

Description

BACKGROUND OF THE INVENTION

[0001] The invention relates to a device and a method for handling ink drops, in particular receiving ink drops from a printhead or a printhead cleaning unit and discharging the ink drops to an ink drop collection tray.

[0002] It is known to collect ink drops falling down from a printhead or a printhead cleaning unit in a collection tray. The ink drops fall in a liquid condition and set in the collection tray, thereby possibly forming stalagmites. These stalagmites may cause a problem in that they may interfere with the movement of the printhead or the cleaner. An operator must be available to periodically and timely remove the stalagmites.

[0003] It is further known to intercept the ink drops falling down from a printhead or a cleaning unit by using a belt conveyor which in a forward track runs from a location of receiving ink drops towards a location of discharge or delivery of the ink drops to a collection tray or the like. At the location of discharge, the conveyor belt is turned to the backward track, the solid ink drops being taken along. At the lower side of the turning area, a stationary scraper engages the ink drops attached to the conveyor belt to scrape them off from the conveyor belt. A disadvantage of this known arrangement is that the scraper, in order to function reliably, must engage the belt surface, the belt surface thus being liable to exhaustive wear.

[0004] In a further known arrangement the ink drops falling down are received on a conveyor belt that circulates about four rollers arranged according to a vertical square: one upper roller, one lower roller and two side rollers. Considered in a cross-section of the belt, the upper roller has a concave belt supporting surface and the lower roller has a convex belt supporting surface. The concave portion of the belt forms a trough for the ink drops. By outward flexing of the belt -as considered in cross-section- towards the convex shape, the ink drops on the belt have to loosen in order to fall on the bottom wall of the refuse chamber in which the arrangement is positioned below an ink drop inlet arranged in the upper wall thereof. Although the intention here is to loosen the ink drops by conversion of the shape of the ink drop support surface, that is the belt, which might result in a simple structure, some ink drops may nonetheless remain attached to the conveyor belt after all.

[0005] Therefore, there is a need for a device for receiving ink drops from a printhead or a printhead cleaning unit and discharging the ink drops to an ink drop collection tray with improved reliable performance.

[0006] In addition, there is a need for a method for receiving ink drops from a printhead or a printhead cleaning unit and discharging the ink drops to an ink drop collection tray with improved reliable performance.

SUMMARY OF THE INVENTION

[0007] From one aspect, the invention provides a device for conveying ink drops from a receiving station, where the ink drops originating from a printhead are received, to a discharge station, where the ink drops in a dried condition are discharged, wherein the device comprises a conveyor belt for conveying the ink drops, the conveyor belt having a belt surface for supporting the ink drops during their conveyance from the receiving station to the discharge station, wherein at the discharge station the conveyor belt is provided with means for loosening at least a leading portion of the dried ink drops by changing the path of movement of the belt surface as considered in a vertical plane.

[0008] From another aspect, the invention provides a method for conveying ink drops from a receiving station, where the ink drops originating from a printhead are received, to a discharge station, where the ink drops in a dried condition are discharged, wherein the method comprises the steps of receiving the ink drops on a belt conveyor surface, allowing the ink drops to set on the belt surface so as to form dried ink drops at the discharge station, progressively peeling off a leading portion of the set ink drops from the belt surface by changing the path of movement of the belt surface, loosening the ink drops in their entirety from the belt surface and delivering the ink drops to an ink drop collector.

[0009] In this way, use can be made of the change in direction of the belt that already has to take place for the backward movement of the belt towards the receiving station. The arrangement may consequently be simple and reliable in operation. Advantageously, use can be made of the more or less flat shape and the rigidity of the ink drops, as considered in a vertical plane comprising the path of the conveyor. The change of shape of the belt during running past the discharge station automatically results in a peeling off of the solidified ink drops on the belt.

[0010] According to a further development of the device according to the invention, said means for loosening are adapted to progressively diverge said leading portion from the path of movement of the belt surface. The peeling-off effect will be improved in case the change is sharp.

[0011] The means for loosening may be adapted to change the path of movement of the belt surface according to a convex turning path, in particular a convex turning path including an angle of at least 90 degrees.

[0012] Advantageously, the radius of the convex turning path is adjusted to the length of the ink drops on the belt surface. By way of example, the radius of the convex turning path may be smaller than the length of the ink drops on the belt surface. A typical radius used is between 1-6 mm.

[0013] In a further development of the device or method according to the invention, the drying of the ink drops, which are positioned between the receiving station and

the discharge station, is accelerated. This can be realised by means of means for accelerating the drying of the ink drops, which means are positioned below the belt surface supporting the ink drops and may comprise a belt supporting plate. The ink drops can be solidified within a short period of time, during which the belt conveyor may be held stationary for a while after receipt of an ink drop, and then shifted to present a next belt surface to the next ink drop that falls down. In this way it is ensured that the ink drops will have been solidified to such an extent that they will be rigid in the vertical plane and the peeling off process will be enhanced.

[0014] In a yet further embodiment of the device and method of the invention, additional means for loosening a trailing portion of the dried ink drops from the belt surface are used. Said means for loosening a trailing portion of the dried ink drops from the belt surface advantageously comprise a stationary stop engaging the loosened leading portion of the ink drops. In this way it is ensured that under all circumstances the ink drops are peeled off completely from the belt surface.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The invention will be elucidated on the basis of an exemplary embodiment of the device and method of the invention, referring to the accompanying drawings, in which:

Figure 1 shows a schematic view in a vertical plane of a device according to the invention, in a first stage of use;

Figure 2 shows a schematic view in a vertical plane of the device of figure 1, in a second stage of use; and

Figure 3 shows a schematic view in a vertical plane of the device of figure 1, in a third stage of use.

DETAILED DESCRIPTION OF THE DRAWINGS

[0016] Figure 1 shows a device 1 embodying an embodiment of the device according to the invention, which device 1 comprises a belt conveyor 4 comprising an endless belt 5 running about drive roller 6 and idle roller 7. The upper track of the belt 5 is positioned below a printhead 2 having a lower surface 3 from which ink can be delivered during printing in a manner known per se. It is remarked that instead of printhead 2 a printhead cleaning unit can be located above the conveyor 4, depending on the structure of the printer arrangement (that is not shown).

[0017] The upper track of the belt 5 is supported on a cooling plate 8, which is adapted to cool the surface 5a of belt 5.

[0018] Adjacent to idle roller 7 an ink drop collection tray 9 has been arranged, which tray 9 defines a collect-

ing space 11. At its upper side, the tray 9 has a curved deflector wall portion 10, which extends to above the upper belt track, at the location of the roller 7.

[0019] Below the roller 7 the tray 9 is provided with a stop or abutment plate 12, the upper end 13 of which is spaced below the roller 7 and the lower track of the belt 5.

[0020] The device 1 of figures 1-3 operates as follows.

[0021] In figure 1, the situation is depicted in which the upper track of the belt 5, supported by plate 8, receives ink drops 20 falling down in the direction A from the lower surface 3 of the printhead 2. When hitting the upper surface of belt 5, the drops 20 flow out over the belt surface to some extent to form disc-shaped plaques 21.

[0022] In this example, the drive roller 6 is not activated, so that the plaques 21 are allowed to dry, assisted by the presence of the cooling plate 8.

[0023] When the plaques 21 have been solidified to a sufficient extent, the drive roller 6 is activated to drive the upper track of the belt 5 in the direction B. As a result, the plaques 21 are conveyed along in the direction B, to arrive at the roller 7. As can be seen in figure 2, the plaques 21 have resistance to bending so that their leading portion 21 a continues its path of movement in the direction C, that is to say the direction of movement of the portion of the belt 5 directly upstream of roller 7. As a consequence, the leading portion 21 a of the plaque 21 will be automatically peeled off from the belt surface 5a.

[0024] Upon continued movement of the belt 5, the plaque 21 will be moved under the deflecting wall 10 and rotate in the direction D. In some cases, the plaque 21 will completely loosen from the belt surface during this movement. In other cases, a small trailing portion 21 b of the ink plaque 21 may remain attached to the belt surface. In that case, the lower surface of the plaque 21 will, as depicted in figure 3, hit the abutment plate 12. Due to the continued movement of the belt 5 the trailing portion 21 b will be urged to loose from the belt surface. Then the plaque 21 will fall downwards from the abutment plate 12 into the space 11.

[0025] An operator may periodically empty the tray 9.

[0026] The device and process according to the invention are particularly suitable for use in hot melt ink printing.

Claims

1. Device for conveying ink drops from a receiving station, where the ink drops originating from a printhead are received, to a discharge station, where the ink drops in a dried condition are discharged, wherein the device comprises a conveyor belt for conveying the ink drops, the conveyor belt having a belt surface for supporting the ink drops during their conveyance from the receiving station to the

discharge station, wherein at the discharge station the conveyor belt is provided with means for loosening at least a leading portion of the dried ink drops by changing the path of movement of the belt surface as considered in a vertical plane.

2. Device according to claim 1, wherein said means for loosening are adapted to progressively diverge said leading portion from the path of movement of the belt surface.
3. Device according to claim 1, wherein said means for loosening are adapted to change the path of movement of the belt surface according to a convex turning path.
4. Device according to claim 3, wherein said convex turning path includes an angle of at least 90 degrees.
5. Device according to claim 3 or 4, wherein the radius of the convex turning path is adjusted to the length of a plaque formed by a number of ink drops on the belt surface.
6. Device according to claim 5, wherein the radius of the convex turning path is smaller than the length of a plaque formed by a number of ink drops on the belt surface.
7. Device according to any one of the preceding claims, further comprising means for accelerating the drying of the ink drops positioned between the receiving station and the discharge station.
8. Device according to claim 7, wherein said means for accelerating the drying of the ink drops are positioned below the belt surface supporting the ink drops.
9. Device according to claim 8, wherein means for accelerating the drying of the ink drops comprise a belt supporting plate.
10. Device according to any one of the preceding claims, further comprising means for loosening a trailing portion of the dried ink drops from the belt surface.
11. Device according to claim 10, wherein said means for loosening a trailing portion of the dried ink drops from the belt surface comprise a stationary stop engaging the loosened leading portion of the ink drops.
12. Method for conveying ink drops from a receiving station, where the ink drops originating from a print-head are received, to a discharge station, where the

ink drops in a dried condition are discharged, wherein the method comprises the steps of receiving the ink drops on a belt conveyor surface, allowing the ink drops to set on the belt surface so as to form dried ink drops at the discharge station, progressively peeling off a leading portion of the set ink drops from the belt surface by changing the path of movement of the belt surface, loosening the ink drops in their entirety from the belt surface and delivering the ink drops to an ink drop collector.

13. Method according to claim 12, wherein the step of peeling off is carried out by sharply changing the path of movement of the belt surface.
14. Method according to claim 12 or 13, wherein the step of peeling off is carried out by changing the path of movement of the belt surface according to a convex turning path.
15. Method according to claim 14, wherein the belt surface is turned about an angle of at least 90 degrees.
16. Method according to claim 15, further comprising the step of adjusting the radius of the convex turning path to the length of the ink drops on the belt surface.
17. Method according to claim 16, wherein the radius of the convex turning path is smaller than the length of the ink drops on the belt surface.
18. Method according to any one of the claims 12-17, further comprising the step of accelerating the drying of the ink drops during their travel from the receiving station to the discharge station.
19. Method according to claim 18, wherein accelerating the drying of the ink drops is carried out by means of a plate positioned below the belt surface supporting the ink drops and supporting the belt.
20. Method according to any one of the claims 12-19, further comprising the step of loosening a trailing portion of the dried ink drops from the belt surface after the leading portion has been peeled off from the belt surface by engaging the leading portion of the ink drops with a stationary stop.
21. Method according to any one of the claims 12-20, wherein the loosened ink drops are collected in a container by falling down from the discharge station.
22. Device provided with one or more of the **characterizing** measures described in the attached description and/or shown in the attached drawings.

23. Method comprising one or more of the **characterizing** steps described in the attached description and/or shown in the attached drawings.

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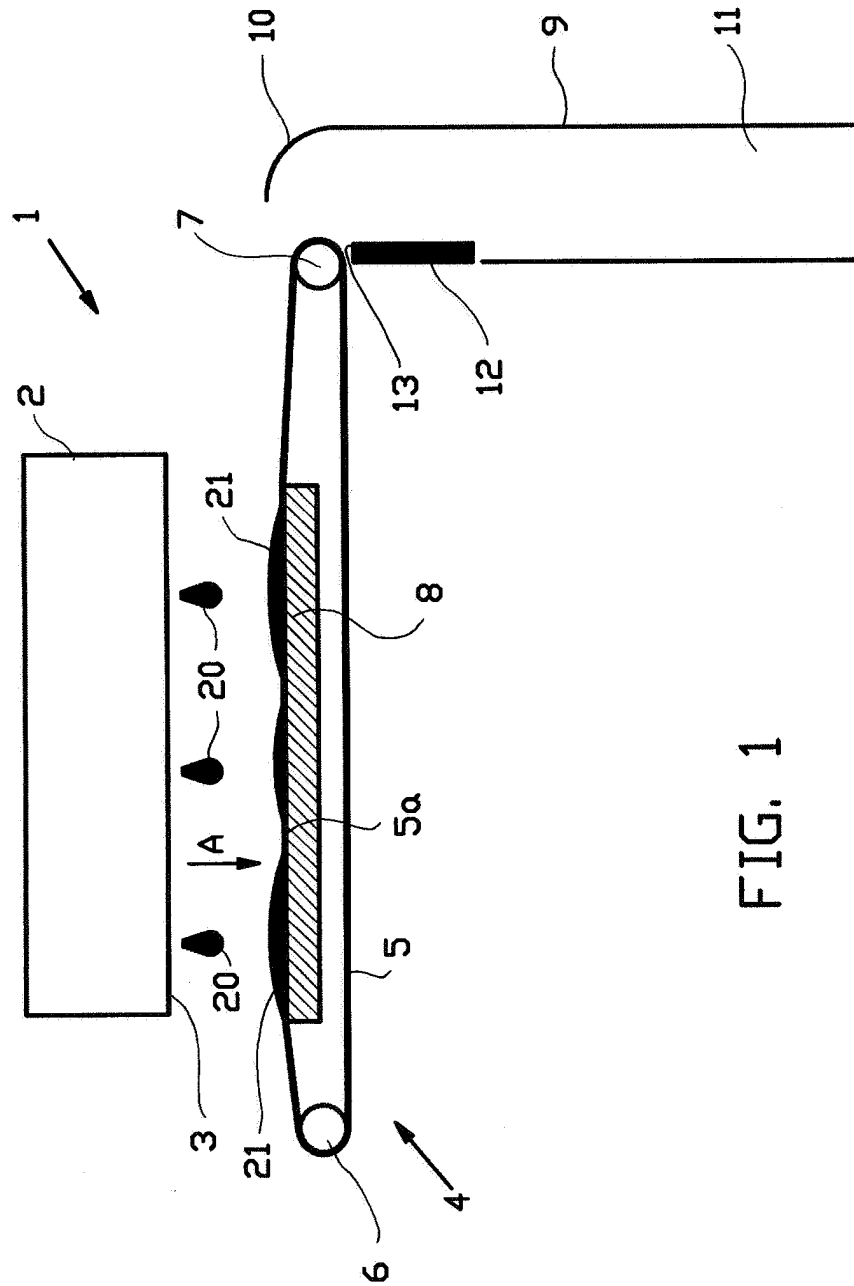
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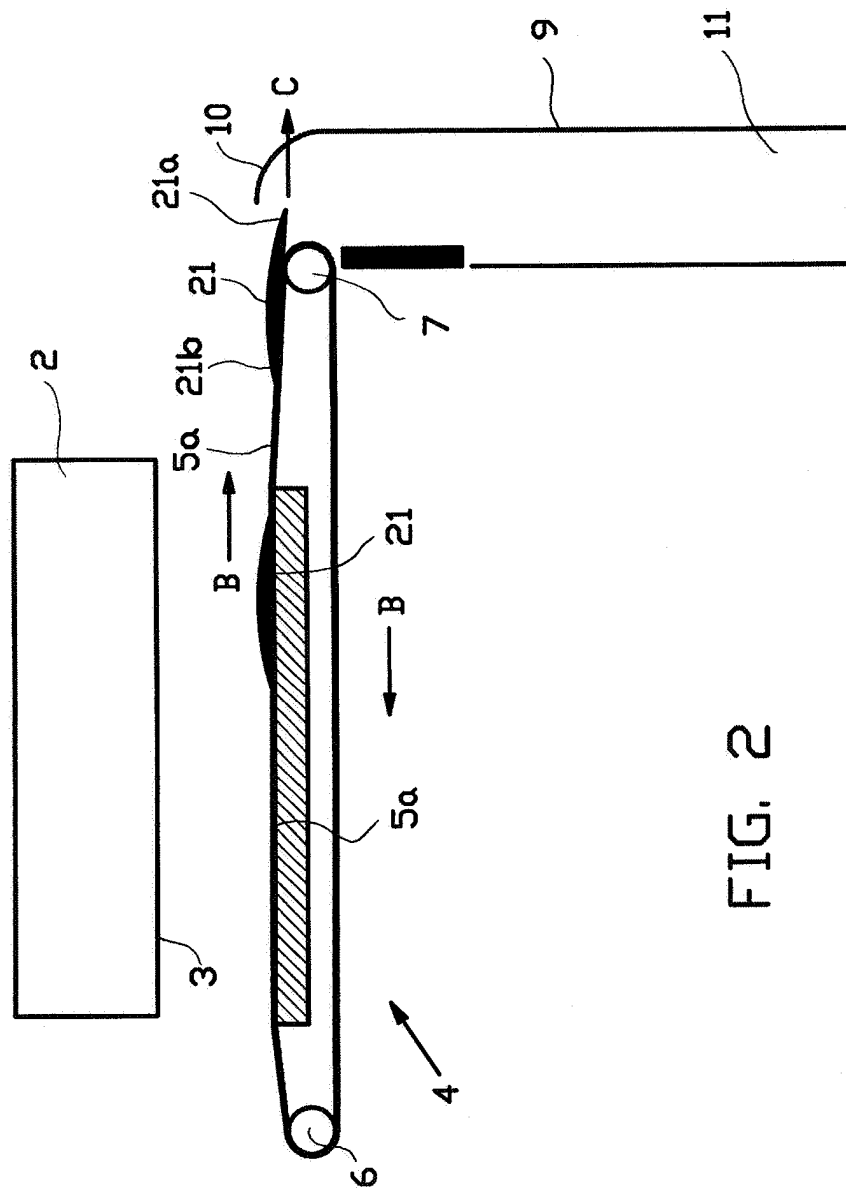
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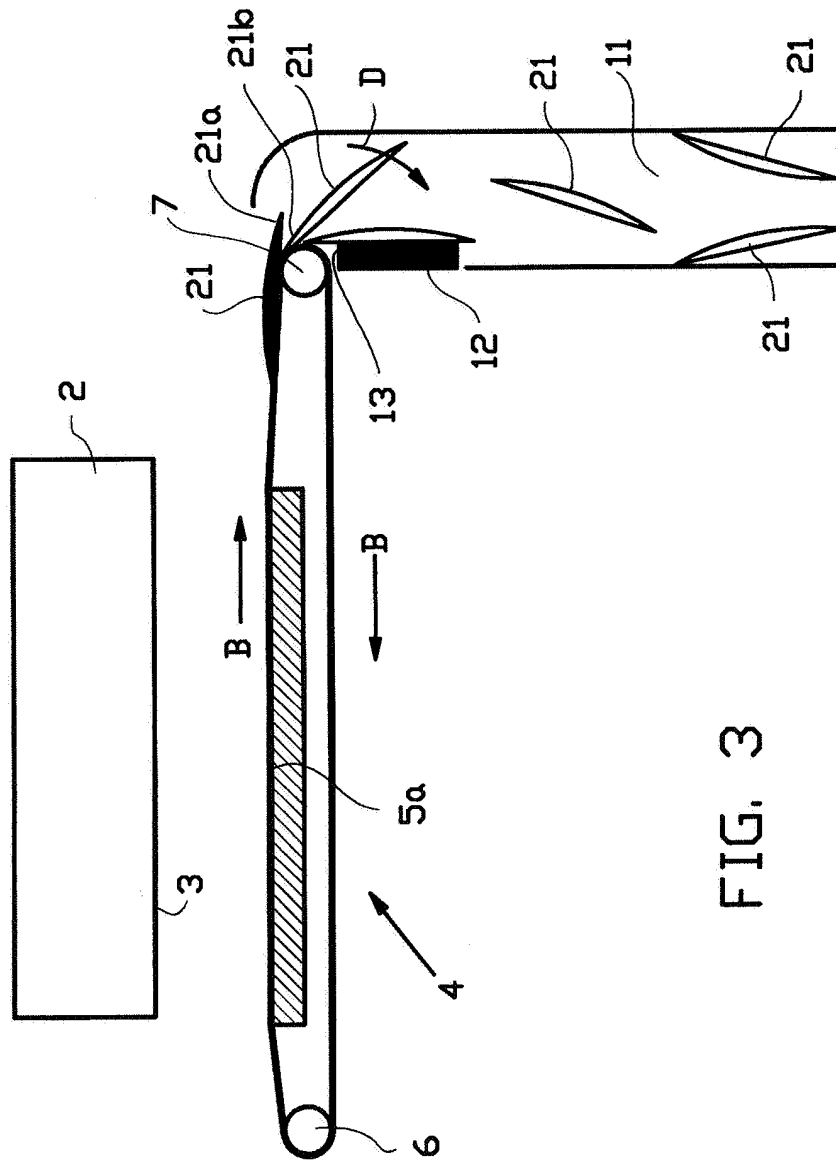
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European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 10 6011

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.7)
X	US 6 082 848 A (TAYLOR BRET) 4 July 2000 (2000-07-04) * column 5, line 46 - column 6, line 35; figures 5-7 *	1-23	B41J2/165
X	US 6 340 220 B1 (MILLMAN MICHAEL S ET AL) 22 January 2002 (2002-01-22) * column 9, line 42 - column 10, line 2; figure 8 *	1-23	
A	US 6 196 654 B1 (IKKATAI MASATOSHI ET AL) 6 March 2001 (2001-03-06) * the whole document *	1-23	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		15 March 2005	Axters, M
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 P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 04 10 6011

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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15-03-2005

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