

(19)



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(11)

EP 1 219 418 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

03.07.2002 Bulletin 2002/27

(51) Int Cl.7: **B41F 15/08**

(21) Application number: **01128482.5**

(22) Date of filing: **06.12.2001**

(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: **15.12.2000 IT MO000274**

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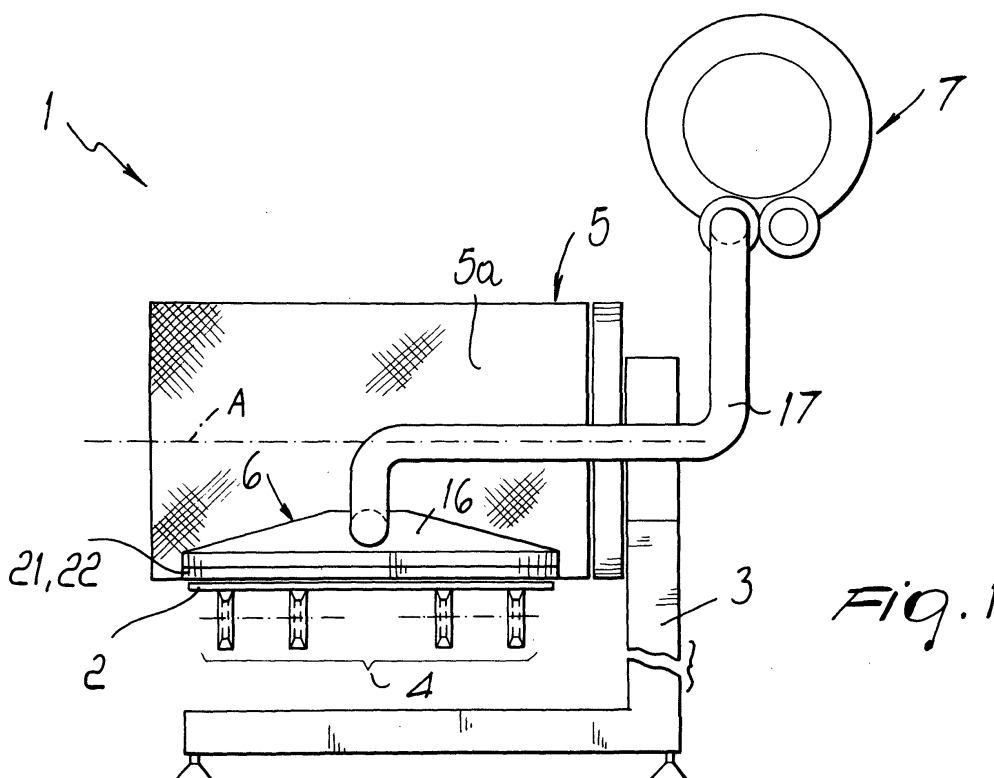
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(54) Machine for continuous surface decoration of products, particularly ceramic tiles

(57) A machine for the continuous surface decoration of products, particularly ceramic tiles, comprises a frame (3) that supports a substantially horizontal portion of a product conveyor (4), above the upper active portion of which a decorating drum (5) is mounted which has a horizontal axis (A) arranged transversely to the direction of advancement of the conveyor (4); the drum (5) is sup-

ported by the frame (3) in a slightly raised position, without contact with the surfaces of the products (2) to be decorated; the perimetric surface (5a) of the decorating drum (5) is perforated according to a design for the passage, from the inside outward, of glazes propelled by a stream of gaseous fluid ejected under pressure from the end portion (6) of a corresponding ejector (7) located inside the drum (5) at the decoration region.



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Description

[0001] The present invention relates to a machine for continuous surface decoration of products, particularly ceramic tiles.

[0002] So-called continuous decoration printing machines have long been known and are used mostly in the ceramics industry to apply decorations to the surfaces of ceramic tiles.

[0003] These machines substantially consist of a frame that supports a portion of tile conveyor, above which a decorating drum is mounted; such drum is rotatable about a horizontal axis and lies transversely to the advancement direction of the conveyor.

[0004] Such drum can be composed of printing screens which are pre-perforated according to the design or composed of a substantially rigid supporting cylindrical core covered, on its outer surface, by a layer of silicone material whose perimetric face is engraved by means of a laser beam so as to reproduce in bas-relief the design to be applied to the tiles.

[0005] Application occurs by moving the tiles in a row on the conveyor below the drum, arranged so that its outer surface rolls without slipping on the surfaces of the tiles, transferring onto them by rolling contact the designs, whether produced on printing screens or on silicone matrices.

[0006] Although these known machines provide a substantially satisfactory performance, they have drawbacks, including first of all the impossibility to decorate tiles whose surface is not flat but has raised and recessed regions.

[0007] A second drawback of these machines, especially for silicone-matrix ones, is that in order to provide the decorations it is necessary to have a very expensive laser-beam apparatus to engrave the various matrices according to the design.

[0008] A third drawback, linked to decoration printing machines that use pre-perforated printing screens, is that since in order to satisfactorily transfer the decoration such screens must be pressed in the contact region by a spatula or doctor, which is also designed to spread the glazes on the inner part of the screen in order to make them pass through the perforations according to the design, such screens have a substantially short life owing to continuous friction with the lip of the spatula.

[0009] Finally, in a conventional multiple-color decoration line, downstream of each station for applying a color to a corresponding monochrome portion of decoration it is necessary to provide a drying apparatus in order to prevent the subsequent application of liquid glaze on regions that are not fully dry from causing mixings between the colors and bleeding out of the contours of the designs, turning the products into commercial rejects; these lines are therefore substantially expensive due to the necessary multiplication of said drying apparatuses.

[0010] The aim of the present invention is to eliminate

the above noted drawbacks of the known art by providing a machine for the continuous surface decoration of products, particularly ceramic tiles, that allows to produce continuous decorations on any kind of product even with surfaces affected by raised and recessed portions, without having early wear phenomena and at significantly low costs.

[0011] This aim and other objects that will become better apparent hereinafter are achieved by the present machine for the continuous surface decoration of products, particularly ceramic tiles, which comprises a frame that supports a substantially horizontal portion of a product conveyor, above the upper active portion of which a decorating drum is mounted which has a horizontal axis arranged transversely to the direction of advancement of the conveyor, characterized in that said drum is supported by said frame in a slightly raised position, without contact with the surfaces of the products to be decorated, the perimetric surface of said decorating drum being perforated according to a design for the passage, from the inside outward, of glazes propelled by a stream of gaseous fluid ejected under pressure from the end portion of a corresponding ejector located inside said drum at the decoration region.

[0012] Further characteristics and advantages of the present invention will become better apparent from the detailed description of a preferred but not exclusive embodiment of a machine for the continuous surface decoration of products, particularly ceramic tiles, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a highly schematic front view of the structure of the continuous surface decoration machine according to the invention;

Figure 2 is a highly schematic side view of the decorating drum that is part of the decoration machine according to the invention;

Figure 3 is an enlarged-scale detail view of the product decoration region of the decoration machine according to the invention;

Figure 4 is a lateral construction diagram of the upper portion of the surface decoration machine according to the invention.

[0013] With reference to the figures, the reference numeral 1 generally designates a machine for the continuous surface decoration of products, particularly ceramic tiles 2.

[0014] The decoration printing machine 1 comprises a frame 3 that supports a substantially horizontal portion of a conveyor 4 for the tiles 2 or for other products, above the upper active portion of which a decorating drum 5 is mounted that is supported on the frame 3 with an axis A that is horizontal and transverse with respect to the advancement direction of the conveyor 4.

[0015] The drum 5 is supported by said frame 3 in an adjustable manner, by way of means that are known to

the person skilled in the art, so as to be slightly raised from the tiles 2 by an extent δ that amounts to a few millimeters, i.e., without contact with the surfaces to be decorated.

[0016] The perimetric surface 5a of the decorating drum 5 is perforated according to the design in order to allow the passage, from the inside outward, of glazes propelled by a stream of gaseous fluid ejected under pressure from the end portion 6 of a corresponding ejector 7 accommodated inside the drum 5 at the decorating region 8, with interposed means 9 for adjusting vertical height.

[0017] The stream of fluid, constituted in practice by air under pressure, has a laminar flow and is directed substantially at right angles to the internal surface of the drum 5.

[0018] Along the outer surface 5a of said drum first scraper means 10a, with a variable contact angle are provided for removing any remaining glaze residues, said first scraper means being located upstream of said decoration region; on the inner surface, too, second scraper means 10b are provided, which also have a variable contact angle, for the uniform distribution of the glazes along the inner surface, said second scraper means being located directly upstream of the decoration region 8.

[0019] Both the first scraper means 10a and the second scraper means 10b are constituted by corresponding doctors 11 and 12, which are supported on the frame 3 by means of interposed articulated lever systems 13 and 14 for connection thereto and have a movement system with micrometric-pitch screws in order to adjust their respective angles of incidence.

[0020] The ejector 7 comprises a compressor 15, which is located outside the drum 5, and a laminar ejection outlet 16, which constitutes said end portion 6 and is accommodated inside said drum 5 so as to be substantially perpendicular to its internal surface and at the decoration region 8; the compressor 15 and the ejection outlet 16 are connected one another by means of a corresponding tube 17.

[0021] The ejection outlet 16 has a box-like body in which the lower portion is flush with the inner surface of the drum 5 and is formed by two converging planes 18 and 19, which form a downward-tapering region and a funnel-shaped cross-section; at least two corresponding lips 21 and 22 are mounted in sliding contact on the surfaces of said tapering planes, converge towards each other and are adjustable as for their position by way of corresponding adjusting means 23 in order to adjust the breadth of the useful gap for the passage of the laminar flow of air under pressure.

[0022] The adjusting means 23 for adjusting the position of said lips 21 and 22 are constituted by respective screw clamps 24, which are alternately adapted to allow or block their movement on the converging planes 18 and 19.

[0023] Said ejection outlet 16 lies transversely parallel

to the axis "A" of the drum 5 and substantially along its entire axial dimension, so as to sweep, during rotation, all of its surface 5a with the air stream.

[0024] Inside the drum 5 the outlet of a glaze supply line 25 is also provided, which as an alternative, and in the presence of particular surfaces 5a, can be alternately made to exit outside said drum.

[0025] The operation of the invention is described hereinafter with reference, merely by way of example, to the decoration of ceramic tiles, and is as follows: the tiles 2 to be decorated are fed on the conveyor 4.

[0026] The drum 5 is kept raised by an extent " δ " from the level at which the surfaces to be decorated lie, so that there is no direct contact between said surfaces and the outer surface 5a of the drum 5.

[0027] Said elevation of the drum 5 is adjusted by way of means that are usually known to the person skilled in the art and accordingly are not described in detail.

[0028] In a manner similar to what occurs in continuous screen-printing decoration machines, the drum 5 is turned about its own longitudinal axis "A" at a rate that advantageously matches the speed at which the tiles 2 perform their translational motion on the conveyor 4.

[0029] The decoration is applied to the surfaces of the tiles 2 by means of a jet of glaze propelled by the laminar flow of air under pressure ejected through the outlet 16; said stream, in the decoration region 8, propels the glaze deposited inside the drum 5 by a conventional supply line 25 through the holes 26 that pass through the surface 5a of the drum 5 and compose, as a whole, the decoration to be applied to the tiles 2.

[0030] Being a spray glaze, the flatness of the surface for which the glaze is meant is not an essential factor: on the contrary, any raised or recessed decoration present on said surfaces is reached by the glaze at each monochrome application, maintaining the contours pre-perforated according to the design on each one of the decorating drums 5 mounted in succession along a conventional multiple-color decoration line.

[0031] The thickness of the curtain of air under pressure ejected by the outlet 16 can be adjusted as required by moving apart or closer the lips 21 and 22 and locking them in position by means of the clamps 24.

[0032] During the rotation of the drum 5, the outer surface 5a of said drum is constantly kept clean by the doctor 11, which is located downstream of the decoration region 8, while the doctor 12 internally distributes uniformly the glaze on the internal surface of the drum, directly upstream of the outlet 16.

[0033] The angles of incidence of the doctors 11 and 12 are both adjustable and modifiable by acting on the screw-type lever systems 13 and 14.

[0034] It should be noted that the drum 5 can be equally constituted by one or more printing screens of the known type, perforated according to the design, or by silicone cylindrical elements, on the surfaces of which the decorations are engraved so as to provide through passage, in order to allow permeability of the glazes

from the inside outward.

[0035] The rotation of the drum 5 during decoration occurs, as mentioned, without contact with the surfaces of the tiles 2 to be decorated; this avoids breaking the tiles owing to contact pressure, as occurs in known decoration printing machines.

[0036] Moreover, since there is no contact, multiple-color decorations can occur sequentially, without having to wait for the applications performed upstream of each station to dry, with the advantage of eliminating the dryers from the decoration lines, which thus become significantly cheaper and have very small longitudinal dimensions.

[0037] In an alternative embodiment of the invention, which can be used particularly in the case of decoration printing machines provided with a drum made of pre-engraved silicone material, the supply line 25 can be transferred outside said drum without altering the method of glaze application.

[0038] In practice it has been found that the described invention achieves the intended aim and objects.

[0039] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

[0040] All the details may further be replaced with other technically equivalent ones.

[0041] In practice, the materials used, as well as the shapes and the dimensions, may be any according to requirements without thereby abandoning the scope of the protection of the appended claims.

[0042] The disclosures in Italian Patent Application No. MO2000A000274 from which this application claims priority are incorporated herein by reference.

[0043] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A machine for the continuous surface decoration of products, particularly ceramic tiles, comprising a frame (3) that supports a substantially horizontal portion of a product conveyor (4), above the upper active portion of which there is mounted a decorating drum (5) which has a horizontal axis (A) arranged transversely to the direction of advancement of the conveyor (4), **characterized in that** said drum (5) is supported by said frame (3) in a slightly raised position, without contact with the surfaces of the products (2) to be decorated, the perimetric surface (5a) of said decorating drum (5) being perforated according to a design for the passage, from the inside outward, of glazes propelled

by a stream of gaseous fluid ejected under pressure from the end portion (6) of a corresponding ejector (7) located inside said drum (5) at the decoration region (8).

2. The decoration printing machine according to claim 1, **characterized in that** said stream of fluid has a laminar flow directed substantially at right angles to the internal surface of said drum (5).
3. The decoration printing machine according to claim 1, **characterized in that** it comprises along the outer surface (5a) of said drum (5) first scraper means (10a) with a variable angle of contact for removal of the residual glaze, said first scraper means (10a) being arranged upstream of said decoration region (8).
4. The decoration printing machine according to claim 1, **characterized in that** it further comprises along the internal surface of said drum (5) second scraper means (10b) whose angle of contact is variable for the uniform distribution of the glazes along the internal surface, said second scraper means (10b) being arranged directly upstream of said decoration region (8).
5. The decoration printing machine according to claims 3 and 4, **characterized in that** said first (10a) and second (10b) scraper means are constituted by corresponding doctors (11, 12), which are supported by said frame (3) with interposed articulated lever systems (13, 14) for connection, which have a movement system with micrometric-pitch screws for adjustment of the respective angles of incidence.
6. The decoration printing machine according to claim 1, **characterized in that** said fluid is constituted by compressed air.
7. The decoration printing machine according to claims 1 and 6, **characterized in that** said ejector (7) comprises a compressor (15) located externally with respect to said drum (5) and a laminar ejection outlet (16) that constitutes said end portion (6), located inside said drum (5), which is substantially perpendicular to its internal surface and at the decoration region (8), said compressor (15) and said ejection outlet (16) being connected one another by way of a corresponding tube (17).
8. The decoration printing machine according to claims 1 and 7, **characterized in that** said ejection outlet (16) has a box-like body in which the lower portion is arranged flush with the internal surface of said drum (5), is formed by two converging planes (18, 19) for forming a downward taper, which form

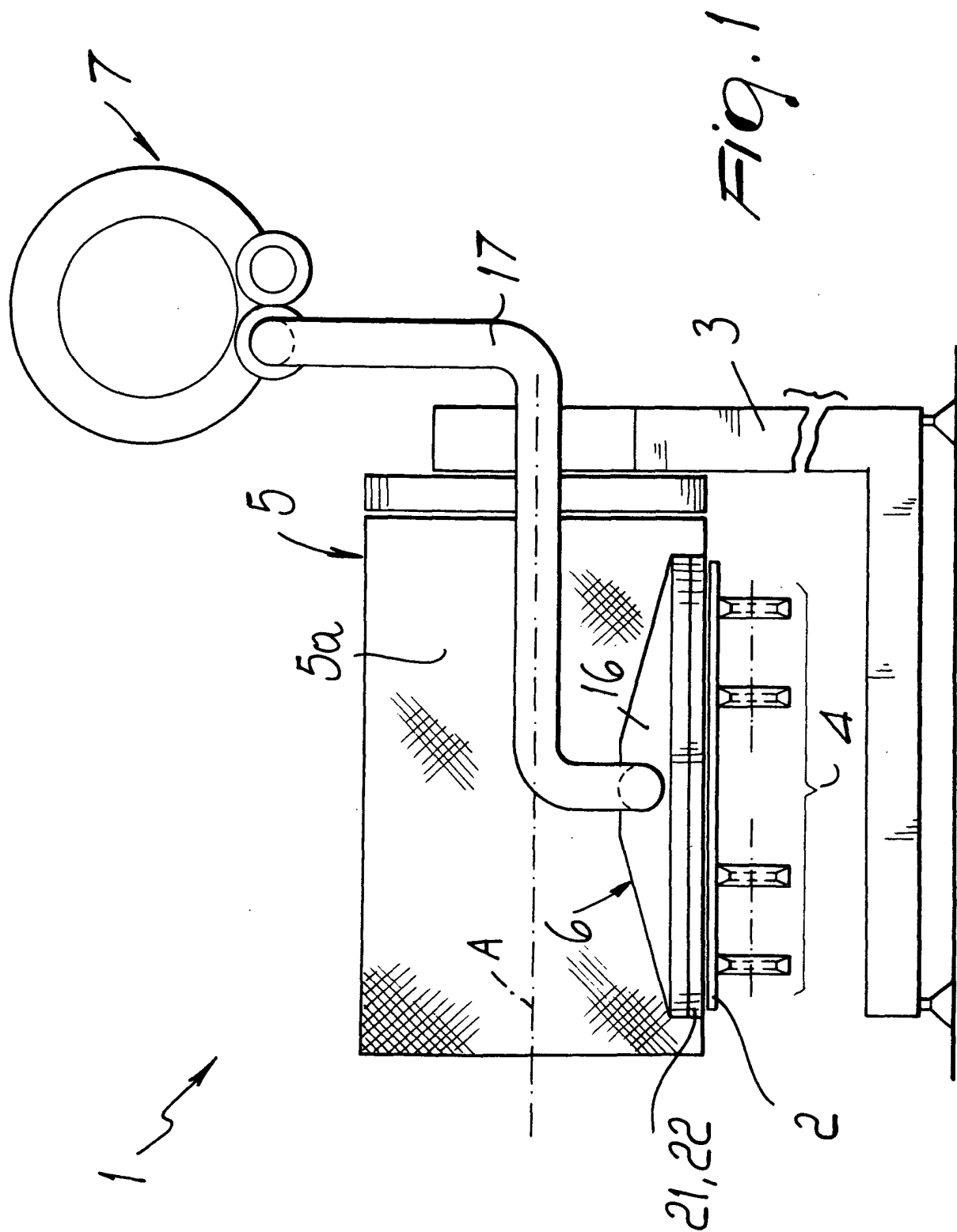
a funnel-like section, at least two corresponding converging lips (21, 22) being mounted in sliding contact on the surfaces of said tapering planes, the position of said lips (21, 22) being adjustable by way of corresponding adjusting means (23) in order to adjust the breadth of the useful gap for the passage of said fluid. 5

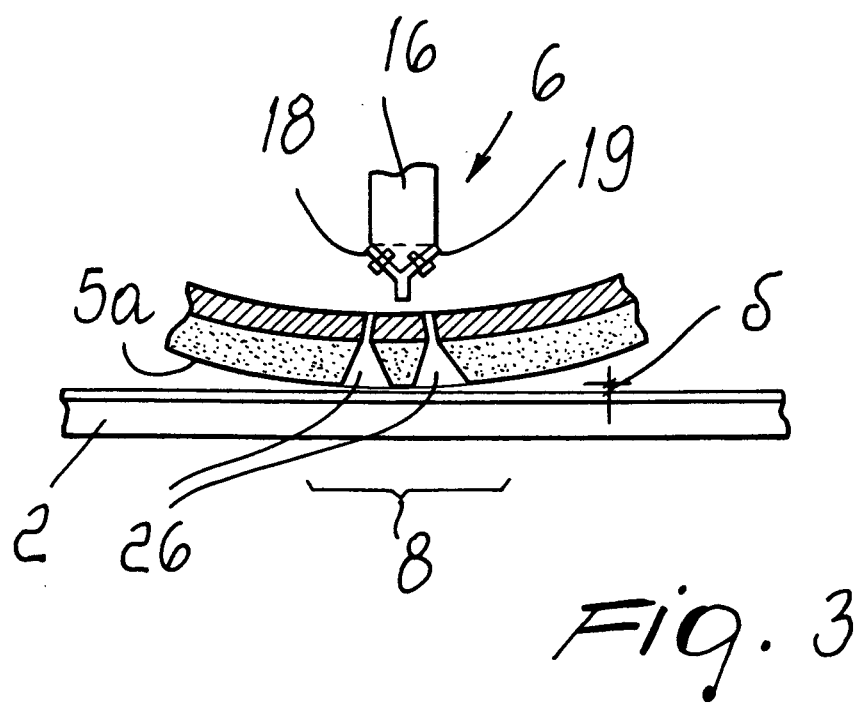
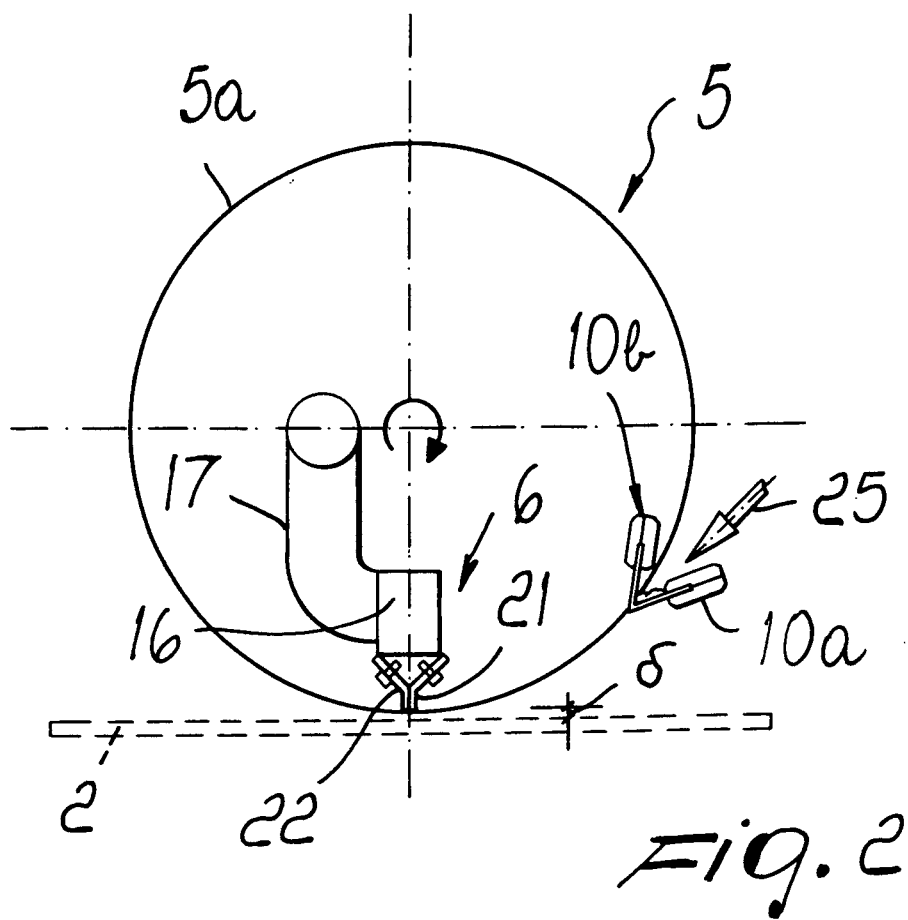
9. The decoration printing machine according to claim 8, **characterized in that** said adjusting means (23) for adjusting the position of said lips (21, 22) are constituted by respective screw clamps (24), which are alternately adapted to allow or block their sliding. 10 15

10. The decoration printing machine according to claims 1, 7, 8 and 9, **characterized in that** said ejection outlet (16) lies transversely substantially along the entire axial dimension of said drum (5). 20

11. The decoration printing machine according to the preceding claims, **characterized in that** it comprises, inside said drum (5), an outlet of a glaze supply line (25). 25

12. The decoration printing machine according to one of the claims 1-10, **characterized in that** it comprises an outlet of a glaze supply line (25), provided outside said drum (5), and arranged substantially tangent to its perimetric surface. 30 35 40 45 50 55





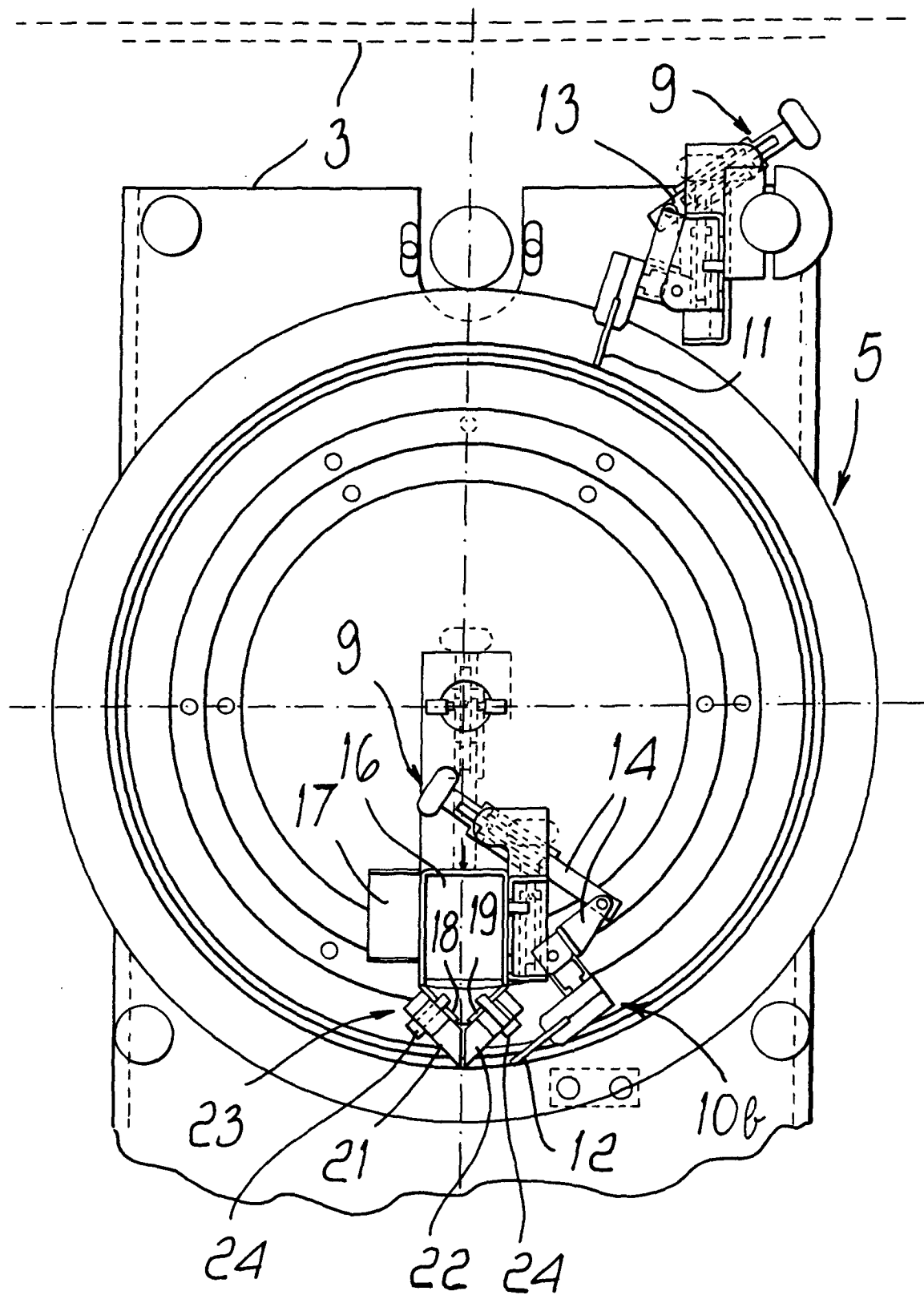


Fig. 4