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(54) **METHOD AND PLANT FOR FORMING CERAMIC TILES OR SLABS**

VERFAHREN UND ANLAGE ZUR HERSTELLUNG VON KERAMIKFLIESEN ODER PLATTEN
PROCEDE ET USINE POUR FORMER DES TUILES OU DES PLAQUES CERAMIQUES

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Description

TECHNICAL FIELD

[0001] The present invention relates to a method and plant for forming ceramic tiles and slabs.

BACKGROUND ART

[0002] Research in the ceramic sector is currently aimed at obtaining products imitating natural stone, such as marble and granite. These products are characterised by the presence of continuous veining of random pattern extending through the entire thickness of the slab.

[0003] Such ceramic tiles or slabs are produced by compacting, by hydraulic presses, semi-dry atomized, ground or re-granulated powders variously mixed together in prearranged or random manner. Specifically, the powder mixtures are deposited by suitable means into the forming cavities of rigid steel moulds with which the presses are provided, and are then pressed to obtain the product.

[0004] A forming method according to EP-A-1321260 which comprises the following operative steps:

- preparing a hopper having a discharge mouth of dimensions at least equal to the dimensions of the at least one cavity of the mould of a forming press, both in the translation direction of an underlying carriage with loading tray and in the direction perpendicular thereto,
- depositing in the hopper in a prearranged and/or random manner a mixture of powders of different characteristics in such a manner as to create therein a mass of powders presenting veining variously disposed within the mass,
- from said mass of powders, withdrawing in succession portions having, in the carriage translation direction, a dimension equal to a fraction of the dimension of the hopper mouth, and in the direction perpendicular thereto the same dimension as the hopper mouth, such as to withdraw an entire layer of powders from said mass,
- depositing said layer in an orderly manner in the interior of said at least one cavity by means of the carriage, and pressing the powders.

[0005] The described method is implemented by a plant comprising a fixed hopper for containing a mixture of powders presenting bulk veining in imitation of a natural stone. With the lower mouth of the hopper, which has the same plan dimensions as the cavity of the forming press, there are associated movable means arranged to deposit in the cavity a succession of powder portions withdrawn from said hopper, until the cavity is completely filled.

[0006] Although it operates well, the described plant is little versatile in terms of format change, this now being

an essential characteristic in a modern plant. In this respect, the technology is increasingly aimed at obtaining ceramic slabs or tile having variable dimensions in accordance with market requirements. There is therefore the need for a more versatile plant which enables the tile or slab format to be changed rapidly without the need for lengthy interruptions in production.

[0007] WO-A-96/15888 discloses an apparatus using a conveyor belt for loading a press for forming ceramic tiles or slabs according to the preamble of claim 4 and a method for forming ceramic tiles or slabs in a continuous press, comprising the following operative steps:

- arranging a hopper, driven with reciprocating movement, above a conveyor belt,
- depositing in the hopper in a prearranged and/or random manner a mixture of powders of different characteristics in such a manner as to create in the hopper a mass of powders presenting veining peculiar to a single block of natural stone,
- depositing said layer onto said belt, and
- pressing the powders.

[0008] The object of the invention is to satisfy said requirement within the framework of a simple and rational solution.

DISCLOSURE OF THE INVENTION

[0009] The invention attains said objects by virtue of the characteristics defined in the claims.

[0010] Specifically the invention provides a method for forming ceramic tiles or slabs in a continuous press arranged to form a slab of indefinite length comprising the following operative steps:

- arranging a hopper above a moving conveyor belt,
- depositing in the hopper in a prearranged and/or random manner a mixture of powders of different characteristics in such a manner as to create in the hopper a mass of powders presenting veining peculiar to a single block of natural stone,
- from said mass of powders, withdrawing in succession portions having, in the belt advancement direction, a dimension equal to a fraction of the dimension of said hopper in the same direction and, in the direction perpendicular to the preceding, the same dimension as the hopper mouth, such as to withdraw an entire layer of said mass,
- depositing said layer onto said belt by gravity, and
- pressing the powders by a continuous pressing system.

[0011] According to the invention, said portions are withdrawn by moving the hopper with reciprocating movement in the belt advancement direction above suitable distribution means.

[0012] Said method is implemented by a tile forming

plant defined in claim 4. Such a plant comprises a conveyor belt, above which there is positioned a hopper movable with to-and-fro movement in the direction of the belt axis and containing a mixture of powders presenting bulk veining in imitation of a natural stone. With said hopper there are associated powder distribution means arranged to enable a succession of powder portions to fall by gravity onto said belt, to create a continuous powder strip which said belt feeds to a continuous pressing station.

[0013] The hopper is driven by usual known means.

[0014] The powder distribution means comprise a fixed plate provided centrally with a slot perpendicular to the direction of translation of said belt, said plate having a dimension in the belt advancement direction equal to at least double the corresponding dimension of the lower mouth of said hopper, and a dimension in the direction perpendicular to said belt advancement direction equal to the corresponding dimension of the lower mouth of the hopper.

[0015] The slot with which the plate is provided presents, in the belt advancement direction, a dimension which is a function of the graphic resolution to be obtained on the finished tile. The slot dimension in the belt advancement direction varies between 10 and 50 mm, and preferably between 20 and 40 mm.

[0016] According to a first embodiment of the invention, said continuous pressing station is arranged to compact the powder strip created on the belt to a pressure sufficient to obtain a continuous coherent product intended to undergo a second final pressing after being divided into blanks of predefined dimensions by a usual cutting station, before feeding the blanks to firing.

[0017] In this first case, the pressure exerted on said powder strip reaches a value not exceeding 100 bar.

[0018] Alternatively, said continuous pressing station compacts the powder strip to a maximum pressure close to 250-300 bar. The thus compacted product does not require a subsequent second pressing, and can hence be divided into blanks by a usual cutting station, to be fed directly to firing. In both embodiments the plant can be provided with scraping devices to remove a thin layer of powders in order to display the veining present in said strip, and also with further devices for the controlled deposition of further decorative powders on said strip.

[0019] The operation of the method of the invention and the constructional characteristics and merits of the relative means for its implementation will be better understood from the ensuing description given with reference to the figures of the accompanying drawings which illustrate a particular preferred embodiment of said means and of some constructional variants thereof by way of non-limiting example.

[0020] Figure 1 is a schematic side view of the plant according to the invention.

[0021] Figure 2 is an enlarged view of the section II-II shown in Figure 1.

[0022] Figures 3 and 4 schematically show the oper-

ation of the invention.

[0023] Said figures show the plant 1, which comprises a conveyor belt 2, above which there are positioned means 3 for creating a continuous powder strip 100 on the belt 2, a suction scraping system 4, a continuous pressing station 5 and a cutting station 6.

[0024] The said means for creating the continuous powder strip 100 comprise a hopper 7 driven with reciprocating motion, in which the powders are deposited by an overlying movable feeder 70 also driven along two mutually perpendicular directions in a plane parallel to the plane of the belt 2, and caused by known means, not shown, to slide above the upper mouth of the hopper 7.

[0025] The purpose of the feeder 70 is to deposit by gravity at least two powders of different characteristics into the hopper 7 such that they together form a mass presenting variously disposed veining reproducing that present in a natural stone. In other words this mass can be said to reproduce a block of natural stone, which is then cut into layers which are deposited on the belt 2 by the distribution means 8 associated with the hopper and described hereinafter.

[0026] In the illustrated embodiment, to limit slippage of the powders during their discharge onto the belt 2, the internal volume of the hopper 7 is divided by baffles 71 (Figure 2) positioned at the hopper exit mouth. A second series of baffles 72 is associated with the upper mouth of the hopper, to mix the powders fed into the hopper 7 in order to create the veining and the aesthetic effects as randomly as possible in imitation of the veining appearing in a block of natural stone.

[0027] In other embodiments of the invention, only the baffles 71 or only the baffles 72 could be provided, or alternatively none at all.

[0028] The hopper 7 is associated with a drive system, not shown, which causes it to translate with reciprocating motion above the powder distribution means 8.

[0029] In the illustrated embodiment, said distribution means 8 are associated with the lower mouth of the hopper 7 and comprise a fixed plate 9 provided with a slot 10, disposed perpendicular to the translation direction of the plate 9.

[0030] The plate 9 has a dimension in the direction perpendicular to the belt advancement direction which is greater than the corresponding overlying dimension of the hopper 7, and a dimension in the belt advancement direction equal to at least double the corresponding dimension of the hopper 7. The slot 10 has a dimension in the direction perpendicular to the belt advancement direction which is equal to the corresponding dimension of the lower mouth of the hopper 7, and a dimension in the belt advancement direction which depends on the graphic resolution to be obtained on the finished tile.

[0031] The slot 10 is provided lowerly with a perimetral surround 101 which delimits the thickness of the powder strip deposited on the belt 2, to prevent the strip sliding against the lower surface of the plate 9.

[0032] The height of the surround 101 varies between

1 and 300 mm, depending on the actual embodiment of the invention.

[0033] Downstream of the hopper 7b there is positioned a usual device 40 for scraping the upper surface of the powder strip 100. Said device 40 is connected to a suction system, not shown being of known type, which enables a thin surface layer of powders to be removed from the strip 100 in order to exalt the graphics and the contrast between the different coloured powders of the strip 100.

[0034] The belt 2 feeds the powder strip to a continuous pressing station 5, also of known type, comprising an upper compacting band 50 provided to compact the powder strip on the lower belt 2 to obtain a continuous compacted product.

[0035] Means for laterally retaining the powder strip on the belt 2 are associated with said compacting band 50. These latter lateral retention means are not shown as they are known to the expert of the art.

[0036] According to the present embodiment, the compaction effected by the compacting band 50 is sufficient to obtain a compacted product which does not require further compacting. In this case the maximum compacting pressure reaches values close to 300 bar.

[0037] Once compacted, the product is divided into blanks of predefined dimensions by a usual cutting device 6. In the illustrated embodiment, said device essentially comprises a rotary blade 60 for making the cut in the direction perpendicular to the belt advancement direction, and at least two further rotary blades 61, only one of which is visible in the figures, for cutting the compacted product in the advancement direction of the belt 2. The described plant is controlled by a processor, not shown, which controls its operation in the following manner.

[0038] While the belt 2 advances (Figure 4), the hopper 7 translates reciprocatingly on the plate 9 in such a manner as to deposit adjacent powder portions on the belt 2, to create thereon a continuous powder strip which is firstly scraped by the system 4, and then compacted in the compacting station 5. Downstream of the compacting station the rotary blades 60 and 61 cut the strip into blanks of predefined dimensions.

[0039] It should be noted that when the hopper movement is reversed (Figure 5) the manner of depositing the powders on the belt 2 varies, to the advantage of their random distribution, resulting in a greater naturalness of the different coloured veining present in the powder strip.

[0040] The manner of distributing the powders can be further varied by changing the hopper translation speed, in addition to the movement of the overlying feeder 70.

Claims

1. A method for forming ceramic tiles or slabs in a continuous press, comprising the following operative steps:

- arranging a hopper, driven with reciprocating movement, above a conveyor belt,
- depositing in the hopper in a prearranged and/or random manner a mixture of powders of different characteristics in such a manner as to create in the hopper a mass of powders presenting veining peculiar to a single block of natural stone,
- from said mass of powders, withdrawing in succession portions having, in the belt advancement direction, a dimension equal to a fraction of the dimension of said hopper in the same direction and, in the direction perpendicular to the preceding, the same dimension as the hopper mouth, such as to withdraw an entire layer of said mass,
- depositing said layer onto said belt, and
- pressing the powders by a continuous pressing system.

2. A method as claimed in claim 1, **characterised in that** the dimension of said powder portions in the belt translation direction is a function of the graphic resolution to be obtained on the finished tile.
3. A method as claimed in claim 1, **characterised in that** the powders are fed to the hopper by at least one feeder movable relative to the hopper.
4. A plant for forming ceramic tiles or slabs comprising a conveyor belt, above which there is positioned a hopper containing a mixture of powders presenting bulk veining in imitation of a natural stone, with said hopper there being associated powder distribution means arranged to feed the powders to the underlying conveyor belt, **characterised in that** said powder distribution means are fixed whereas said hopper is movable above said means to deposit on said advancing belt a succession of powder portions in such a manner as to create a continuous powder strip which said belt feeds to a continuous pressing station.
5. A plant as claimed in claim 4, **characterised in that** said hopper is driven by suitable means which cause it to translate reciprocatingly above said distribution means.
6. A plant as claimed in claim 4, **characterised in that** the speed of translation of said hopper has a modulus or absolute value speed different from the speed of translation of the underlying conveyor belt (2).
7. A plant as claimed in claim 4, **characterised in that** said powder distribution means comprise a fixed plate provided centrally with a slot perpendicular to the direction of translation of said belt, said plate having a dimension in the belt translation direction which

is equal to at least double the dimension of the lower mouth of said hopper in the same direction, and a dimension in the direction perpendicular to the preceding which is at least equal to the dimension of the lower mouth of the hopper in the same direction.

8. A plant as claimed in claim 7, **characterised in that** the dimension of said slot, in the tray translation direction, is between 10 and 50 mm.
9. A plant as claimed in claim 7, **characterised in that** the dimension of said slot, in the tray translation direction, is preferably between 20 and 40 mm.
10. A plant as claimed in claim 7, **characterised in that** said slot has a dimension, in the direction perpendicular to the advancement direction of said belt, which is a function of the corresponding dimension of the tile which is to be formed.
11. A plant as claimed in claim 7, **characterised in that** a perimetral scraping surround is associated with the lower edge of said slot.
12. A plant as claimed in claim 7, **characterised in that** the height of said surround is between 1 and 300 mm.

Patentansprüche

1. Eine Methode zur Formung von Keramikfliesen oder -platten in einer kontinuierlichen Presse, die folgende Operationsschritte umfasst:
 - Anbringung eines Trichters über einer Förderanlage, der mit auf- und abgehenden Bewegungen betrieben wird,
 - Ablage der vorbereiteten oder nach Zufallsprinzip zusammengestellten Pulvermischung unterschiedlicher Charakteristiken im Trichter auf die Art, dass sich im Trichter eine Pulvermasse bildet, die Aderungen ähnlich denen eines einzigen Natursteinblockes aufweist,
 - Aus den besagten Pulvermassen werden in Folge Portionen entnommen, die in Richtung der Förderbandbewegung die gleiche Dimension zu einem Bruchteil der Abmessung des besagten Trichters in der gleichen Richtung haben, und in senkrechter Richtung zur Vorgehensweise zur gleichen Abmessung der Trichteröffnung, um aus der besagten Masse eine vollständige Schicht zu entnehmen,
 - wobei die besagte Schicht auf dem besagten Förderband hinterlegt wird, und
 - die Pulver mit einem kontinuierlichen Presssystem gepresst werden.
2. Eine Methode nach 1 Anspruch, **dadurch gekennzeichnet**,

zeichnet, dass die Abmessung der besagten Pulverportionen in Richtung der Förderbandbewegung eine Funktion der graphischen Resolution ist, die auf der fertigen Fliese erhalten werden soll.

3. Eine Methode nach 1 Anspruch, **dadurch gekennzeichnet, dass** die Pulver mittels mindestens eines Zuflusses, der relativ zum Filter beweglich ist, dem Trichter zugeführt werden.
4. Eine Anlage zur Formung von Keramikfliesen oder -platten, die eine Förderanlage einschließt, über der ein Trichter positioniert ist, der eine Mischung von Pulvern enthält, die in jenem Maße Aderungen aufweist, dass ein Naturstein imitiert wird, wobei mit besagtem Trichter Einrichtungen für die Pulververteilung verbunden sind, die angebracht wurden, um die Pulver auf dem darunter befindlichen Förderband abzulegen, **dadurch gekennzeichnet, dass** die besagten Einrichtungen zur Pulververteilung dort fixiert sind, während der besagte Trichter über den besagten Einrichtungen beweglich ist, um auf dem besagten Förderband eine Folge von Pulverportionen derart abzulegen, dass ein kontinuierlicher Pulverstreifen entsteht, den das besagte Förderband einer kontinuierlichen Presse zuführt.
5. Eine Anlage nach Anspruch 4, **dadurch gekennzeichnet, dass** der besagte Trichter durch geeignete Einrichtungen betrieben wird, die diesen zur wechselseitigen Übertragung auf den besagten Verteilungseinrichtungen veranlassen.
6. Eine Anlage nach Anspruch 4, **dadurch gekennzeichnet, dass** die Übertragungsgeschwindigkeit des besagten Trichters einen Modulus oder absoluten Geschwindigkeitswert hat, der sich von der Übertragungsgeschwindigkeit des darunter befindlichen Förderbandes unterscheidet (2).
7. Eine Anlage nach Anspruch 4, **dadurch gekennzeichnet, dass** die besagte Pulververteilungseinrichtung eine fixierte Scheibe einschließt, die in der Mitte mit einem Schlitz versehen ist, der sich senkrecht zur Übertragungsrichtung des besagten Bandes befindet, wobei die besagte Scheibe in der Richtung der Förderbandbewegung eine identische Dimension mit der mindestens doppelten Dimension der unteren Öffnung des Filters in der gleichen Richtung hat und in der senkrechten Richtung zum Vorgang eine Dimension hat, die mindestens identisch mit der Dimension der unteren Öffnung des Filters in der gleichen Richtung ist.
8. Eine Anlage nach Anspruch 7, **dadurch gekennzeichnet, dass** die Dimension des besagten Schlitzes in Übertragungsrichtung der Ablage zwischen 10 und 50 mm liegt.

9. Eine Anlage nach Anspruch 7, **dadurch gekennzeichnet, dass** die Dimension des besagten Schlitzes in Übertragungsrichtung der Ablage vorzugsweise zwischen 20 und 40 mm liegt.
10. Eine Anlage nach Anspruch 7, **dadurch gekennzeichnet ist, dass** der besagte Schlitz in senkrechter Richtung zur Förderrichtung des besagten Bandes eine Dimension hat, die eine Funktion der entsprechenden Dimension der zur formenden Fliese ist.
11. Eine Anlage nach Anspruch 7, **dadurch gekennzeichnet, dass** eine perimetrisch schabende Umrandung mit der unteren Kante des besagten Schlitzes verbunden ist.
12. Eine Anlage nach Anspruch 7, **dadurch gekennzeichnet, dass** die Höhe der besagten Umrandung zwischen 1 und 300 mm liegt.

Revendications

1. Une méthode pour la formation de carreaux ou de dalles en céramique dans une presse continue, comprenant les phases de travail ci-dessous :
 - agencement d'une trémie, entraînée par un mouvement alternatif, au-dessus d'une courroie transporteuse,
 - pose dans la trémie, d'une façon préétablie et/ou randomisée, d'un mélange de poudres ayant des caractéristiques différentes de façon à créer dans la trémie une masse de poudres présentant une veinure propre à chaque bloc de pierre naturelle,
 - extraction en séquence de ladite masse de poudres de portions ayant, dans le sens d'avancement de la courroie, une taille égale à une fraction de la taille de ladite trémie dans le même sens et, dans le sens perpendiculaire par rapport à cet dernier, la même taille que la bouche de la trémie, de façon à extraire toute une couche de ladite masse,
 - pose de ladite couche par-dessus ladite courroie, et
 - compression des poudres par biais d'un système de compression continue.
2. Une méthode selon la revendication 1, **caractérisée en ce que** la taille desdites portions de poudres dans le sens de translation de la courroie est une fonction de la résolution graphique à obtenir sur le carreau fini.
3. Une méthode selon la revendication 1, **caractérisée en ce que** les poudres sont introduites dans la trémie

par au moins un alimentateur mobile par rapport à la trémie.

4. Une installation pour la formation de carreaux ou de dalles en céramique comprenant une courroie transporteuse, par-dessus laquelle est positionné une trémie contenant un mélange de poudres présentant une veinure pêle-mêle sur l'imitation d'une pierre naturelle, des moyens de distribution des poudres étant associés avec ladite trémie aménagés en vue de transporter les poudres jusqu'à la courroie transporteuse y gisant au-dessous, **caractérisée en ce que** lesdits moyens de distribution des poudres sont fixes tandis que ladite trémie est mobile par-dessus lesdits moyens pour déposer, sur ladite courroie qui avance, une série de portions de poudres de façon à créer une bande de poudres continue que ladite courroie transporte jusqu'à une station de compression continue.
5. Une installation selon la revendication 4, **caractérisée en ce que** ladite trémie est entraînée par des moyens convenables qui la font déplacer par translation alternativement au-dessus desdits moyens de distribution.
6. Une installation selon la revendication 4, **caractérisée en ce que** la vitesse de translation de ladite trémie a un module ou vitesse de valeur absolue différente par rapport à la vitesse de translation de la courroie transporteuse y gisant au-dessous (2).
7. Une installation selon la revendication 4, **caractérisée en ce que** lesdits moyens de distribution des poudres comprennent une plaque fixe munie centralement d'une fente perpendiculaire au sens de translation de ladite courroie, ladite plaque ayant une taille dans le sens de translation de la courroie qui est égale à au moins deux fois la taille de la bouche inférieure de ladite trémie dans le même sens, et une taille dans le sens perpendiculaire par rapport à cet dernier qui est au moins égale à la taille de la bouche inférieure de la trémie dans le même sens.
8. Une installation selon la revendication 7, **caractérisée en ce que** la taille de ladite fente, dans le sens de translation du plateau, est comprise entre 10 et 50 mm.
9. Une installation selon la revendication 7, **caractérisée en ce que** la taille de ladite fente, dans le sens de translation du plateau, est comprise de préférence entre 20 et 40 mm.
10. Une installation selon la revendication 7, **caractérisée en ce que** ladite fente a une taille, dans le sens perpendiculaire par rapport au sens d'avancement de ladite courroie, qui est une fonction de la taille

correspondante du carreau qui va être formé.

11. Une installation selon la revendication 7, **caractérisée en ce qu'**un contour d'écroûtage périmétral est associé au bord inférieur de ladite fente.

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12. Une installation selon la revendication 7, **caractérisée en ce que** la hauteur dudit contour est comprise entre 1 et 300 mm.

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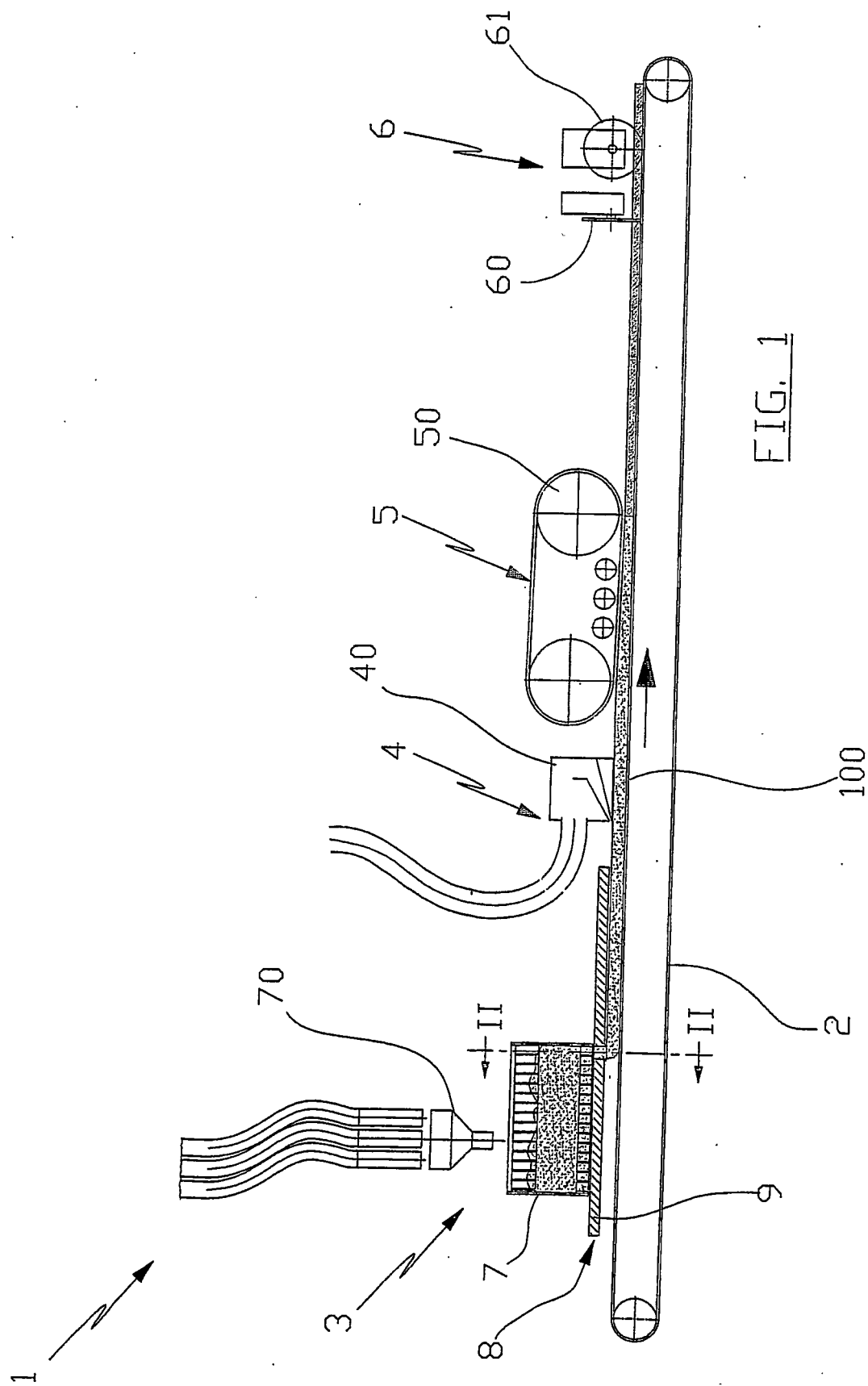
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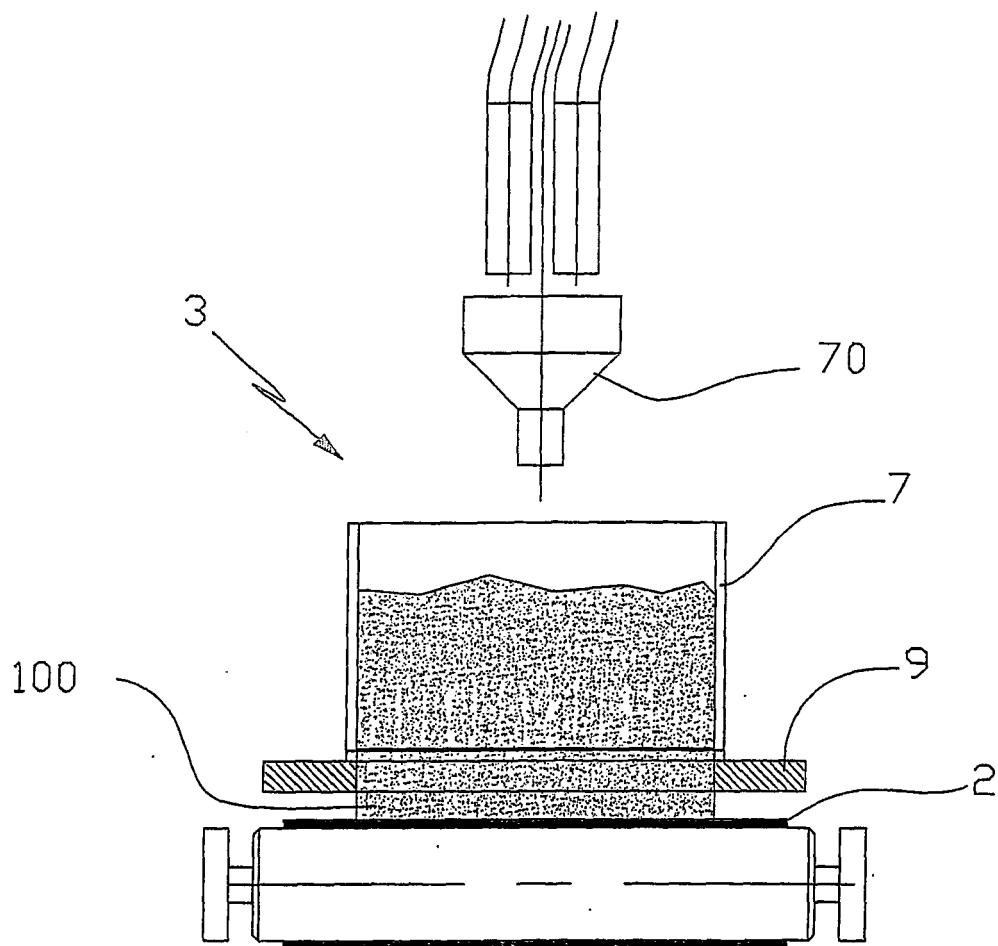


FIG. 2

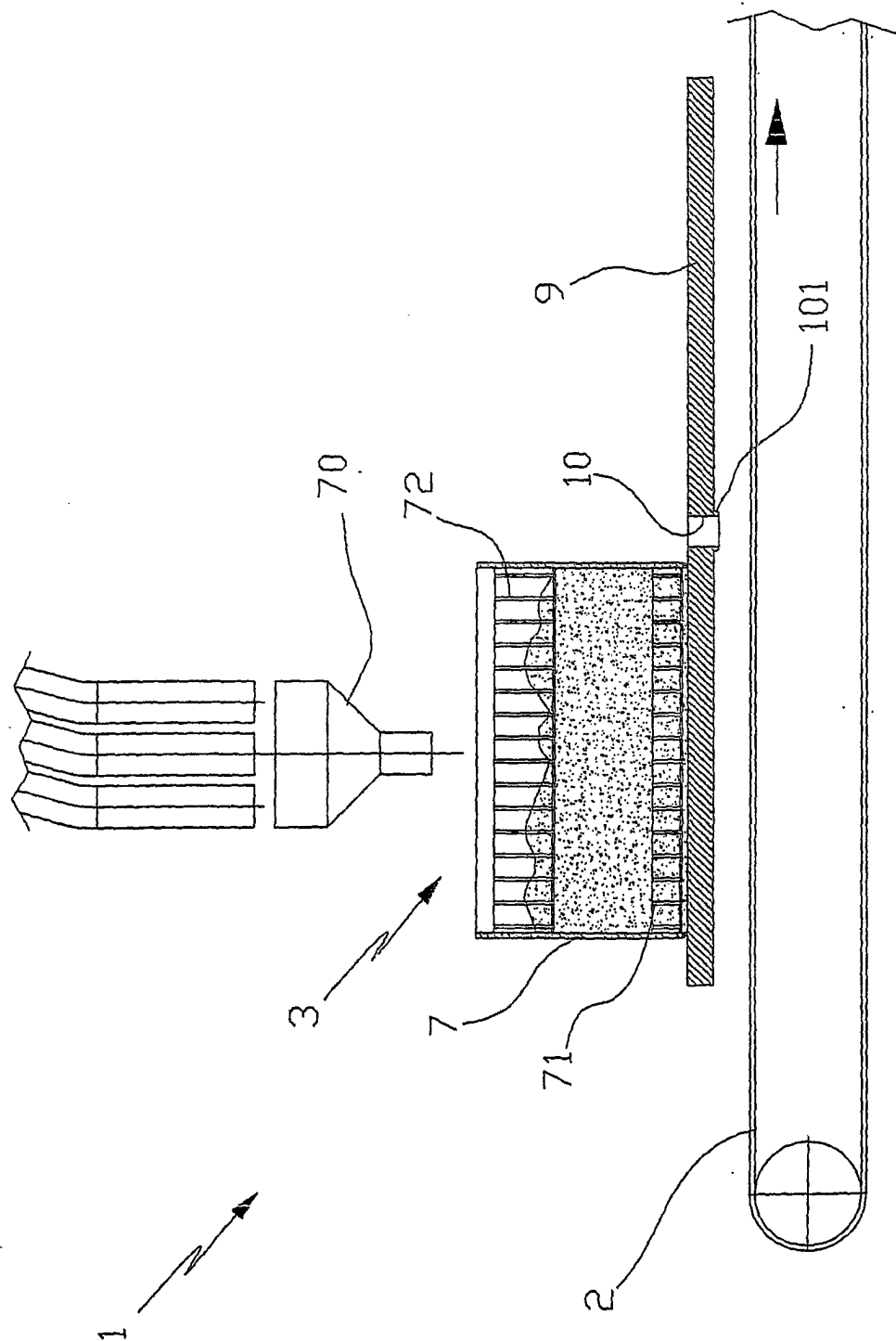


FIG. 3

