(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 381 845 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
16.10.2019 Bulletin 2019/42

(21) Application number: **18164160.6**

(22) Date of filing: **27.03.2018**

(51) Int Cl.:
B65H 5/22 *(2006.01)* ***B65H 29/24*** *(2006.01)*
B41J 11/00 *(2006.01)*

(54) SHEET SUPPORT STRUCTURE

BLATTTRAGESTRUKTUR

STRUCTURE DE SUPPORT DE FEUILLE

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **28.03.2017 EP 17163310**

(43) Date of publication of application:
03.10.2018 Bulletin 2018/40

(73) Proprietor: **OCE Holding B.V.**
5914 CA Venlo (NL)

(72) Inventors:
- **LA VOS, Peter G.**
  5914 CA Venlo (NL)
- **KUYPERS, Hermanus M.**
  5914 CA Venlo (NL)

(74) Representative: **OCE IP Department**
St. Urbanusweg 43
5914 CA Venlo (NL)

(56) References cited:
DE-A1-102009 002 013
JP-A- H11 349 181
US-A- 3 336 028
US-A1- 2011 134 200

EP 3 381 845 B1

Description

[0001] The invention relates to a sheet support structure comprising a rotary drum having a peripheral wall formed with apertures and delimiting a vacuum chamber formed inside of the drum, a perforated belt having a portion trained around at least a part of the peripheral wall of the drum and a flat portion remote from the drum, and a suction system arranged to create an underpressure in the vacuum chamber and at the perforations of the belt.

[0002] Support structures of this type are employed for example in printing systems where printing media sheets have to be supported in a well-defined posture while certain operations or treatments such as printing or drying are applied to the sheets. Frequently, the support structure is capable of conveying the sheet past a treatment station, e.g. past a print head or a print head assembly. For some treatments it is preferred that the sheet is supported in a flat state, whereas other treatments permit that the sheet is supported in a bent state.

[0003] US 2011-134200 A1 discloses a support structure of the type indicated above, wherein the sheets can be conveyed from a flat portion of the belt to a curved portion where the belt is trained around the drum, or vice versa. Thus, the support structure is capable of supporting a part of a sheet in a flat state and another part of the same sheet in a curved state, which allows for a compact design of the printing system as a whole. In order for the sheet to be attracted to the surface of the belt also in the curved portion on the periphery of the drum, it is required that the apertures in the drum and the perforations of the overlap with each other, so that air can be sucked in.

[0004] It is an object of the invention to provide a support structure of the type indicated above which is capable of supporting the sheets more stably and more reliably in a desired posture.

[0005] In order to achieve this object, the support structure according to the invention is characterized in that at least one of the belt and the peripheral wall of the drum has an array of embossments that form spacers between the belt an the peripheral wall of the drum and define a distribution manifold connecting the apertures of the drum to the perforations of the belt portion on the drum.

[0006] The invention has the advantage that the sheet can reliably be attracted to the curved portion of the belt regardless of whether or not the perforations in the belt overlap with the apertures of the drum. Even when there is no overlap at all, the distribution manifold defined by the embossments assures that air can nevertheless be sucked in through the perforations of the belt, so that the sheet or portion of the sheet present on that area of the belt will be attracted reliably.

[0007] More specific embodiments of the invention are indicated in the dependent claims.

[0008] In principle, the embossments may be formed either on the side of the belt that faces the drum or on the outer peripheral surface of the wall of the drum. In any case the embossments and the gaps which are formed therebetween and define the distribution manifold will be covered by a continuous layer of the belt, so that the belt itself will smoothen-out the height differences between the embossments and the gaps therebetween and, consequently, the outer surface of the belt which supports the sheet will have a smooth configuration.

[0009] The perforations in the belt and the apertures in the wall of the drum may have different shapes and cross-sectional areas and may also be arranged at different spacings and patterns. It is preferred however that the average flow resistances which the air has to overcome when being sucked through the perforations of the belt on the one hand and through the apertures of the drum on the other hand are approximately equal.

[0010] The embossments may be arranged in a regular pattern or, alternatively, they may be distributed randomly over the surface of the belt and/or the drum.

[0011] When the belt is trained only over a part of the circumference of the drum, the apertures in the peripheral wall of the drum may also be used for creating a vacuum in the vacuum chamber inside the drum. Thus, a vacuum source, e.g. a blower, may be arranged to have a mouth that faces the peripheral wall of the drum in a position where this wall is not covered by the belt.

[0012] An embodiment example will now be described in conjunction with the drawings, wherein:

Fig. 1 is a cross-sectional view of a support structure of an ink jet printing system according to the invention; and

Fig. 2 is a view of a part of a peripheral surface of a drum forming part of the support structure shown in Fig. 1.

[0013] Fig. 1 shows essential parts of a printing system comprising a print station 10, a drying station 12 and a support structure 14 for print media sheets 16.

[0014] The support structure 14 comprises a rotary drum 18 driven for rotation in the direction of an arrow A, and an endless belt 20 trained around the drum 18 and around a deflection roller 22 which has a smaller diameter than the drum 18. A flat portion 20a of the belt 20 supports the sheet 16 in a flat state. As the drum 18 rotates, the sheet 16 is moved past the print station 10 which has a number of print heads 24, e.g. ink jet print heads, facing the sheet 16 for printing an image on the top surface of the sheet 16 by ejecting droplets of liquid ink onto the sheet.

[0015] The drying station 12 is arranged downstream of the print station 10 and is provided for drying the ink on the sheet 16, by irradiating the sheet 16 with light (visible light, infrared light or ultraviolet light) or by blowing hot air against the sheet 16, for example. The print station 12 is required to have a certain length in transport direction of the sheets 16 in order to assure that the ink is dried sufficiently. In order to reduce the space require-

ment for the printing system, the flat portion 20a of the belt 20 is shorter than would be necessary for accommodating the entire drying station 12, and the drying station has a curved downstream portion matching the curvature of the drum 18 and extending over an upstream part of a curved portion 20b of the belt 20 which is supported on a peripheral wall 26 of the drum 18.

[0016] In order to obtain a printed image with high quality, it is required that the sheet 16 is stably fixed on the belt 20 at least until the trailing end of the sheet has moved past the print station 10. For that purpose, the belt 20 has perforations 28, and a suction system 30 is provided for sucking air through the perforations 28 of the belt at least in the area of the flat portion 20a of the belt underneath the print station 10, so that the sheet 16 is firmly attracted to the belt surface. The suction system 30 comprises a vacuum source (e.g. a suction blower) 32 which, in this example, is disposed in a space surrounded by the belt 20 and is connected to a plenum chamber 34 which is open towards the flat portion 20a of the belt.

[0017] The suction system 30 further comprises a suction box 36 which is also connected to the suction blower 32 and faces a part of the peripheral surface of the drum 18. A top wall of the suction box 36 extends directly underneath the flat portion 20a of the belt and has slots 38 which overlap with the perforations 28 of the belt, so that air can be sucked in through the perforations 28 and the slots 38 also in the part of the flat belt portion 20a that extends beyond the plenum chamber 34.

[0018] However, when the sheet 16 and the belt 20 move on from the position shown in Fig. 1, the leading edge of the sheet 16 will reach the curved portion 20b of the belt and would be likely to be separated from the belt unless it continues to be attracted against the belt also in the curved portion. For that purpose, a fine raster of perforations 40 is formed in the peripheral wall 26 of the drum 18. Consequently, air from the interior of the drum 18 will be sucked into the suction box 36 through the perforations 40 that face this suction box and, as a result, an underpressure will be created in a vacuum chamber 42 that is formed inside the drum 18. Further, a large number of small embossments 44 are formed on the outer peripheral surface of the wall 26 of the drum. In the part of the wall 26 that is covered by the curved portion 20b of the belt 20, these embossments 44 act as spacers between the outer peripheral surface of the drum and the inner surface of the belt portion 20b. Consequently, although the apertures 40 in the wall 26 of the drum do not necessarily overlap with the perforations 28 of the belt, the voids between the embossments 44 will form a distribution manifold which assures fluid communication between the apertures 40 and the perforations 28, so that air can be drawn in and the sheet 16 will be attracted against the belt 20 also in the curved portion 20b.

[0019] Thus, the support structure 14 is capable of safely and reliably supporting the sheet 16 in a well defined position and of moving the sheet past the printing station 10 and the drying station 12 along a well defined trajectory, and it is not necessary to take care that the perforations 28 of the belt are aligned with the apertures 40 of the drum.

[0020] Downstream of the vacuum chamber 42, at the bottom side in Fig. 1, the sheet 12 is released from the belt 20. The sheet 12 may then be transported to a sheet output device such as a stacker or finisher, or to a sheet flipping device, such that the sheet 12 is flipped for printing on its unprinted side. The flipped sheet 12 may then be returned to the flat portion 20a of the belt 20, for example by a further transport belt (not shown), for duplex printing. In this manner, a very compact printing system is obtained.

[0021] Fig. 2 shows a part of the peripheral surface of the drum 18 and also shows the finely distributed embossments 44 as well as the apertures 40. In this example, the embossments 44 are arranged in a regular pattern. The apertures 40 are arranged in several tracks 46 which extend in circumferential direction of the drum. Within each track 46, the apertures 40 are arranged with equal spacings which, however, do not necessarily match with the spacings between the embossments 44.

[0022] In this example, the distribution of the force which attracts the sheet 16 to the belt and to the drum 18 over the width of the sheet is controlled by varying the spacings between the individual tracks 46. For example, the tracks 46 are arranged more densely in the central part of the drum (as seen in axial direction of the drum) and less densely near the ends of the drum. A similar pattern may be provided for the perforations 28 in the belt and/or the arrangement of the slots 38 and/or corresponding suction openings of the plenum chamber 34.

[0023] In a modified embodiment, the embossments 44 might be disposed randomly rather than in a regular pattern. Further, instead of providing the embossments 44 on the outer surface of the drum, it would also be possible to form the embossments on the inner surface of the belt 20.

Claims

1. A sheet support structure (14) comprising a rotary drum (18) having a peripheral wall (26) formed with apertures (40) and delimiting a vacuum chamber (42) formed inside of the drum, a perforated belt (20) having a portion (20b) trained around at least a part of the peripheral wall (26) of the drum (18) and a flat portion (20a) remote from the drum, and a suction system (30) arranged to create an underpressure in the vacuum chamber (42) and at the perforations (28) of the belt (20), **characterized in that** at least one of the belt (20) and the peripheral wall (26) of the drum (18) has an array of embossments (44) that form spacers between the belt (20) and the peripheral wall of the drum (18) and define a distribution manifold connecting the apertures (40) of the drum

to the perforations (28) of the belt portion (20b) on the drum.

2. The sheet support structure according to claim 1, wherein the embossments (44) are formed on the peripheral wall (26) of the drum (18).

3. The sheet support structure according to claim 1 or 2, wherein the embossments (44) are arranged in a regular pattern.

4. The sheet support structure according to claim 1 or 2, wherein the embossments (44) are distributed randomly over the surface of the peripheral wall (26) and/or the belt (20).

5. The sheet support structure according to any of the preceding claims, wherein the suction system comprises a suction box (36) that is connected to a vacuum source (32) and is open towards a portion of the peripheral wall (26) of the drum (18) so as to create the underpressure in the vacuum chamber (42) by sucking air through the apertures (40).

6. The sheet support structure according to claim 5, wherein the suction box (36) has a wall formed with slots (38) and supporting the flat portion (20a) of the belt (20) adjacent to the drum (18).

7. The sheet support structure according to any of the preceding claims, wherein the suction system (30) comprises a plenum chamber (34) facing the flat portion (20a) of the belt (20) and connected to a vacuum source (32).

8. A printing system comprising a print station (10) and a sheet support structure (14) according to any of the previous claims arranged to support a media sheet (16) at least in an area of the print station (10).

9. The printing system according to claim 8, comprising a drying station (12) at least a part of which extends along the curved portion (20b) of the belt (20) on the drum (18).

10. The printing system according to claim 8 or 9, wherein the print station (10) comprises an ink jet print head (24).

Patentansprüche

1. Bogenstützstruktur (14), umfassend eine Drehtrommel (18) mit einer Umfangswand (26), die mit Öffnungen (40) ausgebildet ist und eine Vakuumkammer (42) begrenzt, die innerhalb der Trommel ausgebildet ist, wobei ein perforiertes Band (20) einen Abschnitt aufweist (20b) um mindestens einen Teil der Umfangswand (26) der Trommel (18) und einen von der Trommel entfernten flachen Abschnitt (20a) und ein Saugsystem (30) ausgebildet sind, um einen Unterdruck in der Vakuumkammer zu erzeugen (42) und an den Perforationen (28) des Bandes (20), **dadurch gekennzeichnet, dass** das Band (20) und / oder die Umfangswand (26) der Trommel (18) eine Anordnung von Prägungen (44) aufweist, diese bilden Abstandshalter zwischen dem Riemen (20) und der Umfangswand der Trommel (18) und definieren einen Verteiler, der die Öffnungen (40) der Trommel mit den Perforationen (28) des Riemenabschnitts (20b) auf der Trommel verbindet.

2. Bogenstützstruktur nach Anspruch 1, wobei die Prägungen (44) an der Umfangswand (26) der Trommel (18) ausgebildet sind.

3. Bogenstützstruktur nach Anspruch 1 oder 2, wobei die Prägungen (44) in einem regelmäßigen Muster angeordnet sind.

4. Bogenstützstruktur nach Anspruch 1 oder 2, wobei die Prägungen (44) zufällig über die Oberfläche der Umfangswand (26) und / oder des Riemens (20) verteilt sind.

5. Bogenstützstruktur nach einem der vorhergehenden Ansprüche, bei der das Saugsystem einen Saugkasten (36) aufweist, der mit einer Vakuumquelle (32) verbunden und zu einem Teil der Umfangswand (26) der Trommel hin offen ist (18), um den Unterdruck in der Vakuumkammer (42) durch Ansaugen von Luft durch die Öffnungen (40) zu erzeugen.

6. Bogenstützstruktur nach Anspruch 5, wobei der Saugkasten (36) eine Wand aufweist, die mit Schlitzen (38) ausgebildet ist und den flachen Abschnitt (20a) des Bandes (20) benachbart zur Trommel (18) stützt.

7. Bogenstützstruktur nach einem der vorhergehenden Ansprüche, wobei das Saugsystem (30) eine Sammelkammer (34) aufweist, die dem flachen Abschnitt (20a) des Riemens (20) zugewandt und mit einer Vakuumquelle (32) verbunden ist.

8. Drucksystem mit einer Druckstation (10) und einer Blatttragstruktur (14) nach einem der vorhergehenden Ansprüche, die so angeordnet sind, dass sie ein Medienblatt (16) zumindest in einem Bereich der Druckstation (10) tragen.

9. Drucksystem nach Anspruch 8, umfassend eine Trocknungsstation (12), von der sich mindestens ein Teil entlang des gekrümmten Abschnitts (20b) des Bandes (20) auf der Trommel (18) erstreckt.

10. Drucksystem nach Anspruch 8 oder 9, wobei die Druckstation (10) einen Tintenstrahldruckkopf (24) aufweist.

Revendications

1. Structure de support de feuille (14) comprenant un tambour rotatif (18) ayant une paroi périphérique (26) formée avec des ouvertures (40) et délimitant une chambre à vide (42) formée à l'intérieur du tambour, une courroie perforée (20) comportant une partie (20b) formé autour d'au moins une partie de la paroi périphérique (26) du tambour (18) et d'une partie plate (20a) éloignée du tambour et d'un système d'aspiration (30) agencé pour créer une dépression dans la chambre à vide (42) et au niveau des perforations (28) de la courroie (20), **caractérisés en ce qu** 'au moins l'une parmi la courroie (20) et la paroi périphérique (26) du tambour (18) présente un réseau de reliefs (44) qui forment des entretoises entre la courroie (20) et la paroi périphérique du tambour (18) et définissent un collecteur de distribution reliant les ouvertures (40) du tambour aux perforations (28) de la portion de courroie (20b) sur le tambour.

2. Structure de support de feuille selon la revendication 1, dans laquelle les reliefs (44) sont formés sur la paroi périphérique (26) du tambour (18).

3. Structure de support de feuille selon la revendication 1 ou 2, dans laquelle les reliefs (44) sont agencés selon un motif régulier.

4. Structure de support de feuille selon la revendication 1 ou 2, dans laquelle les gaufrages (44) sont répartis de manière aléatoire sur la surface de la paroi périphérique (26) et / ou de la courroie (20).

5. Structure de support de feuille selon l'une quelconque des revendications précédentes, dans laquelle le système d'aspiration comprend une boîte d'aspiration (36) qui est connectée à une source de vide (32) et est ouverte vers une partie de la paroi périphérique (26) du tambour (18) afin de créer la dépression dans la chambre à vide (42) en aspirant de l'air à travers les ouvertures (40).

6. Structure de support de feuille selon la revendication 5, dans laquelle la boîte d'aspiration (36) a une paroi formée avec des fentes (38) et supportant la partie plate (20a) de la courroie (20) adjacente au tambour (18).

7. Structure de support de feuille selon l'une quelconque des revendications précédentes, dans laquelle le système d'aspiration (30) comprend une chambre de répartition (34) faisant face à la partie plate (20a) de la courroie (20) et connectée à une source de vide (32).

8. Système d'impression comprenant un poste d'impression (10) et une structure de support de feuille (14) selon l'une quelconque des revendications précédentes, agencé pour supporter une feuille de support (16) au moins dans une zone du poste d'impression (10).

9. Système d'impression selon la revendication 8, comprenant un poste de séchage (12) dont au moins une partie s'étend le long de la partie incurvée (20b) de la courroie (20) sur le tambour (18).

10. Système d'impression selon la revendication 8 ou 9, dans lequel le poste d'impression (10) comprend une tête d'impression à jet d'encre (24).

Fig. 1

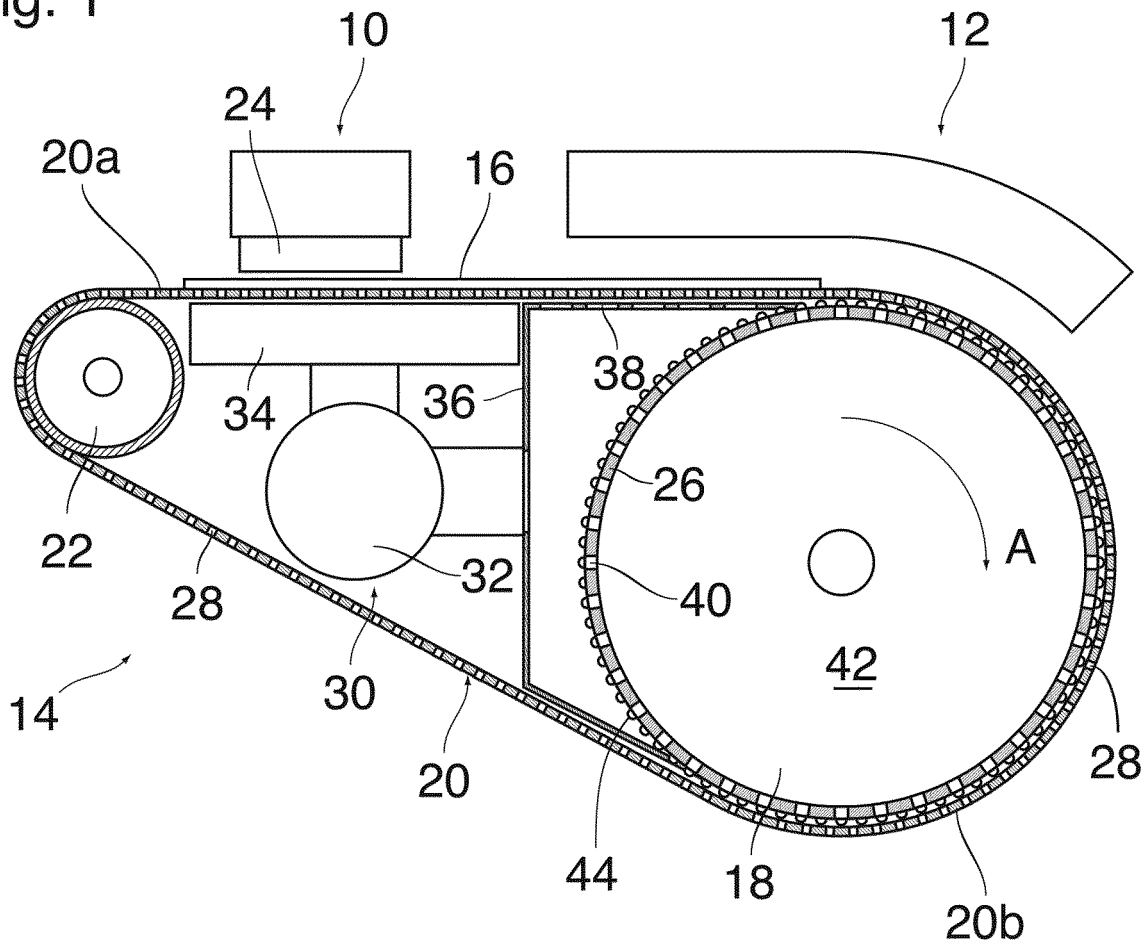
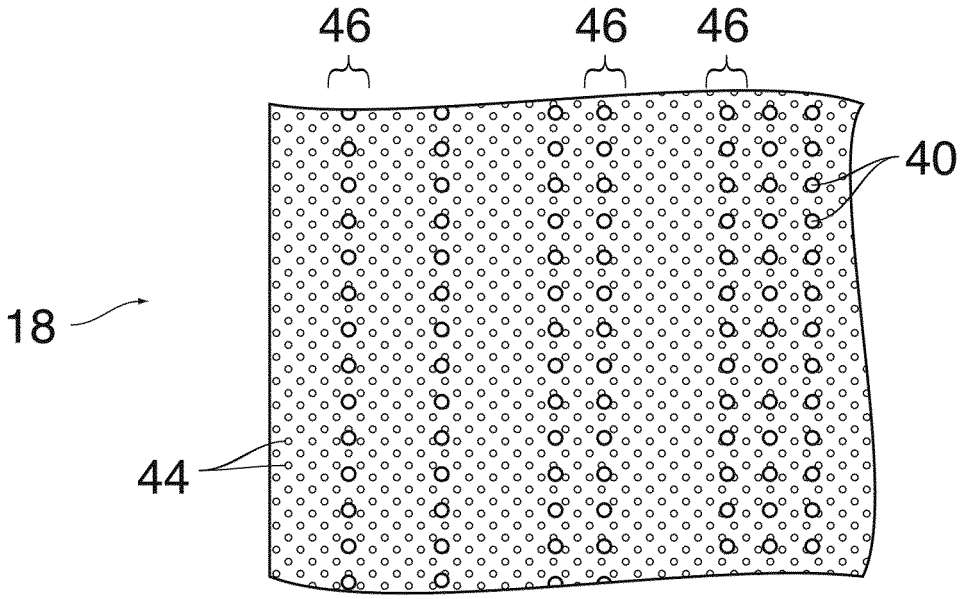

10
12
24
20a
16
38
34
36
26
22
A
32
40
28
42
14
30
28
20
44
18
20b

Fig. 2


46
46
46
40
18
44

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 2011134200 A1 **[0003]**