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**(54) An apparatus for distributing powders on a support in a predefined pattern**

Vorrichtung zum Verteilen von pülverförmigen Materialen in einem vorherbestimmten Muster auf einen Träger

Dispositif pour distribuer suivant un dessin déterminé des matériaux pulvéreux sur un support

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## Description

**[0001]** Especially, though not exclusively, the invention is useful in the production of ceramic tiles.

**[0002]** More specifically, it can be used: for dry decoration using powders on already-pressed tiles on traditional glazing lines; for dry decoration using powders (atomised or otherwise) on a still-soft support, before pressing; for depositing a decoration on a temporary support (for example on a steel belt, or canvas, or other), on which support the base powders (atomised or similar) will be spread so that the decoration is face-down.

**[0003]** Dry decoration using powders is at present done using flat silk-screening machines, similar to those used for liquid glazes, or using rotary machines which generally use cylindrical silk screens, again similar to those used with wet glazes.

**[0004]** Known rotary machines, which as they are rotary are the only machines enabling a continuous-feeding type of operation, do not adapt well in general to use with dry-powder decorations.

**[0005]** EP 0 634 516 disclose an apparatus for distributing powders on a support in a predetermined pattern and comprises: a conveyor belt for transporting the support; an applicator head for applying the powders located above the conveyor belt, the head comprising a belt exhibiting a plurality of perforations set out according to a predetermined pattern in order to allow passage of determined quantities of powders; means for controlled supply of the powders to the head; and a motion of the perforated belt being correlated with a motion of the conveyor belt. US 2 559 543 disclose an apparatus comprising in combination, means carrying sheet material in a substantially horizontal plane, an endless elevating belt conveyor mounted thereover, means mounting the endless conveyor to vertically spaced wheel means, selected portions of the endless belt conveyor cut out, means asynchronizing the peripheral speed of the belt with the lineal rate of movement of the sheet material, means directing a failing stream of particulate material to the inner surface of the lower run of the endless belt and particle elevating means mounted interiorly to the elevating belt conveyor.

**[0006]** WO 95/18020 discloses a silk-screen apparatus for decorating items with liquid glaze comprising a cleaning arrangement for the silk screen which comprises a water and/or cleaning solvent sprayer followed by an air jet dispenser to dry the screen and a collecting trough having an aspirator to discharge the liquid.

**[0007]** Another problem is that the rotary machines are structurally limited in that the cylinders have to be as long as the pattern which is to be transferred onto the support.

**[0008]** This represents a considerable operating limitation in the use of rotary machines.

**[0009]** The main aim of the present invention is to provide an apparatus which distributes powders on a support according to a predefined pattern, overcoming the

drawbacks inherent in the prior art.

**[0010]** The invention has the advantages of being simple as well as easy to apply on production lines.

**[0011]** These aims and advantages and more besides are all attained by the object of the invention, as it is characterised in the appended claims.

**[0012]** Further characteristics and advantages of the present invention will better emerge from the detailed description that follows of some preferred but non-exclusive embodiments of the invention, illustrated purely by way of a nonlimiting example in the accompanying figures of the drawings, in which:

15 figure 1 is a schematic lateral view in vertical elevation of a first embodiment;

figure 2 is a schematic lateral view in vertical elevation of a second embodiment;

figure 3 is a schematic lateral view in vertical elevation of a third embodiment;

20 figure 4 is a partial schematic section made according to line I-I of figure 1.

**[0013]** With reference to the figures, 1 denotes a mobile rest plane constituted by a usual conveyor belt 25 which supplies the supports 2, for example tiles or slabs, with a continuous straight motion.

**[0014]** An applicator head 3 is located above the conveyor belt 1, for applying the powders according to the predefined patterns onto the underlying supports 2 transiting on the conveyor belt 1.

**[0015]** The applicator head 3 comprises a moving surface, in effect a belt 4 bearing a plurality of small perforations arranged in a predefined pattern and of such dimensions that determined quantities of the powders can 35 pass through them.

**[0016]** The moving belt 4 is in effect the equivalent of a silk screen.

**[0017]** The moving belt 4 is a ring-wound non-stretch belt supported and driven by a pair of motorized pulleys 40 6 which are solidly mounted coaxially on a rotation axis which is parallel to the conveyor belt 1.

**[0018]** A special laser technique is preferably used to make the holes in the moving belt 4. This laser technique enables a very high level of precision to be obtained, 45 and a resulting high definition in the final powder distribution.

**[0019]** The ring-wound moving surface 4 is tensioned between the motorised pulley pair 6, between which pulley pair 6 a fixed support drum 11 (on which the belt 4 drags) is interposed, as is a distributor organ 7 having the task of conveying the powders to the internal side of the belt 4.

**[0020]** The belt 4 is driven by the pulleys 6 which for this purpose are externally equipped with projecting radial pins 16, which insert in special slots 14 made at equal distances in the edges of the belt 4.

**[0021]** The slots 14 are elongate in the direction of motion. In the illustrated embodiments the slots 14 are

elliptical, guaranteeing optimum operating precision.

**[0022]** Special means for controlling supply of powders to the applicator head 3 comprise a powder supplier-batcher 8, located above the distributor organ 7; the supplier-batcher 8 is activated according to the level of powders inside the applicator head 3 and on the belt 4, with respect to a predetermined level.

**[0023]** The measurement of this level is taken using a sensor system, schematically denoted by 9.

**[0024]** The supplier-batcher 8 is activated to discharge powders internally of the applicator head 3 when the sensor system 9 signals that a lower limit has been reached, while it stops discharging powders when the sensor system 9 signals that an upper limit level has been reached.

**[0025]** In a first embodiment, the supplier-batcher 8 is constituted by a continuous conveyor belt having a step operation. Discharge of the material is done laterally by effect of rotations of the conveyor about its own longitudinal axis, which rotations are achieved between one step and the next.

**[0026]** In a second embodiment, the supplier-batcher can be constituted by a prepacked cartridge which is very easy to insert and substitute.

**[0027]** In a first illustrated embodiment the distributor organ 7 is constituted by a doctor in the shape of a blade 17 which operates in direct contact with the internal side of the lower part of the perforated belt 4.

**[0028]** In a second illustrated embodiment, the distributor organ 7 is constituted by a sort of fixed double doctor 27 which operates in direct contact with the internal side of the lower part of the perforated belt 4 and which identifies a central chamber for containing powders, which is funnelled in a downwards direction to present a narrowed zone at which the powders are in contact with the internal side of the belt 4.

**[0029]** In a further embodiment the distributor organ 7 is constituted by a blade rotor 37 which is mobile in rotation about an axis which is parallel to the belt 4 and the rest plane, i.e. the conveyor belt 1.

**[0030]** In all of the illustrated embodiments the various distribution organs have the aim of favouring and regularizing the downwards expulsion of the powders through the perforations made in the belt 4.

**[0031]** Cleaning the patterned perforations in the belt 4 is done continuously by a suction effect exerted on the belt 4 by a plurality of suction mouths 5 located in the upper zone of the external cylindrical surface of the fixed support drum 11, the inside of which is kept depressed.

**[0032]** Usual actuating systems, not illustrated, are used for correlating the motion of the motorised pulleys drawing the perforated belt 4 and the supply motion of the conveyor belt 1.

**[0033]** This correlation, which also involves the synchronisation of the motion of the perforated belt 4 which a centred position of each single support 2 below the applicator head 3, determines a correct deposit of the powders on the support according to a predefined pat-

tern.

**[0034]** Among others, the invention has the advantage that deposit of the powders is done by free fall, without any contact taking place between the belt and the underlying support.

**[0035]** A further advantage of the invention lies in the fact that it enables powders to be distributed according to predefined patterns on continuous belt supports, theoretically of infinite length.

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## Claims

**1.** An apparatus for distributing powders on a support in a predefined pattern, comprising:

a conveyor belt (1) for transporting the support (2);  
an applicator head (3) for applying the powders, located above the conveyor belt (1), which head (3) comprises a belt (4) exhibiting a plurality of perforations set out according to a predefined pattern and being of such dimensions as to allow passage of determined quantities of the powders; the perforated belt (4) being ring-wound and being driven by two motorised pulleys (6), which pulleys (6) are coaxial and exhibit a common axis of rotation which is parallel to the conveyor belt (1); means for controlled supply of the powders to the head (3); and a motion of the perforated belt (4) being correlated with a motion of the conveyor belt;

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**characterised in that** it comprises:

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pneumatic means for continuously cleaning the perforations in the perforated belt (4); said pneumatic means comprising a plurality of suction mouths (5) afforded on an upper part of an external cylindrical surface of a fixed support drum (11), which drum (11) is interpositioned between two motorised pulleys (6) and supports the perforated belt (4); the suction mouths (5) being kept in direct communication with an inside of the drum (11) which is maintained in a state of depression; said perforated belt (4) being tensioned between the two coaxial motorised pulleys (6) and a distributor organ (7), which distributor organ (7) conveys the powders to an internal side of the perforated belt (4);

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**2.** The apparatus of claim 1, **characterised in that** the distributor organ (7) is constituted by a radial-bladed rotor (37), also known as a star doctor, which is mobile in rotation about an axis which is parallel to the perforated belt (4) and to the conveyor belt (1).

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3. The apparatus of claim 2, **characterised in that** the radial-bladed rotor (37) rotates in such a way that in a zone of contact with the internal side of the conveyor belt (1), the relative speed is not zero.
4. The apparatus of claim 1, **characterised in that** the motorised coaxial pulleys (6) are peripherally equipped with projecting radial pins (16) which insert in special slots (14) made at equal distances in edges of the perforated belt (4); the special slots (14) being elongate in a direction in which the pulleys move.
5. The apparatus of claim 4, **characterised in that** the projecting radial pins (16) are elliptical in shape.
6. The apparatus of claim 1, **characterised in that** the means for controlled supply of the powders to the head (3) comprise a supplier-batcher (8) of the powders, located above the distributor organ (7), activation of which supplier-batcher (8) is commanded in accordance with a deviation of a level of the powders above the perforated belt (4) with respect to a predetermined level thereof
7. The apparatus of claim 6, **characterised in that** the supplier-batcher (8) is constituted by a continuous stepper conveyor belt; discharge of the powders being effected laterally by rotations occurring between one step of the belt and a next about a longitudinal axis thereof.
8. The apparatus of claim 6, **characterised in that** the supplier-batcher (8) is constituted by a prepacked cartridge.

#### Patentansprüche

- Vorrichtung zum Verteilen von Pulvern in einem vorbestimmten Muster auf einem Träger, enthaltend:
  - ein Förderband (1) zum Transportieren des Trägers (2);
  - einen Auftragekopf (3) zum Auftragen der Pulver, angeordnet oberhalb des Förderbandes (1), welcher Kopf (3) ein Band (4) enthält, das eine Anzahl von Bohrungen aufweist, die nach einem bestimmten Muster angeordnet und von solchen Abmessungen sind, dass der Durchlass einer bestimmten Menge von Pulvern erlaubt ist; wobei das gebohrte Band (4) ringförmig gewunden und von zwei angetriebenen Riemscheiben (6) vorgezogen wird, welche Riemscheiben (6) koaxial sind und eine gemeinsame Drehachse aufweisen, welche parallel zu dem Förderband (1) verläuft;
  - Mittel zur gesteuerten Zuführung der Pulver an

- den Kopf (3); wobei eine Bewegung des gebohrten Bandes (4) mit einer Bewegung des Förderbandes (1) zusammenhängt;
- 5 **dadurch gekennzeichnet, dass** sie wie folgt enthält:
- pneumatische Mittel zum kontinuierlichen Reinigen der Bohrungen in dem gebohrten Band (4); wobei die genannten pneumatischen Mittel eine Anzahl von Ansaugöffnungen (5) enthalten, aufgewiesen an einem oberen Teil einer äusseren zylindrischen Oberfläche einer feststehenden Trägertrommel (11), welche Trommel (11) zwischen den beiden angetriebenen Riemscheiben (6) eingesetzt ist und das gebohrte Band (4) stützt; wobei die Ansaugöffnungen (5) in direkter Verbindung mit einem Innenraum Trommel (11) stehen, welcher in einem Zustand des Unterdruckes gehalten ist; und wobei das genannte gebohrte Band (4) zwischen den beiden koaxialen, angetriebenen Riemscheiben (6) und einem Verteilerelement (7) gespannt gehalten wird, welches Verteilerelement (7) die Pulver an eine Innenseite des gebohrten Bandes (4) leitet.
- 10 **2. Vorrichtung nach Patentanspruch 1, dadurch gekennzeichnet, dass** das Verteilerelement (7) aus einem Rotor (37) mit radialen Schaufeln gebildet ist, auch bekannt als Sternrakel, welcher in der Umdrehung um eine Achse beweglich ist, die parallel zu dem gebohrten Band (4) und dem Förderband (1) verläuft.
- 15 **3. Vorrichtung nach Patentanspruch 2, dadurch gekennzeichnet, dass** der Rotor (37) mit radialen Schaufeln sich auf solche Weise dreht, dass in dem Kontaktbereich mit der Innenseite des Förderbandes (1) die entsprechende Geschwindigkeit nicht Null ist.
- 20 **4. Vorrichtung nach Patentanspruch 1, dadurch gekennzeichnet, dass** die angetriebenen koaxialen Riemscheiben (6) umlaufend mit hervorstehenden radialen Zapfen (16) versehen sind, welche sich in spezielle Schlüsse (14) einschieben, die in gleichmässigen Abständen in die Ränder des gebohrten Bandes (4) eingearbeitet sind; wobei die speziellen Schlüsse (14) in einer Richtung verlängert sind, in welcher sich die Riemscheiben bewegen.
- 25 **5. Vorrichtung nach Patentanspruch 4, dadurch gekennzeichnet, dass** die hervorstehenden radialen Zapfen (16) elliptisch in der Form sind.
- 30 **6. Vorrichtung nach Patentanspruch 1, dadurch gekennzeichnet, dass** die Mittel zum gesteuerten Zu-

führen der Pulver an den Kopf (3) einen Speise-Dosierer (8) für die Pulver enthalten, angeordnet oberhalb der Verteilerelementes (7), wobei die Aktivierung des Speise-Dosierers (8) in Übereinstimmung mit einer Abweichung der Höhe der Pulver auf dem gebohrten Band (4) im Verhältnis zu einer vorgegebenen Höhe derselben ausgelöst wird.

7. Vorrichtung nach Patentanspruch 6, **dadurch gekennzeichnet, dass** der Speise-Dosierer (8) aus einem kontinuierlichen Schrittförderband besteht; wobei das Entladen der Pulver seitlich durch Umdrehungen erfolgt, die zwischen einem Schritt des Bandes und dem nächsten um eine Längsachse desselben ausgeführt werden.
8. Vorrichtung nach Patentanspruch 6, **dadurch gekennzeichnet, dass** der Speise-Dosierer (8) aus einer vorgefertigten Kartusche besteht.

#### Revendications

1. Dispositif pour distribuer suivant un dessin pré-déterminé des matériaux pulvérulents sur un support, comprenant:

un tapis convoyeur (1) pour transporter le support (2);  
une tête d'application (3) pour appliquer les matériaux pulvérulents, disposée au-dessus du tapis convoyeur (1), laquelle tête (3) comprend un tapis roulant (4) présentant une pluralité de perforations disposées selon un dessin pré-déterminé et étant de dimensions telles qu'elles permettent le passage de quantités pré-déterminées de matériaux pulvérulents; le tapis roulant perforé (4) étant enroulé en anneau clos et étant actionné par deux poulies motorisées (6), lesquelles poulies (6) sont coaxiales et présentent un axe de rotation commun parallèle au tapis convoyeur (1);  
des moyens d'alimentation contrôlée en matériaux pulvérulents de la tête (3); et  
un mouvement du tapis roulant perforé (4) étant corrélé à un mouvement du tapis convoyeur;

**caractérisé en ce qu'il comprend:**

des moyens pneumatiques pour le nettoyage continu des perforations dans le tapis roulant perforé (4); lesdits moyens pneumatiques comprenant une pluralité de bouches aspirantes (5) disposées sur une partie supérieure d'une surface cylindrique externe d'un tambour de support fixe (11), lequel tambour (11) est positionné entre deux poulies motorisées (6) et supporte le tapis roulant perforé (4); les bouches aspi-

rantes (5) étant directement communicantes avec l'intérieur du tambour (11) dépressurisé; ledit tapis roulant perforé (4) étant tendu entre les deux poulies motorisées coaxiales (6) et un organe de distribution (7), lequel organe de distribution (7) convoie les matériaux pulvérulents sur un côté interne du tapis roulant perforé (4).

2. Dispositif selon la revendication 1, **caractérisé en ce que** l'organe de distribution (7) est constitué d'un rotor à pales radiales (37), ou racle en étoile, mobile en rotation autour d'un axe parallèle au tapis roulant perforé (4) et au tapis convoyeur (1).
- 15 3. Dispositif selon la revendication 2, **caractérisé en ce que** le rotor à pales radiales (37) pivote de manière à ce que, dans une zone de contact avec le côté interne du tapis convoyeur (1), la vitesse relative soit différente de zéro.
- 20 4. Dispositif selon la revendication 1, **caractérisé en ce que** les poulies motorisées coaxiales (6) sont pourvues sur leur périphérie de broches radiales saillantes (16) qui s'insèrent dans des orifices spéciaux (14) réalisés de manière équidistante sur les bords du tapis roulant perforé (4); les orifices spéciaux (14) étant allongés dans la direction du mouvement des poulies.
- 25 5. Dispositif selon la revendication 4, **caractérisé en ce que** les broches radiales saillantes (16) sont de forme elliptique.
- 30 6. Dispositif selon la revendication 1, **caractérisé en ce que** les moyens d'alimentation contrôlée en matériaux pulvérulents de la tête (3) comprennent un alimentateur doseur (8) de matériaux pulvérulents, disposé au-dessus de l'organe distributeur (7), l'activation duquel alimentateur doseur (8) est commandée en fonction d'une différence du niveau de matériaux pulvérulents au-dessus du tapis roulant perforé (4) par rapport à un niveau pré-déterminé.
- 35 7. Dispositif selon la revendication 6, **caractérisé en ce que** l'alimentateur doseur (8) est constitué d'un tapis convoyeur continu avec mouvement pas à pas; le déchargement des matériaux pulvérulents est effectué latéralement par rotation entre un pas et l'autre du tapis autour de son axe longitudinal.
- 40 8. Dispositif selon la revendication 6, **caractérisé en ce que** l'alimentateur doseur (8) est constitué d'une cartouche préemballée.



