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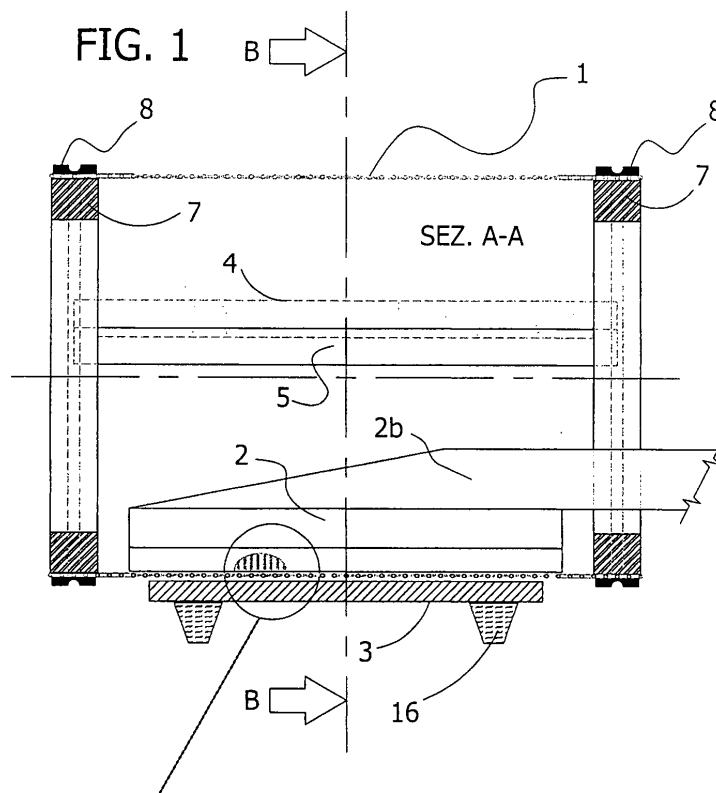
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41100 Modena (IT)(54) **A roller screen for decoration of tiles with fluid-jet nozzles**

(57) The device of the invention is applicable to ceramic tile decoration machines mounted in typical rotary silk screening machines. Essentially the device comprises a net wound about a roller fixed by ends thereof to flanges and rings connected to the external machine for support and rotation thereof. The roller is impregnated

with liquid glaze by the doctors and nozzles located inside the body blow a fluid at the net, transferring droplets of glaze entrapped in the net onto the surface of the tile to be decorated. The nozzles are provided with microvalves so that a line of a decoration is formed by a predetermined combination of openings of at least a part of the nozzles.



Detail showed in FIG.5 and FIG.6

Description

[0001] The invention relates to a new device for decorating ceramic tiles consisting in a roller screen in a net of which a liquid colorant or glaze is introduced, which is subsequently transferred by force onto an underlying tile by one or more lines of nozzles emitting fluid particles.

[0002] The device is characterised in that the nozzles are arranged in a line in a fixed position internally of the screen. The screen rotates while the tiles pass synchronously with no relative sliding.

[0003] The prior art teaches how the aesthetic aspect is vital to production of finished ceramic tiles, in terms of decoration which in the majority of cases is applied on glazing lines by various devices and in successive stages.

[0004] The main device is the silk screen, as it applies decorations of any type, from imitation of natural stones or marbles to fantasy figures for tiles destined for application in kitchens or bathrooms.

[0005] The tiles to be decorated are usually unfired, with a preliminary coat of glaze to facilitate silk-screening application. Generally on a line there are several silk screening machines which, in succession, add a part of the decoration to the passing tiles.

[0006] Many types of silk screening machines exist on the market, having various constructional characteristics which, however, provide very similar aesthetic effects.

[0007] The most used type of silk screening machine is the roller screen, which has supplanted the flat-screen model. The roller screen can operate with the tiles moving along the line, which has the effect of increasing production rates.

[0008] Roller silk screening machines in the prior art are all characterised by the following things:

during application the roller, impregnated with glaze, is brought into contact with the surface of the tile;
each type of decoration requires a series of roller screens bearing on surfaces thereof a specific incision, dedicated to that particular part of the decoration;
the roller screens have a limited working life.

[0009] The drawbacks of these screens are:

during contact small particles of glaze attach to the roller from the undercoat of glaze previously spread on the tiles, which then mix with the liquid glaze of the decoration, causing changes to the final tone of the application;
storing (usually on shelves) of a large number of rollers for the applications already made and to be made again in future;
long waiting times for obtaining the rollers incised (by the specialist companies in the field) according to the designs required;
frequent mounting/dismounting operations of the

rollers, necessary for the various production glazing line changes.

[0010] There are other drawbacks, too, including the difficulty of producing small batches of a particular decoration or the impossibility of experimenting with new aesthetic designs (which often require much modification and variation) with short preparation times.

[0011] The main aim of the present invention is to obviate the above-described drawbacks and not least to improve some aspects of the production organisation. At the same time, the machine built using the new applicational solutions will be of a similar size and work in a similar way to existing silk screening machines located along glazing lines.

[0012] The machine of the present invention is characterised mainly in that it is a new device for application of glazes on tiles, constituted by a system of injectors, or nozzles, located above a screen (either a roller or a flat screen, with nets sized proportionally to the exactness of decoration required), below which the tiles are advanced. By a fluid-dynamic action (impact of a gas or liquid) the drops of glaze imprisoned in the net of the screen will be transferred onto the underlying tiles advancing on the glazing line.

[0013] The detailed description that follows of the invention is illustrated by the accompanying figures, in which:

Figure 1 shows the device inserted in a cylindrical screen, in an axial section;
Figure 2 shows the device inserted in a cylindrical screen, in a radial section;
Figures 3 and 4 are schematic views of the device inserted on a flat screen according to two sections;
Figures 5 and 6 show an enlarged detail of the section of figures 1 and 3 in two successive moments during operation.

[0014] The following description relates mainly to a roller screen, in order to draw a closer comparison between prior-art roller silk screens; however, the injector system is equally adaptable to flat screen operations, as shown in figures 3 and 4, to which reference will briefly be made at the end of the following description.

[0015] The figures illustrate only the decoration application device, i.e. the roller with accessories; details of the drive and roller holder mechanisms are not included, nor is the silk screen in its entirety, as these are all known in the

prior art.

[0016] Figures 1 and 2 show the roller constituted by the screen 1 fixed to the flanges 7 by means of rings 8; as mentioned, the organs holding the flanges 7 to maintain the degree of stretch and the roller drive are not illustrated, nor are the internal devices.

[0017] The external surface of the roller 1 does not quite touch the underlying tile 3 transported on the belt (16) of the glazing line.

[0018] The roller screen is impregnated with glaze 6 by the doctors 4 and 5 so that the glaze remains in the form of small droplets entrapped in the cells of the net constituted by the warp 10 as shown in figures 5 and 6.

[0019] The system of nozzle injectors 2 is contained in the lower part of the roller, and is supported and connected to the external supply devices by the arm 2b.

[0020] Figures 5 and 6 show an enlarged detail of the circled part of figure 1.

[0021] In both figures, in section, a part of a tile 3 is visible, as are the warps belonging to the net of the roller 1 and the injector system 2 which are in part sectioned in order to show the nozzles 12 delimited by the sectors 13 above which microvalves are located (one for each novel, not illustrated) which when activated (opened for a short time) enable a pressurised fluid jet to issue (gas or liquid) in a direction according to the arrows 11, with sufficient energy to detach the droplets 9 from the roller screen and transfer them onto the tile.

[0022] The warps of the screen net are specially distanced from the nozzles and the underlying tile to be decorated.

[0023] As previously mentioned, the machine for decorating having this new device is overall a normal silk screening machine having a rotary roller (having a peripheral velocity which is equal to an advancement velocity of an under-passing tile) which roller is of a comparable size to prior-art examples, and which roller is supplied with liquid glazes having chemical-physical properties which are similar to those in use. This constitutes an advantage in that the invention's replacing an existing conventional machine does not lead to any substantial operations on the glazing line.

[0024] The nozzles can be arranged in one or more ranks; the dimensions shown in figures 5 and 6 relating to the thickness of the tiles, the nets of the screens and the nozzles 12, 13 are to be considered merely indicative and by way of offering a clear description of the invention.

[0025] The simultaneous command of the microvalves (open/close) of the line of nozzles determines a line in the design transferred onto the tile. The command is given by connections between the arm and the computer connected, possibly, to the laboratory in the factory.

[0026] The system operates in a sequence as follows.

- a). The rotating screen is rapidly immersed in the glaze contained in the reservoir formed by the doctors 4 and 5, which doctors also remove excess of glaze by scraping against the screen, leaving glaze only in the net.
- b). The tract of net comprised between points A and B is completely impregnated with glaze; it is in effect a rotating sheet having an internal support matrix constituted by the net.
- c). At point B a small sector of roller completely im-

pregnated with glaze is below the line of nozzles. A part of the microvalves opens instantaneously according to a predetermined programme relating to the design to be printed on the tile, transferring the glaze droplets from the screen onto the tile 15.

d). As soon as this sector of roller has gone past the nozzle line (with a part of the net emptied of glaze), a new sequence of microvalve opening begins, thus creating another line of decoration.

e). The succession of microvalve opening sequences occurs in time periods that depend on the velocity of the advancing tiles and also by the sharpness of the final decoration required; in any case, the part of net passing below the nozzles must always be kept completely impregnated with glaze.

f). The part of net B-A located between the nozzles and the doctors 4 and 5 is partially emptied of glaze; when it passes newly between the doctors 4 and 5 it will be replenished.

g). The cycle is repeated according to the above sequence.

[0027] The configuration of the open/close sequence of the nozzles which creates a line of decoration is codified in an electronic file containing all of the instructions relating to the sequence. In a glazing line, where there will be several machines of this type, the change-product operation will be practically instantaneous, depending mainly on any required changes of colours. For this reason research into new products and experimentation will be easier and faster to set up.

[0028] The nozzle device is also easily insertable on a flat screen, as shown in figures 3 and 4. The device, in the case of a flat screen, will be flanked by two reservoirs 6 containing the glaze.

[0029] The frame of the screen is able to make movements along the axis of the line, as shown by the arrows 20, in order to keep the net below the nozzles constantly impregnated with glaze.

Claims

1. A device for applying damp decorations on ceramic tiles by means of one or more ranks of nozzles arranged in a line or lines transversally to an advancement direction of the tiles, **characterised in that** it comprises:

- a body containing the nozzles and also microvalves fixed to a support arm also bearing electrical and fluid connections to an external system;
- a cylindrical screen located between the nozzles and the tile to be decorated, the screen being fixed at ends thereof to flanges of rings;
- a supply system of liquid glaze for the screen, formed by two doctors arranged one internally

and another externally of the screen in such a way as to constitute a reservoir for a correct replenishing of the net of the screen and in order contemporaneously to remove excess glaze from the net.

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2. The device of claim 1, **characterised in that** the device is mounted on and motorised by a suitable machine for supporting and rotating the screen, a peripheral velocity of the screen being equal to an advancement velocity of the tile to be decorated. 10
3. The device of claim 1, **characterised in that** the nozzles, the screen and the tile to be decorated do not contact one another. 15
4. The device of claim 1, **characterised in that** fluid issuing from the nozzles can be a gas or a liquid.
5. The device of claim 1, **characterised in that** a contemporaneous opening of a part of the microvalves corresponds to a creation of a line of a decoration, and that the decoration is constituted by a number of lines and an opening of a number of microvalves for each said line which is predetermined, which can involve adjacent nozzles or distanced nozzles, and which corresponds to achieving a sought decoration on the tile. 20 25
6. The device of claims 2, 3 4 or 5, **characterised in that** the nozzles can be applied on a flat screen, as shown in figures 3 and 4. 30

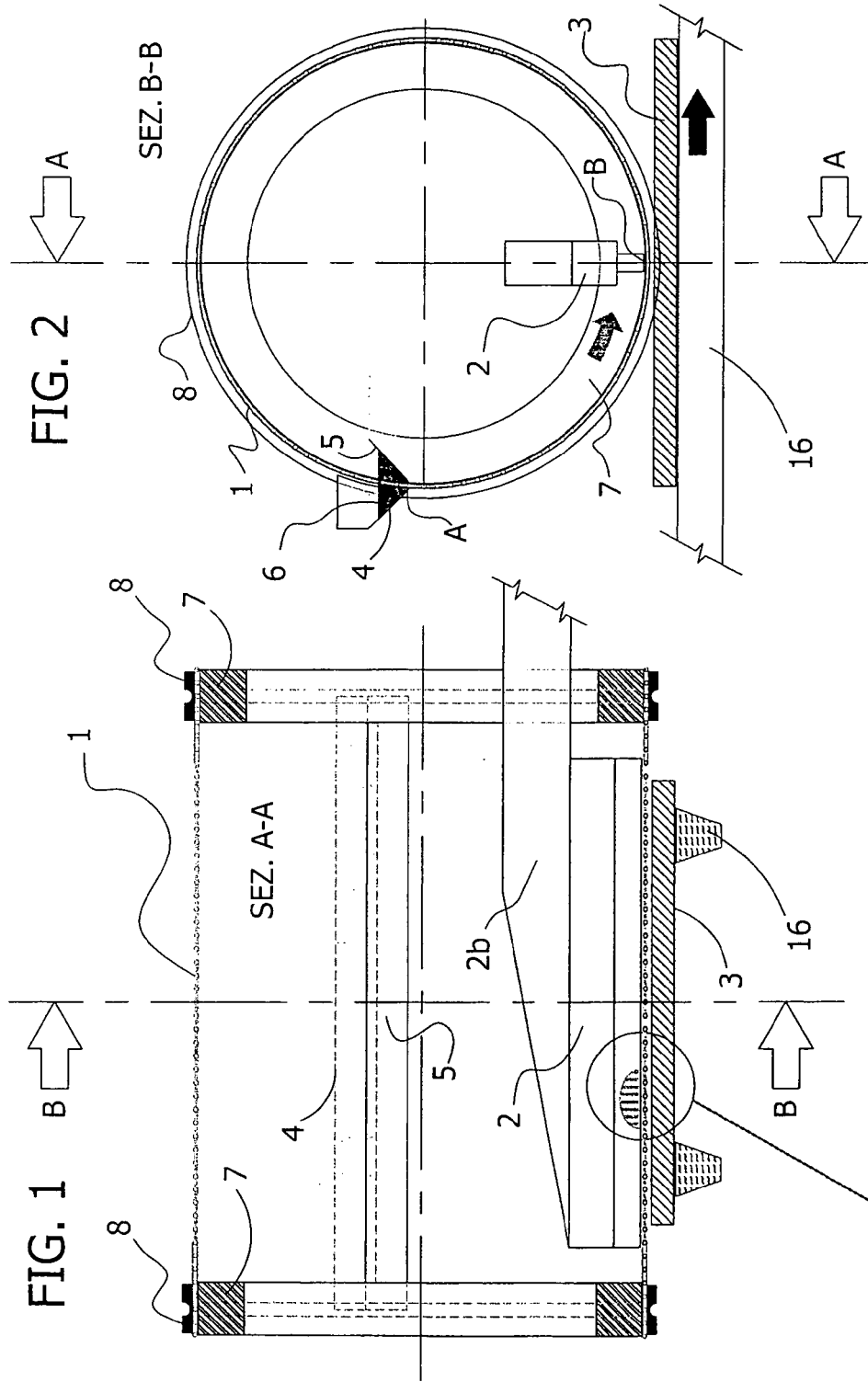
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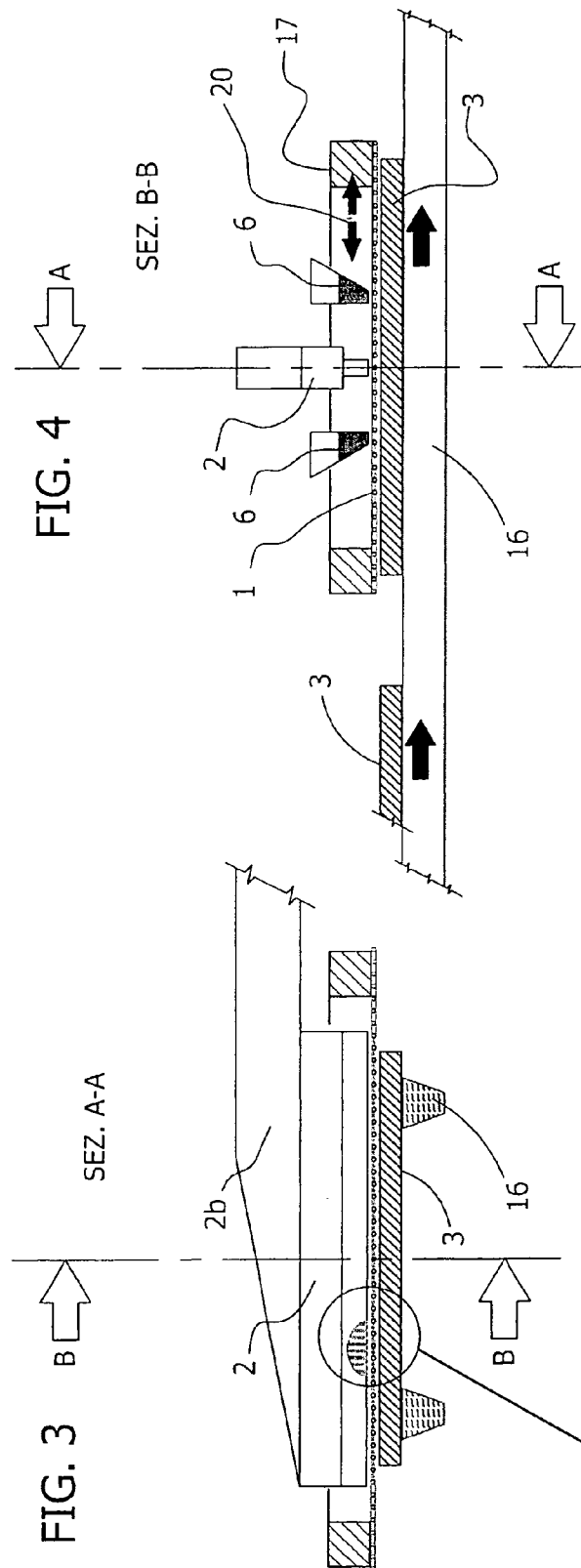
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Detail showed in FIG.5 and FIG.6



Detail showed in FIG.5 and FIG.6

Detail of FIG.1

FIG. 5

FIG. 6

