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(54) **FLATBED PRINTER**

(57) A flatbed with a medium support plate assembly (1) comprising a plurality of through-holes (H1-H4) and defining different suction zones (Z1-Z3) for differently sized print substrates, wherein each through-holes (H2-H4) along the full circumference (C) are configured to have average cross-sectional through-flow area per unit area larger than through-holes (H1) in a central area (A) circumscribed by said circumference.

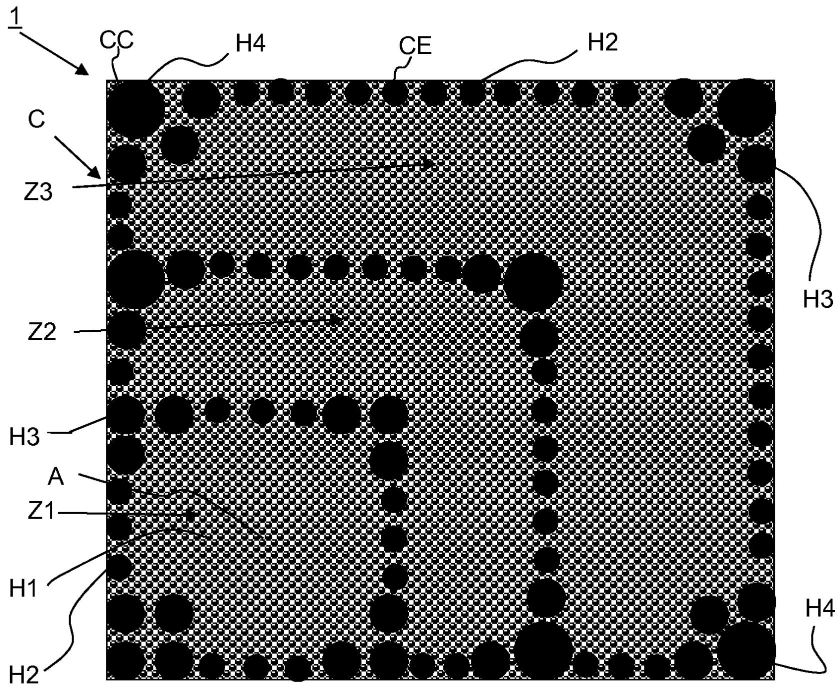



Fig. 4



Printed by Jouve, 75001 PARIS (FR)

## Description

### BACKGROUND OF THE INVENTION

### 1. Field of the invention

**[0001]** The invention relates to a printer comprising a medium support plate assembly provided with through-holes. Such a printer may for example be a flatbed printer comprising a scanning inkjet print head carriage. The invention further relates to a method for printing on such a printer.

### 2. Description of Background Art

**[0002]** Flatbed printers having a medium support plate assembly provided with suction holes are known from e.g. EP2580062 A1. A flatbed printer comprises an inkjet print head carriage moveable over the medium support plate assembly for forming an image on substrates on the medium support plate assembly. The medium support plate assembly is provided with a plurality of through-holes for applying an underpressure to one or more print substrates on the medium support plate assembly. During printing the substrates are held down on the medium support plate assembly by an underpressure applied via the through-holes in the medium support plate assembly to avoid collisions between the carriage and the substrates. The underpressure further maintains the print surface of the substrates in a generally flat state on the medium support plate assembly. The flatness contributes to the print quality. Generally, multiple substrates are loaded onto the medium support plate assembly, but not in a manner fully covering all through-holes. Uncovered through-holes result in air "leaking" into the suction table below the medium support plate assembly, negatively affecting the holding down of the substrates. Such leak air effects may be compensated by increasing the power of the vacuum pump, though this requires a relatively expensive pump or fan. In practice, through-holes not covered by substrates are closed by separate sealing means, such as tape, masks, or waste material cut to size. This closing operation is time consuming and reduces productivity.

**[0003]** It is known to divide the medium support plate assembly, such that it defines a plurality of suction zones, each suction zone having predetermined dimensions different from the other zones. The suction zones correspond to e.g. commonly used substrate dimensions (e.g. A0, A1, A2, B0, etc.). It is known to provide e.g. a dedicated valve system for closing off uncovered suction zones in their entirety or to provide sealing masks with shapes and size corresponding to the layout of the suction zones. Such solutions require additional components as well as operator time in applying them.

### SUMMARY OF THE INVENTION

**[0004]** It is an object of the invention to increase the productivity of a flatbed printer, specifically with regard to the preparation time required for suitably preparing substrates on the medium support plate assembly prior to printing.

**[0005]** In accordance with the present invention, a printer according to claim 1 and a method according to claim 11 are provided.

**[0006]** In the printer according to the present invention an average cross-sectional through-flow area per unit area of through-holes positioned along a circumference of each zone is larger than the average cross-sectional through-flow area per unit area of through-holes in a central area of each respective zone. It is the insight of the inventors that a larger flow of air is required at the areas of the substrate with the greater risk of being released from the medium support plate assembly, specifically the edges and the corners. It is the further insight of the inventors that this increased air flow may be achieved by enlarging the effective open area of through-holes at said edges and corners. Along the circumference of each suction zone the average cross-sectional through-flow area per unit area is increased with respect to central area by providing through-holes along said circumference with a larger average cross-sectional area or in a denser grouping as compared to the central area of the suction zone. This results in a secure holding down of the substrates, while the amount of air leaking into the suction table is kept relatively low, since the effective open area of uncovered through-holes in central areas is relatively small. As such, there is no need for an operator to seal off uncovered through-holes prior to printing. Additionally, the inventors found that during printing the air velocity around the print head carriage, specifically between the print heads and the substrates was lowered due to the relatively small ari flow inside the suction zones. This resulted in a reduction in ink misting, which is caused by ejected droplets being displaced in flight by air flows. In consequence, less cleaning time is required, but also the accuracy of droplet positioning and thereby the image quality is improved. Thereby the object of the present invention has been achieved.

**[0007]** More specific optional features of the invention are indicated in the dependent claims.

**[0008]** In an embodiment, the average cross-sectional through-flow area per unit area of through-holes positioned along the substantially entire circumference of each zone is larger than the average cross-sectional through-flow area per unit area of through-holes in a central area of each respective zone. To reduce the risk of collisions between substrates and the print head carriage, it is preferred to improve the through-flow along the full circumference of a substrate. The circumference herein is an endless boundary line circumscribing the area of the substrate (or the suction zone). The effective open area of the through-holes is thus increased locally along the entire circumference of the suction zone. The central area is thereby fully enclosed by an endless loop formed of through-holes having an average cross-sectional through-flow area per unit area larger than in the central area itself.

**[0009]** In an embodiment, the average cross-sectional through-flow area per unit area of the through-holes at the circumference increases with a local radius of the curvature of the circumference at the respective through-holes. It was found that corners provide a greater risk of being released than straight edges. The inventors thus deduced that a greater radius of curvature of a portion of the circumference requires a higher through-flow of air to provide sufficient hold down. In consequence, the effective open area of through-holes at the corners is preferably made larger than along edges extending between corners.

**[0010]** In an embodiment, the printer further comprises a spacer structure supporting the medium support plate assembly and a plurality of connection lines extending through the spacer structure for forming a fluid connection between the through-holes and a suction source. The connection lines are distributed, such that a majority of and/or substantially all through-holes are spaced apart from a connection line by at most a small number of through-holes. Said number is preferably smaller than twenty, ten, five, or three. The advantages of the locally increased cross-sectional through-flow may be improved by providing a low air resistance suction table below the medium support plate assembly. To ensure flatness of the medium support plate assembly, a spacer structure is provided inside the suction table to support the medium support plate assembly. Such spacer structures generally limit air flow at least in directions parallel to the plane of the medium support plate assembly. Each connection line forms a relatively low air resistance connection to the suction source, which may for example be achieved by providing the connection lines with a sufficiently large cross-section. As such, efficient removal of air from the through-holes is achieved.

**[0011]** In an embodiment, the printer further comprises a spacer structure releasably attachable to a bottom side of the medium support plate assembly, which spacer structure defines an air distribution manifold on the bottom side of medium support plate assembly. The releasable spacer structure may for example be formed of magnetic spacer bars, which allow an operator to shape the air distribution manifold to suit a particular print job. Due to the relatively large size of the printer, the height of the releasable spacer structure is small compared to its length and width. The air flow chamber which holds the releasable spacer structure is thus relative narrow in the height direction. This results in a relatively high air flow resistance in the horizontal directions. The drawbacks of the narrow air flow chamber may be avoided by providing a sufficiently high density of the connection lines, such that substantially each through-hole is positioned relatively near or in proximity of a connection line. The distance air needs to travel through the high resistance air flow chamber is thereby limited, reducing the impact of the narrow air flow chamber on the total air flow. In top down view, the entry openings of the connection lines are distributed over the area of the medium support plate assembly, such that no more than a small number of through-holes is positioned between nearest neighbors of the entry openings. Said small number is preferably no greater than 25, 20, 15, 10, 5, 3, or 1 through-holes.

**[0012]** Further scope of applicability of the present invention will become apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the present invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the present invention will become apparent to those skilled in the art from this detailed description.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0013]** The present invention will become more fully understood from the detailed description given herein below and the accompanying drawings which are given by way of illustration only, and thus are not limitative of the present invention, and wherein:

Fig. 1 is a perspective, schematic view of a flatbed printer;

Fig. 2 is a cross-sectional schematic view of the printer in Fig. 1;

Fig. 3 is a schematic representation of an embodiment of a medium support plate assembly for a printer according to the present invention;

Fig. 4 is a schematic representation of another embodiment of a medium support plate assembly for a printer according to the present invention;

Fig. 5 is a schematic representation of a further embodiment of a medium support plate assembly for a printer according to the present invention; and

Fig. 6 is a schematic representation of the steps of the method according to the present invention for printing on the printer in Fig. 1.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

**[0014]** The present invention will now be described with reference to the accompanying drawings, wherein the same reference numerals have been used to identify the same or similar elements throughout the several views.

**[0015]** Fig. 1 is a print system 5 (or printer) comprising a number of workstations 8B, 8C, which may be personal computers or other devices for preparing image data for prints to be printed. These workstations have access to a network N for transferring print jobs comprising the image data to a print controller 8A that is configured to receive the print jobs for prints and derive pass images. The print controller 8A may be part of the print system 5 connected to a control unit of the print system 5 via a connection 6. The print system 5 further comprises a print head 2 attached to an armature 7 for applying colorants, for example cyan (C), magenta (M), yellow (Y), black (K) and white (W) colorant, or varnish to pieces 9, 9A of flat print media placed on a flatbed surface 1 in order to obtain a printed image. The armature 7 comprises a gantry above the flat bed surface 1 as shown in Fig. 1 moving in a plurality of directions over the flat bed surface 1. The flatbed surface 1 is the surface of the flatbed which is at least partially printable by the print head 2. The pieces of media may be so small that they are completely placed on the flatbed surface 1, but a piece of media which is larger than the flatbed surface, in which case an image which is going to cover the whole piece of media must be printed into a plurality of parts of the image, is not excluded. A first piece 9A has already been printed upon, while the other pieces 91, 92 are not provided with any recording material yet. The print head 2 reciprocally scans the flatbed surface 1 in the scanning direction X along a gantry 7 perpendicular to a non-scanning direction Y of the gantry 7 over the flatbed surface 1 along guiding parts 10. During printing of an image on the piece 9, 9A of media the piece 91, 92, 9A of media is not moved on the flatbed surface 1. This way of working is advantageous for rigid print media. Such a print head may be moveable in at least one direction over the flatbed surface 1. The piece of media 9A may have a thickness of 10 mm, while the pieces of media 91, 92 may have a thickness of 20 mm.

**[0016]** Fig. 2 illustrates a cross-section of the printer in Fig. 1. Below the carriage holding the print heads 2, the suction table 12 is provided. The suction table surface 1 is formed by the medium support plate assembly 1, which may comprise one more plates provided with through-holes. Below the medium support plate assembly 1 a first spacer assembly 14 is provided. Preferably, the first spacer assembly 14 is formed by a plurality of longitudinal spacer bars 14 which are releasably mounted in the suction table 12. The spacer bars 14 may be repositioned on the bottom surface of the medium support plate assembly 1 to adjust the layout and dimensions of the first spacer assembly 14 to the requirements of an upcoming print job. Preferably, the spacer bars 14 comprise a magnetic material for releasably attaching these to the medium support plate assembly 1, which may be formed of a suitable material such as metal. Such magnetic spacer bars 14 are described in detail in EP2580062 A1, which is herein incorporated by reference. The first spacer assembly 14 forms a first airflow chamber 15 wherein air may flow along the bottom surface of the medium support plate assembly 1. The first spacer assembly 14 defines a manifold inside the first air flow chamber 15 for distributing air along at least a bottom portion of the medium support plate assembly 1.

**[0017]** A second spacer assembly 16 is provided inside the suction table 12 for supporting the first spacer assembly 14. The first air flow chamber 15 is enclosed on opposite sides by respectively the medium support plate assembly 1 and the second spacer assembly 16. The second spacer assembly 16 may for example be formed of a honeycomb structure to provide a low costs and flat support surface. Connection lines 17 form fluid connections between the first air flow chamber 15 and a second air flow chamber 18 positioned on an opposite side of the second spacer assembly 16 as the first airflow chamber. The connection lines 17 may be formed as tubes or pipes extending through the second spacer assembly 16 to fluidly connect the first and second airflow chambers 15, 18. The second airflow chamber 18 comprises an opening which connects to a suction line 22 extending towards a suction source 20. The suction source 20 may be a fan or pump for providing an underpressure in the second air flow chamber 18. The height (measured perpendicular to the medium support plate assembly 1) of the second air flow chamber 18 is relatively large to provide low air resistance as compared to the first air flow chamber 15. With relatively low power of the suction source 20 sufficient underpressure may thus be achieved in the second airflow chamber 18. The connection lines 17 provide a low air resistance fluid connection between the second air flow chamber 18 and the first air flow chamber 15 formed by the first spacer assembly 14. The connection lines 17 are provided in relative close proximity, for example with at most 30, 25, 20, 15, or 10 cm between them. In consequence, the distance between through-holes in the medium support plate assembly 1 and the connection lines 17 is relatively small for all through-holes. The height of the first air flow chamber 15 (i.e. the height of the spacer bars 14) may then be relatively small. Preferably, every substantially through-hole in the medium support plate assembly 1 has no more than 10, preferably no more than 5, very preferably no more than three, even more preferably no more than two through-holes between itself and its closest connection 17, when viewed from above. The flatness of the medium support plate assembly 1 can thus be maintained without the relatively high air resistance of the narrow first airflow chamber 15 negatively affecting the air flow. The distance the air travels through the first air flow chamber 15 is kept relatively small due to each through-hole being in close proximity to a connection line 17.

**[0018]** Fig. 3 schematically illustrates the distribution of the effective through-flow open area across the surface of the medium support plate assembly 1. The top surface of the medium support plate assembly 1 is formed by one or more plates provided with a large number of through-holes. The through-holes are in fluid connection to the suction source 20, e.g. in the manner shown in Fig. 2. Below the medium support plate assembly 1 an actuable seal 24 is provided. The seal 24 is configured to seal a first portion (left side in Fig. 3 with respect to the seal 24) of the suction table 12 from a second side (right side in Fig. 3 with respect to the seal 24). The seal 24 may be controlled via an actuator for providing a fluid connection between the first and second portion or sealing these off from one another. This allows an operator to actively work on one portion of the medium support plate assembly 1 to remove and place substrates while simultaneously printing on substrates in place on the second portion.

**[0019]** The medium support plate assembly 1 comprises a plurality of suction zones Z1-Z10, each having predetermined dimensions corresponding to commonly used substrate dimensions. As can be seen, the suction zones Z1-Z10 overlap to provide a space efficient arrangement. A substrate is to be placed in a suction zone Z1-Z10 with the corresponding dimensions. Even while sealing of the first portion of the suction table 12 from the second portion, a substantial number of through-holes then remain uncovered by the substrate. The number varies on the size of the substrate used.

**[0020]** Each suction zone Z1-Z10 is formed by a central area A with through-holes H1 having a first average cross-sectional area. The central area A of each suction zone Z1-Z10 is circumscribed by a circumference C comprising through-holes H2, H3 with a second average cross-sectional area different from the first. As shown in Fig. 3, the central area A forms the majority of each suction zone Z1-Z10 and thus forms a significantly larger area portion of the medium support plate assembly 1 than the latter circumference C. The area ratio of the central area A as compared to that of the circumference C may, for example, be at least a factor 10, 20, 30, 50, or 100. To minimize the amount of leak air through uncovered through-holes, the majority of the through-holes H1 are provided with a relatively small effective cross-sectional area. This may be achieved by a small open area per through-hole and/or a low density of through-holes per unit area. A small effective cross-sectional area leads to low through-flow, which is effective against leak air, but was found to negatively affect the holding down of the substrate. These through-holes H1 with a relavtively small effective cross-sectional area are positioned in the central areas A and define the larger portion of the medium support plate assembly 1. The circumference C of the suction zones Z1-Z10 are configured to provide a relatively higher through-flow of air than through-holes H1 positioned away from said circumferences H2, H3. The cross-sectional open area per through-hole H2, H3 and/or the through-hole density at the circumferences C is thereto greater than in the remainder of the medium support plate assembly 1, specifically great than in the central areas A of each suction zone Z1-Z10. The corners H3 of the circumference C H3are provided with an even greater average cross-sectional through-flow area per unit area than the rest of the circumference H2, specifically the straight portions H2 connecting the corners H3. As can be seen in Fig. 3, the average cross-sectional through-flow area per unit area is greater than in the central area A along the full length of the circumference C of each suction zone Z1-Z10.

**[0021]** Fig. 4 illustrates in an exaggerated view an embodiment of the medium support plate assembly 1 according to the present invention. In Fig. 4 the average cross-sectional through-flow area per unit area is substantially determined by the effective through-flow area of each opening or through-hole H1-H4. A greater opening results in a lower air resistance, and thus an increased amount of air flow flowing through said area as compared to a similar area in the central area A. Note that this effect is improved by the relatively low air resistance of the suction table 12 as shown in Fig. 2. The density of the low air resistance connection lines 17 is sufficiently high, such that most or each through-hole H1-H4 is positioned relatively close to a connection line 17. Fig. 4 defines multiple suction zones Z1-Z3. The suction zones Z1-Z3 have different dimensions but are provided in an overlapping configuration. Part of the circumference C of the first suction zone Z1 forms overlaps and/or forms part of the circumference C of the other suction zones Z2-Z3. Each suction zone Z1-Z3 comprises a boundary line C, which is formed as an endless loop C around a central area A of each suction zone Z1-Z3. The through-holes H2-H4 forming the looped boundary line C of the circumference are substantially all greater in area than the through-holes H1 in the central area A circumscribed by said boundary line C. At the corners CC, where the radius of curvature of the circumference C is relatively high, the relative area of through-the holes H3, H4 is greater as compared to the straight sections CE of the circumference. The larger through-holes H3, H4 are positioned at the corners CC and exceed in size the through-holes H2 along the straight edges CE of the suction zones Z1-Z3. The through-holes H2 at the straight edges CE are larger than those through-holes H1 remote from the boundary line of the circumference. In consequence, a relatively large air flow may be achieved at the edge area or zone C of the suction zones Z1-Z3, while air flow in minimized in the central areas A. This allows for printing with uncovered through-holes H1, improving producitivity by reducing the substrate preparation time. Additionally, the air flow over the table 12 is kept relatively small due to the reduced cross-sectional open area of the through-holes H1-H4. In consequence, the trajectory of droplets jetted from the print heads 2 is not or minimally affected by said air flow, improving the droplet positioning accuracy and thereby the print quality. Also, contamination of the table 12 due to misplaced ink droplets is reduced, such that less downtime for cleaning is achieved.

**[0022]** Fig. 5 illustrates a similar configuration as in Fig. 4. However in Fig. 5, the average cross-sectional through-flow area per unit area is substantially determined by the density of similar sized through-holes H1-H4 per unit area. Substantially all through-holes H1-H4 in Fig. 5 have the same cross-sectional open area through which air may pass. However, the density or number of through-holes per unit area is increased along the circumference C with respect to the density in the central areas A of each suction zone Z1-Z3. Whether the density or the area per through-hole is increased as in

Fig. 4, the result is an increase in the open through-flow area per unit area along the circumference C. This results in a locally larger effective open area along the circumference C, resulting in a larger air flow at said circumference C as compared to the central area A. In central area A the effective open area per unit area may be kept small to reduce leak air, but also to reduce the velocity of air around the print head carriage 2 during printing. The latter reduces contamination and improves print quality as less air disturbance results in an improved control over the positioning of the ink droplets on the substrates 91, 92. The greater cross-sectional through-flow area at the circumference C during printing provides sufficient holding down of the regions of the substrate most likely to become released. Advantageously, it was found that when an edge or corner of a substrate is locally released, the locally large through-flow at the circumference C results in a force pulling the released edge or corner back onto the support surface 1. This effect is believed to be in part due to the Bernoulli effect, which result in a decrease in the stationary air pressure when the air velocity and thus the dynamic air pressure is locally increased.

**[0023]** Fig. 6 illustrates a method for printing on the printer in Fig. 1. In a first step the substrates 91, 92 are placed in their respective suction zones Z1-Z3. Each substrate 91, 92 is compared to in size and shape to the suction zones Z1-Z3 to select the suction zone Z1-Z3 with the suitable dimensions. With the substrates 91, 92 on the medium support plate assembly 1, the suction source 20 is activated. The substrates 91, 92 are thereby adhered to the medium support plate assembly 1. Since the majority of the uncovered through-holes H1-H4 is of the smaller average cross-sectional through-flow area per unit area, the air resistance of the uncovered areas is relatively high. No covering or sealing is applied to said areas, as leak air inflow is sufficiently minimized by the smaller average cross-sectional through-flow area per unit area. Printing then commences while said areas remain uncovered. Due to the effectively small open area of the uncovered regions, proper holding of the substrates 91, 92 is still ensured, as the amount of air leaking into the table 12 is relatively small. Also, as explained previous the relatively small effective through-flow area in the uncovered regions ensure that ambient air is sucked along the carriage 2 at a relatively low velocity, such that the paths of ejected inkjet droplets are minimally affected.

**[0024]** The average cross-sectional through-flow area per unit area is preferably averaged over a plurality of neighboring through-holes, for example at least three, preferably at least five, and very preferably at least ten through-holes. Through-holes H1 with the lowest density or smallest area may also be locally positioned along or in the circumference C, while these in combination with surrounding through-holes H2-H4 with increased cross-sectional through-flow area still result in an increased average cross-sectional through-flow area per unit area with respect to the central area A.

**[0025]** Although specific embodiments of the invention are illustrated and described herein, it will be appreciated by those of ordinary skill in the art that a variety of alternate and/or equivalent implementations exist. It should be appreciated that the exemplary embodiment or exemplary embodiments are examples only and are not intended to limit the scope, applicability, or configuration in any way. Rather, the foregoing summary and detailed description will provide those skilled in the art with a convenient road map for implementing at least one exemplary embodiment, it being understood that various changes may be made in the function and arrangement of elements described in an exemplary embodiment without departing from the scope as set forth in the appended claims and their legal equivalents. Generally, this application is intended to cover any adaptations or variations of the specific embodiments discussed herein.

**[0026]** It will also be appreciated that in this document the terms "comprise", "comprising", "include", "including", "contain", "containing", "have", "having", and any variations thereof, are intended to be understood in an inclusive (i.e. non-exclusive) sense, such that the process, method, device, apparatus or system described herein is not limited to those features or parts or elements or steps recited but may include other elements, features, parts or steps not expressly listed or inherent to such process, method, article, or apparatus. Furthermore, the terms "a" and "an" used herein are intended to be understood as meaning one or more unless explicitly stated otherwise. Moreover, the terms "first", "second", "third", etc. are used merely as labels, and are not intended to impose numerical requirements on or to establish a certain ranking of importance of their objects.

**[0027]** The present invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the present invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

## Claims

1. A printer (5) comprising a medium support plate assembly (1) provided with a plurality of through-holes (H1-H3) for applying an underpressure to a print substrate (91, 92) on the medium support plate assembly (1), wherein the medium support plate assembly (1) defines a plurality of suction zones (Z1-Z10), each suction zone (Z1-Z10) having predetermined dimensions different from the other zones (Z1-Z10), **characterized in that** an average cross-sectional through-flow area per unit area of through-holes (H2-H4) positioned along a circumference (C) of each zone (Z1-Z10) is larger than the average cross-sectional through-flow area per unit area of through-holes (H1) in a central area (A) of each respective

zone (Z1-Z10).

**2.** The printer (5) according to claim 1, wherein the average cross-sectional through-flow area per unit area of through-holes (H2-H4) positioned along the substantially entire circumference (C) of each zone (Z1-Z10) is larger than the average cross-sectional through-flow area per unit area of through-holes (H1) in the central area (A) of each respective zone (Z1-Z10).

**3.** The printer (5) according to claim 1 or 2, wherein the average cross-sectional through-flow area per unit area of the through-holes (H2-H4) at the circumference (C) increases with a local radius of the curvature of the circumference (C).

**4.** The printer (5) according to any of the previous claims, wherein the circumference (C) comprises edges (CE) and corners (CC), wherein the average cross-sectional through-flow area per unit area of the through-holes (H1-H4) for each suction zone (Z1-Z10) increases in the order of central area (A), the edges (CE), and the corners (CC) of each respective zone (Z1-Z10).

**5.** The printer (5) according to claim 4, wherein the average cross-sectional through-flow area per unit area of the through-holes (H1-H4) increases by increasing the density of through-holes (H1-H4) and/or increasing the cross-sectional through-flow area of individual through-holes (H1-H4).

**6.** The printer (5) according to any of the previous claims, wherein the circumference (C) is an endless boundary line (C), along substantially the entire length of which the average cross-sectional through-flow area per unit area of the through-holes (H2-H4) is greater than in the central area (A) of each respective suction zone (Z1-Z10).

**7.** The printer (5) according to any of the previous claims, wherein the cross-sectional through-flow area per unit area of the through-holes (H1-H4) is proportional and/or equal to the through-flow opening of a through-hole (H1-H4) when viewed perpendicular to a plane of the medium support plate assembly (1).

**8.** The printer (5) according to any of the previous claims, wherein the suction zones (Z1-Z10) are partially overlapping, such that the circumference (C) of a first suction zone (Z1) forms part of the circumference of suction zones (Z2-Z3) other than the first suction zone (Z1).

**9.** The printer according to any of the previous claims, further comprising a spacer structure (16) supporting the medium support plate assembly (1) and a plurality of connection lines (17) extending through the spacer structure (16) for forming a fluid connection between the through-holes (H1-H4) and a suction source (20), wherein the connection lines (17) are distributed, such that a majority of and/or substantially all through-holes (H1-H4) are spaced apart from a connection line (17) by at most a small number of through-holes (H1-H4), said number preferably being smaller than twenty, ten, five, or three.

**10.** The printer (5) according to any of the previous claims, further comprising a gantry (7) moveable over the medium support plate assembly (1) in a non-scanning direction and an inkjet print head carriage (2) moveable along the gantry (7) over the medium support plate assembly (1) in a scanning direction (X) perpendicular to the non-scanning direction.

**11.** The printer (5) according to claim 10, wherein the printer is an inkjet flatbed printer (5).

**12.** A method for printing substrates on a flatbed printer (5), comprising the steps of:

- positioning one or more substrates (91-92) in respective suction zones (Z1-Z10) on a medium support plate assembly (1) provided with through-holes (H1-H4), each substrate having dimensions corresponding to those of its respective suction zone (Z1-Z10), wherein along a circumference (C) of each suction zone (Z1-Z10) an average cross-sectional through-flow area per unit area of the through-holes (H2-H4) is larger than the average cross-sectional through-flow area per unit area of the through-holes (H1) in a central area (A) of each suction zone (Z1-Z10);
- applying an underpressure to the substrates (91-92) via the through-holes (H1-H4); and
- printing on said substrates (91-92) while an underpressure is applied to said substrates (91-92).

**13.** The method according to claim 12, wherein after the positioning step a plurality of through-holes (H1-H4) remain uncovered by the substrates (91-92) and wherein during the printing step said uncovered through-holes (H1-H4) remain uncovered.

**14.** The method according to claim 13, wherein during the printing step air in sucked in through the uncovered through-holes (H1-H4).

**15.** The method according to any of claims 12 to 14, further comprising the step of comparing substrate dimensions to suction zone dimensions and based thereon selecting a suction zone (Z1-Z10) for each substrate.

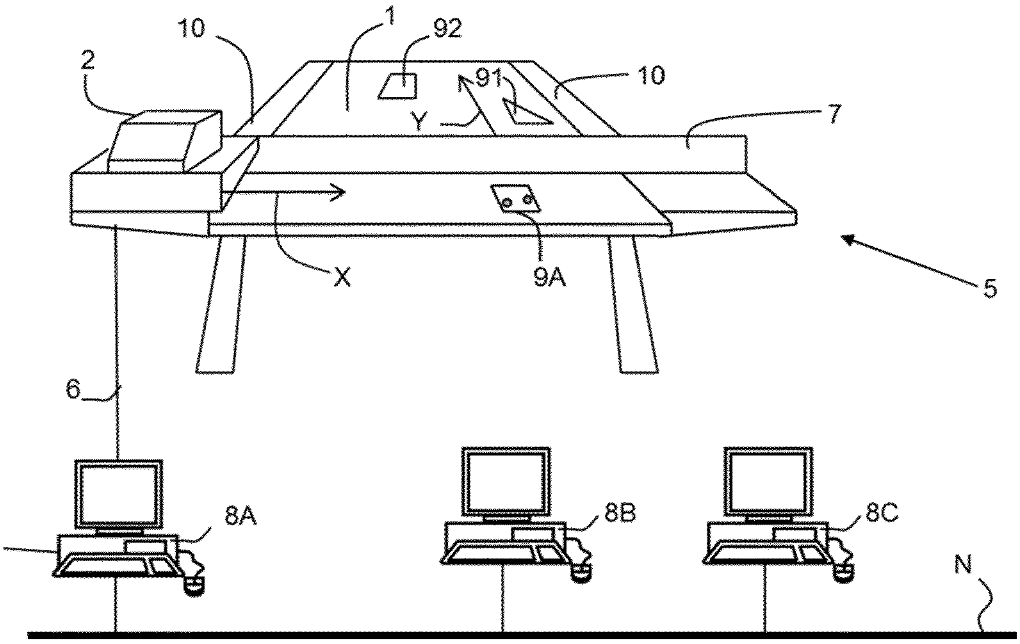



Fig. 1

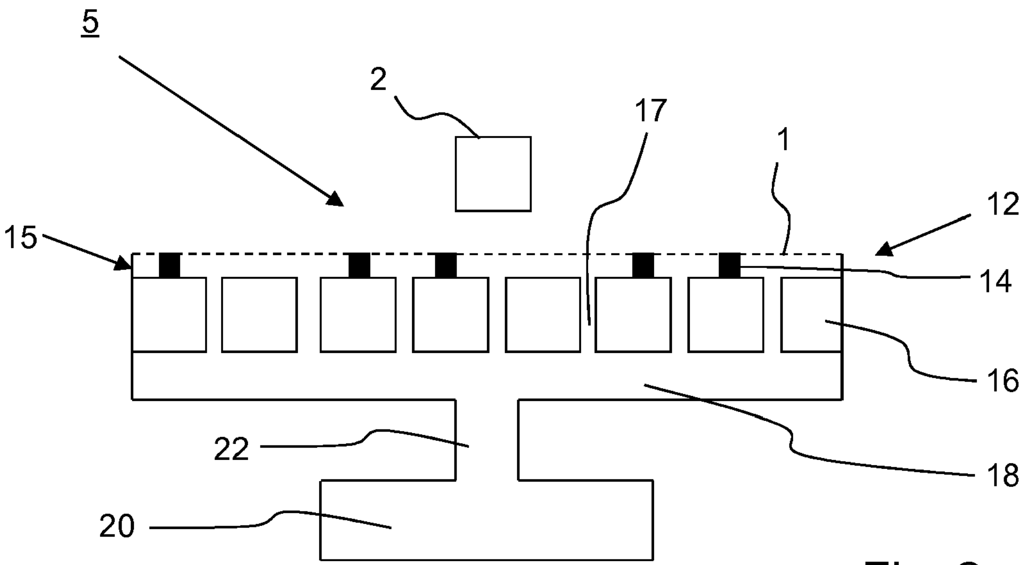
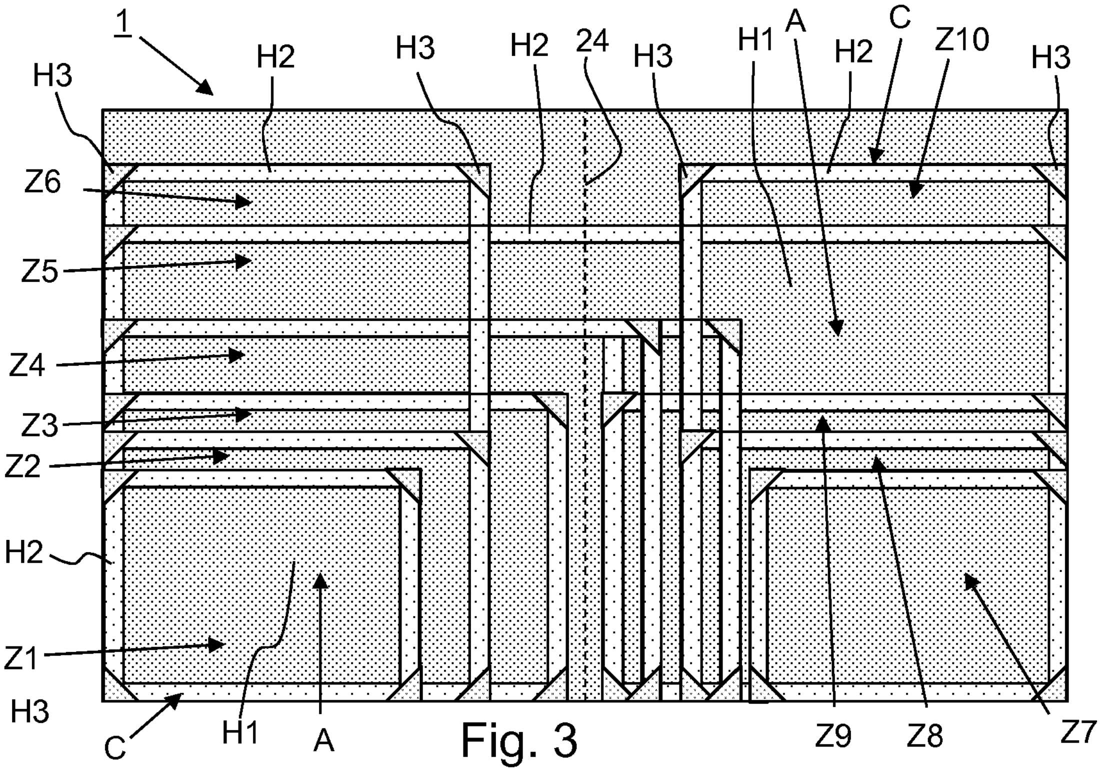



Fig. 2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H2
H3
H2
24
H3
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H3
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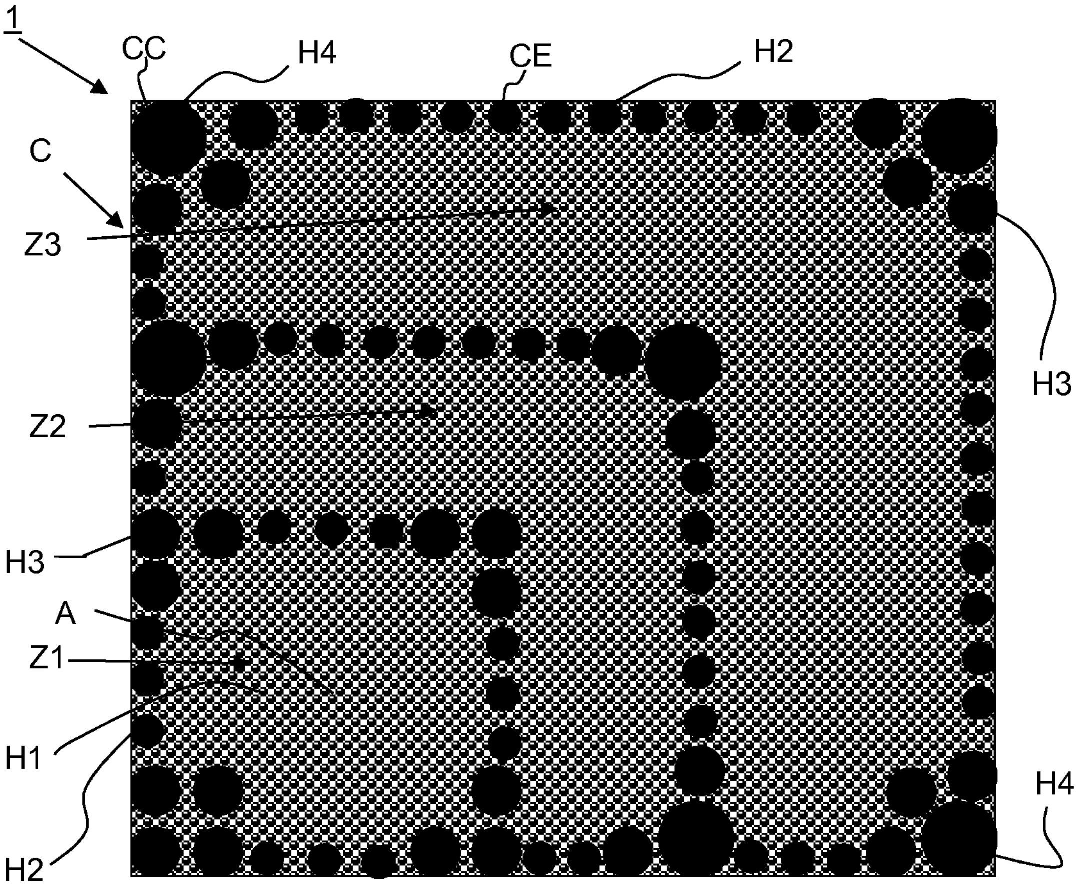
Z3
Z2
H2
Z1
H3
C
H1
A
Z9
Z8
Z7

Fig. 3


1
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H2
H4

Fig. 4

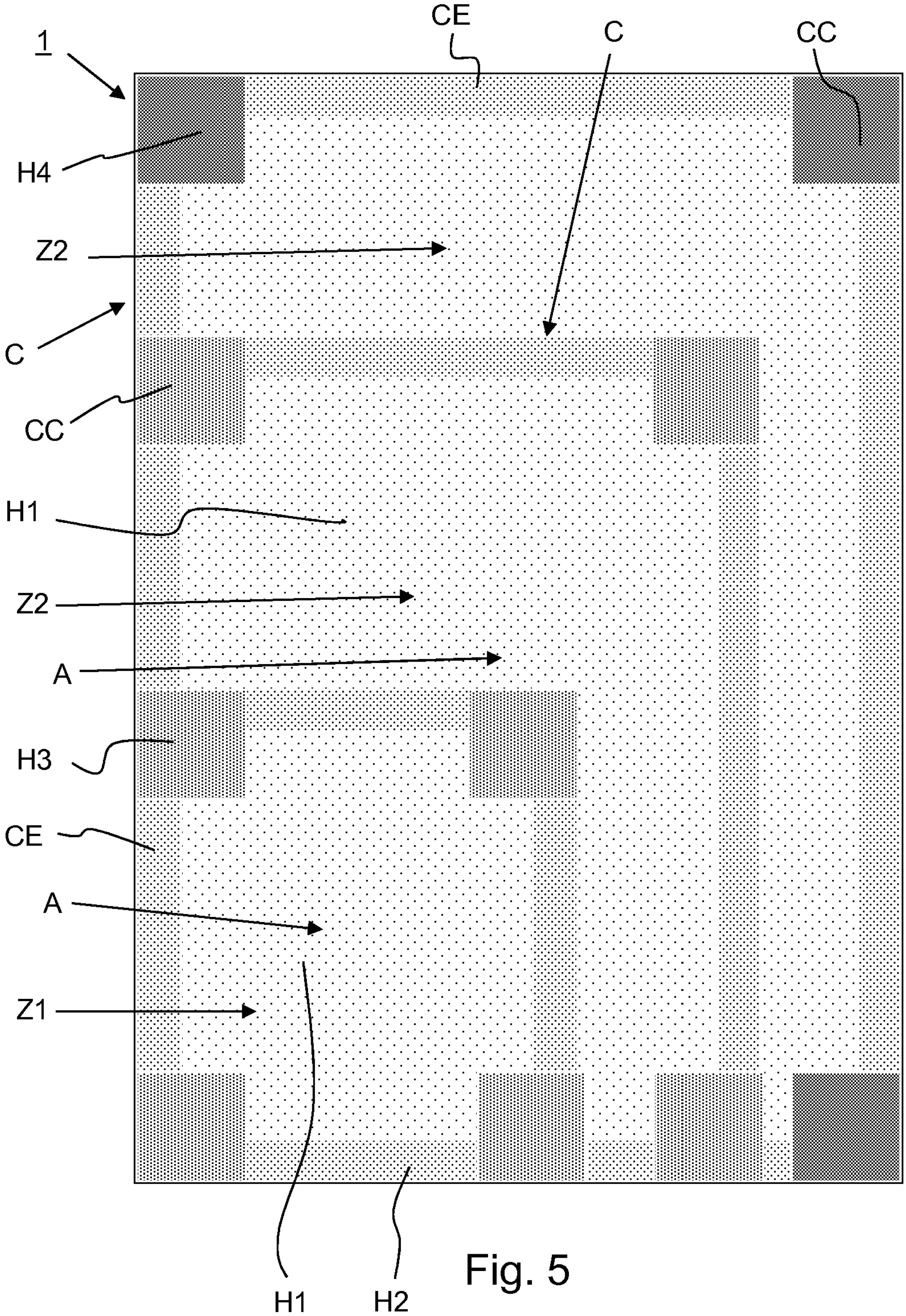


Fig. 5

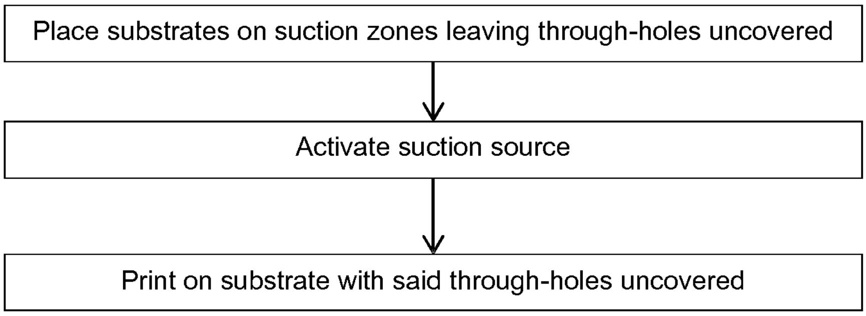
Place substrates on suction zones leaving through-holes uncovered
Activate suction source
Print on substrate with said through-holes uncovered

Fig. 6

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# EUROPEAN SEARCH REPORT

Application Number
EP 19 19 8530

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| | | | B41J |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| The Hague | 25 March 2020 | Gaubinger, Bernhard |

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CATEGORY OF CITED DOCUMENTS

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