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(54) **Printing machine for tiles and the like**

(57) A machine for printing on tiles and the like, comprising a support structure (6) for a plurality of printing modules (7) comprising respective heads provided with nozzles (8) for ejecting a printing fluid, and means (9) for advancing the tiles to be printed according to a direction

(A) arranged below said printing modules (7). Each printing module (7) is slidably associated to said support structure (6) according to a given sliding direction, so as to be able to be translated outside from the encumbrance of said advancing means (9).

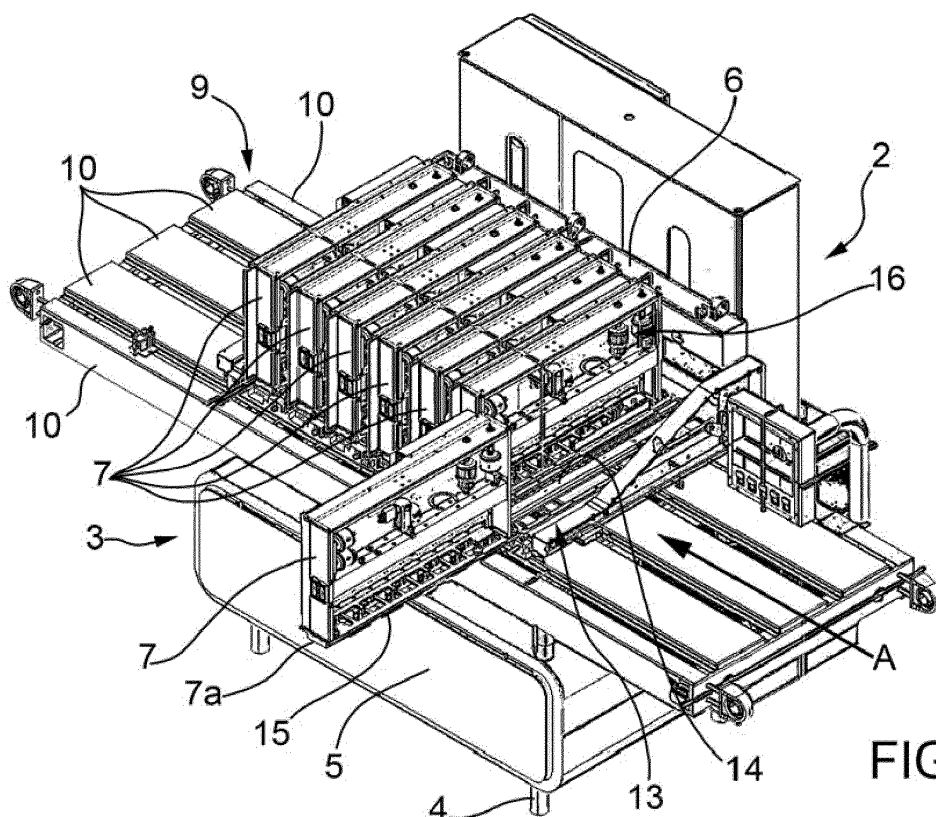


FIG. 2

Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention relates to a machine for printing on tiles and the like.

STATE OF THE ART

[0002] In the field of production of ceramic tiles and the like, machines are used for ink-jet printing which allow obtaining surface decorations having high quality and repeatability.

[0003] These machines typically comprise one or more printing modules, for example one for each colour of the decoration, each provided with a color bar holding in turn one or more digital heads, which have a high number of nozzles which eject small ink drops which settle on the tile surface.

[0004] The objects to be printed or decorated, for example ceramic tiles or the like, are carried on a belt, or other similar transport means, through a region under the printing modules, in such a way that they pass near the nozzles of the heads for a time necessary to allow the ink drops to settle on the surfaces to be decorated.

[0005] In the known devices the printing modules are fixed close to each other to a supporting structure arranged over said transport means.

[0006] Since the printing modules need periodic maintenance, enough room is provided between the adjoining modules in order to perform the appropriate operations.

[0007] The provision of such rooms, obviously, adversely affects the longitudinal encumbrance of the printing machine.

[0008] Furthermore, the printing machines of the known type are little versatile as for the interchangeability of the printing modules, for instance when it is necessary to vary the succession of the colors deposited on each tile.

[0009] About this, it is stated that the repositioning of each color bar within the machine is not only very frequent, but also strategic for performing a decoration, where the coloring may be performed in an additive or subtractive way.

[0010] One must also keep in mind that it is not possible to simply change the ink feeding to a certain color bar, since cleanliness problems would arise; in some cases, some problems may arise regarding setting incompatibilities due to the use of inks with different features.

[0011] Obviously, the repositioning of a color requires also the repositioning of the whole printing module.

OBJECT OF THE INVENTION

[0012] The technical object of the present invention is to improve the state of the art.

[0013] Within such technical object, it is a purpose of the present invention to develop a printing machine for

tiles and the like capable to overcome the above cited drawbacks regarding the accessibility to the printing modules and their interchangeability, within a solution with minimal longitudinal encumbrance.

[0014] This object and this purpose are achieved by the machine for printing on tiles and the like according to the attached claim 1.

[0015] According to one aspect of the present invention, the machine comprises a support structure for a plurality of printing modules comprising respective heads provided with nozzles for ejecting a printing fluid on tiles, in which each printing module is slidably associated to the support structure according to a given sliding direction, which may be substantially perpendicular to the advancing direction, or it may also be different, for example oblique with respect to the advancing direction.

[0016] In this way, the printing modules are easily accessible, outside the encumbrance of the machine, for performing maintenance operations.

[0017] According to another aspect of the present invention, each printing module is associated to a respective carriage slidable with respect to the support structure, housing a respective ink supply system. Such supply system is selectively connectable, through quick couplings, to ink cans, or other fluids cans, housed in the base of the machine, in order to change at will the succession of the colors deposited on each tile during printing.

[0018] Further advantageous features are described in the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The features of the invention will be better understood by each man skilled in the art from the following description and from the attached drawing sheets, given as a non-limiting example, in which:

figure 1 is a frontal view of the machine according to the invention;

figure 2 is an isometric view of the machine;

figure 3 is another isometric view of the machine, from a different perspective;

figure 4 is a schematic representation of the ink supply system of the color bar of each printing module of the machine;

figure 5 is a back detailed view of the machine;

figure 6 is a detail of figure 5.

EMBODIMENTS OF THE INVENTION

[0020] With reference to the attached figure 1, reference number 1 wholly indicates a machine for printing on tiles and the like according to the present invention. The machine is suitable for depositing inks, enamels, and other printing fluids on tiles and the like. Hereinafter, therefore, the word ink must be intended in a more general meaning, i.e. each printing fluid suitable to be de-

posited on tiles or other similar objects.

[0021] The machine 1 comprises, in a per se known way, a frame, wholly indicated with 2.

[0022] The frame 2 comprises, more in particular, a base 3 with feet 4, for example of the adjustable type.

[0023] The frame 2 further comprises a box element 5 of the drawer type, laying on the base 3, which may be used to store, for example, various containers or cans for printing fluids, machine spare parts, various equipments or the like, in a per se known way.

[0024] The machine 1 comprises a support structure 6 for a plurality of printing modules 7, which house one or more color bars 7a, provided in turn with heads with nozzles 8 for ejecting a printing fluid, to be deposited on tiles, the latter not being represented in the drawings.

[0025] It is specified that the expression printing module 7 means a device finalized to the digital print, usually finalized to manage one single color at a time, comprising the following elements:

- at least a digital color bar 7a, composed by one or more digital printing heads, provided with a plurality of ejecting nozzles 8;
- an electronic local drive unit, for driving the color ejection process of the printing heads;
- a local fluidic system, comprising a double tank with recirculation system;
- a local wiring, for locally feeding the actuators.

[0026] The support structure 6 of the printing modules 7 is integral with the frame 2 of the machine 1, particularly in its front part.

[0027] The machine also comprises advancing means, wholly indicated with 9, of the tiles to be printed along a direction A.

[0028] The advancing means 9 are arranged directly under the printing modules 7, as shown in figures 1-3, in such a way that the tiles that move on the advancing means are at a predetermined distance from the nozzles 8, to achieve an optimal printing process.

[0029] According to an aspect of the present invention, each printing module 7 is slidably associated to the support structure 6 according to a given sliding direction.

[0030] For instance, such sliding direction may be substantially perpendicular to the advancing direction A, with the technical advantages which will be clearer hereafter.

[0031] Alternatively, such sliding direction may also be different, for example oblique with respect to the advancing direction A.

[0032] It is specified that each head composing each color bar 7a of each printing module 7 of the machine 1 is of the per se known type in the technical field of the invention, and it is suitable to eject a controlled quantity, per time unit, of small ink drops or other equivalent printing fluid drops, that must be deposited on the surface of the object to be printed.

[0033] Each head will not be further described in detail, since it is not an object of the present invention.

[0034] The advancing means 9 of the tiles comprise a framework constituted, for example, by side members 10 fixed to the central part of the frame 2 of the machine 1.

[0035] The advancing means 9 of the tiles are particularly of the belt type and comprise, in a known way, drive means which may consist, for example, in a gear motor unit. with such drive means are associated a driving roller 11 and an idle roller 12, the latter being rotatably supported by the side members 10.

[0036] A belt, not shown in the figures, is enveloped on the rollers 11, 12, and the tiles lay on such belt, aligned one after the other.

[0037] The support structure 6 of the printing modules 7 is substantially bracket-shaped, embossed on the advancing means 9.

[0038] The support structure 9 may house, for example, a printing module 7 for each color used in the printing. The printing modules 7 are juxtaposed, in such a way to limit at the minimum the room between them.

[0039] In the practical use, the printing modules 7 are little spaced, in other words spaced enough to allow relative displacement without rubbing.

[0040] According to an aspect of the present invention, each printing module 7 is associated with the support structure 6 by guiding means 13.

[0041] More in detail, the guiding means 13 are of the telescopic kind and comprise a stationary portion 14 integrally associated with the support structure 6, and a movable portion 15 associated with the printing module 7.

[0042] Each printing module 7 is substantially box shaped and open in the bottom part, in order to allow the nozzles 8 to eject the printing fluid.

[0043] In the represented embodiment, the stationary and movable portions 14, 15 of the guiding means 13 are arranged by the bottom wall of each printing module 7, as shown in particular in figure 2.

[0044] By the way, in other embodiments not shown, the guide means 13 may be provided by the top wall of each printing module 7 or in other parts, according to the specific application needs.

[0045] The lateral walls of each printing module 7 comprise openings, preferably passing openings, in order to allow access to each single component, for example in order to perform maintenance operations or other operations.

[0046] In particular, in order to perform maintenance operations on the selected printing module 7, or possibly on other components of the machine, the operator should simply draw the selected printing module 7 with respect to the support structure 6, along the sliding direction.

[0047] In this way, the selected printing module 7 is outside of the encumbrance of the advancing means 9, and it is therefore frontally and laterally accessible.

[0048] In this way a color bar 7a or a single damaged head may be changed, or various maintenance or changing operations may be performed, since the printing module 7 is fully accessible from all directions.

[0049] Furthermore, the printing module 7 and the re-

spective color bar 7a, after its displacement, are completely outside of the operative zone of the machine: in this way, all maintenance operations may be performed without stopping the machine and the flow of the tiles which cross the machine.

[0050] According to another aspect of the present invention, as stated above, each printing module 7 houses a respective ink supply system, or another printing fluid, to the respective color bar 7a, wholly indicated with 16.

[0051] In particular, the ink supply system 16 installed in each printing module 7 is suitable to generate a constant ink flow across the respective color bar 7a and therefore across the heads, in such a way that the ink itself can be continuously filtered in order to hold possible sediments, dirt, air bubbles, or any other element which may damage the color bar 7a and the heads.

[0052] Such ink supply system 16 is schematically shown in figure 4.

[0053] The ink supply system 16 comprises, more in detail, a first accumulation tank 17 and a second accumulation tank 18, connected by a delivery line 19, along which the color bar 7a is inserted, and therefore the relative printing heads.

[0054] Furthermore, it is provided a return line 20 from the second tank 18 to the first tank 17, along which a recirculation pump 21 is installed.

[0055] The first tank 17 is opened to atmosphere through a respective vent opening 22, while the second tank 18 is associated with pressure control means 23, which are suitable to keep inside the second tank 18 a pressure value which is lower to the atmospheric pressure.

[0056] The ink supply system 16 is described in greater detail in european patent n. EP 2093065 B1 of the same applicant, enclosed in the present description for reference.

[0057] Along the delivery line 19 and the return line 20 respective filters 24,25 are provided, which remove from the ink possible extraneous elements like sediments, air bubbles, etc..

[0058] The first tank 17 comprises an inlet duct 26 through which the ink contained in a can, not shown, is supplied inside the first tank 17 itself.

[0059] The can, containing ink or other printing fluid, may be, for example, lodged inside the box element 5 provided in the frame 2 of the machine 1.

[0060] The pressure control means 23 comprise, for example, a venturi tube, which is connected to the second tank 18 through a suction duct 27 which is connected to the narrow section of the venturi pipe 23 itself. The venturi pipe 23 is crossed by a continuous air flow, in order to obtain a pressure drop in said narrow section, and therefore in order to depressurize the second tank 18.

[0061] The machine 1 according to the invention comprises a compressed air circuit 28 which, among other functions, generates the continuous air flow which crosses the venturi pipe 23.

[0062] The portion of the circuit 28 particularly suitable

to generate such continuous air flow is schematically represented in figure 5, which is a back view of the machine 1.

[0063] The circuit 28 comprises, more in detail, a central plate 29 supporting various components, associated with adjusting means 30 of its vertical position.

[0064] Such adjusting means 30 may comprise, for example, a gear motor unit 31 associated with a screw 32, being provided in the central plate 29 a nut screw 33 which is coupled to said screw 32.

[0065] Alternatively, other equivalent adjusting means 30 may be provided.

[0066] A collector 34, which communicates with the venturi pipe 23, is fixed to the central plate 29.

[0067] The venturi pipe 23, as stated before, is inserted along a traditional compressed air line 35, provided with a main pump - not shown in the figures - and with an emergency pump 36.

[0068] Across a first opening 37 provided in the frame 2 of the machine 1, the suction ducts 27 directly connected to the second tanks 18, communicate with the collector 34.

[0069] More in detail, for each printing module 7 a collection vessel 38 is provided with the aim to prevent that possible liquid ink residues penetrate inside the compressed air circuit 28.

[0070] In fact, suction branches 39 are provided which perform a connection between the collection vessels 38 and the collector 34.

[0071] The communication between the various suction branches 39 and the collector 34 is regulated by respective opening and closing electro-valves 40.

[0072] According to a further aspect of the present invention, the machine comprises a plurality of quick couplings 41 which selectively put the first tanks 17 of each printing module 7 in communication with the ink cans housed in the box element 5.

[0073] Such quick couplings 41 allow, for example, to modify in a fast and easy way the sequence of the colors deposited on the tiles, according to the specific production needs.

[0074] In detail, the quick couplings 41 are mounted on a single support rod 42 fastened to the frame 2 of the machine 1, and they are associated with respective visual indicators 43 having, for example, a respective serial number corresponding to that of the printing modules 7 they are connected to.

[0075] As shown in figure 6, the quick couplings 41 put the inlet ducts 26 - which communicate with the first tanks 17 housed in the printing modules 7 - in communication with supply ducts 44 which are directly connected with the respective ink cans provided in the box element 5. The inlet ducts 26 reach the front part of the machine 1, where the support structure 6 is provided, through a second opening 45 provided in the frame 2 of the machine 1.

[0076] Also the connection between the inlet ducts 26 and the first tanks 17 of the printing modules 7 is operated by fluidic quick couplings.

[0077] It is finally specified that, as stated above, the printing modules 7 comprise respective electrical connection means - for examples wire, connectors, and the like - to a control unit of the machine mounted on the frame 2 of the machine 1, of the per se known type in the field of the invention and which will not be further described, which manages the whole operation of the machine

[0078] Also the electric and electronics parts of each printing module 7 are connected to the electrical power supply of the machine or to the control unit through respective quick-fit of the known type, for example terminals.

[0079] In the upper part of the frame 2 a control panel 46 of the machine operation is further provided, which is associated with the control unit and with other components or organs of the machine, in a per se known way.

[0080] The operation of the machine according to the invention is, according to what have been described, fully intuitive, as well as the technical advantages achieved by the invention.

[0081] The printing modules 7 eject, in a calibrated way managed by the control unit, respective ink quantities in form of small drops on the surfaces of the tiles which pass below transported by the advancing means 9, the ink being constituted, for example, by a pigments suspension, or another printing fluid like and enamel or similar, or by a vitreous suspension.

[0082] In case one or more color bars 7a of a printing module 7, but also one or more heads of the same bar 7a, are not employed in a printing operation, the respective ink supply system 16 keeps the ink in circulation bypassing the color bar 7a or the head, according to the modality described in the cited patent n. EP 2093065 B1 of the same applicant.

[0083] As stated before, the maintenance operations on the printing modules 7 or on the respective ink supply systems 16 may be performed in an extremely easy way thanks to the possibility to extract each printing module 7 outside of the encumbrance of the advancing means 9, as shown in figures 2,3, laterally accessing to the provided openings.

[0084] Furthermore, thanks to the presence of the quick couplings 41, the sequence of the colors deposited on the tiles by the printing modules 7 may be modified at will in a fast and easy way, according to the specific production needs.

[0085] In other words, in order to modify the position of each color, i.e. to modify the position of each printing module 7, one may quickly and easily operate on the quick couplings 41, either on the ink cans side or on the printing module 7 side.

[0086] One may also quickly operate on the quick-fits of the electrical or electronical parts.

[0087] All these advantages are achieved within a machine having little longitudinal encumbrance, i.e. along the advancing direction A of the tiles.

[0088] In the practical use of the machine according

to the invention, using a given color may be necessary for some decorations, for other its use may not be provided; therefore, it is particularly frequent the need to remove and store for small or long times certain printing modules and the relative color bars, this fact being particularly easy thanks to the features of the present invention.

[0089] Furthermore, if the decoration plant comprises more decoration machines of the same kind, it is important to plan the use of a same color bar alternatively on a machine or on another machine: this advantage is achieved thanks to the possibility to extract the single printing modules of the machine according to the invention.

[0090] The machine configuration allows a gradual investment without modifying it in an invasive way: in fact one may start with a minimal configuration in trichotomy - 3 color bars - with the possibility, in time, to add new bars simply adding new printing modules.

[0091] It is evident that the invention reaches the proposed objects.

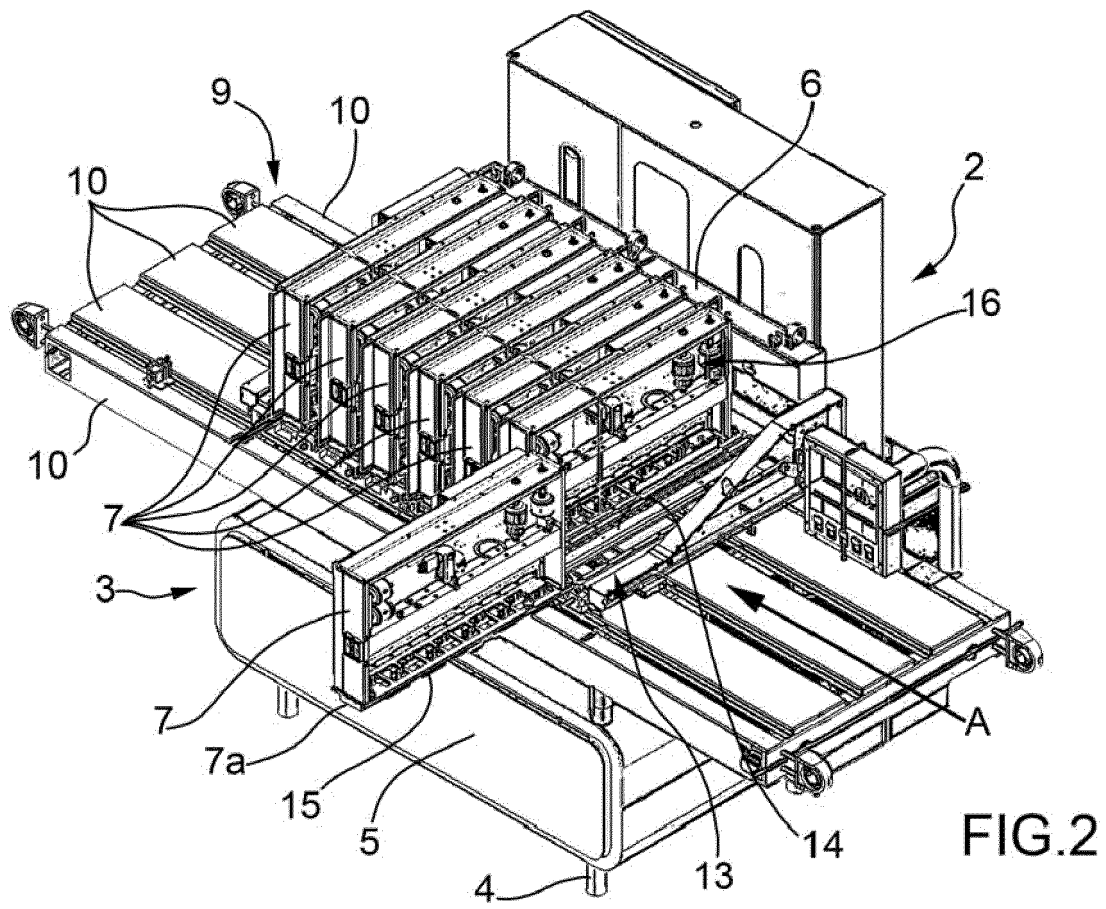
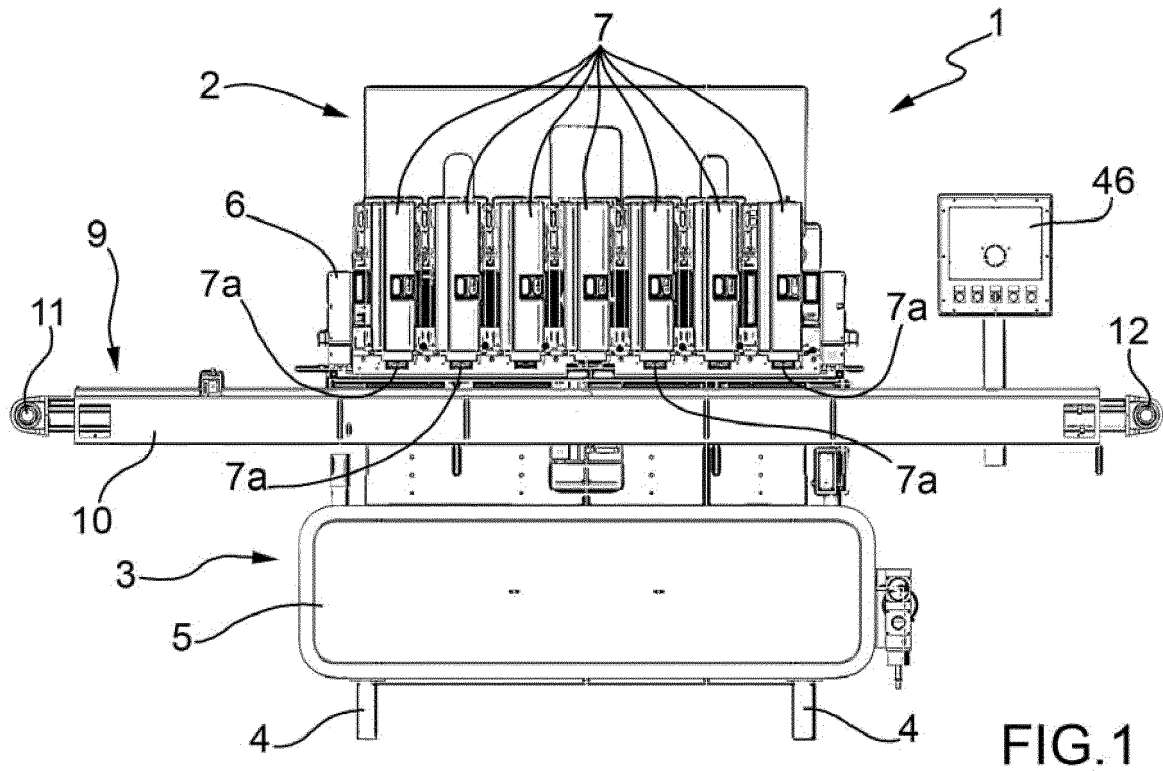
[0092] The present invention has been described according to preferred embodiments, but equivalent variations may be conceived without exiting from scope of the following claims.

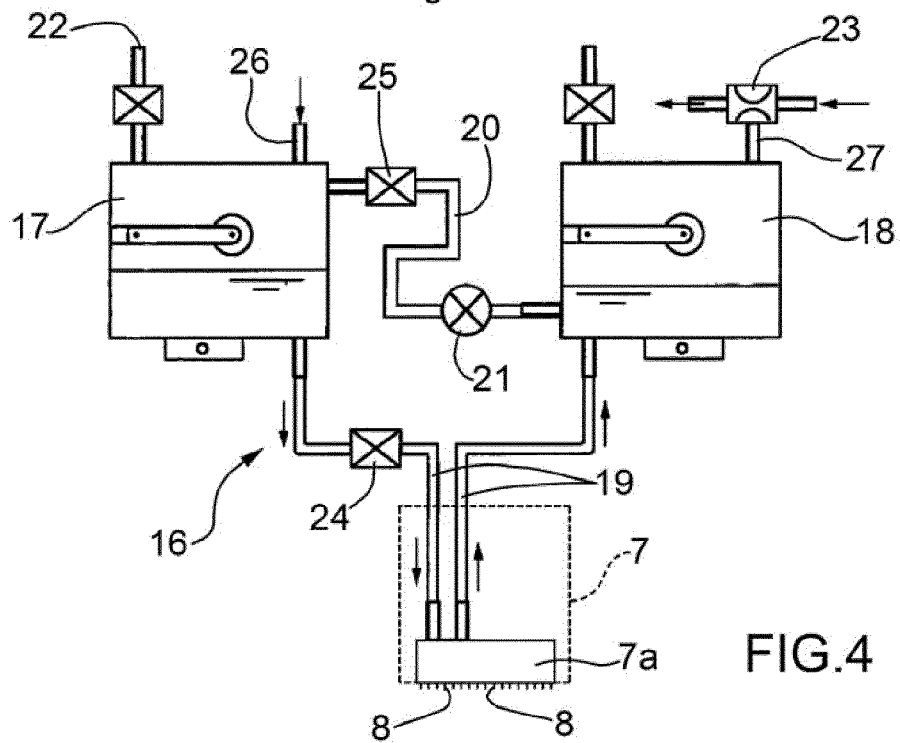
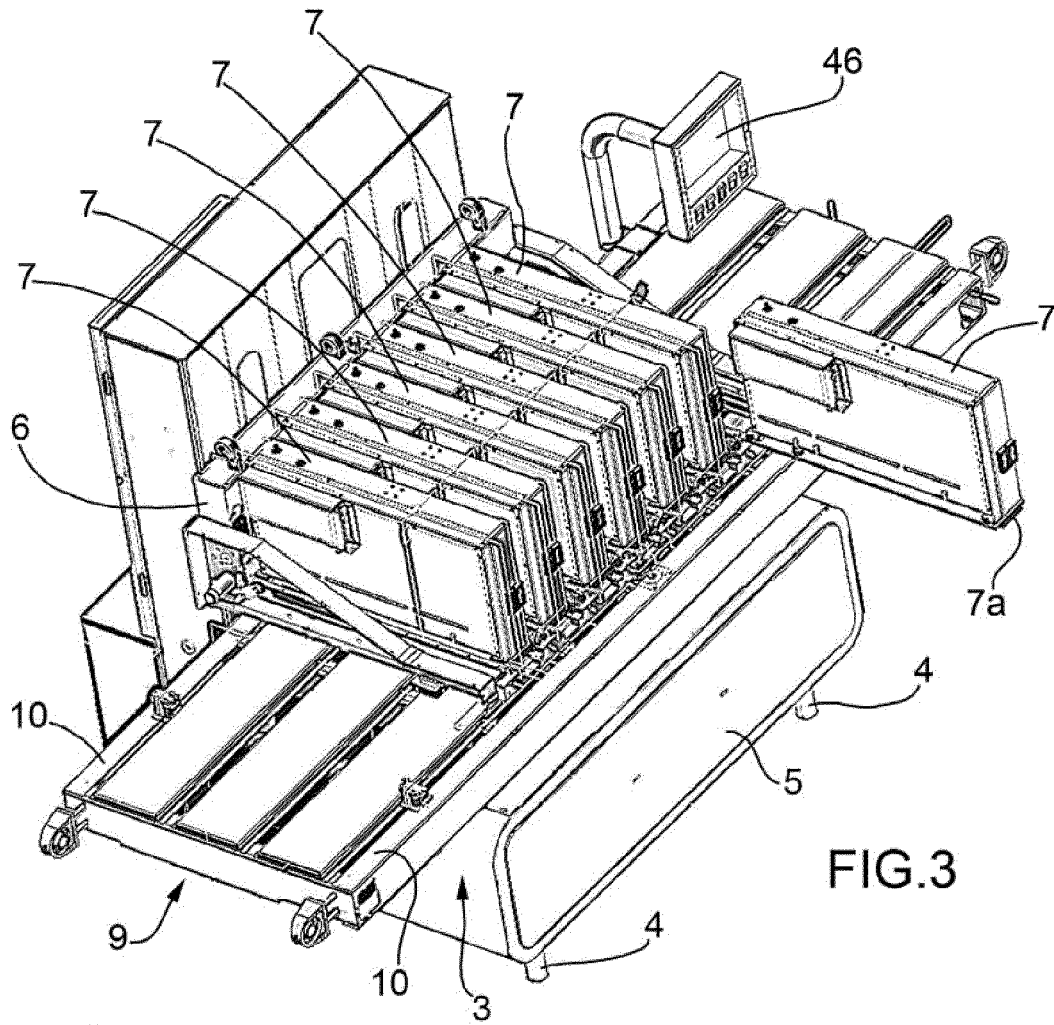
Claims

1. Machine for printing on tiles and the like, comprising a support structure (6) for a plurality of printing modules (7) comprising respective heads provided with nozzles (8) for ejecting a printing fluid, and means (9) for advancing the tiles to be printed according to a direction (A) arranged below said printing modules (7), **characterised in that** each of said printing modules (7) is slidably associated to said support structure (6) according to a given sliding direction, so as to be able to be translated outside from the encumbrance of said advancing means (9).
2. Machine according to claim 1, wherein said sliding direction of each of said printing modules (7) is substantially perpendicular to said advancing direction (A), or oblique with respect to it.
3. Machine according to claim 1 or 2, wherein said printing module (7) is associated with said support structure (6) by guiding means (13) of the telescopic type comprising a stationary portion (14) integrally associated with said support structure (6), and a movable portion (15) associated with said printing module (7).
4. Machine according to one of the previous claims, wherein said printing module (7) houses a respective ink supply system (16), or another printing fluid, to at least a colour bar (7a) comprising said heads.

5. Machine according to claim 4, wherein said supply system (16) comprises a first accumulation tank (17) and a second accumulation tank (18), connected by a delivery line (19), along which said at least one colour bar (7a) is inserted, a return line (20) being provided from said second tank (18) to said first tank (17) along which a recirculation pump (21) is installed. 5
6. Machine according to claim 5, wherein along said delivery line (19) and said return line (20) respective filters (24,25) for ink or another printing fluid are provided. 10
7. Machine according to claim 5, wherein said second tank (18) is associated with pressure control means (23), which are suitable to keep a pressure value lower than the atmospheric pressure inside it. 15
8. Machine according to claim 5, wherein said first tank (17) comprises an inlet duct (26) of ink or another printing fluid communicating with a can housed in the frame (2) of the machine. 20
9. Machine according to claim 8, comprising a plurality of quick couplings (41) which selectively put said first tanks (17) of each printing module (7) in communication with respective cans housed in said frame (2), so as to change as desired the connection of the supplies of the individual printing fluids to the colour bars (7a), after the rearrangement thereof or addition of new colour bars (7a). 25 30
10. Machine according to claim 9, wherein said quick couplings (41), on the side of said cans, are mounted on a single support rod (42) fastened to said frame (2). 35
11. Machine according to claim 9 or 10, wherein said quick couplings (41) are associated with respective visual indicators (43) having a respective serial number corresponding to that of the printing modules (7) they are connected to. 40
12. Machine according to one of the previous claims, wherein each of said printing modules (7) comprises electrical connection means, of the quick-fit type, to a control unit of the machine mounted on said frame (2) and/or to the machine electrical power supply. 45 50

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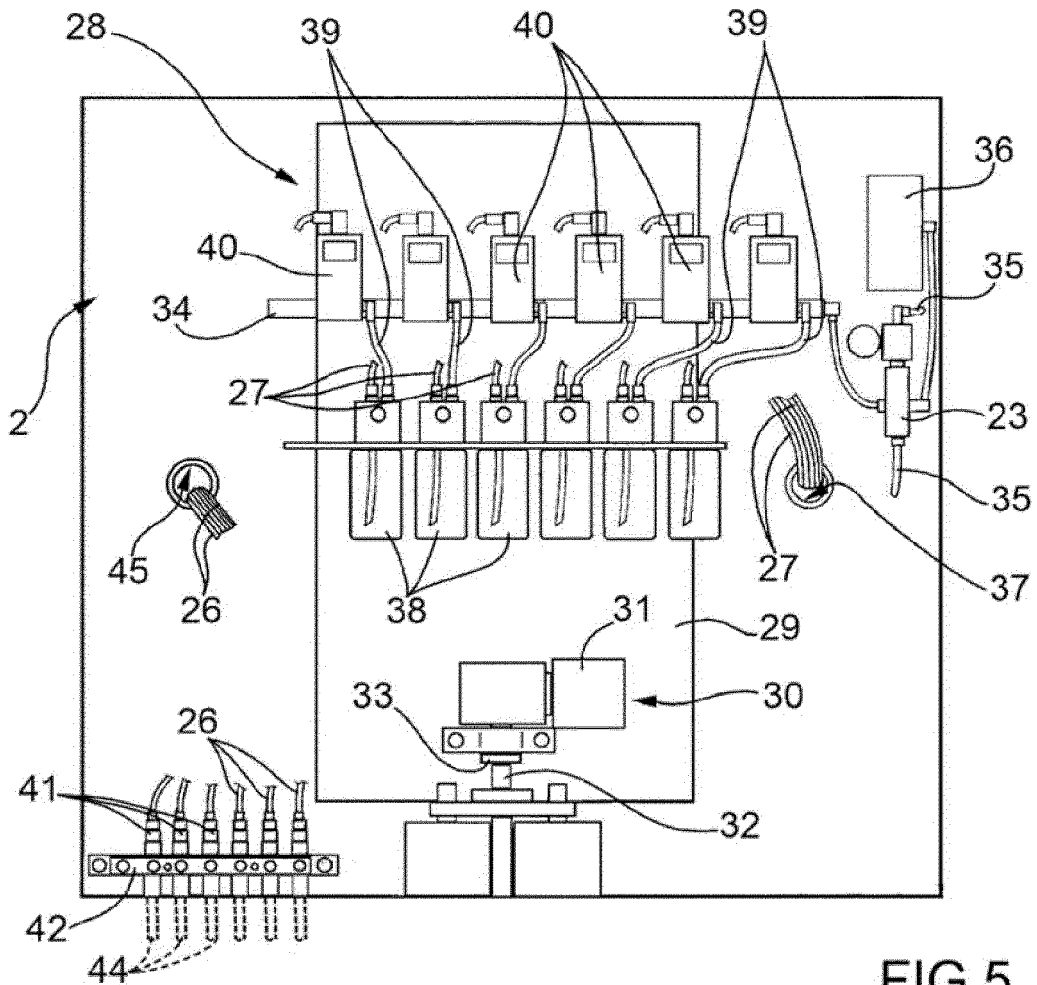


FIG.5

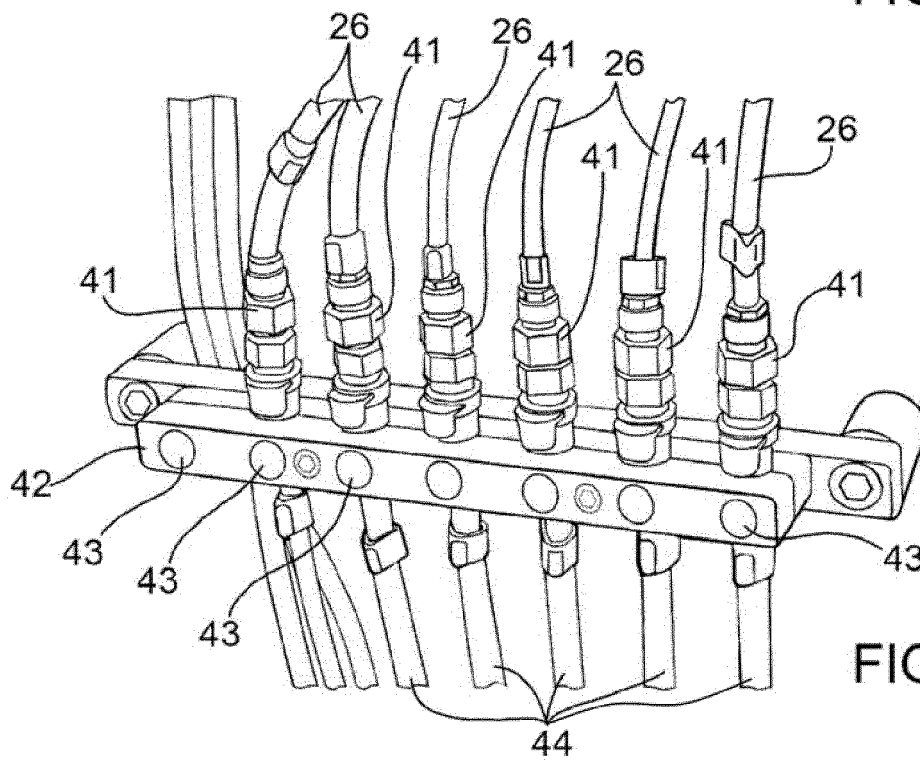


FIG.6



EUROPEAN SEARCH REPORT

Application Number
EP 12 15 7358

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
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Place of search		Date of completion of the search	Examiner
The Hague		8 June 2012	Gavaza, Bogdan
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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- EP 2093065 B1 [0056] [0082]