



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
02.05.2002 Bulletin 2002/18

(51) Int Cl.7: **B28B 11/04**, B28B 17/00,
B05C 5/00, B05C 11/10

(21) Application number: **01830635.7**

(22) Date of filing: **08.10.2001**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE TR**
Designated Extension States:
AL LT LV MK RO SI

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(30) Priority: **17.10.2000 IT MO000227**

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(54) **A machine for decorating ceramic tiles**

(57) The plant for decorating ceramic tiles comprises a distributor (3) of glaze from which a thin continuous vertical shower of glaze descends, which deposits on the upper surfaces of tiles transiting beneath the distributor (3). A main pipe (6) carrying neutral-coloured glaze terminates at an inlet of the distributor (3). Various supply pipes (8) of coloured glazes, connected to tanks (7),

terminate at the main pipe (6). An injector (10), located internally of the distributor (3), is connected to supply pipes (9) of coloured glaze and exhibits a plurality of outlets for coloured glazes located superiorly to the outlet of the distributor (3). The decoration on the tiles is incorporated into a base layer of glaze formed on the tile upper surfaces.

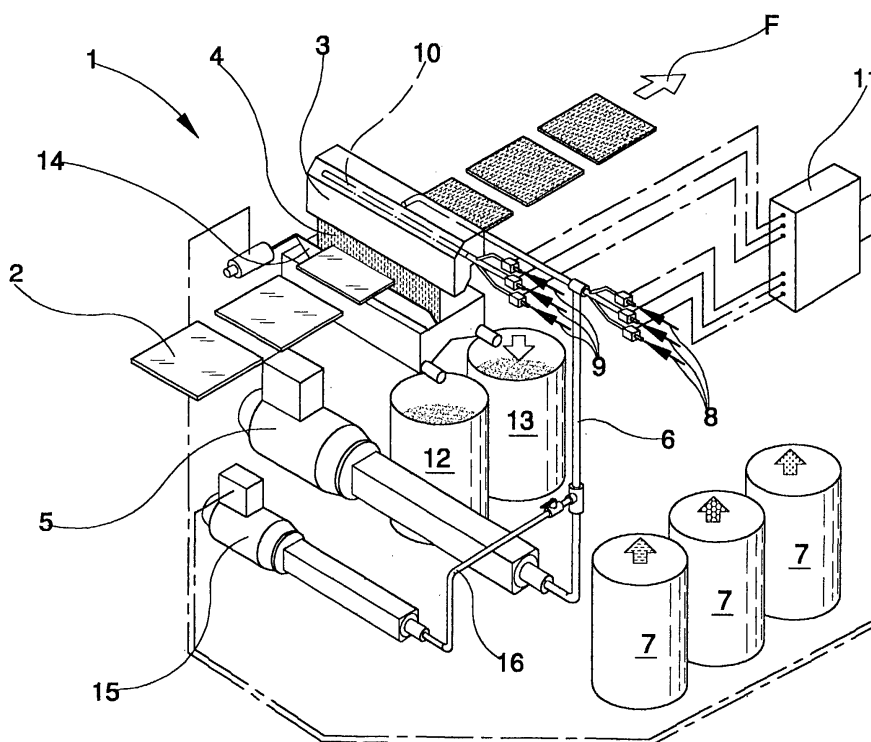


Fig.1

Description**Description.**

[0001] The invention makes particular reference to a plant made according to what is set out in accompanying claim 1.

[0002] A machine of this type is already known from Italian patent application no. MO98A000142, which describes a shower-type machine that distributes a continuous and uniform layer of neutral-coloured glaze over whole upper surfaces of ceramic tiles.

[0003] In prior-art plants, the neutral-coloured glaze forms the base for a subsequent decoration made using decorating machines positioned downstream of the shower machine.

[0004] In the known plant the decorations are formed by one or more extremely thin layers deposited on top of a uniform base layer of a neutral glaze. The coloured layers, due to their extreme slimness, are subject to rapid aesthetic deterioration as a result of abrasion.

[0005] This plant is also relatively complicated due to the presence of at least two machines arranged one after another, i.e. a shower machine for distributing the base coat of neutral glaze and at least one decorating machine for distributing an upper layer of coloured glaze.

[0006] The main aim of the present invention is to provide a plane and a process for decorating, which obviates the limitations and drawbacks of the above-mentioned prior art.

[0007] Thanks to the present invention the coloured glaze or glazes which form the decoration can be incorporated deeply and internally of the base layer formed by the neutral glaze. In this way the decoration of the ceramic tiles exhibits a relatively high thickness, making it considerably resistant and long-lasting, and which even makes it suitable for subsequent sanding operations.

[0008] An advantage of the invention is to make decorations which cannot be achieved with known systems, i.e. which are distinguished by their graphic definition, distribution and tone modulation.

[0009] A further advantage is to make available a constructionally simple plant in which the neutral base layer and the coloured decorative glazes can be laid by the same machine.

[0010] A still further advantage is to enable glazing and decorating of special three-dimensional workpieces, in perfect coordination with the decoration of the corresponding flat tiles.

[0011] The technical characteristics of the present invention, according to the above-mentioned aims and advantages, result clearly from the accompanying claims. Further 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 non-limiting exam-

ple in the accompanying figures of the drawings, in which:

figure 1 is a diagram of a plant made according to the invention;

figure 2 is an enlarged-scale view of a schematic transversal section of the shower machine 3 which equips the invention;

figure 3 is a schematic perspective view of the main component parts of the shower machine 3.

[0012] With reference to the figures of the drawings, 1 denotes in its entirety a plant for decorating ceramic tiles 2 comprising a horizontal conveyor plane along which the tiles 2 advance in an ordered consecutive line, in an advancement direction F.

[0013] The plant 1 comprises a distributor 3 of a shower 4 of glaze, predisposed above the conveyor plane, for distributing the glaze on transiting tiles 2. The distributor 3 comprises all the characteristics of the machine described in Italian patent no. MO98A000142; those characteristics are to be considered as incorporated into the present description.

[0014] The distributor 3 is provided with a distribution chamber 30 which is supplied both with the neutral glaze and with the coloured glazes destined to form the decoration on the tiles 20.

[0015] 5 denotes a first positive displacement pump predisposed to supply neutral glaze to the distribution chamber 30. 6 denotes a pipe supplying the neutral glaze, which the above-mentioned pump 5 serves and which pipe 6 terminates in the distribution chamber 30.

[0016] The distribution chamber 30 has a downwards-facing outlet, narrow and elongate in a transversal direction to the advancement direction of the tiles 2. The outlet is predisposed such that the glaze exits in a continuous vertical thin shower 4 which is deposited on the upper surfaces of the tiles 2 as they pass underneath on the conveyor. Both the breadth and the length of the outlet can be adjusted so as to regulate the quantity of glaze to be applied on the tiles 2 and thus minimise the quantity of excess glaze delivered, i.e. which does not fall onto the tiles 2 and which must therefore be recuperated.

[0017] Under normal working conditions the tiles are constantly supplied to the distributor, at a minimum and uniform reciprocal distance, with the aim of reducing to a minimum the quantity of mixed glaze to be recuperated.

[0018] The plant comprises a plurality of coloured glaze tanks 7, each of which is connected to at least one inlet of the distribution chamber 30. In the illustrated embodiment there are three tanks 7, but the number of the tanks i.e. of the coloured glazes to be used can be varied.

[0019] Each tank 7 is associated to means for supplying the coloured glazes to the distribution chamber 30. In the particular case, for each tank 7 two supply pipes

8 and 9 for colours are predisposed, one of which, denoted by 8 in the figures, terminates in the supply pipe 6 of the neutral glaze, and injects the coloured glaze into the flow of neutral coloured glaze just before the inlet of the distribution chamber 30. The other supply pipe 9 carries the coloured glaze to an injector 10 which injects the various coloured glazes internally of the distribution chamber 30. The injector 10 has a plurality of outlets for the coloured glazes located internally of the distribution chamber 30 and above the outlet thereof. The injector 10 comprises a tube, parallel to the outlet of the distribution chamber 30 and having an end which is external to the distribution chamber 30, where the supply pipe 9 (or numerous supply pipes) of the coloured glaze terminate. The outlets are distributed along the tube, and are constituted by holes arranged in a line which is parallel to the outlet of the distribution chamber 30.

[0020] Each supply pipe 8 and 9 for the coloured glazes is provided with an intercept valve (illustrated but not numbered so that the figure is better visible) connected to a central command and control unit 11 for commanding the coordinated opening and closure of the various valves in predefined sequences. In particular the central unit 11 commands the injection and intermittent delivery of controlled quantities of coloured glazes to within the mass of neutral glaze.

[0021] Two techniques can be used to inject the coloured glazes into the mass of neutral glaze: it can be injected directly into the distribution chamber, in proximity of the outlet of the chamber 30, by means of the injector 10; or it can be injected into the pipe 6 carrying the neutral glaze immediately upstream of the distribution chamber 30. The two techniques can be used singly, i.e. one without the other, or can be used in combination. In each case injection of the coloured glazes into the mass of neutral glaze forms coloured lines or strands which, though remaining partly separate, tend to diffuse into the neutral glaze. This, together with the lamination associated with the formation of the shower 4, gives rise to veins, streaks or spots on the tiles, with varying tones and hues. The plant 1 comprises two distinct tanks 12 and 13 for recuperating the excess glaze exiting from the distribution chamber 30 but not settling on the tiles. A first tank 12 collects only the neutral glaze while a second tank 13 collects the neutral glaze mixed with coloured glazes. A shunt 14, commanded by the central unit 11, is predisposed between the conveyor plane of the tiles 2 and the collection tanks 12 and 13 to take the excess glaze selectively towards one or the other of the two tanks 12 and 13.

[0022] The second tank 13 is associated with a second positive displacement pump 15, commanded by the central unit 11, to send the mixed glaze towards the main pipe 6 supplying the neutral glaze, through a return pipe 16, so that the excess mixed glaze (neutral and coloured glazes together) is mixed with "fresh" neutral glaze and redirected to the distribution chamber 30. The second positive displacement pump 15 is connected to means

for self-regulating (of known type and not illustrated) which maintains a constant level in the tank 13 of the mix of neutral and coloured glazes.

[0023] The distributor 3 internally affords the distribution chamber 30, which is substantially delimited by a fixed part 31 and a mobile part 32. The central zone of the fixed part 31 exhibits a supply mouth 60 which is in fact the discharge end of the pipe 6 situated downstream of the pipe 8 couplings. Spinners are located near to the supply mouth 60 to create turbulent motion in the jet exiting the supply mouth 60, with the aim of creating movement in the fluid fillets and imparting a special pattern of the coloured strands in the shower 4 (with ensuing special aesthetic effects in the coat of glaze deposited on the tiles 2).

[0024] The arrangement of the fluid strands, and the consequent aesthetic effect depend on the conformation of the spinner, which could be made of first elements 33 and second elements 34 applied; the first elements 33 on the internal wall of the mobile part 32, in front of the mouth 60, and the second elements 34 on the internal wall of the fixed part 31 close to the mouth 60.

[0025] The elements 33 and 34 can be of very different conformations and are preferably made of a plastic material or rubber; preferably they are fixed to the relative walls by gluing.

[0026] There follows a description of how the plant operates.

[0027] Initially the distributor 3 of the glaze is started up by regulating the breadth and length of the outlet of the distribution chamber 30 according to the operative mode required (for example, the thickness of glaze needed, the width of the tiles to be decorated etc.)

[0028] Also, for each coloured glaze a cyclic sequence is programmed of open/close phases of the intercept valves regulating injection of glaze, to obtain the aesthetic effect desired.

[0029] The neutral and coloured glazes are thus sent in circulation around the plant, initially without activating the tile conveyor plane, with the shunt 14 directing the whole flow of glaze coming out of the distribution chamber 30 towards the second tank 13, which collects the mix of neutral and coloured glazes in the exact ratios of neutral-to-coloured which will be cyclically maintained during the whole operation.

[0030] When the second tank 13 reaches a predetermined level, the conveyor plane is activated to advance the tiles 2. The self-regulator of the pump 15 associated to the second tank 13 transfers the mixed glaze towards the neutral glaze supply pipe 6 at a determined flow-rate, so as to maintain the level in the second tank 13 at a constant level.

[0031] After a short transitory period the quantity of mixed glaze sent into circulation and added to the "fresh neutral" glaze is equal to the quantity of excess mixed glaze which is collected in the second tank 13, so that the base glaze (to which the various coloured glazes are added and which is constituted mainly by "fresh" neutral

glaze and a relatively small percentage of mixed glaze) has a uniform tone.

[0032] When the line of tiles 2 for some reason ceases (a sensor, such as a photo sensor, can be used to indicate an interruption in the line of advancing tiles), the central unit 11 automatically suspends supply of coloured glazes and activates the shunt 14 so that the glaze discharging from the distribution chamber 30 is conveyed towards the first tank 12 of the neutral glaze; the supply of neutral glaze is continued so as to maintain the shower outflow of glaze from the distribution chamber, a recycling device (not illustrated) is activated to keep the mixed glaze circulating so that the supply pump 15 of the mixed glaze is kept at operating level.

[0033] When the tile line restarts the central unit 11 reactivates the supply of coloured glazes from the point at which it was stopped, resets the shunt 14 so that the recuperated glaze is conveyed towards the second tank 13 with the mixed glaze, turns the recycling device from the active setting, in which the mixed glaze is recycled by the supply pump 15, into an inactive configuration, in which the supply pump 15 injects the mixed glaze into the flow of neutral glaze.

[0034] The application of the first and second elements 33 and 34 internally of the distribution chamber 30 enables various aesthetic effects to be achieved with the injection of coloured glazes into the neutral glaze.

[0035] It has been seen that the ceramic tiles obtained using the above-described plant exhibit a pleasant colour effect, of the "veined" type, in imitation of natural stone; this is not achievable with other decorative techniques.

[0036] The plant combines in one apparatus both the glazing and the decorating functions, with a consequent reduction in costs. Furthermore, the decoration is advantageously distributed over the whole width of the glaze distributed on the tiles.

Claims

1. A plant for decorating ceramic tiles, comprising:

at least one horizontal conveyor line, along which tiles (2) advance one behind another according to an advancement direction (F);
at least one distributor (3) of a shower (4) of glaze, predisposed above the conveyor line, for distributing the glaze on the transiting tiles (2), provided with a distribution chamber (30) with at least one inlet for the glaze and at least one outlet, facing downwards, narrow and elongate according to a transversal direction to the advancement direction (F) of the tiles; a continuous vertical thin shower (4) of glaze exiting from the outlet and falling onto an upper surface of the transiting tiles on the conveyor line;

characterised in that it comprises a plurality of tanks (7) of coloured glazes, each of which is connected to the inlet of the distribution chamber (30), and supply pipes (8, 9) for supplying coloured glazes to the distribution chamber.

2. The plant of claim 1, **characterised in that** it comprises a main pipe (6) for supplying neutral glaze which terminates at an inlet of the distribution chamber (30), and a plurality of the supply pipes (8) of the coloured glazes, at least one of which supply pipes (8) for each tank, which supply pipes (8) terminate in the main pipe (6).

3. The plant of claims 1 or 2, **characterised in that** it comprises at least two tanks (2, 13) for recuperating excess glaze which exits from the distribution chamber (30) and which does not deposit on the tiles (2), and at least one shunt (14) for directing the excess glaze selectively towards one of the at least two tanks (12, 13).

4. The plant of any one of the preceding claims, **characterised in that** it comprises an injector (10) located internally of the distribution chamber (30), which injector (10) has at least one inlet connected to the supply pipes (9) of the coloured glazes, and a plurality of outlets of the coloured glazes located superiorly to the outlet of the distribution chamber.

5. The plant of claim 4, **characterised in that** the outlets of the injector (10) are distributed in a line which is parallel to the outlet of the distribution chamber (30).

6. The plant of claims 4 or 5, **characterised in that** the injector (10) comprises a pipe having an end at which the supply pipes (9) of the coloured glazes terminate.

7. The plant of any one of the preceding claims, **characterised in that** the supply pipes (8, 9) of the coloured glaze comprise, for each coloured glaze, a valve for regulating a flow of the coloured glaze.

8. The plant of any one of the preceding claims, **characterised in that** the distribution chamber (30) exhibited internally of the distributor (3) is delimited by a fixed part (31) and a mobile part (32); a supply mouth (60) being located at a central zone of the fixed part (31), which supply mouth (60) is at a discharge end of the pipe (6) situated downstream of couplings of the supply pipes (8), in proximity of which supply mouth (60) a spinner is located, which spinner artificially creates a turbulent movement in a jet exiting from the supply mouth (60), imparting a special arrangement of the coloured and neutral glazes into the shower of glaze, so that a special

disposition of glazes falls onto the transiting tiles, leaving a particular pattern thereon.

9. The plant of any one of the preceding claims, **characterised in that** the spinner comprises first elements (33) and second elements (34) applied respectively the first elements (33) on an internal wall of the mobile part (32), in front of the supply mouth (60), and the second elements (34) on an internal wall of the fixed part (31), close to the supply mouth (60); the first elements (33) and the second elements (34) being preferably made of plastic or rubber and being fixed to the relative walls by glue. 5 10

10. A process for decorating ceramic tiles, in which neutral-coloured glaze is supplied to a distribution chamber (30) from which the glaze exits through a long and narrow lower outlet and forms a shower (4) of thin and vertical continuous glaze which falls onto ceramic tiles transiting there-beneath, 15 20
characterised in that the neutral-coloured glaze is mixed with one or more coloured glazes before the shower (4) is formed.

11. The process of claim 10, **characterised in that** one or more coloured glazes are intermittently injected into a mass of the neutral-coloured glaze. 25

12. The process of claim 10 or 11, **characterised in that** in a first phase of plant start-up the shower (4) of glaze is formed without causing the tiles (2) to pass there-beneath and the glaze is accumulated in a tank (13), and in a second phase the tiles are advanced and excess glaze which does not fall onto the transiting tiles is collected in the tank (13) and a predetermined quantity of glaze in the tank is mixed with neutral-coloured glaze supplied by the distribution chamber, the quantity of glaze being adjusted so as to be equal to the amount in excess which is collected in the tank (13). 30 35 40

13. The process of any one of claims from 10 to 12, **characterised in that** the coloured glazes are added to the flow of neutral-coloured glaze supplied to the distribution chamber (30) just before an inlet of the chamber (30). 45

14. The process of any one of claims from 10 to 13, **characterised in that** the coloured glazes are added to the neutral-coloured glaze internally of the distribution chamber. 50

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Fig.1

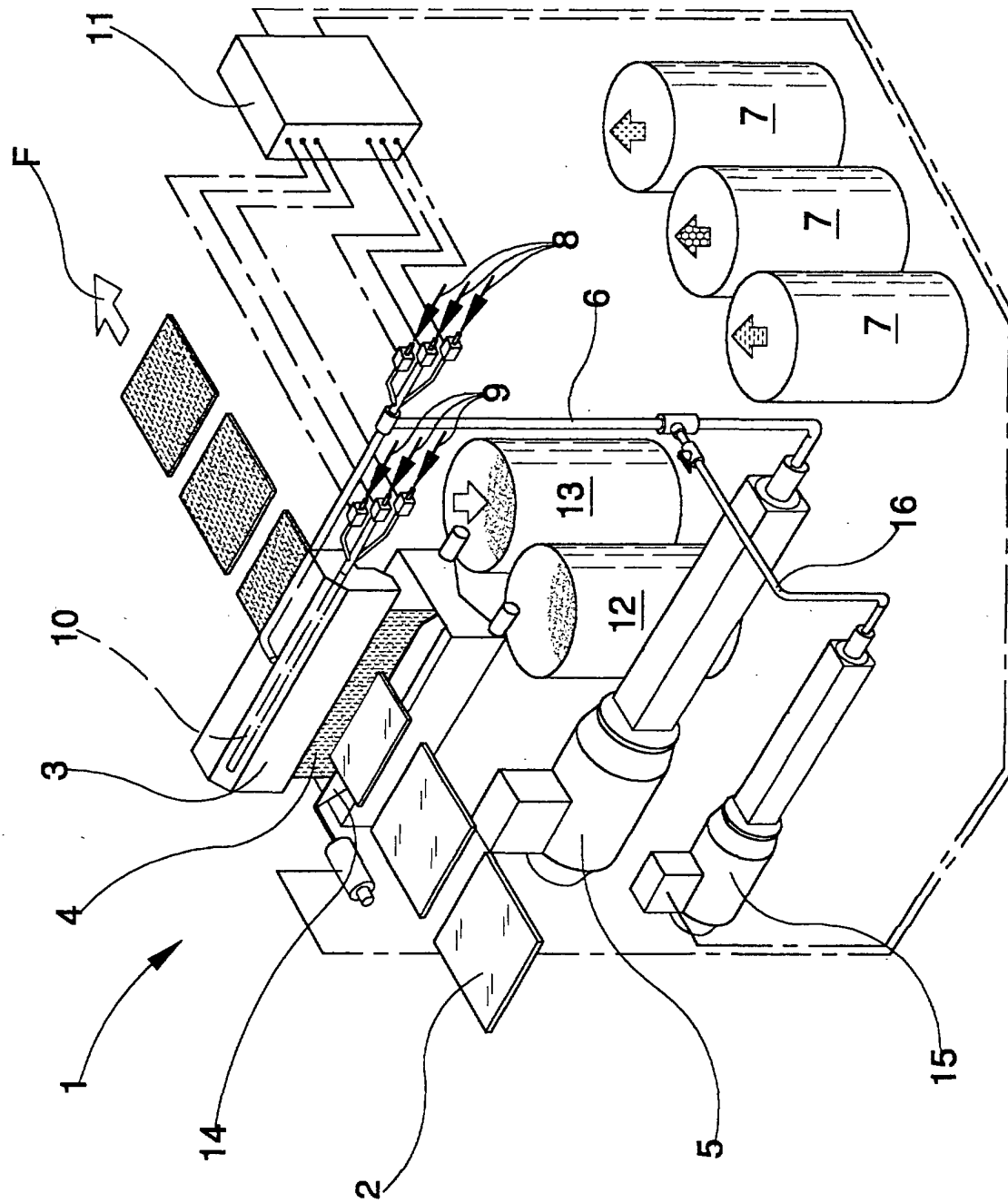


Fig. 2

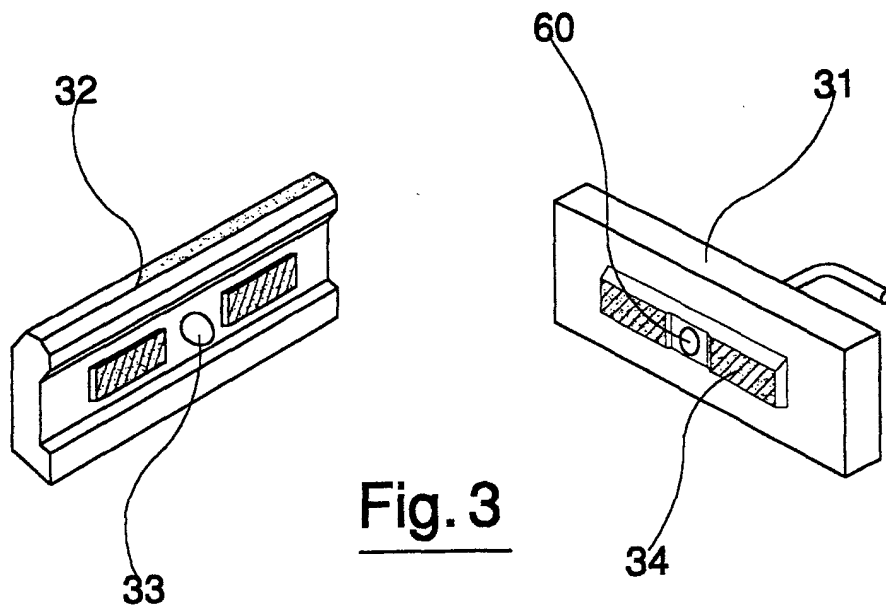
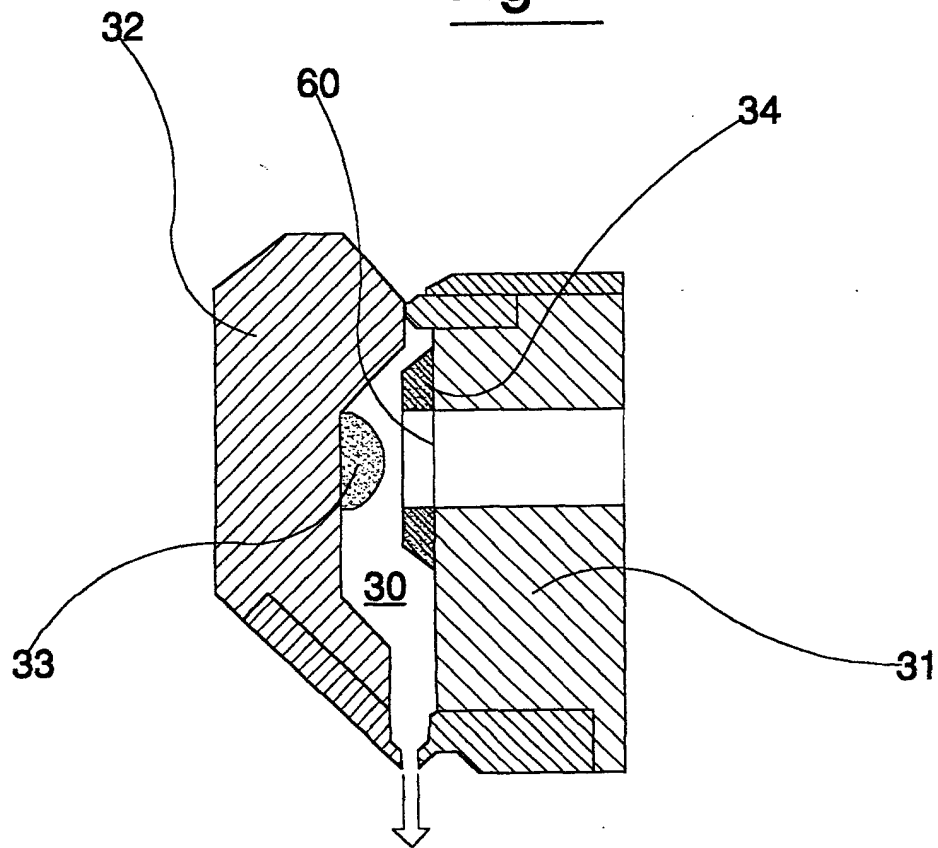


Fig. 3