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(54) Device and method of manufacturing ceramic tiles.

(57) The invention relates to a device for manufacturing ceramic tiles, said device being provided with a mould having a lower die (2) and an upper die (3), with a filling cart (5) for introducing starting material in said mould and with an endless conveyor belt (17). An upper part of the conveyer belt (17), which extends at least substantially horizontally, is movable in a direction towards and away from the mould (2). At least two bunkers (19,20) are disposed one behind the other, when seen in the direction of movement of said upper part, so as to deposit various materials on said upper part of the conveyor belt (17), via outlets (21,22) located near the bottom side of said bunkers. Said materials can be deposited on base material present on the lower die (2) by driving the conveyor belt (17) during the movement of the conveyor belt (17) over said lower die (2). A strickling means (23) is disposed between the outlets (21,22) of the two bunkers (19,20), so as to determine the layer thickness of the material deposited from one (20) of said bunkers on the conveyor belt (17) and conveyed under the outlet of the other bunker (19) in the direction of the mould. The other bunker (19) is provided with a dosaging means (22) for regulating the amount of material which is discharged from the other bunker (19) during each operating cycle.

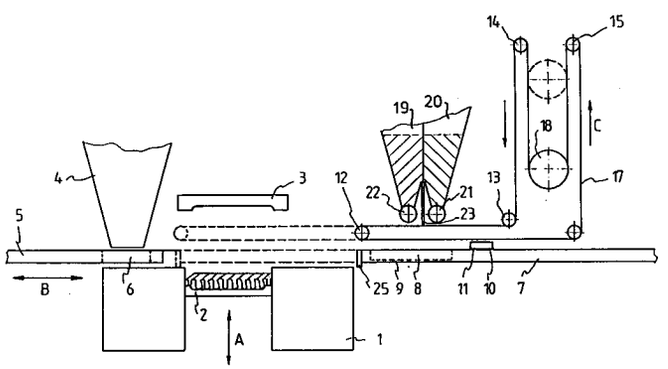

Fig 1

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The invention relates to a device for manufacturing ceramic tiles, said device being provided with a mould having a lower die and an upper die, with a filling cart for introducing base material in said mould and with an endless conveyor belt, of which at least one upper part, which extends at least substantially horizontally, is movable in a direction towards and away from the mould, whilst at least two bunkers are disposed one behind the other, when seen in the direction of movement of said upper part, so as to deposit various materials on said upper part of the conveyor belt, via outlets located near the bottom side of said bunkers, whereby said materials can be deposited on base material present on the lower die by driving the conveyor belt during the movement of the conveyor belt over said lower die.

Such a device is known from EP-A-0,300,523. In this known device a brush means is arranged near the discharge end of the conveyor belt, so as to determine the layer thickness of the material which is supplied from the bunkers on the horizontally extending upper part of the conveyor belt. In practice this device is only suitable for processing comparatively fine materials, whereby additional materials all have at least substantially the same comparatively small grain size.

According to the invention a strickling means is disposed between the outlets of the two bunkers, so as to determine the layer thickness of the material deposited from one of said bunkers on the conveyor belt and conveyed under the outlet of the other bunker in the direction of the mould, whilst the other bunker is provided with a dosaging means for regularing the amount of material which is discharged from the other bunker during each operation cycle.

When using the construction according to the invention it is possible to supply fine material, whose layer thickness on the conveyor belt is determined by the strickling means, from the one bunker, whilst a coarser granular material can be supplied from the other bunker, which eventually results is a tile wherein the surface which will be exposed to view will show relatively coarse grains besides the other fine material forming the upper surface.

It is noted that from DE-A-1,170,850 there is known a device for manufacturing artificial marble, said device being provided with two bunkers. During operation material flows from said bunker on a conveyor belt for forming two layers of material on said belt, one lying upon the other. The thickness of each layer is thereby determined by a strickling board associated with the corresponding bunker.

The use of such strickling boards is only possible in forming relatively thick layers of material. Contrary thereto the use of a dosaging means, as proposed by the present invention, makes it possible to make only a very thin upper layer, covering eventually the lowermost layer only in part.

Further in manufacturing tiles it is often required to be able to provide colour and/or pattern gradations in the upper surface of the tile in a simple manner.

In view thereof the storage bunker could be provided with a plurality of compartments arranged side by side in a row, said compartments being reciprocatingly movable at least substantially in the longitudinal direction of said row.

When using such a construction materials having different colours and/or grain sizes or the like may be introduced into the various compartments as required. By moving the interconnected compartments to and fro during operation, when material is gradually being discharged from the bunker, the material flowing from neighbouring compartments will be mixed, so that when the device according to the invention is used the upper surface of the tile that will be exposed to view can be given a patterned appearance.

The invention also relates to a method for providing striated patterns on the upper surface of tiles which are formed in a mould, whereby a layer of base material is provided on a lower die of the mould and whereby subsequently, additional material deposited on said upper part is deposited on said layer of base material by means of an at least substantially horizontally extending upper part of a conveyor belt, whilst simultaneously the conveyor belt is driven, in such a manner that said additional material falls from one end of the conveyor belt on the base material.

A similar method is likewise known from European patent no. 0,300,523.

The object of the invention is to create a possibility of forming wispy colour patterns in the upper surface of the tiles.

According to the invention this can be achieved in that use is made of a conveyor belt whose side receiving the material is provided with grooves disposed in a desired arrangement, into which the additional material is introduced in order to be subsequently deposited from said grooves onto the base material.

The grooves may or may not be provided in a random pattern on the side in question of the conveyor belt, so that the material initially received in said grooves and then deposited on the upper surface of the tile will land on the upper surface of the tile in corresponding, whether or not random patterns.

Preferably also the cross-sectional dimensions of the grooves are varied, whether or not in a randon manner.

A further influencing of the configuration may

furthermore be effected by varying the velocity of displacement of the belt.

In using the above mentioned method it is possible to form striated patterns on the tiles by using only a relatively small quantity of the additional material.

For obtaining tiles having an appearance of artificial marble in the device according the above cited DE-A-1,170,850 the layers of material lying upon each other are transported by the conveyor belt towards a device comprising a number of interengaging fingers upon which the materials are dumped for mixing the materials. So both said materials have to be supplied in relative big quantities for obtaining the desired varied marble pattern.

Further in EP-A-0 312 938 there is disclosed a device for manufacturing tiles having a striped pattern. In said known device there is dumped on a conveyor belt a layer of a base material and on said layer of base material there is dumped additional material in various spaced strips. Then all the material lying on the conveyor belt is dumped by the conveyor belt into a funnel. From said funnel the material is discharged into moulds. Also is said known device there has to be dumped a relatively great quantity of additional material on the base material for obtaining the stripe effect on the surface of the tile due to the fact that a mixing of base material and additional material will occur in the funnel.

The invention will be further explained hereafter with reference to the accompanying Figures.

Figure 1 is a diagrammatic side elevational view of a device according to the invention.

Figure 2 is a diagrammatic elevational view of a part of a conveyor belt to be used with the device of Figure 1.

Figure 3 is a diagrammatic, perspective view of a possible embodiment of a bunker to be used with the device of Figure 1.

The device illustrated in Figure 1 comprises a diagrammatically depicted frame 1, in which one or more lower dies 2 are reciprocatingly movable in vertical direction by means of (a) setting cylinder(s) (not shown), as is indicated by means of the arrow A. For each lower die 2 there is provided an upper die 3 co-operating therewith, said upper die likewise being reciprocatingly movable in vertical direction with the aid of setting means (not shown).

The device is furthermore provided with a bunker 4 for base material. A filling cart 5 is disposed under said bunker, which is reciprocatingly movable over the frame in the direction according to the arrow B with the aid of drive means (not shown). The filling cart has an opening 6 provided therein, into which opening, in the position of the filling cart 5 illustrated in Figure 1, base material can flow from the bunker 4.

A further filling cart 7 is disposed more or less in the extension of the filling cart 5, said further filling cart likewise being reciprocatingly movable in horizontal direction. Near one of its ends the filling cart 7 has a passage 8, a sieve 9 being disposed in the lower end of said passage. A charging slide 10 is reciprocatingly movable in horizontal direction over said filling cart 7 with the aid of drive means (not shown). The charging slide 10 is thereby provided with a receiving room 11 for receiving additional material.

The filling cart 7 is mobile, together with a frame part (not shown), in which rollers 12 are rotatably journalled about a horizontal axis of rotation extending perpendicularly to the direction of movement of the filling cart 7. Further rollers 13 - 16 extending parallel to said roller 12 are journal led in a fixed frame part.

The rollers 12 - 16 function to guide an endless conveyor belt 17 in the manner illustrated in Figure 1, said conveyor belt being guided by the rollers in such a manner that the conveyor belt 17 has a horizontal part, which extends across the end of the filling cart 7 directed towards the dies 2 and 3. The conveyor belt 17 is furthermore passed over a roller 18, which is vertically movable.

Two bunkers 19 and 20 are arranged above the horizontally extending part of the conveyor belt 17. Near its bottom end the bunker 20 is provided with an outlet opening, whilst a roll feeder 21 is disposed near said outlet opening. In a similar manner the bunker 19 is near its bottom side provided with an outlet opening, whilst a roll feeder 22 is disposed near said outlet opening. A downwardly extending plate 23 functioning as a strickling means is disposed between the two roll feeders, said plate with its lower boundary edge at least substantially abutting against the upper side of the upper horizontal part of the conveyor belt 17.

The bunker 20 is intended for accommodating fine additional material, whereas the bunker 19 is intended for accommodating coarser additional material having a diameter of 2 - 7 mm. In order to enable a well-dosaged discharge of said coarser material from the bunker 19 the dosaging means 22 consists of a roller, whose circumferential surface is is provided with fine recesses, said recesses being dimensioned such that the recesses are suitable for receiving grains of the granular material present in the bunker 19.

When the device is put into operation it will first be necessary to put the lower die 2 in a position in which the distance between the upper side of said lower die 2 and the upper surface of the frame 1, across which the filling cart 5 moves to and fro, will be at least substantially equal to the required thickness of the layer of base material to

be formed on the lower die 2. After the die 2 has been adjusted the filling cart 5 will be moved towards the right, when seen in Figure 1, so that material present in the recess 6 can be provided on the die 2 and also be smoothed by means of the filling cart. Meanwhile the charging slide 10 has been placed in a position in which the receiving room 11 provided in said charging slide 10 is filled with additional material from a bunker (not shown). When the filling cart 5 moves towards the left, when seen in Figure 1, after the layer of base material has been provided on the lower die 2, said lower die is moved downwards over a distance corresponding with the thickness of an upper layer yet to be provided, and the filling cart 7 is moved towards the left, when seen in Figure 1, so that the sieve 9 will come to lie above the lower die 2. The frame part supporting the roller 12 will thereby move along with the filling cart 7, so that the various movable parts will reach the position illustrated in dotted lines in Figure 1. During this movement the roller 12 is prevented from rotating and the roller 18 will move upwards from the position illustrated in full lines in Figure 1 towards the position illustrated in dotted lines.

When the sieve 9 is positioned above the lower mould the charging slide 10 is moved to and fro above the sieve, so that material accommodated in the charging slide 10 can fall from the receiving room 11, through the openings in the sieve, on the layer of base material, whereby any undesirable coarse constituents will be retained by the sieve 9.

Then the filling cart 7, the charging slide 10 which is movable over said filling cart and the frame part supporting the roller 12 will be returned to the starting position illustrated in Figure 1, whilst at the same time the conveyor belt 17 will be driven in the direction indicated by the arrow C, so that the upper part of the horizontally extending part of the conveyor belt will move towards the left, when seen in Figure 1. During this return movement of said parts from the position illustrated in dotted lines to the position illustrated in full lines the material supplied from the bunkers 19 and 20 which is present on said upper part will then be spread over the material already present on the lower die 2.

When the filling cart 7 and the frame part supporting the roller 12 move towards the left, when seen in Figure 1, material is supplied from the bunkers 19 and 20, whilst a surplus of fine material supplied from the bunker 20 is retained by the strickling means 23.

Since it is not necessary for the granular materials supplied from the bunker 19 during the latter movement of the various movable parts to move past the strickling means 23, said strickling means 23 can be arranged with its lower edge quite close to the upper surface of the conveyor belt. The quantity of granular material which can be supplied during each operating stroke of the device can be regulated by the number of revolutions the dosaging means 22 is caused to make, since the quantity per revolution of the dosaging means is at least substantially determined by the number of recesses provided in the circumferential surface of the dosaging means for receiving the granular material. Thus it is possible, with the aid of the dosaging means 22, to influence the quantity of material deposited on the belt 17 during each operating stroke.

After all the material has thus been deposited on the lower die 2 the material can be compressed between the lower die 2 and the upper die 3 in the required manner. After that the upper die 3 is moved upwards again and the lower die 2 is positioned such that when the filling cart moves to the right, when seen in Figure 1, the tile now formed will be moved to the right by said filling cart, so as to be discharged.

Preferably a strickling means 25 is mounted at the end of the filling cart 7, so as to strickle material present on the upper surface of the frame 1. Said strickling means 25 is thereby connected to the filling cart 7, by means of guide rods or the like, in such a manner that said strickling means 25 can move, parallel to the direction of movement of the filling cart 7 during operation, along a very limited distance, with respect to the filling cart. As a result of this it is effected that when the filling cart 7 moves towards the left, when seen in Figure 1, the filling cart 7 will push the strickling means 25 ahead as far as the position of the strickling means illustrated in dotted lines in Figure 1, in which position the strickling means is supported on the left-hand side of the recess in the frame 1 supporting the lower die 2. When subsequently the filling cart 7 and the roller 12 of the conveyor belt 17 connected thereto are moved towards the right, the strickling means 25 will initially remain behind in the position illustrated in Figure 1, and not be carried along by the filling cart 7 before the roller 12 has also been moved along a certain distance. Consequently, when the various movable parts move towards the right, when seen in Figure 1, the strickling means 25 will follow the roller 12 of the conveyor belt 17 and thus strike off any material which has fallen from the conveyor belt 17 on the frame 1, near the end of the conveyor belt 17 located near the roller 12, so that no more material will be present on the upper surface of the frame 1, which material will prevent the effective closing of the die 3.

Preferably use will be made of a conveyor belt 17, whose upper surface coming into contact with material supplied from the bunkers 19 and 20 is

provided with grooves 26, as is diagrammatically depicted in Figure 2. Such grooves may be provided along the entire length of the conveyor belt, whether or not in a random and erratic pattern, whilst also the cross-sectional width of the grooves may extend in a varied, preferably erratic manner along the length of the grooves. The adjustment of the device will generally be such that the fine material from the bunker 20 fills the grooves, whilst at least very little of said material is present on the part of the relevant surface of the conveyor belt located between the grooves.

It will be apparent that the material accommodated in the grooves 26 will also be deposited on the upper surface of the tile in wisps corresponding with the arrangement of said grooves, so that wispy patterns will be provided in the tile that is eventually manufactured. The configuration of said wispy patterns can furthermore be influenced by varying the velocity of movement of the conveyor belt when the material is being deposited on the upper surface of the tile by means of the conveyor belt.

Figure 3 shows an embodiment of a bunker 27, which may e.g. be used instead of a bunker 19 or 20, or for the supply of material to the charging slide 10. Near its bottom end this bunker is again provided with an outlet or dosaging means 28. In the illustrated embodiment the bunker is built up of two parts 29 and 30 located one above the other. The upper part 30 of the bunker is divided, by means of a number of division plates 31, into a number of compartments arranged in a row. Materials having different colours and/or grain sizes and the like may be deposited in the various compartments arranged side by side. By moving said upper part 30 of the bunker to and fro (arrow D) with the aid of drive means (not shown) during operation, the materials present in the various compartments will be mixed in a random manner while flowing from the upper part 30 of the bunker into the lower part 29, which will eventually result in corresponding, random patterns of the additional material provided on the upper surface of the tile.

It will be apparent that it is also possible to construct the bunker 27 in one piece, whereby the bunker can be made to move reciprocatingly in its entirety during operation.

Claims

1. A device for manufacturing ceramic tiles, said device being provided with a mould having a lower die and an upper die, with a filling cart for introducing starting material in said mould and with an endless conveyor belt, of which at least one upper part, which extends at least substantially horizontally, is movable in a direction towards and away from the mould, whilst at least two bunkers are disposed one behind the other, when seen in the direction of movement of said upper part, so as to deposit various materials on said upper part of the conveyor belt, via outlets located near the bottom side of said bunkers, whereby said materials can be deposited on base material present on the lower die by driving the conveyor belt during the movement of the conveyor belt over said lower die, characterized in that a strickling means is disposed between the outlets of the two bunkers, so as to determine the layer thickness of the material deposited from one of said bunkers on the conveyor belt and conveyed under the outlet of the other bunker in the direction of the mould, whilst the other bunker is provided with a dosaging means for regulating the amount of material which is discharged from the other bunker during each operating cycle.

2. A device according to claim 1, characterized in that said dosaging means is a drum, in whose circumferential surface recesses are provided for receiving grains of said granular material.

3. A device according to claim 1 or 2, characterized in that a strickling means is provided on the movable part of the conveyor belt, said strickling means cooperating with the upper surface of a frame accommodating the lower die, whereby the strickling means is connected to the movable part of the conveyor belt via a mechanism allowing a lost movement, all this in such a manner that when the movable part moves over the lower die in a first direction the strickling means is moved along with the movable end of the conveyor belt, and that when the movable part moves in an opposite direction the strickling means initially remains stationary and is not moved along before the discharge end of the horizontally extending part of the conveyor belt has been moved along a certain distance.

4. A device according to claim 2 or 3, characterized in that said strickling means is connected to a charging lorry disposed under the horizontal part of the conveyor belt, which is movable to and fro during operation.

5. A device according to any one of the preceding claims, characterized in that the surface of the conveyor belt, on which material is deposited by means of the conveyor belt, is provided with grooves.

6. A device according to claim 5, characterized in that said grooves are provided on the surface in a random arrangement.

7. A device according to claim 5 or 6, characterized in that the cross-sectional dimensions of the groove are varied along the length of said grooves.

8. A device according any of the preceeding claims, characterized in that a storage bunker is provided with a plurality of compartments arranged side by side in a row, said compartments being reciprocatingly movable at least substantially in the longitudinal direction of said row.

9. A method for providing striated patterns on the upper surface of tiles which are formed in a mould, whereby a layer of base material is provided on a lower die of the mould and whereby subsequently, additional material deposited on said upper part is deposited on said layer of base material by means of an at least substantially horizontally extending upper part of a conveyor belt, whilst simultaneously the conveyor belt is driven, in such a manner that said additional material falls from one end of the conveyor belt on the base material, characterized in that use is made of a conveyor belt whose side receiving the material is provided with grooves disposed in a desired arrangement, into which the additional material is introduced in order to be subsequently deposited from said grooves onto the base material.

10. A method according to claim 9, characterized in that the velocity of displacement of the belt is varied.

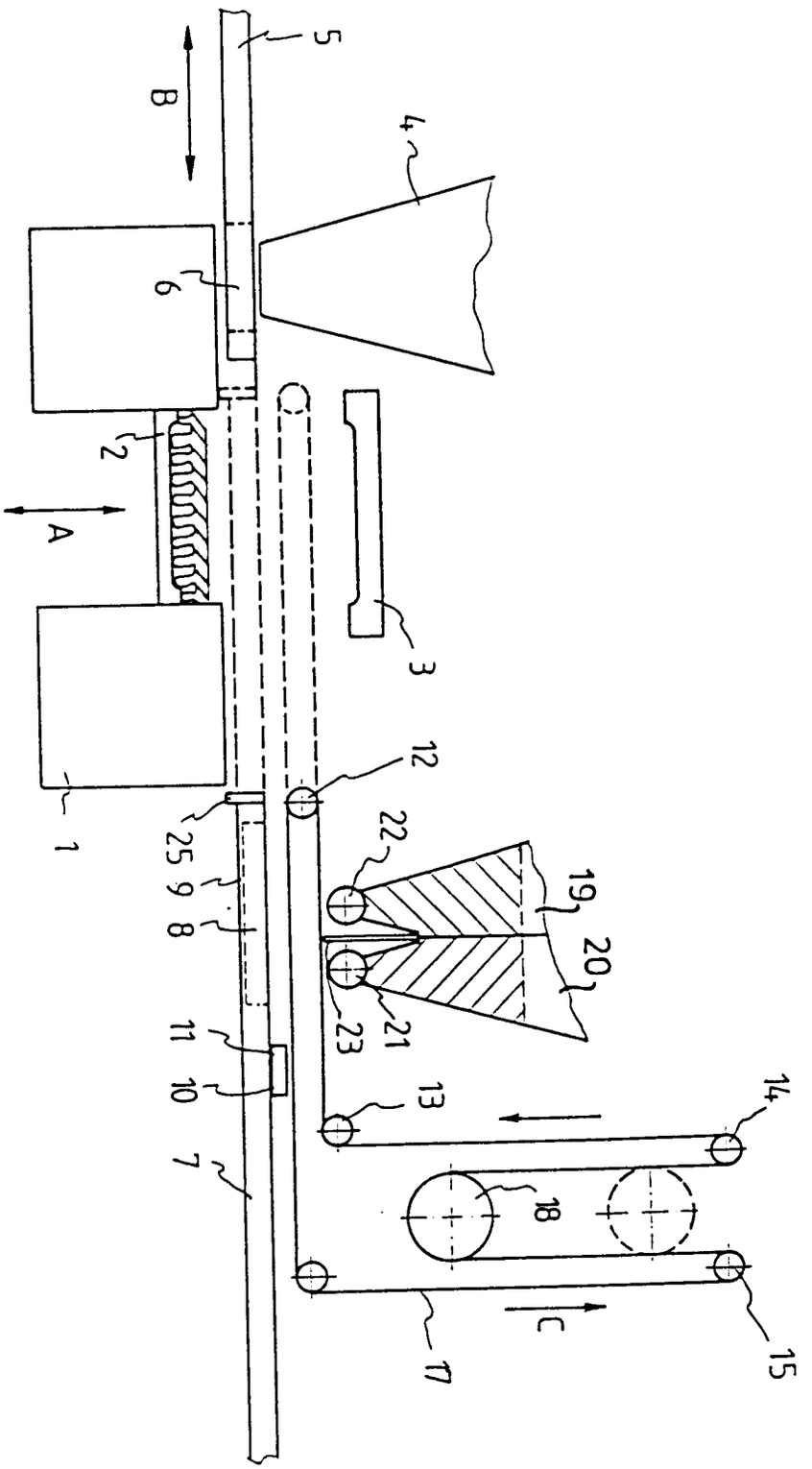

Fig 1

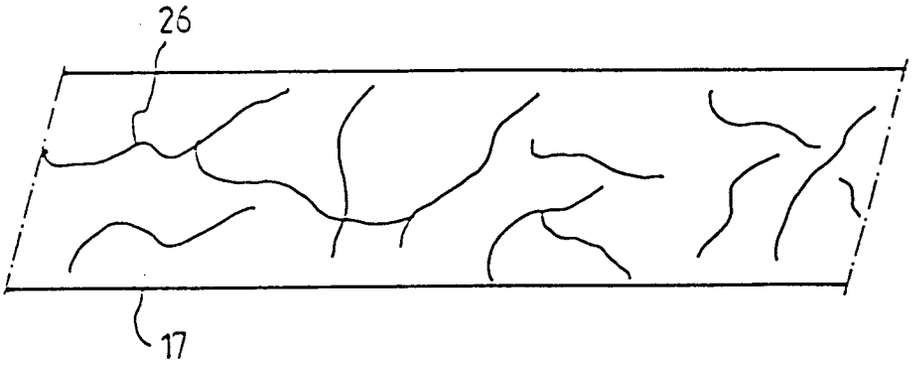

Fig 2

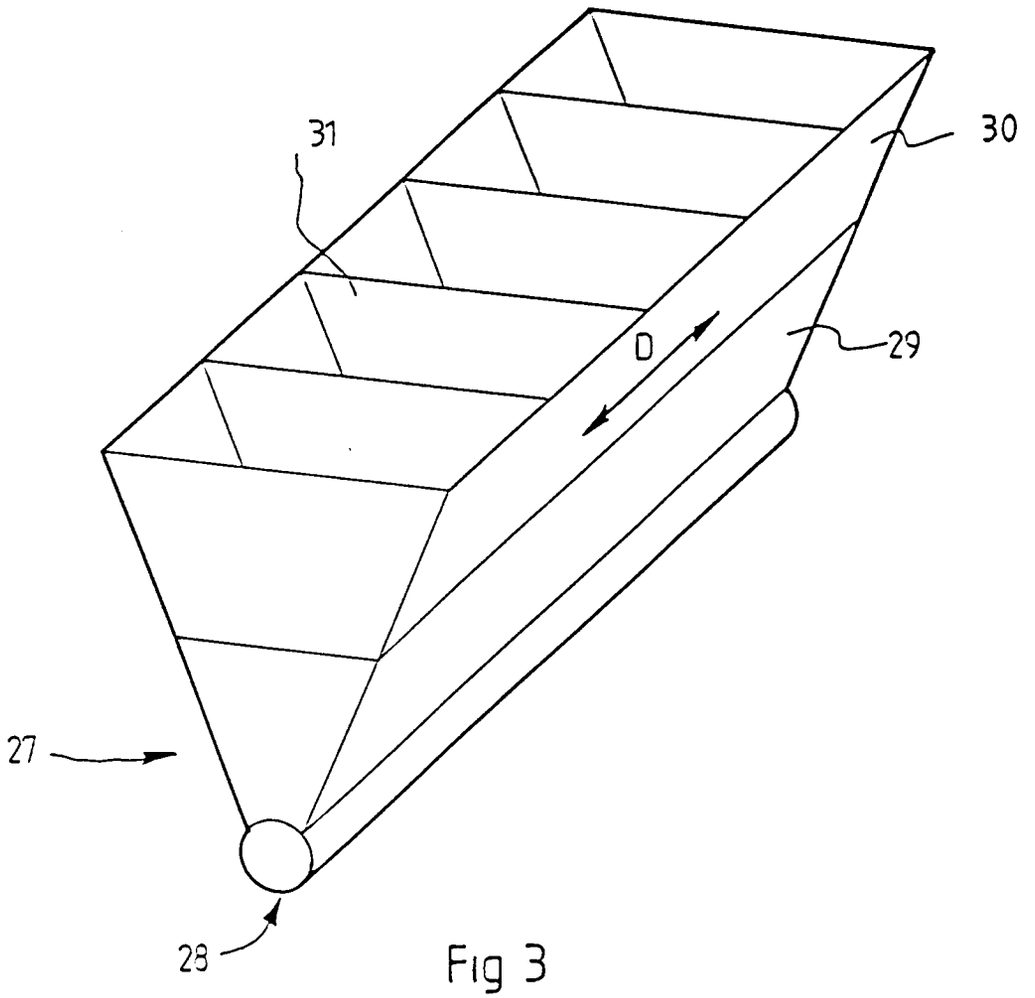

Fig 3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 20 3374

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y,D	EP-A-0 300 532 (KONINKLIJKE MOSA B.V.) * the whole document *	1,2,8,10	B28B13/02
A		9	

Y,D	DE-B-1 170 850 (BOHUMIL VASKA,MERKLIN) * the whole document , in particular col.1 l.46-51 *	1,2,10	
A		9	

Y,D	EP-A-0 312 938 (VILLEROY & BOSCH AG) * the whole document *	8	
A		1,5-7,9	

Y	EP-A-0 024 237 (SO.DE.EM) * page 5, line 16 - page 8, line 9; figure 1 *	10	
A		1,3,9	

Y	FR-A-355 255 (M. BRABANDER) * the whole document *	8	

A	DE-B-1 281 915 (VEB THURINGIA FEINKERAMIKMASCHINEN) * the whole document *	1-4	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
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A	LU-A-34 512 (S.A. CERABATI) * the whole document *	1	B30B

A	FR-A-2 196 603 (A. MINATO) * the whole document *	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	06 APRIL 1992	GOURIER P.A.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
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E : earlier patent document, but published on, or after the filing date
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