in claims 1, 3, 5, 7 and 8, characterized in that said at least one channel system consists of at least two separate parts (24, 25), (240, 250), each connected to a respective suction unit.

10. A mold as claimed in claims 5 and 9, characterized in that between said at least one channel system and the lower face of said at least one upper die (15) there are provided separator means (158, 88, 99, 26) arranged to connect said at least one channel system to respective series of cuts (162).

11. A mold as claimed in claim 9, characterized in that said at least two suction units are arranged to subject said at least two parts (24, 25) and (240, 250) of said at least one channel system to substantially equal vacuums of relatively small extent.

12. A mold as claimed in claim 9, characterized in that said at least two suction units are arranged to subject said at least two parts (24, 25) and (240, 250) to relatively very different vacuums.

13. A mold as claimed in the preceding claims, characterized in that said at least one upper die (15) is received in a pressing cavity (80) provided in a counter die-plate (33) supported by the press cross-member (11), the die (15) or the counter die-plate (33) being height-adjustable, and said cavity (80) being able to contain all the material (or materials) necessary for forming the ceramic product, such as a tile.

14. A mold as claimed in the preceding claims, in particular claim 13, typically for forming non-flat ceramic products such as a ceramic element (901) of right-angled cross-section, characterized in that said at least one upper die (15), said at least one lower die (5), the upper face of the die-plate (30) and the lower face of the counter die-plate (33) are, in a horizontal direction parallel to the travel direction of said at least one service loader, are shaped as said cross-section of said non-flat ceramic product.

15. Means for loading a ceramic mold claimed in claims 1 to 14, in particular for feeding at least one finishing material to the upper die or dies (15) of said mold, characterized by comprising at least one container arranged to move between a rest position in which it lies to the side of the mold below the level of the raised die or dies (15), and a position in which it lies below said die or dies (15) and at a short distance therefrom.

16. Means as claimed in claim 15, characterized in that said at least one container consists of an upperly open chamber for containing a pulverulent material such as powdered ceramic glaze (55; 66) and having a horizontal rigid flat base (104) and a deformable lateral surface (105), such as a bellows, said chamber being provided with means (108, 109) for causing said base to rise in accordance with the level of filling of said chamber.

17. Means as claimed in claim 15, characterized in that said at least one container consists of a sort of tray for containing a preformed decoration, such as a sort of transfer in the form of a thin sheet of thermolabile material, such as paper, carrying a decorative motif in ceramic glaze.

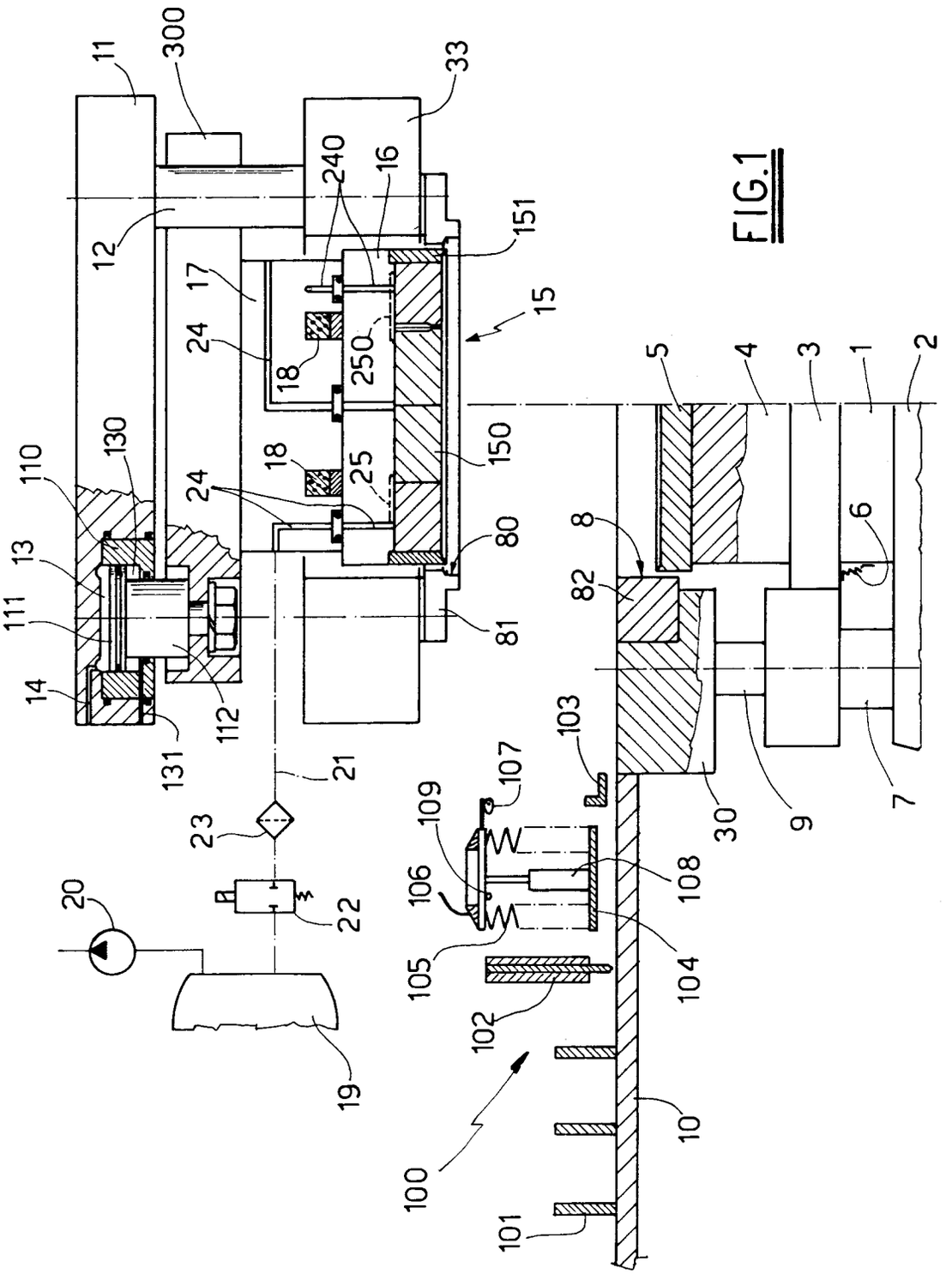
18. Means as claimed in claim 15, characterized in that said at least one container consists of a table for supporting at least one preformed insert having a plan shape contained within that of said upper die (15), such as a clay insert having a lesser degree of compacting than the ceramic material on termination of pressing.

19. Means as claimed in claim 15, characterized in that said at least one container is situated on the trolley (100) for loading at least one material (44) to be compacted within the forming cavity or cavities of the mould die-plate or counter die-plate.

20. Means for loading a ceramic mold claimed in claims 1 to 14, in particular claims 13 and 14, characterized in that the upper and lower region of said at least one loader are configured as the corresponding facing regions of the ceramic press.

21. A ceramic press for forming flat or non-flat ceramic products, characterized by being equipped with a mold claimed in claims 1 to 14 and with loading means claimed in claims 15 to 20.

22. Flat or non-flat ceramic products, of the type obtained by pressing at least one pulverulent material, characterized by being molded by a press claimed in claim 21.


11
300
33
240
16
12
151
17
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24
18
250
5
4
3
1
2
130
110
18
25
150
24
80
8
13
6
111
82
81
14
112
131
103
21
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9
7
106
108
20
22
105
104
102
19
100
10
101

FIG.1

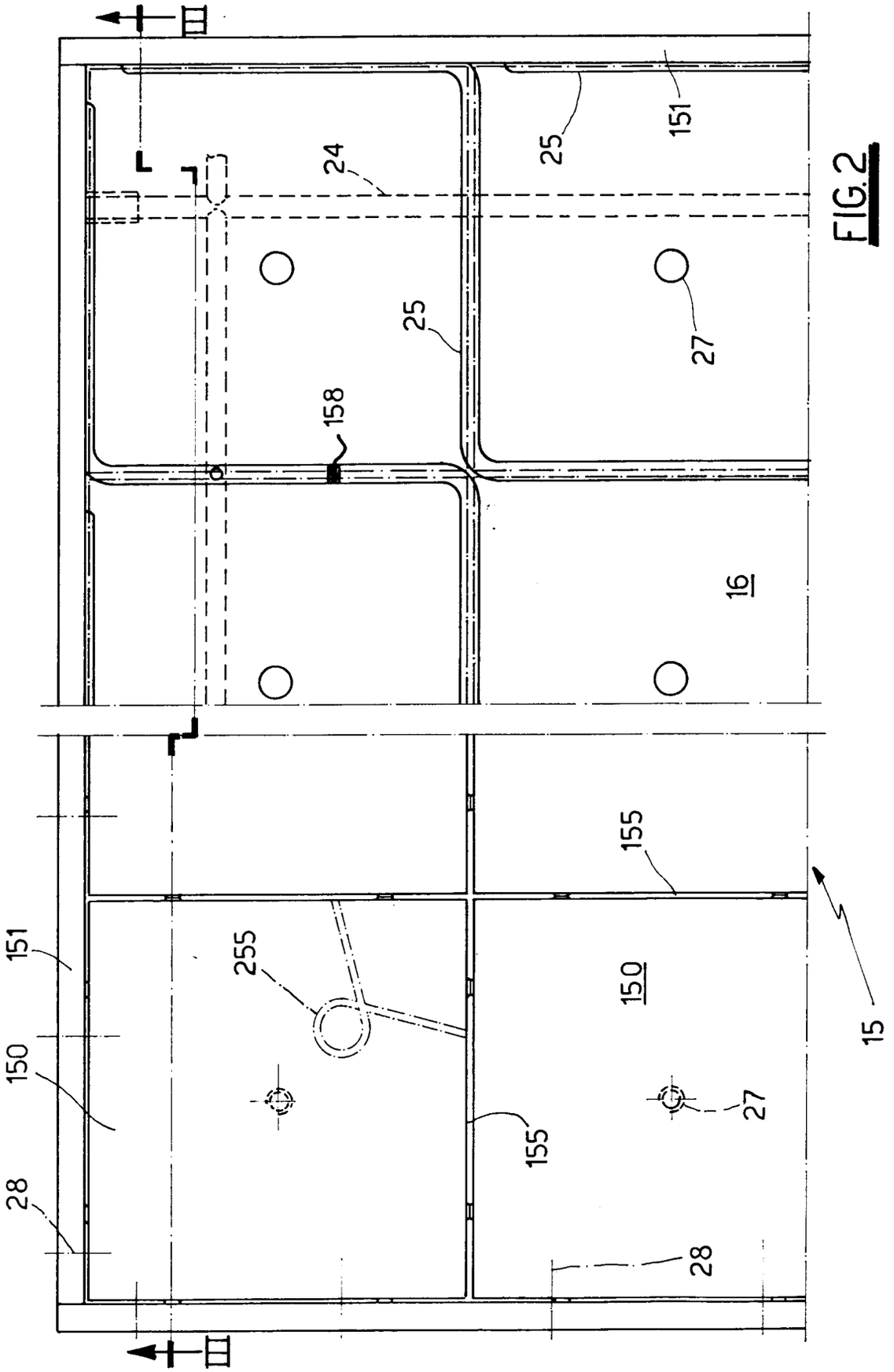


FIG.2

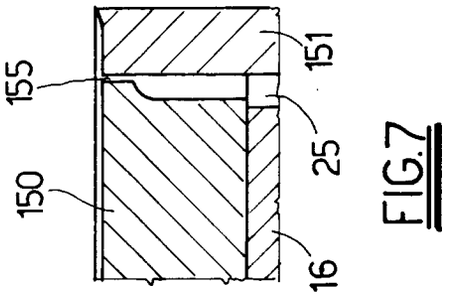


FIG.7

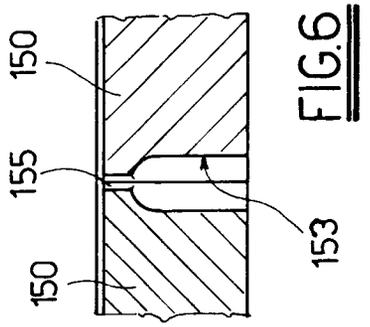


FIG.6

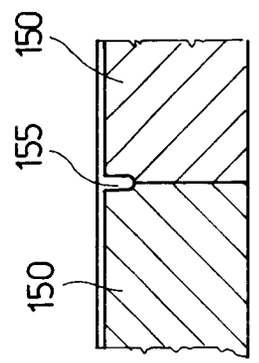


FIG.5

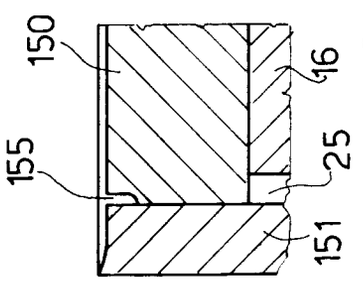
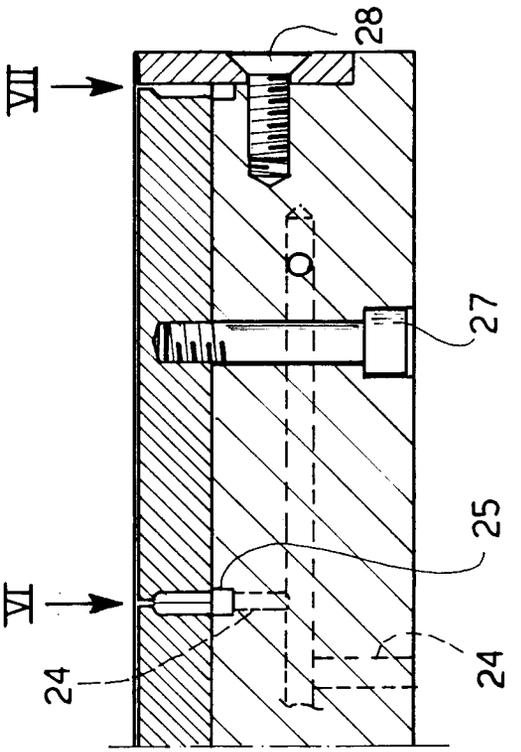


FIG.4



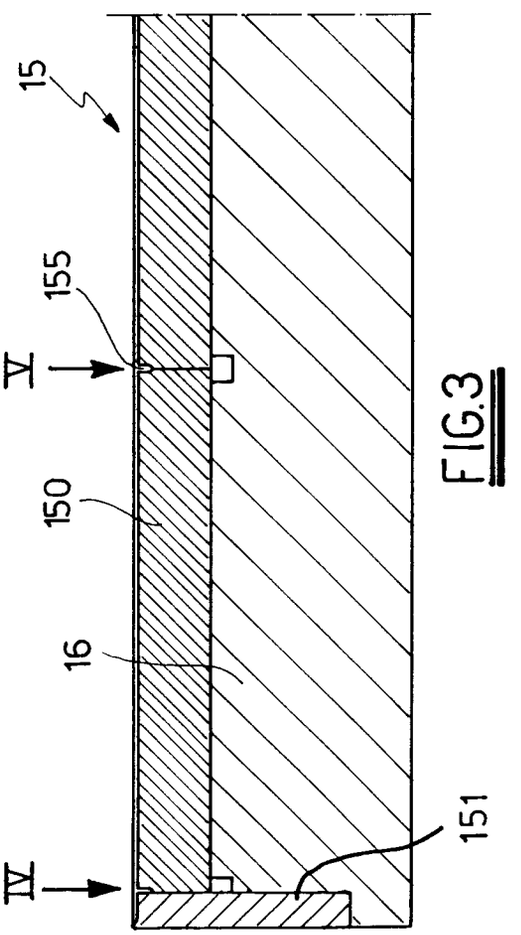


FIG.3

FIG.10

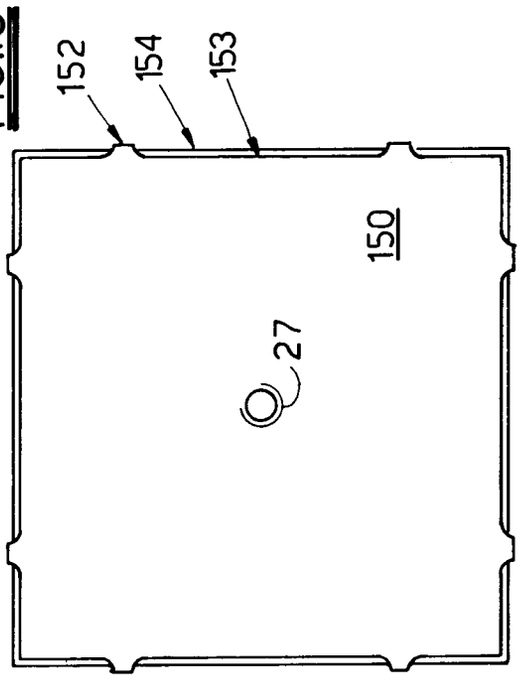


FIG.9

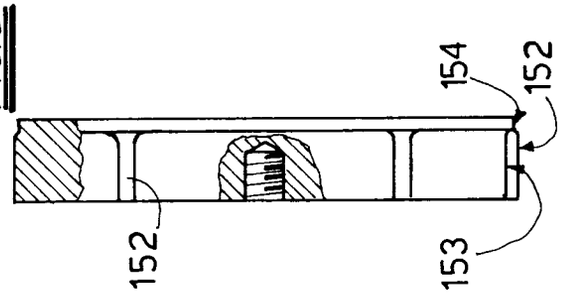


FIG.8

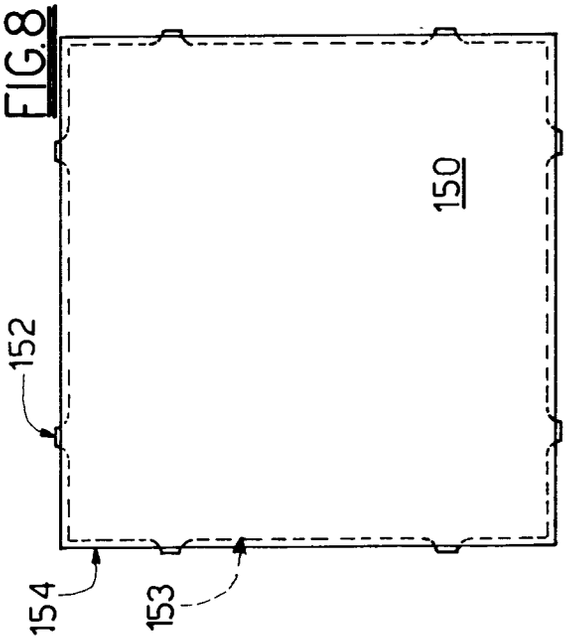
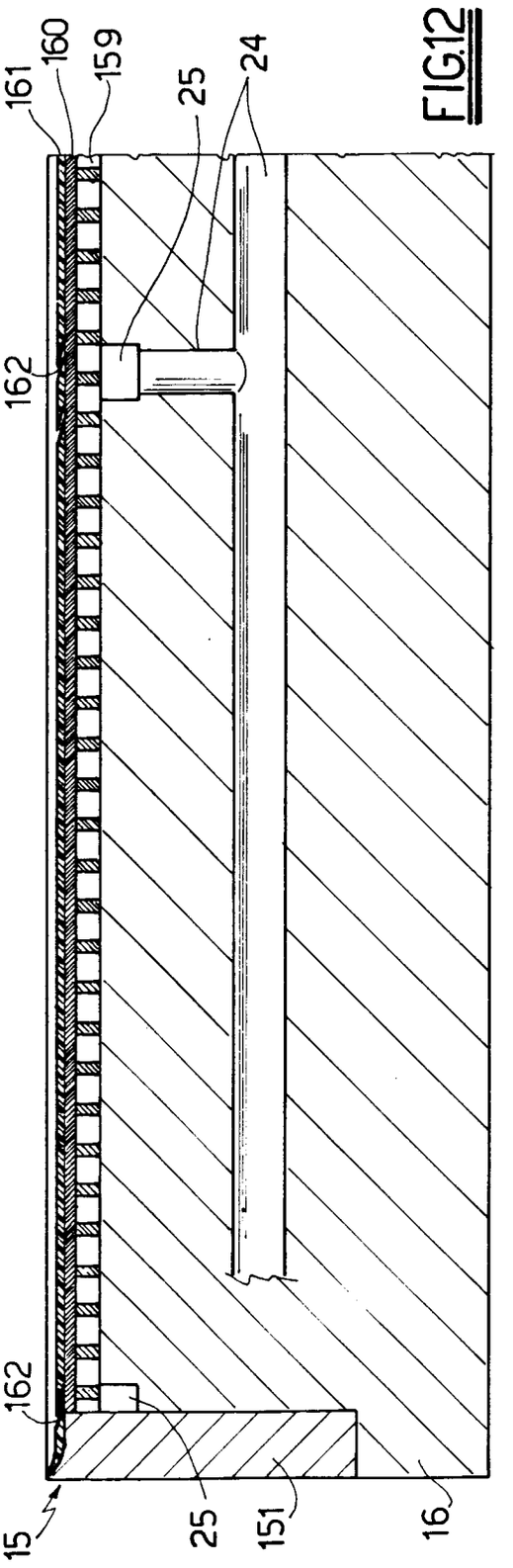


FIG.12



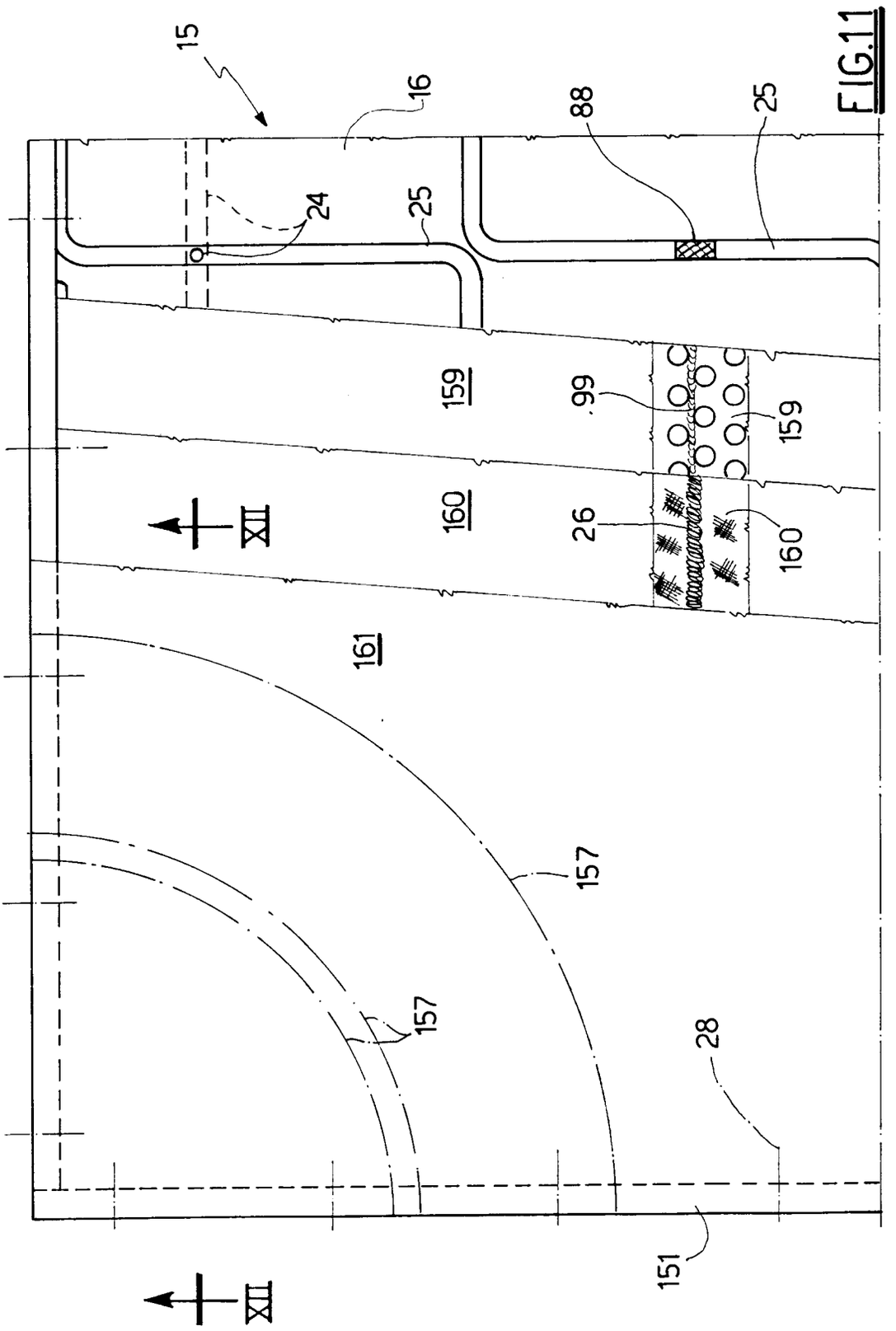


FIG.11

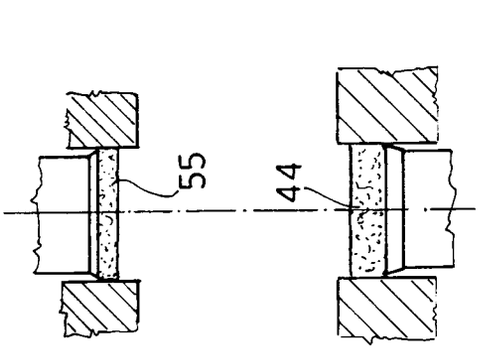


FIG.16

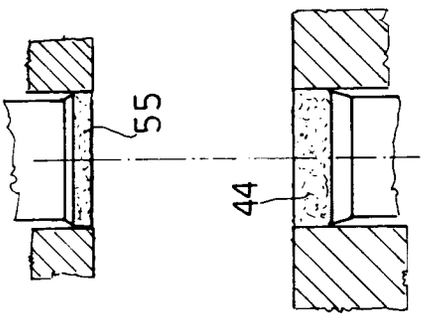


FIG.15

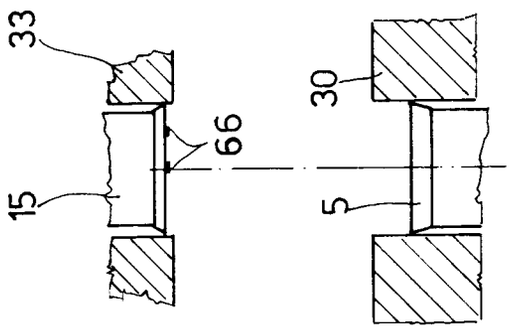


FIG.14

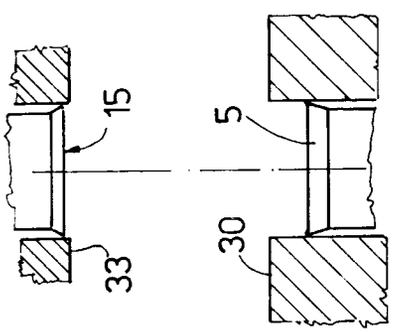


FIG.13

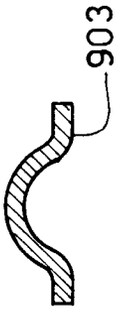


FIG.20

FIG.19

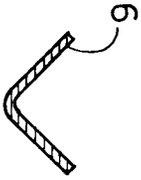


FIG.18

FIG.17

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 93 20 1036

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.5)
A	EP-A-0 414 149 (INAX CORPORATION) * the whole document *	1,15,17, 19,21,22	B28B13/02 B28B3/02 B28B23/00
A	DE-A-2 513 072 (LONGINOTTI S.P.A.) * the whole document *	1,15,19, 21,22	
A	DE-A-3 133 663 (BUCHER-GUYER AG MASCHINENFABRIK) * the whole document *	1,15, 17-19	
A	EP-A-0 444 730 (L.B. OFFICINE MECCANICHE S.P.A.) * the whole document *	1,15,19, 21,22	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

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	20 JULY 1993	GOURIER P.A.

CATEGORY OF CITED DOCUMENTS

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Y : particularly relevant if combined with another document of the same category
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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