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(54) METHOD AND DEVICE FOR CONTROLLING THE AMOUNT OF ENAMEL APPLIED ONTO CERAMIC TILES OR SLABS

(57) The method allows to control and keep within a desired margin of tolerance the weight of enamel applied per unit of surface on ceramic tiles or slabs (3), as well as its distribution on the same, in a decoration station (2), constantly checking the patterns (V) delivered by the spray nozzles (5), which have a progressive wear, and includes the following operational steps: periodic acquisition of at least one image of each spray pattern (V); evaluation of the nrightness of the image, in comparison with predetermined reference values, the difference between said measured brightness value and said reference values allowing the identification of a variations in density of the product emitted by said nozzle (5) and, as a result, of the weight of product deposited per unit area.

When the first preset threshold value is exceeded, at least one compensation action is activated, consisting of an increase in the flow rate of the pump (P) that supplies the nozzles (5) and/or an increase in the speed of advancement of the ceramic tiles or slabs (3); beyond a second threshold, the entire station is stopped for replacement of the nozzles (5).

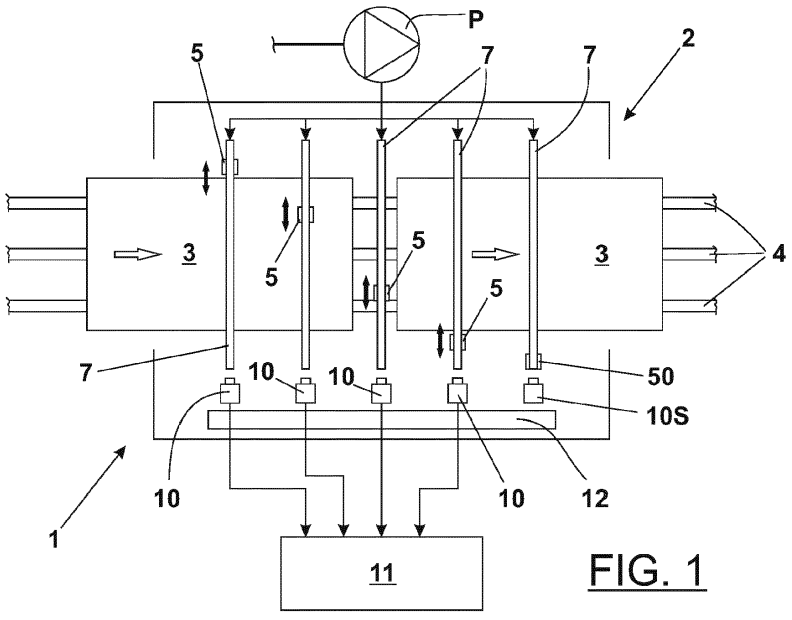

FIG. 1

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Description

DESCRIPTION OF THE INVENTION

[0001] The present invention relates to the technical field of the ceramic industry, with particular reference to the decoration process of ceramic tiles and/or slabs to give their visible surface the desired chromatic and/or graphic treatment.

PRIOR ART OF THE INVENTION

[0002] One of the most used of the above mentioned decoration processes is carried out by spraying a ceramic enamel on the tiles, which takes place in glazing chambers served by belt conveyors, which feed the tiles making them pass under the spraying nozzles inside.

[0003] In well-known chambers, also called multi-axis chambers, the ceramic tiles or slabs are moved at a constant forward speed by a conveyor, so as to enter, pass through an array of spray nozzles arranged along the same station in succession and finally exit.

[0004] Each nozzle, which usually sprays the same colour as the others, is carried by a carriage, operated by a translator moving in a direction crosswise to the forward direction, with to-and-fro movements: The enamel is then applied by combining the two movements, the tile advancement movement and the transversal movement of the nozzles.

[0005] For a uniform result it is necessary that the tiles advance under the nozzles with constant speed and without stops, to avoid the formation of areas with the enamel layer of different thickness.

[0006] The spray nozzles for this application are equipped with a head having a calibrated hole, which delivers the spray enamel with a fan-shaped jet.

[0007] The nozzle head is usually made of tungsten carbide, to give better properties of resistance to abrasion action exerted by the enamel ceramic, which, as known, incorporates suspended glass particles that can quickly erode even the hardest materials.

[0008] In fact, despite the use of this head, a nozzle of this type has an average operating time of about six hours, after which it must be replaced.

[0009] The abrasive action of the enamel on the calibrated hole of the nozzle causes progressive wear, increasing its diameter. This causes an increase in the flow rate of the product passing through the calibrated hole, and changes the distribution of the product in the pattern. In fact, the width of the pattern remains substantially unchanged, but a greater quantity of product is conveyed to the central part of the pattern itself compared to the peripheral part, making its distribution uneven. Therefore, a higher density of the product can be seen in the central part of the pattern which visibly modifies its brightness characteristics.

[0010] Due to nozzle wear, the quantity of enamel deposited on the ceramic tile or slab is also altered, which tends to increase progressively, changing the final result of the decoration until it produces, beyond certain limits, waste tiles or slabs.

[0011] In other words, ceramic tiles or slabs produced from when the nozzles are new to when they are to be replaced, undergo a progressive increase in the layer of enamel deposited thereon, so the weight of the latter, per unit of surface area of the tile or slab, increases cporrespondingly.

[0012] Since the ceramic enamel is a rather expensive material, the increase in its consumption represents an economic waste that, for obvious reasons, should be as much as possible limited.

[0013] A further drawback is that, as already mentioned, the distribution of the product across the pattern is not homogeneous, but tends to increase in the central part of the same. This leads to an accumulation of enamel on the portions of the slab covered by the central part of the pattern, which is greater than the portions covered at both sides. These differences are visible on the finished product as unacceptable differences in colour, in particular for high quality products, such as, generally, for or large-format ceramic slabs or tiles.

[0014] In theory, the wear of each nozzle present is homogeneous, but in practice it can be verified that over the estimated duration of six hours a nozzle can wear out more and another one wears less, thus creating unevenness in the application of the enamel, which can generate product waste.

[0015] It is easy to understand, therefore, that even with a scrupulous planning of replacement interventions, having waste products, even in large numbers, cannot be prevented with absolute certainty.

[0016] If the financial loss can be considered limited for small tiles, it becomes very high in the case of large ceramic slabs, of the order of a few square meters of surface area, which are currently enjoying much success in high-end ceramic production.

[0017] As it is easy to understand, the dimensions of these slabs, in particular of the one in the advancement direction, greatly increase the probability of production waste in case of failure of even only one nozzle.

[0018] It should also be borne in mind that removing a large defective sheet from the line is a fairly laborious operation, which requires equipment and specialized personnel, with a downtime that is by no means negligible; all this increases the already considerable economic losses caused by the defective sheet(s) as such.

[0019] The same Applicant, with the aim of monitoring in real time the operation of a decoration station for ceramic tiles or slabs in order to avoid as much as possible the production of waste, has filed an application for a National Patent for Industrial Invention under the No. 102017000130704. This application protects an auxiliary applicator device associated with a station for decorating ceramic tiles or slabs, which provides for a plurality of transversely mobile applicators, equipped with spray nozzles.

[0020] By means of video-cameras associated with each of these nozzles, if one of them produces a pattern that does not conform to a standard, stored in electronic processing devices, this is immediately detected.

[0021] The spray nozzle in failure is stopped immediately and its action is replaced by an additional nozzle, which until then has not been operational.

[0022] The stopped ordinary spray nozzle is replaced or cleaned, depending on the type of defect found in the respective spray pattern.

[0023] In this way, the decoration station does not have to be stopped and the production of waste ceramic slabs or tiles is considerably limited.

OBJECTS OF THE INVENTION

[0024] The object of this invention is to propose a method and a device for controlling, in real time and downstream of the applicators, the quantity of enamel applied by each individual applicator on ceramic tiles or slabs in a decoration station, so as to intervene promptly with suitable actions when anomalies occur, and before such anomalies give rise to the production of wastes.

[0025] A further object of the invention is to further improve the homogeneity of enamel application on the different surface areas of the slab or tile, and thus to minimize the percentage of waste.

[0026] Another object of the invention is to keep the weight of enamel deposited per unit area of tiles or slabs as constant as possible, both to avoid those with defective glazing and to limit the consumption of enamel.

[0027] Another object of the invention is to provide a method that can be implemented in a simple way and with a device easy to implement, with a reliable operation and such that it can be installed even in existing decoration stations, without major changes.

SUMMARY OF THE INVENTION

[0028] These and other objects are entirely achieved by means of a method and device for controlling the quantity of enamel applied to ceramic tiles or slabs in a decoration station, said ceramic tiles or slabs being moved by a conveyor, so that they enter the station, pass in succession by at least one application device equipped with a spray nozzle arranged in the same decoration station and finally exit the station, said method comprising the following operation steps:

- periodical acquisition of at least one image of the spray pattern generated by the aforementioned at least one spray nozzle;
- detection of at least one brightness value in said pattern for each of said acquisitions, and comparison of the detected value with predetermined reference values, the difference between the detected brightness value and said reference values identifying a corresponding variations of density of a product emitted by said nozzle and, correspondingly, of the weight of the product per unit of surface applied by said nozzle onto said ceramic tiles or slabs;
- activation of at least one action for compensating the effect of said variation in density on the weight of the product deposited on each surface unit when a first predetermined threshold value is exceeded.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] The characteristics of the present invention will be evident from the following description of a preferred embodiment of the method and device for controlling the amount of enamel applied to ceramic tiles or slabs in a decoration station, referred to in the summary, in accordance with what is proposed in the claims and with the help of the attached drawings, in which:

- Fig. 1 shows a schematic plan view of a decoration station for ceramic tiles and slabs, with an associated device for implementing the method in question;
- Fig. 2 shows, in a view similar to Fig. 1, an optional step of the method, in which a replacement nozzle temporarily replaces a defective stopped nozzle;
- Fig. 3 shows, in a magnified schematic lateral view, a spray pattern generated by a new spray nozzle;
- Fig. 4 shows, in a view similar to Fig. 3, a spray pattern at the limit of acceptable parameters.

DETAILED DESCRIPTION OF THE INVENTION

[0030] In the above figures, reference 1 indicates as a whole a device that implements the method of the present invention for controlling the quantity of enamel.

[0031] Device 1, described below, is associated with a decoration station 2 for decorating ceramic tiles or slabs 3, intended for the application of ceramic enamel on the latter.

[0032] The decoration station 2 is driven and controlled by processing equipment 11, according to substantially known techniques.

[0033] The ceramic tiles or slabs 3 are moved forward by a conveyor 4, so as to enter the station, to move in succession under one or more applicators equipped with respective spray nozzles 5, arranged in the same station 2, and finally to exit. The conveyor 4 is powered with the possibility of controlling the forward speed by suitably interfacing it with the aforementioned processing equipment 11.

[0034] The figures show a decoration station 2, in which there is preferably a set of applicators with spray nozzles 5 arranged in series, with each of them carried by a carriage 6, driven by a reciprocating movement by a shifter (not shown in detail) along a guide 7 extending transversally to conveyor 4.

[0035] The applicators are supplied by a pump P, of generally known type, for which pressure and/or flow rate can be controlled.

[0036] Usually, even if not necessarily, all the spray nozzles 5 of the decoration station 2 deliver enamel of the same colour; it is obviously possible that this decoration station 2 is followed by another one, which adds different colours or transparent enamels to the same tiles or ceramic slabs 3, to complete a pre-established pattern.

[0037] The method according to the invention essentially involves the execution of a sequence of operations on the spraying pattern V generated by each spray nozzle 5, and possible activation of compensation operations, consisting in the variation of at least one operating parameter of the decoration station 2, according to what will be better detailed here below.

[0038] In particular, the method involves the periodic acquisition of an image of the spraying pattern V during normal decoration operations; advantageously, the method involves the acquisition of an image at each operating cycle of the back-and-forth run made by the spraying nozzle 5.

[0039] Under normal operating situation, with nozzles 5 in perfect condition, a V pattern is created (see figure 3) with homogeneous product distribution characteristics and with product density per unit of surface area as predefined by the operational characteristics of pump P, and in particular by its operation pressure and its overall flow rate.

[0040] At least one brightness value is detected for each of these acquisitions at one or more selected spots in the V pattern; these values are compared with predetermined reference values.

[0041] It has been verified that, with the progressive wear of the nozzle 5 and the consequent increase in diameter of its dispensing hole, the product is dispensed into the V pattern with progressive density variations in different areas of the same pattern. In particular (see figure 4), a higher density is found in the central part of the pattern V, and a corresponding lower density in the peripheral areas. These variations correspond to detectable variations in the brightness characteristics in different areas of the pattern V, which are usually related to an increase of brightness in areas with higher density. However, depending on the type and colour of the product dispensed and/or the conditions of lighting, areas with higher product density may be darker than those with lower density.

[0042] In any case, with the difference in brightness resulting from the wear of nozzle 5, and with the aid of suitable computer program procedures operating in processor 11, respectively for measuring the brightness and comparing the values being found with other reference values, as well as with the use of suitable calculation algorithms or tables, the indirect quantification of the enamel density delivered by the corresponding spray nozzle 5 is obtained, from which the weight of enamel deposited per unit of surface on the underlying tile or ceramic slab 3 can be calculated.

[0043] When the first preset threshold value for the aforementioned difference in brightness is exceeded, one or more actions are then activated to compensate for the effect of this change in density on the product weight per unit area and on the distribution of the product on different areas of the surface. This first threshold value is generally obtained empirically from experimental evaluations of the relationship between the variations in the density of supply in the different areas of the pattern V - and therefore in the luminosity of the same - and the effect that this has on the variations in the weight of the product deposited and on its distribution over the tile or slab 3.

[0044] A preferred embodiment of the method involves acquiring the brightness parameters of the spray pattern V when a spray nozze 5 is new (Fig. 3), and using the same parameters as predetermined reference values with which to make the above comparison later.

[0045] The detection of the brightness in the pattern V is carried out, preferably but not necessarily, near the portion of the latter closest to the relative spray nozzle 5 in one or more spots, not highlighted in the figures as they are not significant for the understanding of the invention.

[0046] If the detection is made at more than one spot, the comparison can be made, according to an initial embodiment of the method, on the basis of a calculation of the average of the differences between the values of brightness detected compared to the default values for these spots, to determine the activation, or not, of the action, or actions, for compensation.

[0047] In a variant of the method, the compensation action is triggered on the basis of exceeding, even at one of the aforementioned spots, the threshold value set for the latter.

[0048] The above compensation action, according to the method, may include an appropriate correction, normally in increase, of the flow rate of the above mentioned pump P, intended to feed the sprayer nozzle(s) 5 while keeping the pressure constant; alternatively, or in combination, the compensation action consists in the correction, also usually in increase, of the forward speed of conveyor 4.

[0049] When the above mentioned difference in brightness exceeds a second preset threshold value, greater than the first one, for which there is no more possible correction given by the increase of the pump P flow rate and/or by the increase of the conveyor 4 advance speed, the method provides for the stop of the applicator, with suspension of the enamel supply by the relative spray nozzle 5 and the replacement of the latter, as a necessary compensation action.

[0050] In the presence of a plurality of said applicators, and afte detecting similar results for all the relative spray nozzles 5, according to the method all the spray nozzles sare completely stopped, that is, of entire decoration station 2 and the worn nozzles 5 are wholly replaced with a new series.

[0051] Advantageously, the method involves stopping for maintenance, or replacing, the spray nozzles 5 in their

respective positions so as to be clear of the side of the ceramic tiles or slabs 3, in transit within the station 2, thus avoiding possible damage to the same (see Fig. 2).

[0052] The proposed method, in practice, is based on the expected progressive wear of the spray nozzles 5, mentioned in the introduction and which determines a lack of homogeneity in the distribution of the enamel in the pattern V generated, and in particular a greater accumulation in the central part thereof.

[0053] Without any action, there would be significant changes in the density distribution within the pattern V. In particular, if the pump P is regulated so as to maintain a constant feed pressure, there is a gradual increase of the enamel density in the central part of pattern V as the graduated hole in the nozzle increases in diameter, and an increase in the weight of enamel deposited per unit area of ceramic tile or slab 3, with an uneven distribution of the enamel on the different areas of the slab affected by pattern V; beyond a certain degree of variation of these parameters, the slab would be discarded.

[0054] By monitoring with high frequency the brightness of the pattern V, whose brightness decreases with decreasing density and vice versa, the application parameters of the ceramic enamel and also the state of wear of the nozzles 5 are controlled in progress.

[0055] When the differences in density in the generated pattern V are even greater (see Fig. 4, in which areas of pattern V1 ,V2 with different brightness characteristics are highlighted), as compared to the pattern initially produced by a new nozzle 5 (Fig. 3), the necessary increase in flow rate made by acting on pump P would cause an increase in the weight of enamel per unit area no longer within the permitted values, so it is necessary to intervene in a dual way, simultaneously increasing also the forward speed of conveyor 4.

[0056] It is understood that the compensation actions described above can also be carried out independently of each other, depending on specific design or management needs of the decoration station 2.

[0057] Beyond a certain preset wear value of nozzle 5, with a pattern V no longer conforming to prefixed standard, the above corrective actions are no longer sufficient; so it becomes imperative to stop either the individual applicator with the nozzle 5 worn out, or all applicators and related nozzles 5, to allow replacement before you have to produce waste tiles or slabs.

[0058] For small variations with respect to the preset values, it is also possible to simply compensate for the variations in the flow rate of the individual nozzle 5 by increasing the measured proportion of the flow rate of pump P, and re-setting the density value, while remaining within the tolerance for the weight of enamel allowed per unit area and application homogeneity.

[0059] The device 1 mentioned above, for the implementation of the method described above, comprises a plurality of 10 video-cameras, at a rate of at least one for each of these spray nozzles 5.

[0060] The video-cameras 10 are located inside the decoration station 2, next to conveyor 4, and are suitable for taking real time images of the corresponding spraying patterns V generated by the 5 spraying nozzles, preferably for each of the back-and-forth operating cycles performed by the latter, in order to measure the brightness parameters.

[0061] The above mentioned electronic processing equipment 11 are interfaced to the video-cameras 10, and consist of a dedicated computer, or include the same computer used to control the station 2, for the acquisition of the images being taken. These images are appropriately processed according to predetermined calculation algorithms, to quantify the enamel density delivered by the relative spray nozzle 5 and determine, consequently, the weight of the same enamel deposited, per unit area, on the ceramic tiles or slabs 3.

[0062] In addition, the computer 11 is conveniently interfaced, according to known techniques, to the transport drive and/or the control of pump P.

[0063] The decoration station 2 is equipped with lighting elements 12 that make the respective spray pattern V visible to each of these video-cameras 10 in the best possible way.

[0064] According to a first design solution, as shown in the figures, the lighting elements 10 are so arranged that said spraying patterns V are illuminated on the front side, with respect to the video-cameras 10, so that the brightness parameters are obtained due to light reflection.

[0065] According to another design solution, not shown herein, the lighting elements 12 are so arranged that said spraying patterns V are illuminated from the back side, with respect to the video-cameras 10, so that the brightness parameters are obtained due to light transmission.

[0066] According to the technical teaching contained in the patent application owned by the same Applicant, mentioned in the introduction, a device 1 includes advantageously an additional spray nozzle 50, associated with a corresponding trolley 6 and controlled by a corresponding video-camera 10S.

[0067] The additional spray nozzle 50 is kept inoperative when all other spray nozzles 5 are operating properly (Fig. 1).

[0068] When a condition occurs, in which one sprayer nozzle 5 needs to be replaced, a further operation step of the method is allowed, in which the defective sprayer nozzle 5 is deactivated and stopped while, simultaneously, the additional sprayer nozzle 50 is activated, to replace the operation of the other (Fig. 2).

[0069] In this way, ceramic tiles or slabs 3 can continue to pass through and be enameld regularly, without the risk of any damage.

[0070] The above description clearly shows the specific characteristics of the operating method in question, as well as the device that implements it, in particular to control and maintain the weight of enamel applied per unit of surface on tiles or ceramic slabs in a decoration

station within desired ranges of tolerance, constantly checking the patterns delivered by the spray nozzles and promptly implementing compensation actions to restore the correct values, until replacement of the nozzles due to excessive wear becomes unavoidable.

[0071] Preferred compensation actions according to the invention advantageously include adjusting the transport speed 4, adjusting the delivery parameters of pump P, and/or replacing the nozzle 5 which is no longer within the acceptable operating range.

[0072] Advantageously, therefore, the production of ceramic tiles or slabs obtained during the working life of a set of spray nozzles has a weight of enamel deposited per unit of surface almost constant and corresponding to optimal values.

[0073] Thanks to this, the quality of production is increased, overall, the probability of waste is reduced and, at the same time, waste of expensive ceramic enamels is avoided.

[0074] The proposed method can be implemented in a simple and effective way and with a device easy to implement, with a reliable operation and such that it can be installed even in existing decoration stations, without substantial changes.

[0075] A further benefit, in order to avoid defective tiles or slabs, at the same time stopping the production as little as possible, is given by the additional nozzle, which allows the stopped nozzle to be replaced or its correct functioning to be restored, while keeping the decoration station in regular operation.

[0076] It is understood, however, that what is described above has an illustrative value and does not limit the invention, therefore any variants of detail that may be necessary for technical and/or functional reasons, both in the method and in the device, are considered from now on to fall within the same protective scope defined by the claims below.

Claims

1. Method for controlling the amount of enamel applied onto ceramic tiles or slabs in a decoration station (2), said ceramic tiles or slabs (3) being moved by a conveyor (4), so that they enter said station, pass in succession by at least one application device equipped with a spray nozzle (5) arranged in the same station (2) and finally exit said station, said method being **characterized by** including the following operative steps:

   - periodical acquisition of at least one image of the spray pattern (V) generated by the aforementioned at least one spray nozzle (5);
   - the detection of at least one brightness value in said pattern (V) for each of said acquisitions, and comparison of the detected value with predetermined reference values, the difference between the detected brightness value and said reference values identifying a corresponding variations of density of a product emitted by said nozzle (5) and, correspondingly, of the weight of the product per unit of surface applied by said nozzle (5) onto said ceramic tiles or slabs (3);
   - activation of at least one action for compensating the effect of said variation in density on the weight of the product deposited on each unit of surface when a first predetermined threshold value is exceeded, said action for compensating comprising the variation of at least one operating parameter of said decoration station (2).

2. Method according to the claim 1, **characterised in that** said detection of at least one brightness value in said pattern (V) is carried out near a portion of the latter as close as possible to the aforementioned spray nozzle (5).

3. Method according to the claim 1, **characterised in that** said brightness detection in said pattern (V) is carried out at different spots of the same and **in that** said action of compensating is activated on the basis of a calculation of the average of the differences between the brightness values detected with respect to predetermined values for said spots.

4. Method according to the claim 1, **characterised in that** said brightness detection in said pattern (V) is carried out at different spots of the same and **in that** said action of compensating is activated on the basis of said first threshold value being exceeded, even in only one of said spots.

5. Method according to the claim 1 or 2 or 3 or 4, **characterised in that** said action of compensating consists in the correction of the flow rate of a pump (P) designed to feed said at least one spray nozzle (5).

6. Method according to the claim 1 or 2 or 3 or 4, **characterised in that** said action of compensating consists in correcting the forward rate of said conveyor (4).

7. Method according to the claim 1 or 2 or 3 or 4, **characterised in that** said action of compensating implies stopping one said application device when a second predetermined threshold value, greater than the first threshold value, is exceeded for that application device, including suspension of enamel supply by the relative spray nozzle (5), as well as when the latter is replaced.

8. Method according to the claim 1 or 2 or 3 or 4, **characterised in that** said action of compensating implies stopping all the aforementioned application devices and complete replacement of the relative spray

nozzles (5) when a second predetermined threshold value, greater than the first one, is exceeded.

9. Method according to the claim 1, **characterised by** including acquisition of brightness parameters of the spray pattern (V) when said at least one spray nozzle (5) is new, and using the same parameters to define said predetermined reference values with which the aforementioned comparison is subsequently to be carried out.

10. Device for controlling the amount of enamel applied onto ceramic tiles or slabs in a decoration station (2), said ceramic tiles or slabs (3) being moved by a conveyor (4), in said station through at least one application device provided with a spray nozzle (5), arranged in the same decoration station (2) and supplied by at least one pump (P), said device (1) being **characterized by** including:

- a plurality of video cameras (10), with at least one of them for each of said spray nozzles (5), designed to take, in real time, images concerning the spray pattern (V) generated by the relative spray nozzle (5) in each of the back and forth operating cycles performed by the latter;
- electronic processing means (11), destined to acquire the digital images taken during each cycle by each of said video cameras (10);
- a procedure for detecting the brightness of the said spray pattern (V), for each image and in at least one spot of the mentioned pattern (V), the procedure being stored in said electronic processing means (11) and designed to process each image according to predetermined calculation algorithms in order to quantify the enamel density delivered by the relative spray nozzle (5);
- a procedure for comparing said brightness values with reference values, stored in said electronic processing means (11), in order to identify intervention thresholds as a function of differences detected between said brightness values and said reference values;
- means for controlling operation of said conveyor (4) and/or said pump (P), designed to compensate variations of density in said enamel delivered by applying corresponding variations of operating parameters of said conveyor (4) and/or pump (P).

11. A device according to claim 10, **characterized by** providing, lighting members (12) provided in said decoration station (2) and capable of making visible the respective spray pattern (V) to each of said cameras (10).

12. A device according to claim 11, **characterised in that** said lighting members (12) are so arranged that said spraying patterns (V) are illuminated on the front side, with respect to said cameras (10), so that the above mentioned brightness parameters are obtained due to light reflection.

13. A device according to claim 11, **characterised in that** said lighting members (12) are so arranged that said spraying patterns (V) are illuminated on the rear side, with respect to said cameras (10), so that the above mentioned brightness parameters are obtained due to light transmission.

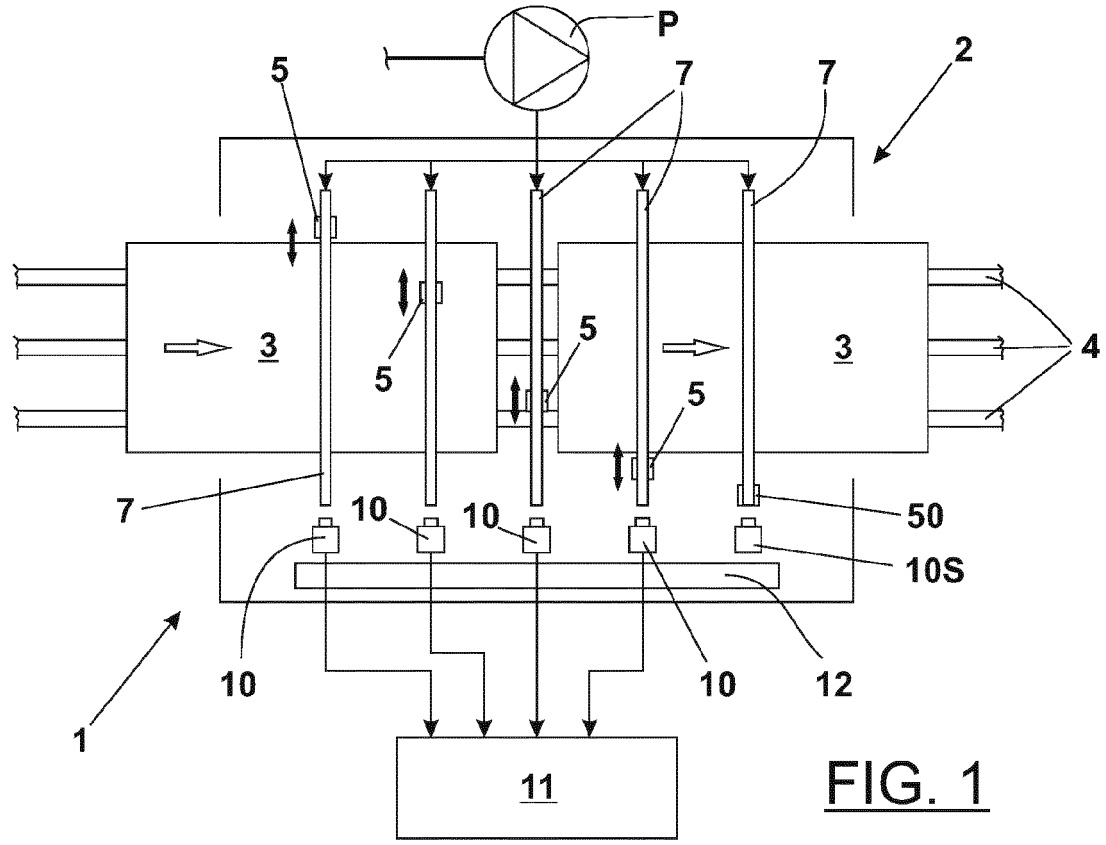
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FIG. 1

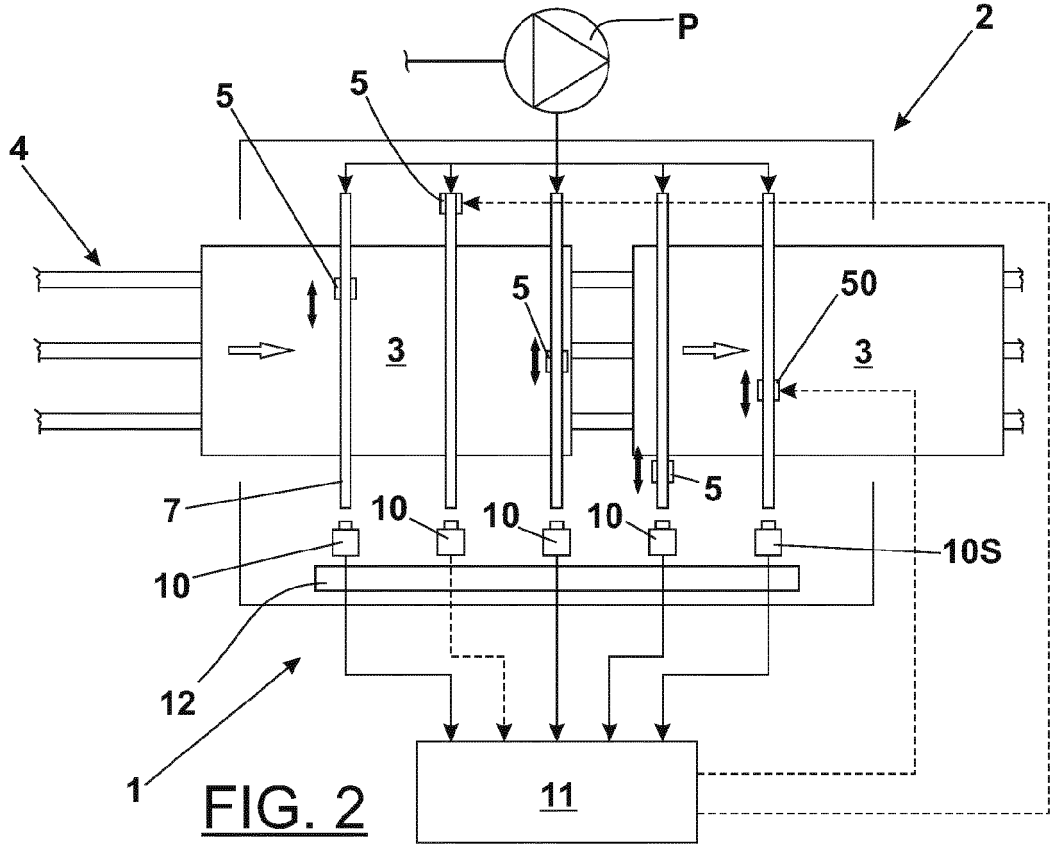
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FIG. 2

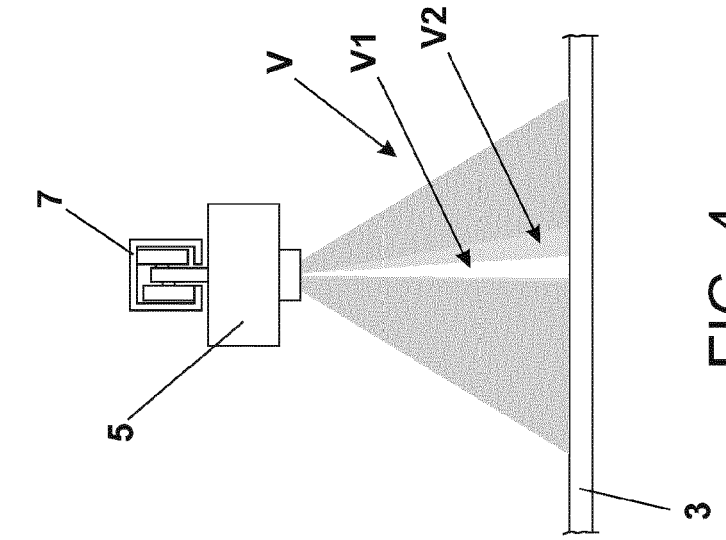

FIG. 4

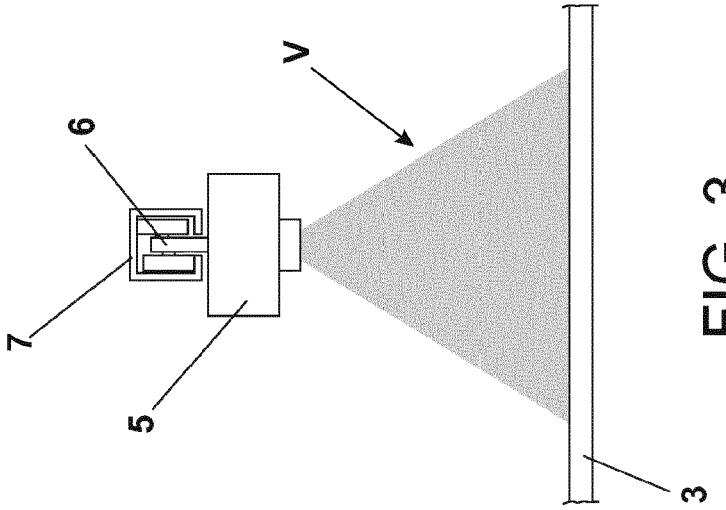

FIG. 3

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European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 19 15 3852

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 3 238 900 A1 (AIR POWER GROUP S P A [IT]) 1 November 2017 (2017-11-01) * figures 1-5 * * paragraphs [0028] - [0032] * -----	1-13	INV. B28B11/00 B28B11/04 B28B17/00 B05B12/08 B05B13/04
A	JP 2006 266718 A (SUMITOMO CHEMICAL CO) 5 October 2006 (2006-10-05) * figure 1 * * paragraphs [0020] - [0024] * -----	1-13	
A	US 2006/102741 A1 (CESAK JAMES [US]) 18 May 2006 (2006-05-18) * figures 1-9 * * paragraphs [0019], [0025] * -----	1-13	

TECHNICAL FIELDS SEARCHED (IPC)

B28B
B05B
G01B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	18 June 2019	Voltz, Eric

CATEGORY OF CITED DOCUMENTS

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