



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
24.01.2007 Bulletin 2007/04

(51) Int Cl.:
B28B 11/04 (2006.01) B05C 1/14 (2006.01)

(21) Application number: **06117388.6**

(22) Date of filing: **18.07.2006**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
 Designated Extension States:
AL BA HR MK YU

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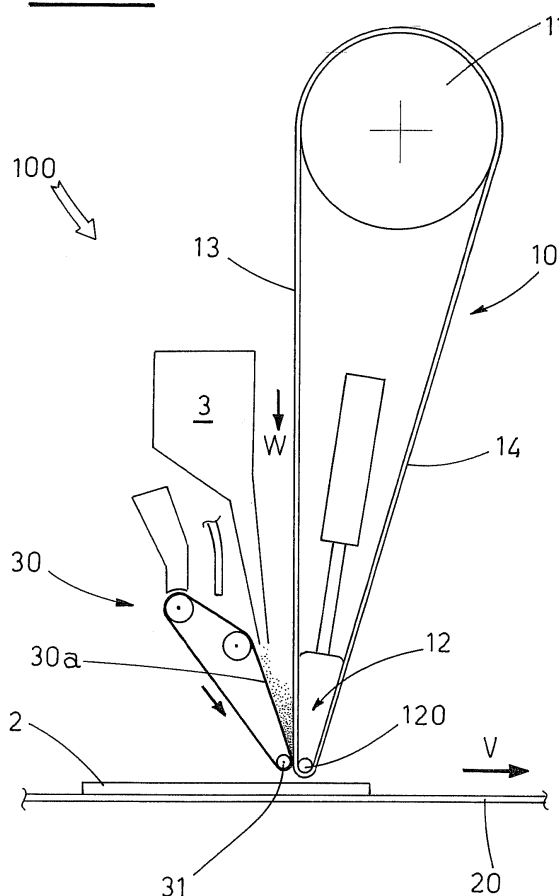
(30) Priority: **22.07.2005 IT BO20050490**

(54) **Apparatus for dry application of decorations on articles**

(57) The apparatus (100) includes a ring-like, endless band (10), stretched between a motor roller (11) and a lower cusp (12), whose tip (120) is rounded and turned downward.

The band (10) has pits (1) on its outer surface, which define the decoration pattern to be obtained by powder enamel (S) introduced into the pits (1) in a filling station (R), upstream of the tip (120) of the cusp (12). A decoration station (D) is situated at the tip (120) of the cusp (12), where the pits (1) are emptied, due to gravity, and the enamel (S) falls on the tile (2) passing therebelow. The apparatus (100), according to the invention, includes the filling station (R), situated close to the rounded tip (120), immediately upstream of the decoration station (D). For this purpose, the idler roller (31) of a belt (30), associated to the band (10) and tangential thereto in the filling station (R), has a small diameter, preferably such that the curvature radius imposed to the belt (30) is similar to the one imposed to said band (10) by the rounded tip (120).

FIG. 1



Description

[0001] The present invention relates to dry application of decorations on items, in particular ceramic floor or fur-

[0002] As it is known, the dry decoration includes a first step, in which a suitable quantity of powdered enamel of prefixed granulometry, or granule size, is put down on the surface to be decorated, according to a prefixed scheme, so as to reproduce the pattern of the desired decoration.

[0003] Afterwards, the tile and the decoration are subjected to baking, so as to vitrify the enamel and fasten it to the tile.

[0004] The European Patent Application EP 1 419 863, filed by this Applicant, relates to an apparatus for dry application of powder dry enamel to items, in particular ceramic tiles, which includes an endless belt of elastic material, whose outer surface has a plurality of pits, defining a decoration matrix and receiving powder enamel, so as to place it on the passing items, carried by a conveying line.

[0005] The belt, known as "sleeve" in technical jargon, is placed sloping above the conveying line, and is stretched between a driving roller, situated above, and a lower cusp, whose tip is rounded and turned downwards, not far from the upper surface of the tile to be decorated.

[0006] The sleeve is operated by the driving roller in the same direction and synchronously with the motion of the tiles on the conveying line, so as to define a sleeve forward run, upstream of the rounded cusp, and a backward run, downstream of the cusp.

[0007] The powder enamel is overfed to the forward run, near the cusp and directly upstream of means for removing exceeding enamel, which has not entered the pits, and for compacting the enamel in the pits.

[0008] When the pits reach the rounded tip of the cusp, whose curvature radius is suitably small, they result to be turned downwards and stretched due to the sleeve curving on the cusp, and consequently the enamel powder contained therein falls, due to gravity, onto the surface of the tile below, so as to define the decoration.

[0009] According to a particularly advantageous embodiment, included in the technical solution described in the above Patent Application, the aforementioned means for removing exceeding enamel include a close belt, wound endlessly on relative rollers, one of which is a driving roller.

[0010] The belt is placed sloping, with the lower roller tangential to the sleeve forward run, near the rounded cusp.

[0011] The powder enamel is fed between the belt upper run and the sleeve forward run.

[0012] The belt is operated with a counter-rotation with respect to the forward run, so as to graze continuously the latter, in order to remove the exceeding enamel and to compact the enamel, which has entered the pits.

[0013] The main advantages of the just described ap-

paratus derive from the arrangement of the forward and backward runs of the sleeve with respect to the horizontal surface of the tiles and from the cusp pointed shape, which determine such a path of the sleeve, as to empty the pits rapidly, in well defined positions and with low dispersion of the powder in the surrounding areas, thus obtaining a high design definition.

[0014] Moreover, the same arrangement prevents the accumulation of humidity in the emptied pits of the backward run, together with all difficulties resulting therefrom.

[0015] The quality of the obtained decoration, intended as the definition details, the effect and fading of various hues tones, in practice, the accuracy of the reproduced image with respect to the starting one, depends not only on the apparatus constructive characteristics, but also on the characteristics of the used enamel, in particular on the granulometry and residue humidity of the powder materials constituting it, which define its flowability.

[0016] This flowability has an effect on the bigger or smaller enamel capacity of remaining inside the pit in the portion of the forward run comprised between the end of the pit charging step and the pit discharging step, as well as on the discharge manner, in the latter step.

[0017] It can happen during the production cycle that two separate lots of enamel, or enamels coming from different suppliers have slightly different characteristics, although the values on the label are the same.

[0018] Therefore, undesired effect differences are noticed between one lot of tiles and another, which makes a further product selection necessary, with all the consequent negative aspects.

[0019] Another disadvantage results from the high wear of these elements of the apparatus that are in contact with powder enamel, which is highly abrasive because of many vitreous parts contained therein.

[0020] The object of the present invention is to propose an improved apparatus for dry application of decorations to items, which derives from the technical solutions described in the above mentioned patent application, and whose characteristic features ensure higher quality of the thus obtained decoration with respect to the previous one.

[0021] At the same time, the quality of the decoration must be affected as less as possible by small differences of the characteristics of the powder enamel used each time.

[0022] Another object of the present invention is to propose an improved apparatus, which allows a high decoration quality to be maintained also with high operation speeds.

[0023] A further object of the present invention is to propose an apparatus, which reduces the wear of the elements which make it up.

[0024] The characteristic features of the invention are pointed out in the following description of a preferred but not exclusive embodiment, in accordance with the contents of the claims and with reference to the enclosed figures, in which:

- Figure 1 is a schematic, lateral view of the improved apparatus, according to the invention;
- Figure 2 is an enlarged view of a detail of Figure 1;
- Figure 3 is a similar view as Figure 2, of a first embodiment of the apparatus;
- Figures 4 and 5 are similar views as Figures 2 and 3, of a second embodiment of the apparatus.

[0025] Regards the above mentioned figures, the reference numeral 100 indicates the proposed improved apparatus, as a whole.

[0026] Like the apparatus reminded in the introductory note, the proposed apparatus is aimed at dry applying of powder enamel S to the items 2, in particular ceramic tiles, and includes a ring-like, endless band 10 (or sleeve) of elastic material, having on its outer surface a series of pits 1, which define the decoration pattern and which are aimed at receiving powder enamel S, so as to place it on the passing tiles 2, carried in a horizontal arrangement by a conveying line 20 with a uniform speed in a direction V

[0027] The sleeve 10 is positioned above the conveying line 20 and is stretched between a motor roller 11, situated above, and a lower cusp 12, whose tip 120 is rounded and turned downward, at a short distance from the upper surface of the tile 2 to decorate.

[0028] The radius of curvature of the rounded tip 120 is suitably small (about 5 - 6 mm), so as to facilitate rapid emptying of the pits 1 of the enamel, as it has been already mentioned in the introductory note.

[0029] The sleeve 10 is operated by the motor roller 11 in a direction W, concordant and synchronized with the movement of the tiles 2 on the 20, so as to define a forward run 13 of the sleeve 10, upstream of the lower cusp 12, and a backward run 14, downstream thereof.

[0030] According to a first embodiment of the apparatus 100 (Figures 1, 2, 4), the forward run 13 is vertical, while the backward run is sloping.

[0031] According to another embodiment (Figures 3 and 5), the forward run 13 is inclined, so that the smaller angle, formed with respect to the horizontal direction, is located downstream, in the tile 2 feeding direction V.

[0032] The rounded tip 120 can be fixed and the sleeve 10 grazes it with sliding friction, possibly reduced with suitable devices.

[0033] According to other solutions, the tip 120 has revolving means, aimed at making the friction with the sleeve 10 rolling.

[0034] Said devices and revolving means have not been shown in detail, since not relevant to the invention.

[0035] The powder enamel S is overfed by a feeding device of a known type, situated next to the sleeve 10, on the side of the forward run 13.

[0036] The enamel S falls onto the upper run 30a of an endless belt 30, which is stretched between relative

rollers and inclined, so that the lower part of said upper run 30a, where the belt winds around a corresponding idler roller, is tangent to the sleeve 10.

[0037] A station R for filling the tips 1 is defined in the contact area between the belt 30 and the sleeve 10.

[0038] The belt 30 is operated to counter-rotate with respect to the sleeve 10, so as to slide thereon, and is aimed at removing the exceeding enamel from the sleeve in a way known in itself, and at compacting the enamel, which has entered the pits 1 in the filling station R.

[0039] The exceeding enamel goes up the upper run 30a of the belt 30, so as to be recovered and reintroduced into the circulation, in a known way.

[0040] The powder enamel S introduced into the pits 1 is transferred, by the movement of the sleeve 10, to a decoration station D, situated below, in a region corresponding to the rounded tip 120, where the powder enamel S leaves the respective pits 1, due to gravity, and settles on the upper surface of the passing tiles 2, so as to reproduce thereon the decoration pattern.

[0041] According to the invention, the filling station R is situated close to the rounded tip 120 of the lower cusp 12, immediately upstream of the decoration station D, so as to reduce as much as possible the distance, which the pits 1, filled with the powder enamel S, must cover before being emptied.

[0042] Obviously, the belt 30 must be guided, at the outlet of the filling station R, along such a path that does not interfere with the tiles 2 passing below.

[0043] In order to lower as much as possible the tangential point between the belt 30 and the sleeve 10, that is the filling station R, it is necessary to reduce as much as possible the radius of the idler roller 31, whose optimal value has been experimentally established as almost equal to the one of the rounded tip 120, so that nearly the same curvature radius can be imposed to the sleeve 10 and the belt 30.

[0044] The fully safe working of the apparatus 100 is assured by the adjusting of the idler roller 31 height, so that a difference G of about $2 \div 3$ mm remains between the lower edge of the belt 30 and the one of the sleeve 10.

[0045] When the forward run 13 of the sleeve 10 is inclined, as shown in Figures 3 and 5, the tangential point between the belt 30 and the sleeve 10 is situated at a position situated in the rounded tip 120 section.

[0046] This configuration can be advantageous with some types of enamel, In this condition, in fact, the enamel is introduced in the pits where the pits 1 are already extended due to the sleeve 10 curvature.

[0047] The idler roller 31 can be not only of traditional kind, with an idle axis (Figures 2 and 3), but it can be also formed by a fixed tubular element (Figure 4 and 5), having fastened thereto blowing means 32, aimed at giving off compressed air toward the inner part of the belt 30, which pass over the fixed tubular element 31, so as to create an air cushion 40, interposed between the element 31 and the belt 30, in order to reduce the friction therebetween.

[0048] In the illustrated example, the blowing means 32 include members, not shown, for supplying compressed air into the fixed tubular element 31.

[0049] The compressed air goes out through a series of calibrated holes 33.

[0050] The described invention allows to improve the quality of obtained decorations, due to the fact that the distance from the filling station R to the decoration station D, that the pits 1, filled with enamel, must cover, is reduced to few millimeters, thus the possibility of an accidental enamel leakage on the way is almost eliminated.

[0051] Consequently, an undesired dispersion of powder is avoided and, at the same time, a complete placing of the enamel in the prefixed points is obtained.

[0052] The above feature makes the possible small smoothness variations, which can occur between one lot of enamel and another, practically irrelevant to the decoration quality.

[0053] The apparatus, obtained according to the invention, allows to maintain high quality of decorations, also at high working speed.

[0054] The described constructive solutions are aimed at reducing the frictions, and consequently the wear, which in such apparatuses can be really rapid, in consideration of the nature of vitreous elements contained in the powder enamels, that are strongly abrasive.

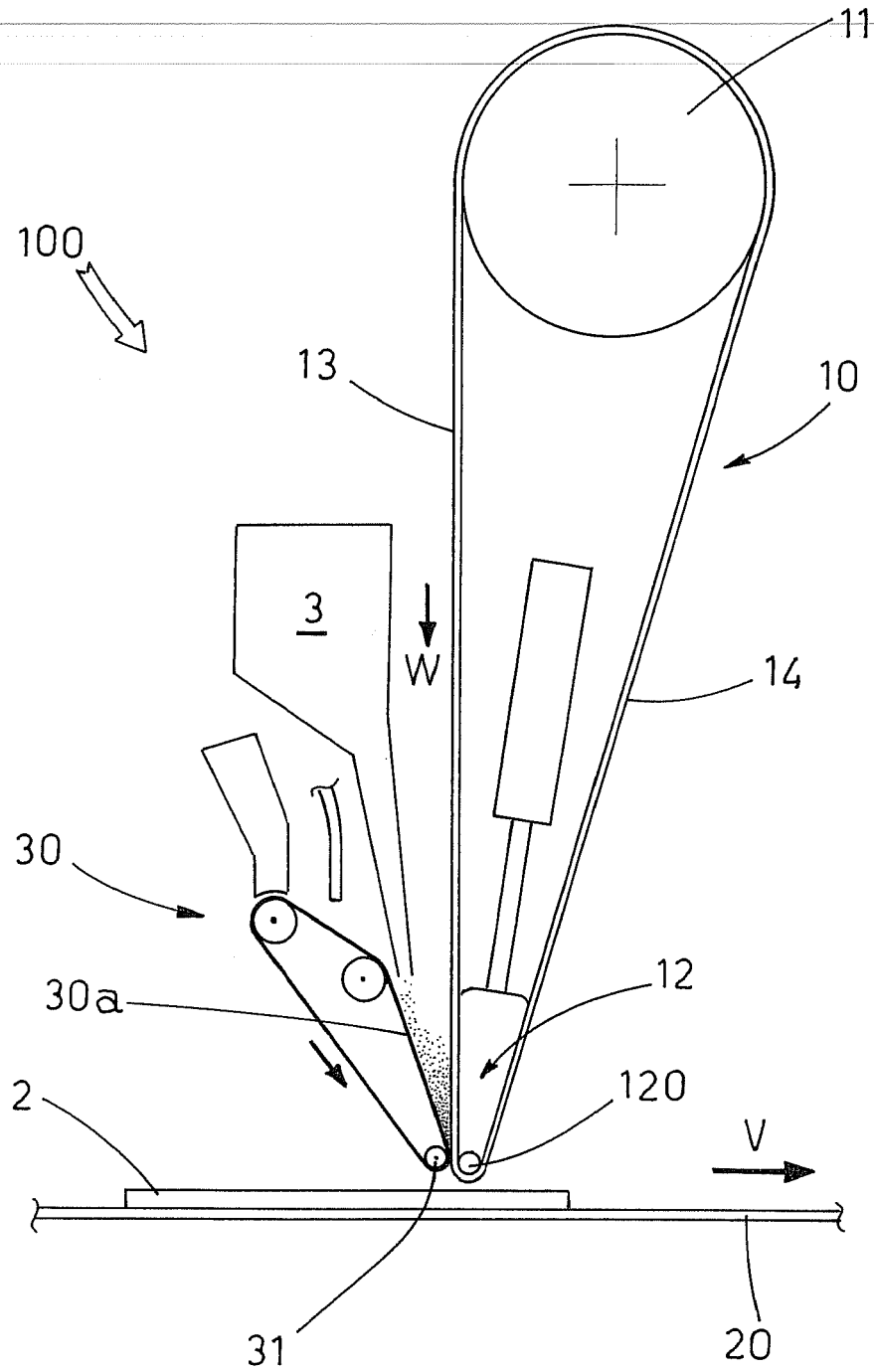
Claims

1. Improved apparatus for dry application of decorations on items, said apparatus including a ring-like, endless band (10) of elastic material, stretched between a motor roller (11), situated above, and a lower cusp (12), whose tip (120) is rounded and turned downward, said band (10) being situated above a conveying line (20) for the items (2) and having on its outer surface a series of pits (1), which define the decoration pattern and which receive powder enamel (S) fed onto a ring-like, endless belt (30), arranged inclined and stretched between relevant rollers and tangential to said band (10) at a station (R) for filling said pits (1), with said belt (30) operated in counter-rotation with respect to said band (10) for removing the exceeding enamel, which has not entered said pits (1), the latter being designed for transferring the powder enamel (S), contained therein, to a decoration station (D), situated below, in a region corresponding to said rounded tip (120) of said cusp (12), where said powder enamel (S) leaves the respective pits (1), due to gravity, and settles on said items (2) passing therebelow, so as to reproduce thereon said decoration, with said apparatus (100) **characterized in that** said filling station (R) is situated close to the rounded tip (120) of said lower cusp (12), immediately upstream of the decoration station (D), with said belt (30) being guided, at the outlet of said filling station (R), along such a path, as not to interfere with

said items (2) passing therebelow.

2. Apparatus, according to claim 1, **characterized in that** the idler roller (31) of said belt (30), situated in said filling station (R), is idle on its axis and has such a diameter, that the curvature radius imposed to the belt (30) is similar to the one imposed to said band (10) by the rounded tip (120) of said cusp (12).
3. Apparatus, according to claim 1, **characterized in that** the idler roller (31) of said belt (30), situated in said filling station (R), is a fixed tubular element, which has such a diameter, that the curvature radius imposed to the belt (30) is similar to the one imposed to said band (10) by the rounded tip (120) of said cusp (12), and **in that** blowing means (32) are fastened to said fixed tubular element (31) for giving off compressed air to the inner part of said belt (30) and for generating an air cushion (40), interposed between the fixed tubular element (31) and the belt (30), to reduce friction.
4. Apparatus, according to claim 2 or 3, **characterized in that** the height of the idler roller (31) is adjusted, so that a difference (G) of about $2 \div 3$ mm remains between the lower edge of the belt (30) and the one of the band (10).

FIG. 1



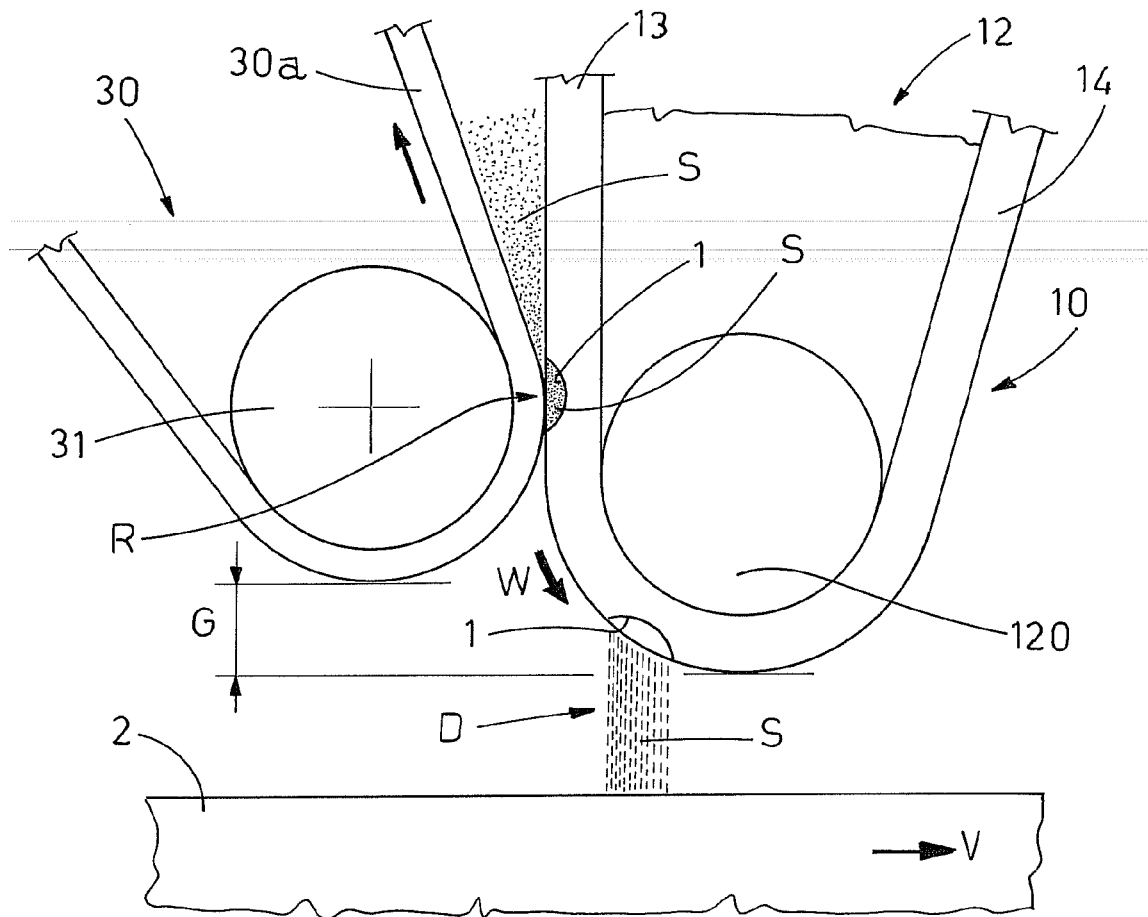
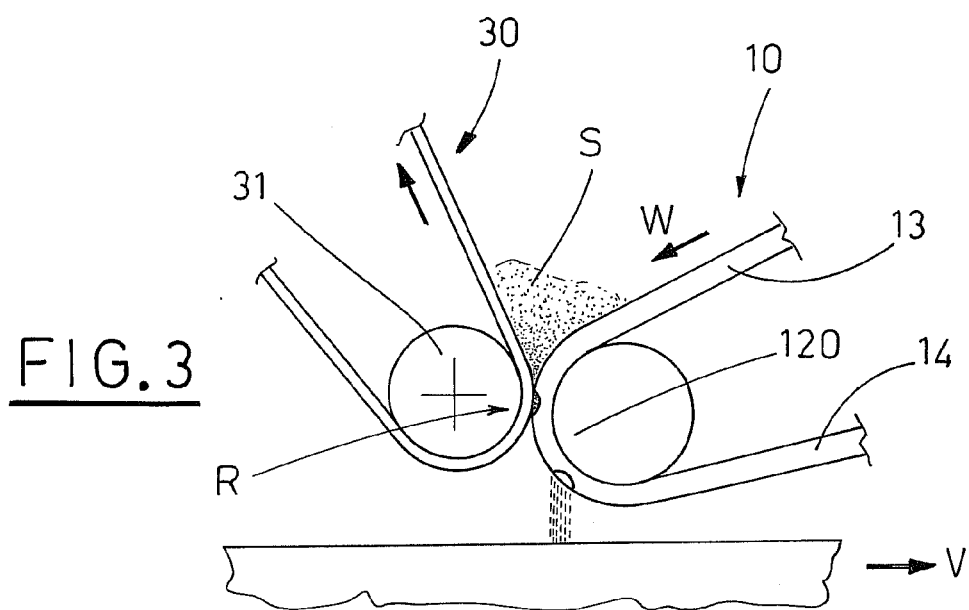


FIG. 2



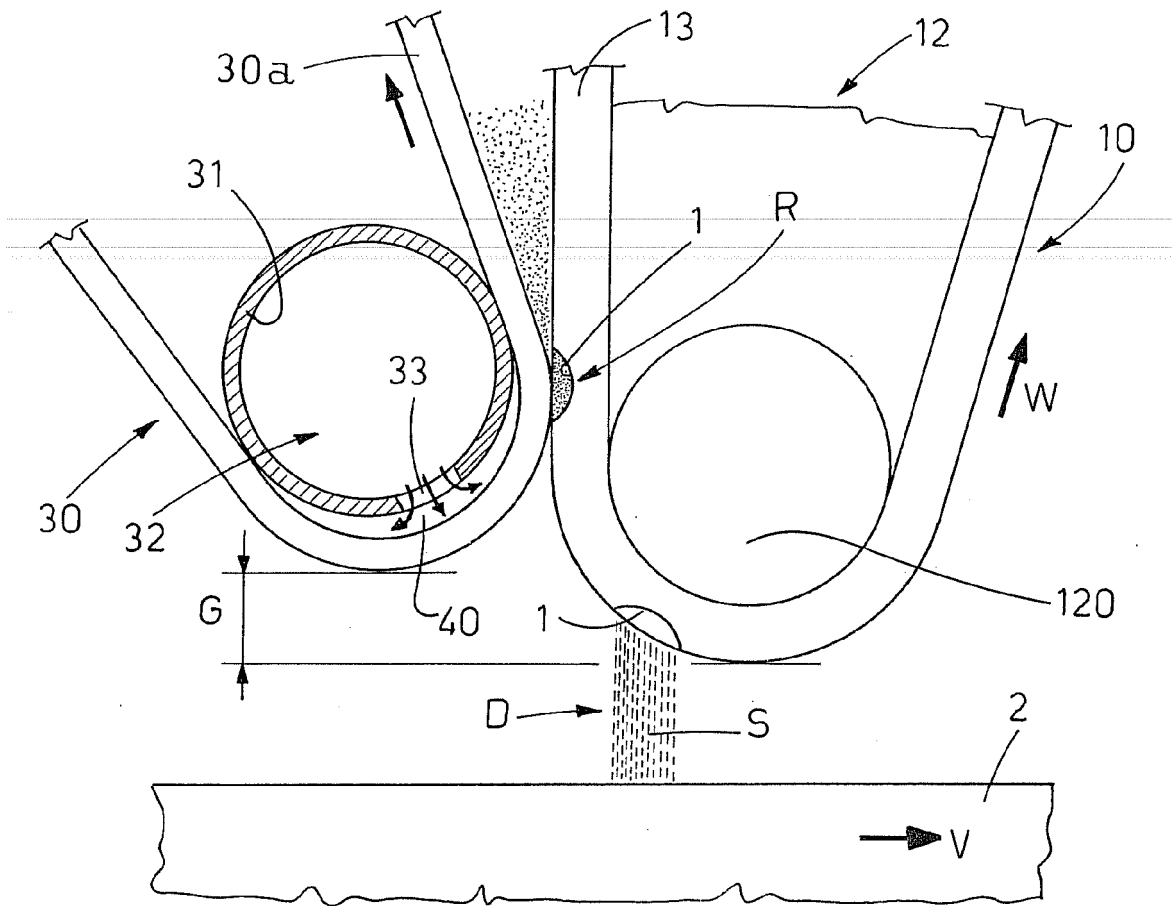
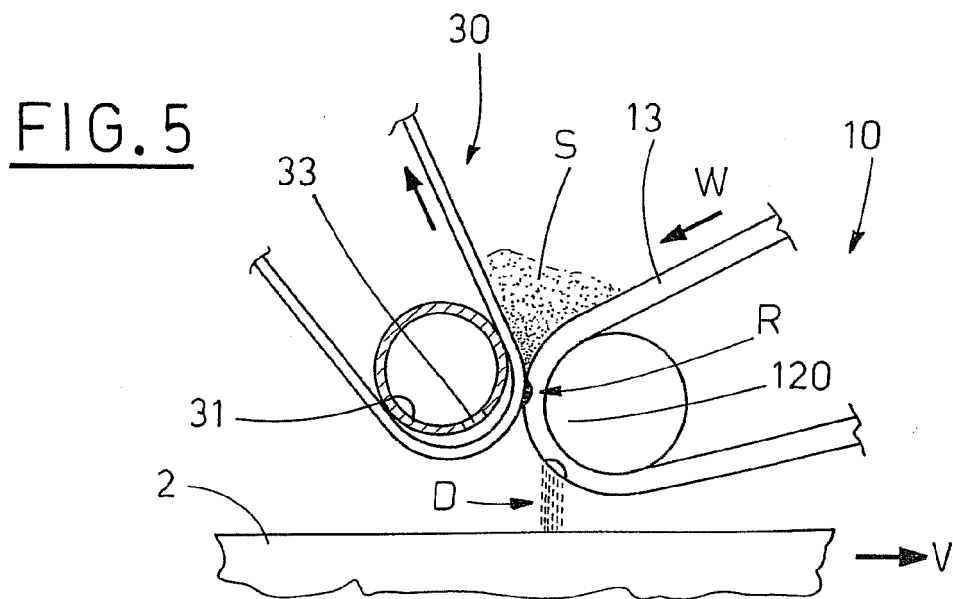


FIG. 4



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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