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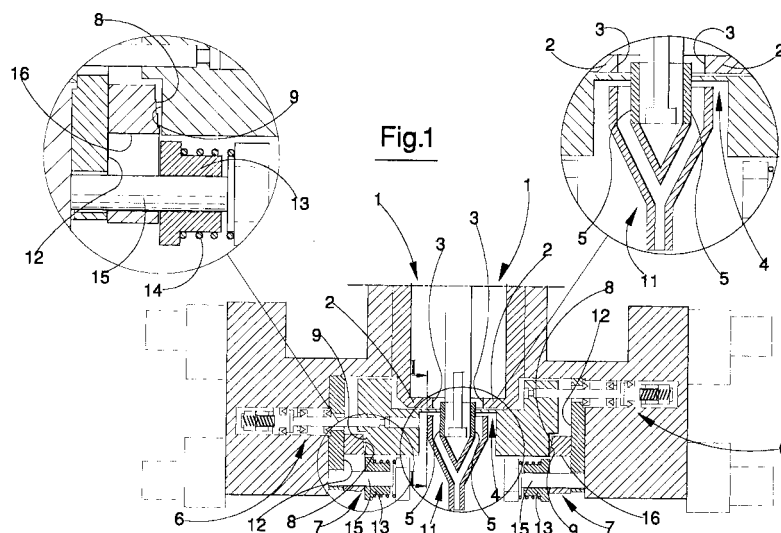
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(54) **An apparatus for distributing batched quantities of powder or granular materials on surfaces**

(57) The apparatus of the invention distributes batched quantities of granular or powder material on surfaces, and comprises a hopper (1) having a bottom (2) which affords at least one plurality of openings (3) for releasing the powder, each of the openings (3) being associated to an obturator. The obturator comprises a stopper (4) having a U-shaped transversal section

which acts tangentially in proximity of a portion of surface of the bottom (2) affording the opening (3). The stopper (4) inserts, by means of upwardly-projecting ribs (40) at ends thereof, into hollow seatings (30) afforded in the bottom (2), and thus closes and frontally seals against a sealing surface (5) arranged laterally to the opening (3). Upper edges of the ribs (40) are located higher than the openings (3).



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Description

[0001] The invention is particularly useful for the application of "dry" ceramic materials in granular or powder form, such as for example glazes, on the surfaces of other ceramic materials used in the manufacture of ceramic tiles, with the aim of realising, through an appropriate program-controlled distribution of the powders, a design giving rise to a decoration.

[0002] A preferred application of the invention is to achieve a controlled distribution of dry glaze on the material destined to form tiles, which application is done directly in the die used for pressing. The special structure of the invention means that it can be inserted between the lower and the upper part of the die, guided by a horizontally-slidable truck.

[0003] The invention can also be inserted statically in a usual production line, along which the material to be decorated with dry glaze is transferred.

[0004] The depositing of dry glaze on the top side of the tile in order to produce special effects (veining, spotting, nuances etc.) can at present be achieved either in the press during the tile-forming phase or on the production line.

[0005] There are two popular techniques used for the above process, each used according to the type of product to be obtained.

[0006] The desired design can be made by distributing the dry and coloured materials over the whole tile width, so that subsequently, during the polishing and/or after the laying phases, it can be sanded to eliminate imperfections or signs of wear. This method is typical in the production and application of vitrified stoneware. The full-breadth product is of high quality and is expensive.

[0007] To avoid the use of such high-quality but expensive material, for a vast range of products a production technique which is being increasingly used involves loading a die in layers, where a first load contains materials of not particularly high aesthetic quality (and therefore cheap), and a second load contains better-quality materials (always in powder form).

[0008] Both of the above methods share two main characteristics.

[0009] The first of these consists in making identical decorations, or partially varied though in the nature of variations on a principal theme (e.g. veining, colours arranged in spots, all done with a certain regularity, mixed colours following a cyclical logic). This leads to a product which contains relatively casual combinations on the various individual tiles, conferring thus a decorative result which is predictable only in its most typical and essential elements.

[0010] The second of the shared characteristics consists in obtaining the decorations by using apparatus having the common characteristic of having to be replaced either totally or in part when the decoration or tile format is to be changed.

[0011] These substitutions or modifications, with a consequent need for laborious adjustments lead to relatively long halts in the pressing activities, with obvious negative repercussions on productivity.

[0012] Another production method exists in which the tiles formed at the press have already been glazed, a single-colour undercoat, and are then decorated on the production line with a dry glaze, using silk-screens or shaped templates if an identical pattern is to be made on each tile, or by specially-made machines which distribute the glaze, usually decorating fairly irregularly with vein patterns.

[0013] Whether concerning silk screens or templates, or special glaze distributors, however, whenever production changes there has to be a regulation or indeed a replacement of the apparatus used. It follows that there is an inevitable halt in production for all the time necessary for resetting and/or substituting and resetting.

[0014] It is thus not possible, in prior-art applications, to proceed in real-time, to changing a decoration without resorting to time-consuming halts in production. The main aim of the present invention is to obviate the limitations and drawbacks in the prior art by providing an apparatus which can carry out in-line decorations while being able to change decoration at each decoration cycle. Another aim of the invention is to enable any desired distribution of dry glaze to be made on the single tiles, completely independently of each other, so as to obtain designs or decorations which are different and various without any need for substituting the special apparatus needed for producing the designs.

[0015] A further aim of the invention is to enable a dripping or mottling of batched and differentiated quantities of powders.

[0016] A still further aim is to enable, for each "drip", a depositing of a batched quantity of a mixture of two powders (i.e. colours) in which the composition is predetermined.

[0017] The invention has the advantage of being simple to construct and functional.

[0018] A further advantage of the invention consists in its limited mass, which enables it to be inserted between the bottom and top dies of the mould. It is guided by a horizontally-movable truck.

[0019] A still further advantage of the invention is that it can operate with more than one colour.

[0020] These aims and advantages and others besides are all attained by the invention as it is characterised in the appended claims.

[0021] Further characteristics and advantages of the present invention will better emerge from the detailed description that follows of a preferred but non-exclusive embodiment of the invention, illustrated purely by way of nonlimiting examples in the accompanying figures of the drawings, in which:

figure 1 is a schematic transversal section made ac-

cording to a vertical plane;
 figure 2 is part of a schematic view from below of figure 1, in which some parts have been removed better to evidence others;
 figure 3 is a schematic lateral view of figure 1;
 figure 4 is an enlarged-scale view of a part of a section made according to line I-I in figure 1;
 figure 5 is a schematic lateral view in vertical elevation of the application of the invention to a press equipped with a tile-forming die.

[0022] With reference to the figures of the drawings, 1 denotes in its entirety a hopper having a bottom 2.

[0023] The bottom 2 affords openings 3 which, in the illustrated embodiment, are constituted by round holes.

[0024] The openings 3 are identical and are arranged parallel and side-by-side in two rows, where each row comprises a plurality of identical and aligned equidistant openings 3.

[0025] In a simpler embodiment, not illustrated, one line alone of openings 3 could be afforded, still identical and equi-distantly arranged.

[0026] In the illustrated embodiment the two pluralities of openings 3 arranged parallel and side-by-side in two rows are located perfectly symmetrically with respect to the median line of the two rows, and belong to two different hoppers 1.

[0027] An obturator acts independently on each of the openings 3. The obturator comprises a stopper 4, having a U-shaped transversal section, which is predisposed to act tangentially in proximity of the portion of surface of the bottom 2 which affords the relative opening 3, so that the upwardly-projecting ribs 40 can insert in the hollow seatings 30 afforded in the bottom 2, thus effectively closing and frontally sealing on a sealing surface 5 arranged laterally to the opening 3.

[0028] The top ends of the upwardly-projecting ribs 40 are located higher than the corresponding openings 3. This prevents the powder supplied by the opening 3 from exiting laterally.

[0029] The U-shaped frontal section of the stopper 4, destined to contact with the surface 5 to effect the seal, is very thin and is characterised by a very small contact surface which helps to prevent an undesired loss of powders as well, in general, as other defects of closure due to an accumulation of powders between the front of the stopper 4 and the corresponding sealing surface 5.

[0030] The frontal closure also guarantees: long working life for the various components due to the fact that there is no dragging between working parts; wide passage sections for the powders, with limited runs for all the parts involved in the aperture manoeuvres, which results in high operative frequency; a uniform fall of the powders over the whole breadth of the stopper 4.

[0031] Each U-shaped stopper 4 is operated by a linear actuator constituted by a cylinder 6, a run of which can be regulated so as to enable regulation of the aperture of the stopper 4.

[0032] An endrun stop 7 is provided for the above purpose, which can be displaced and positioned, on command, on a perpendicular plane to the direction of action of each cylinder 6 and parallel to the sealing surface 5.

[0033] The endrun stop 7 exhibits a face which is composed of little steps 8, each of which is predisposed to interact with a corresponding stop surface 9 provided on each stopper 4. This stop surface 9 blocks the aperture run of the stopper 4. In the illustrated embodiment a plurality of stoppers 4 operate on each of the two rows of openings 3; the stoppers 4 are identical and are predisposed so that in the position of closure, their frontal parts achieve the respective closure by effecting a frontal seal on the corresponding sealing surfaces 5 arranged laterally. The stoppers 4 operating on one row are opposite to those operating on the other row.

[0034] Regulation of the run of the cylinders 6 is done in the same way for all of the cylinders 6 of each row of openings 3. For each row of apertures there is a single endrun stop 7, i.e. a horizontal bar parallel to the openings 3 and being displaceable and positionable on command on a plane 12 which is perpendicular to the direction of action of the cylinders 6 and parallel to the corresponding sealing surface 5. The endrun stop 7, i.e. the horizontal bar, is commanded by actuators 10 to assume the predetermined vertical position, at which the single step 8 interacts with the corresponding stop surface 9 of the stoppers 4.

[0035] Contact is guaranteed by the presence of a plurality of bushes 13 pushed by springs 14 against the endrun stop 7. The bushes 13 are axially slidable along headed pivots 15 fixed to the plane 12 and are freely housed internally of slots 16.

[0036] Deposit of the powders released by the openings 3 is not done directly, but rather by means of a small symmetrical hopper 11 which is predisposed below the openings 3 so as to collect and convey the powder or granular material released by the openings 3 to guide the dispensing thereof from a symmetrically-arranged opening with respect to the two pluralities of openings 3.

[0037] The use of the hopper 11 not only means that the exact position of release of the powders for all the pairs of symmetrically-facing openings 3 can be spatially determined, but also enables (for each release cycle) the two powders stored in the two symmetrically side-by-side hoppers to be mixed. The composition of the mixture is easily obtained by batching the quantities released by each of the two symmetrically-facing openings 3.

[0038] The openings 3 being both small and closely-aligned, the cylinders 6 for moving the stoppers 4 of each of the plurality of openings 3 associated to a single hopper 1 are arranged on at least two parallel rows, one row located above the other, so that the axis of each cylinder 6 in the higher row is contained in the vertical median plane halfway between the axes of two contiguous cylinders 6 located in the lower row.

[0039] From the constructional point of view, the cyl-

inders 6 are afforded in equal assemblable blocks. Each block 17 is constituted by two parallel rows each of which is composed of a same number of cylinders 6 in which the surfaces laterally delimiting the blocks coincide with the vertical halfway planes of two contiguous cylinders 6.

[0040] The above-described blocked modular structure makes construction and assembly of the whole apparatus extremely simple. Furthermore, the modular nature of the blocks means that hoppers of any length can be made, in accordance with the tile formats under production.

[0041] Management of each single stopper 4 is electronically controlled by means of a system receiving a start-cycle signal after a prefixed displacement of the hopper with respect to the tile (on which the powders are to be deposited in a predetermined pattern).

[0042] The signal starts the cycle, which then commands each single stopper 4 independently according to a prefixed program determined by a "point-by-point" reconstruction of the pattern to be produced. Obviously, the "points" are batched quantities of powders deposited at distances one from another which correspond, in one direction, to the interaxis between the openings 3 of the single hopper 1, while in the other direction - i.e. the relative motion of the hopper with respect to the underlying tile - they correspond to the displacements which the whole hopper makes at each cycle.

[0043] The hopper - constituted by two hoppers 1 symmetrically placed side-by-side - carries out its function following a relative translation motion with respect to the surface on which the granular or powder material is to be deposited.

[0044] The distribution, specially designed to create a particular pattern or decoration, is controlled by a program which correlates the relative hopper-surface position with the aperture (followed by the release and therefore the deposit of the material) or the closure of the single opening 3.

[0045] The program generates a sort of virtual silk screen or matrix on a predetermined surface on which the design or pattern is to be produced by depositing (or not depositing) batched quantities of dry material (dry glaze in ceramic applications) at predetermined points.

[0046] When applying powder glaze on base material predisposed in a die for ceramic tiles, the apparatus of the invention can also be solidly associated to the loading truck which usually equips the press used for forming the tiles. The limited mass of the apparatus of the invention means that in order to carry out the operative cycle the run of the truck is subject to only a small increase with respect to the normal run, which increase corresponds to the transversal dimension of the hopper. This leads to a very small reduction in productivity with respect to the normal pressing cycle.

[0047] As depositing batched quantities of glaze in powder form is controlled by program, it is obviously possible to produce different patterns in rapid succes-

sion. In the illustrated embodiment, for example, different patterns can be reproduced on the tiles in two consecutive cycles of the press. In another situation, in which the fixed hopper operates on the tiles transiting beneath it, it will be possible to deposit two different patterns on two successive tiles on the line.

[0048] In any case the possibility of changing patterns in very quick time does not require modifications or substitutions of mechanical parts which would inevitably lead to loss of good production time.

[0049] Furthermore, given the special qualities of the invention, with which the release of a batched quantity of material can be controlled independently by each opening 3, the format of the tiles passing below can be matched immediately and automatically, with no need for mechanical operations or parts replacement.

Claims

1. An apparatus for distributing batched quantities of powder or granular materials on surfaces, comprising a hopper (1) inferiorly provided with a bottom (2) which affords at least one plurality of powder release openings (3), each of which openings (3) is independently opened and closed by an obturator, characterised in that the obturator comprises a stopper (4) having a U-shaped transversal section, which stopper (4) operates tangentially in proximity of a portion of surface of the bottom (2) containing an opening of the plurality of openings (3); the stopper (4) having upwardly-projecting ribs (40) at ends thereof which insert internally of hollow seatings (30) afforded in the bottom (2), realising a closure and a frontal seal on a sealing surface (5) arranged laterally of the opening (3); upper edges of the upwardly-projecting ribs (40) being located higher than the opening (3).
2. The apparatus of claim 1, characterised in that the U-shaped transversal section of the stopper (4), which transversal section is destined to contact the sealing surface (5) to achieve the seal, is very thin and has a very small contact surface.
3. The apparatus of claim 2, characterised in that each stopper (4) with U-shaped transversal section is activated by a linear actuator constituted by a cylinder (6); means being provided for regulating a run of the stopper (4), in which run the stopper (4) opens the opening.
4. The apparatus of claim 3, characterised in that the means for regulating the run of the stopper (4) comprise an endrun stop (7) which can be displaced and positioned on command on a plane which is perpendicular to a direction of action of the cylinder (6) and parallel to the sealing surface (5); the endrun

stop (7) exhibiting a face which is composed of steps (8), each of which steps (8) interacts with a corresponding stop surface (9) provided on the stopper (4) to function as an endrun stop for the run of the stopper (4).

5. The apparatus of claim 4, characterised in that it comprises a plurality of openings (3) which are identical, aligned and located at constant intervals.

6. The apparatus of claim 4, characterised in that it comprises two pluralities of openings (3) arranged parallel and side-by-side in two rows; each of the rows comprising a plurality of openings (3) which are identical and aligned and located at constant intervals; a plurality of stoppers (4) operating on the openings (3); the stoppers (4) being identical and arranged so that in a closure position of the openings (3), front parts of the stoppers (4) achieve the closure position by creating a frontal seal on corresponding sealing surfaces (5) arranged laterally; stoppers (4) operating on a row being located opposite to stoppers (4) operating on another row.

7. The apparatus of claim 6, characterised in that the two pluralities of openings (3) arranged parallel and side-by-side in two rows are located perfectly symmetrically with respect to the median line of the two rows; the two pluralities of openings (3) being arranged parallel and side-by-side in order to form two rows served by two different hoppers (1).

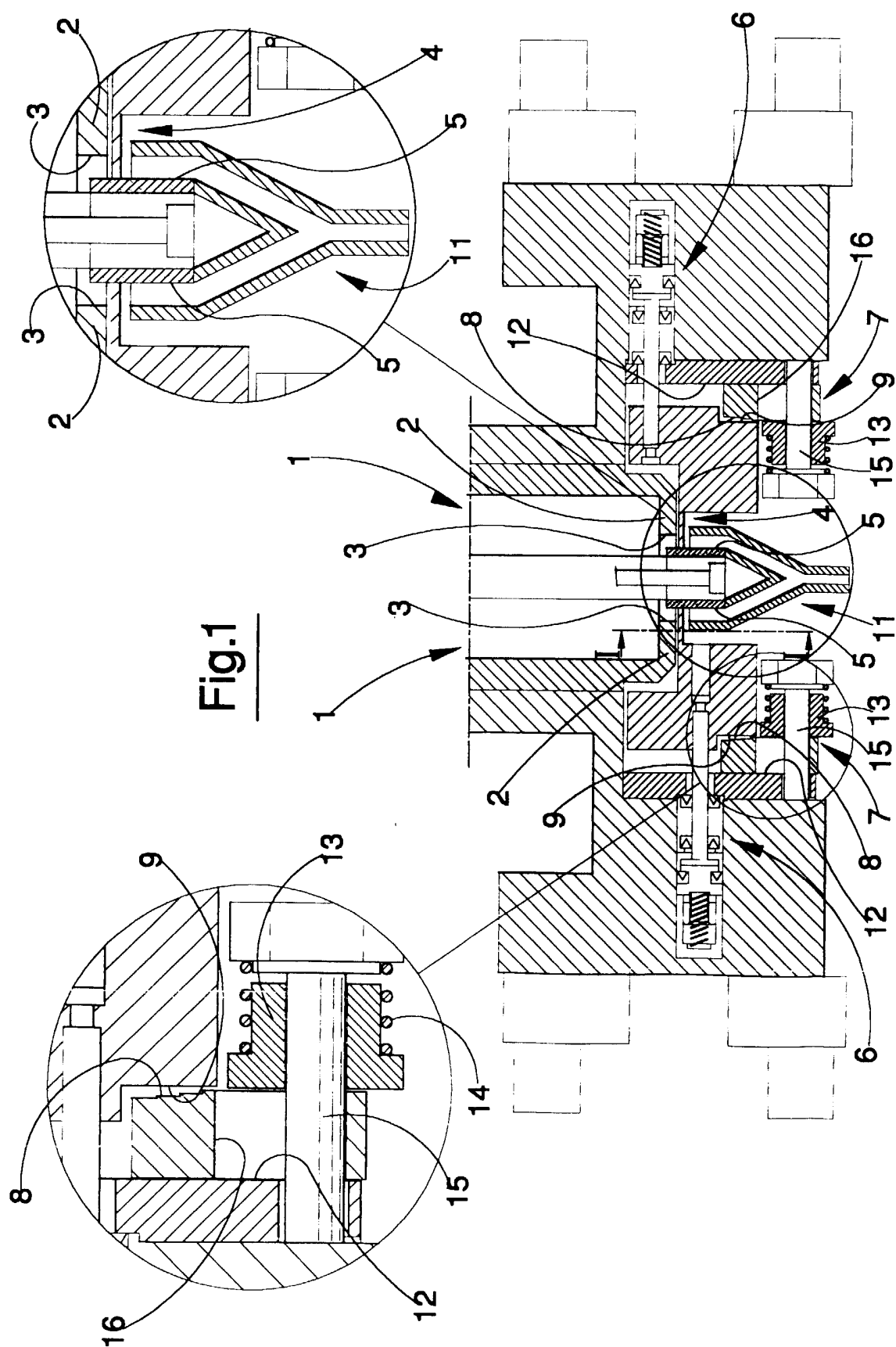
8. The apparatus of claim 6 or 7, characterised in that for each row of openings (3) there is a single endrun stop (7) which is a horizontal bar situated parallel to the openings (3) and able on command to be displaced and positioned on a perpendicular plane to a direction of action of the cylinders (6) and parallel to a corresponding sealing surface (5); the endrun stop (7) being commanded by actuators (10) to assume a predetermined vertical position at which an interaction of a single step (8) can occur with a corresponding stop surface (9) on a stopper (4).

9. The apparatus of claim 8, characterised in that it comprises a small symmetrical hopper (11) predisposed inferiorly of the openings (3) in order to collect and convey the granular or powder material released from the openings (3) and conduct the powder material into an outlet which is arranged symmetrically with respect to the two pluralities of openings (3).

10. The apparatus of claim 9, characterised in that the cylinders (6) for moving the stoppers (4) of each plurality of openings (3) are arranged on at least two parallel rows, one row being situated at a higher level than another so that an axis of a single cylinder

(6) of an upper row thereof is contained in a median vertical plane halfway between two contiguous and aligned cylinders (6) of the lower row thereof.

11. The apparatus of claim 10, characterised in that the cylinders (6) are made in equal blocks which can be added together to make bigger blocks; each block being composed of two parallel rows, one situated above another, each of which is composed of a same number of cylinders (6); lateral surfaces of the blocks coinciding with the median vertical plane.



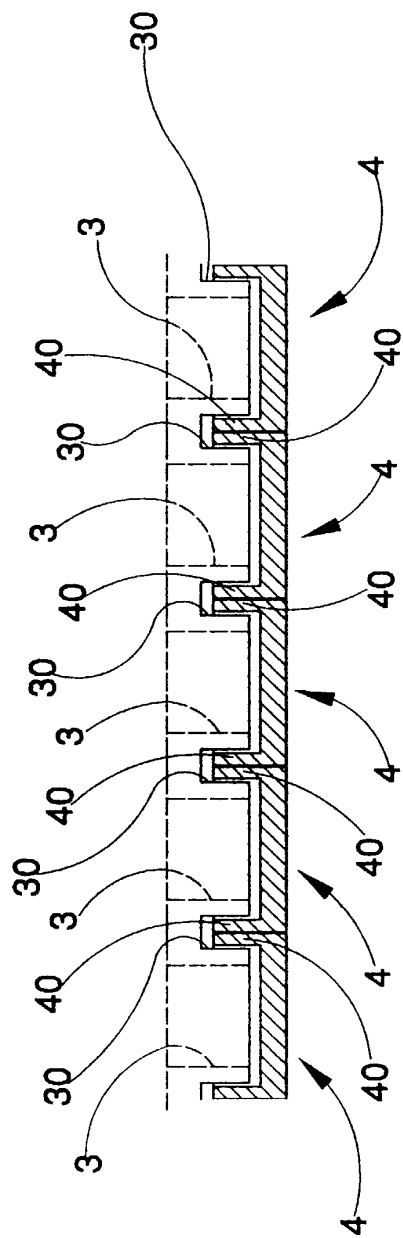


Fig. 4

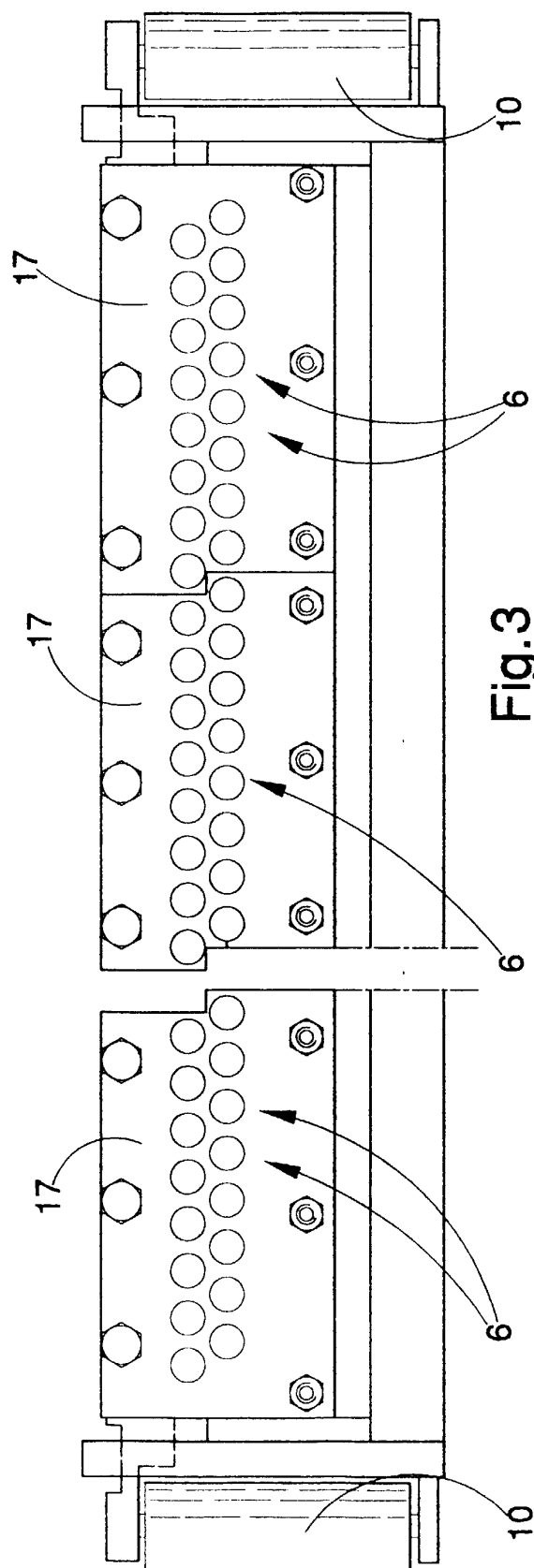


Fig. 3

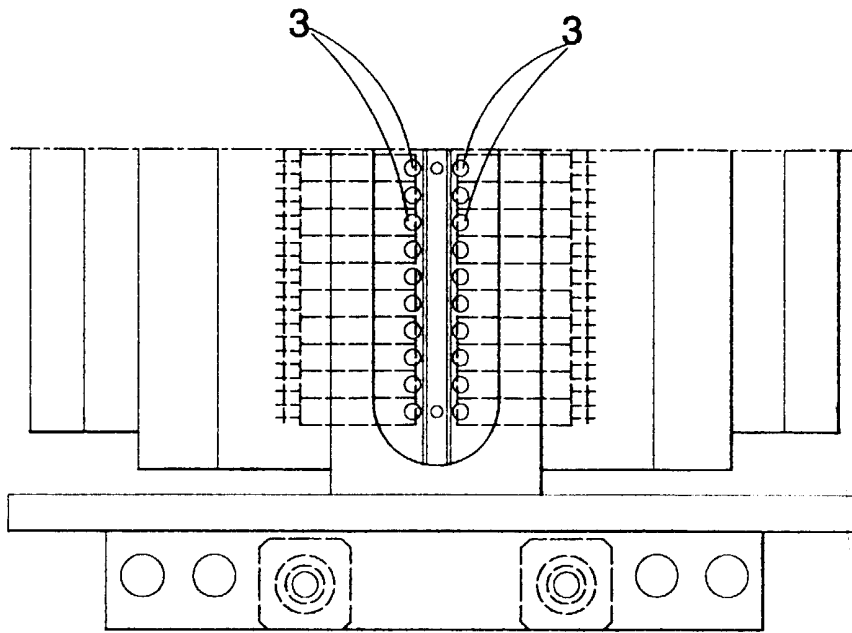


Fig. 2

Fig. 5

