

(19)



(11)

EP 3 370 966 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
14.08.2019 Bulletin 2019/33

(51) Int Cl.:
B41F 15/20 ^(2006.01) **B41J 11/00** ^(2006.01)
B41J 11/06 ^(2006.01)

(21) Application number: **16788497.2**

(86) International application number:
PCT/EP2016/075847

(22) Date of filing: **26.10.2016**

(87) International publication number:
WO 2017/076719 (11.05.2017 Gazette 2017/19)

(54) **MEDIUM SUPPORT MEMBER**

MEDIENUNTERSTÜTZUNGSELEMENT

ÉLÉMENT DE SUPPORT

(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: **04.11.2015 EP 15192900**

(43) Date of publication of application:
12.09.2018 Bulletin 2018/37

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

(72) Inventor: **RYBOLOV, Alexander
5914 CA Venlo (NL)**

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

(56) References cited:
**JP-A- H07 323 517 JP-A- 2004 122 554
JP-A- 2005 088 565 US-A1- 2010 079 532
US-A1- 2010 117 293 US-A1- 2013 087 276**

EP 3 370 966 B1

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

FIELD OF THE INVENTION

[0001] The invention relates to a medium support member, especially for print media, and a vacuum support device.

DESCRIPTION OF THE INVENTION

[0002] In the field of printing, it is known to use medium support members for holding and flattening of print media during a print process in which the print media are scanned with a print head. It is known to use a suction box as medium support member. Such a suction box usually has a perforated top surface, and the inner volume of the suction box is maintained at an underpressure by means of a vacuum pump. It is a disadvantage of this kind of medium supports that the suction box must have a very complex structure in order to be able to evenly distribute the underpressure from the suction device over the surface of the print medium. As the distance between the printhead and the print medium must be very well defined and preferably constant over the whole print area, the support surface should be very perfectly flat. Further, it is generally known in the field of printing that sheets may be aligned prior to printing to ensure a proper positioning of the printed image on the sheet. To this end registration pins are generally applied, which pins are positioned in recesses or openings in the overlay, for example at the edges of the overlay. One or more sheet edges may be pushed against the registration pins to align the sheet with respect to the table and/or print head.

[0003] EP2580062 (A1) discloses a medium support member comprising an overlay to a bottom surface of which magnetic strips are bonded. The overlay is perforated by a plurality of through-holes which are regularly distributed over the top surface of the overlay in between the through-holes. As such, a sheet may be firmly drawn against the top surface of the overlay by applying an underpressure via the through-holes. The overlay, which may be relatively thin and flexible, should be safely prevented from forming warps which, in view of the very small distance between the printhead and the surface of the print medium, might lead to collisions between the printhead and upwardly bulged surface areas of the print medium or the support surface. In practice it has been found, that when registration pins are applied in the medium support member according to EP2580062 (A1), there is a risk of collisions between wrinkles and curls in the sheet and the print head moving over the sheet (so-called "head touch"). This may result in damage to the print head.

SUMMARY OF THE INVENTION

[0004] It is an object of the invention to provide a medium support member wherein the overlay is reliably se-

cured on the top surface of the table and the risk of collisions between the print head and upwardly bulged surface areas of the print medium is reduced.

[0005] In accordance with the present invention, a medium support member according to claim 1 and a vacuum support device according to claim 14 are provided.

[0006] The medium support member according to the invention comprises an overlay for being placed on a top surface of a table. The overlay comprises a top surface, a bottom surface, and a plurality of through-holes for applying a suction force to a medium. The medium support member further comprises a spacer array, which comprises at least one spacer member. The spacer array, and as such the spacer member, are provided on the bottom surface of the overlay. When the spacer array is positioned on the top surface of the table, the top surface of the table is spaced apart from the bottom surface of the overlay to define and/or form a gap between the table and the overlay. The table is further arranged for being connected to a vacuum source for providing an underpressure in the gap. Via the through-holes a suction force may be applied to a medium (or sheet) positioned on the top surface of the overlay for drawing the medium firmly against the overlay.

[0007] The medium support member according to the present invention further comprises a recess. The recess extends from the top surface of the overlay to the bottom surface of the overlay. Basically, the recess extends through the overlay. A medium registration element may be received in the recess. The recess may, for example, be an opening in the overlay or a notch or cutout along the edge of the overlay, wherein the medium registration element may be received. The medium registration element may preferably be arranged for aligning or positioning a medium by positioning the medium against the medium registration element. Such a medium registration element may be a registration strip or pin positioned e.g. at the edge of the overlay.

[0008] It is the insight of the inventor that "head touch" in medium support members according to the prior art is caused by wrinkling of a region of the sheet adjacent a medium registration element.

[0009] The at least one spacer member on the bottom surface of the overlay is positioned between the recess and a through-hole, e.g. when viewed from above during use. In general, the spacer array is applied to define and seal the gap between the table and the overlay, for example by means of a peripheral spacer member along the edges of the overlay. Since the recess extends through the overlay, a spacer member is generally provided near or around the recess to keep the gap sealed. A spacer-member in a region near or adjacent the recess excludes through-holes from being positioned in that region, since the spacer member would block any through-holes provided over it. Thus, through-holes may not be positioned in close proximity to the recess and the medium registration member received in said recess.

[0010] When in use, a medium's edge is pushed

against a medium registration element received in the recess. The medium's edge on the top surface of the overlay then extends over the at least one spacer member on the bottom surface of the overlay. As explained above, no through-holes are provided adjacent the recess. This prevents the medium's edge next to the medium registration element from being properly held down against the overlay. As a result, the medium may comprise wrinkles near the medium registration element. Said wrinkles in turn may come into contact with the print head, potentially damaging the print head.

[0011] It is the further insight of the inventor that "head touch" may be avoided if a suction force is applied to the region of the sheet positioned against the medium registration element by means of a groove extending from a through hole in the top surface of the medium support member.

[0012] According to the present invention, a groove is provided in the top surface of the overlay and which groove extends from the through-hole over the at least one spacer member for applying a suction force to the medium. As seen from above, the groove runs over the spacer array. Thereby, a suction force may be applied to a region of the medium positioned over the groove close to or against the medium registration element. The groove effectively extends the underpressure in the through-holes to regions of the overlay where such through-holes cannot be provided or are blocked by the spacer array. Substantially the entire surface of the medium may thus be securely drawn against the overlay, preventing the upward bulging of any regions of the medium. The groove allows for reliably securing a medium onto an overlay, reducing the risk of head touch. Thereby the object of the present invention has been achieved.

[0013] More specific optional features of the invention are indicated in the dependent claims.

[0014] In a preferred embodiment, the groove extends to a region in the vicinity of the recess. As such, the groove may be positioned sufficiently near or in vicinity to the recess to prevent upward bulging or wrinkling of a region of the medium positioned adjacent the recess. When in use, said region of the medium is positioned against the medium registration element. The relative vicinity of the groove to the recess may be determined by medium characteristics: for stiff media, the groove may relatively remote from the recess compared e.g. to weak or flexible media.

[0015] In another embodiment, the groove extends from the through-hole towards an adjacent edge of the overlay and/or towards the recess. The bottom surface of a periphery of the overlay is generally covered with a circumferential spacer member for defining and sealing the gap. Hence, no through-holes are generally provided in this peripheral region. By means of the groove according to the present invention, the underpressure may be extended to (or near to) the periphery or edge of the overlay. Similarly, a groove according to the present invention may extend towards a recess, which may for example

be a notch along the edge or opening in the overlay. Generally, a spacer member is provided on the bottom surface of the overlay near to or around said recess for separating and sealing the gap from the recess. A groove may then be extended over the spacer member in the direction of the recess to apply an underpressure to a region of a medium positioned above the spacer member. Thereby, a suction force may be applied to the medium close or near the recess (and the medium registration element received in the recess).

[0016] In an embodiment, the at least one spacer member is positioned adjacent the recess, and the through-hole is positioned adjacent the at least one spacer member. The spacer member may be positioned next to or near the recess, for example at a distance of a few centimeters or less. The through-hole is preferably located close to or near the spacer member, for example a distance of a few centimeters or less.

[0017] In an embodiment, the medium support member further comprises holding elements for holding the overlay on the top surface of the table. Thereby, the overlay is temporarily secured to the table. By positioning the recess, spacer member and through-hole relatively close to one another, the impact of the recess on the remainder of the overlay is minimized. Hence, the present invention may be applied with little modification required to existing systems.

[0018] In an embodiment, a groove, which extends from a through-hole, is in fluid communication with said through-hole. The groove is thus connected to the gap via the through-hole. This allows an underpressure in the through-hole (and the gap) to extend to the groove. No additional vacuum source or underpressure distribution manifold is required. The groove according to the present invention may thus be easily implemented.

[0019] In an embodiment, a first end of the groove is open-ended for fluid communication with the through-hole, such that air may flow from the groove, via the through-hole to the gap. A second end of the groove is closed-ended for substantially sealing the groove. When a medium is placed over the groove, air in the groove may then only flow towards the through-hole. Thereby, an underpressure is effectively provided in the groove, providing an improved holding force on the medium near a medium registration element.

[0020] In an embodiment, the at least one spacer member extends at least partially around the recess. The recess preferably comprises a curved edge, along which edge the spacer member extends, preferably in a corresponding curve. The edge of the recess and/or the spacer member may for example be circular or semi-circular. The spacer member may at least partially enclose the recess, such that the recess is separated or isolated from the gap. This prevents the underpressure in the gap to "leak away" via the recess.

[0021] In an embodiment, the medium support member comprises a sealing frame provided on the bottom surface of the overlay, preferably peripherally or circum-

ferentially. The sealing frame may extend along the edges of the overlay, for example in the form of a longitudinal sealing strip. The sealing frame is arranged for delimiting and sealing the gap between the bottom surface of the overlay and the top surface of the table. An underpressure may then be formed in the gap by means of the vacuum source. The groove preferably extends over the sealing frame from a through-hole positioned adjacent or in the vicinity of the sealing frame. In a preferred embodiment, the sealing frame is at least partially formed by the spacer member positioned between the recess and the through-hole. As such, the sealing frame is adjacent the recess and may prevent air leaking into the gap via the recess. Sealing the gap reduces the power consumption of the vacuum source.

[0022] In an embodiment, the spacer array comprises magnetic strips arranged for holding at least portions of the overlay and corresponding portions of the table together by magnetic attraction. The holding elements for holding the overlay on the top surface of the table may be formed by the magnetic strips. The magnetic strips may be secured to the bottom surface of the overlay, by fastening means or by magnetic force. In a preferred embodiment, it will be, at least among others, the marginal or outer peripheral portions of the overlay that are magnetically drawn against the table. Then, when the print media have a format that is smaller than the size of the support member, the area where underpressure is applied may be limited to the actual area of the print media, so as to avoid leakage of air through the open through-holes in the marginal portion of the overlay, thereby reducing the energy consumption of the vacuum pump. Nevertheless, the magnetic attraction will prevent the overlay from forming warps.

[0023] In order to provide for the magnetic attraction, one of the overlay and the table may be made of a magnetically attractable material, whereas the other of the table and the overlay, respectively, is provided with permanent magnets. As an alternative, the table and the overlay may be made of non-magnetic materials, and magnetically attractable material may be attached to those portions of the table and the overlay, respectively, that cooperate with the permanent magnets.

[0024] In a particularly preferred embodiment, the permanent magnets will form at least some of the spacer members of the spacer array provided between the top surface of the table and the bottom surface of the overlay. For example, the spacer members may take the form of magnetic strips that are fixed at the bottom surface of the overlay by means of an adhesive.

[0025] The spacer members that are distributed over the central part of the overlay may also be formed by magnetic strips. Preferably, the through-holes are regularly arranged in rows and columns, and the magnetic strips are configured as elongated members. The magnetic strips may then be positioned in between pairs of the rows and/or columns. For example, the magnetic strips may be each disposed in an interval between two

neighboring rows of the through-holes. When all spacer members are formed by magnetic strips that have exactly the same thickness, the width of the gap between the table and the overlay will be defined with high precision. When the spacer members, i.e. magnetic strips, are detachably secured at the bottom surface of the overlay, the configuration of the spacer array may easily be modified and may thus be adapted to varying sizes of the print media.

[0026] Of course, the magnetic strips forming the spacer members or the spacer array may be arranged such that they do not close-off the through-holes that are needed for applying underpressure to the media.

[0027] In an embodiment, at least some of the magnetic strips are distributed over the bottom surface of the overlay and are separated from one another for defining an underpressure distribution manifold in the gap between the bottom surface of the overlay and the top surface of the table. This allows the underpressure to be distributed over the bottom surface of the overlay.

[0028] In an embodiment, a through-hole from which a groove extends is enlarged with respect to a through-hole from which no groove extends. The through-hole's diameter may be enlarged to compensate for the increased air flow required for forming an underpressure in the groove. In this manner, the underpressure and/or suction force on the medium may be kept similar for all through-holes and grooves. The through-holes may have relatively small diameters so as to prevent the portions of the print media covering these through-holes from being bent.

[0029] In an embodiment, the groove extends from the through-hole towards an adjacent edge of the overlay. The recess in this case may be positioned at the edge of the overlay. The through-hole is positioned spaced apart from the edge due to a sealing strip of the sealing frame extending along the edge of the overlay. An end of the groove is positioned spaced apart from the adjacent edge of the overlay, by a distance corresponding to at least the width of the sealing strip. As such, the underpressure and/or suction force in the through-hole may be extended towards the edge of the overlay.

[0030] In an embodiment, magnetic strips are secured to the overlay, and the table is made of a magnetically attractable material, and in that the spacer array comprises spacers that are formed by the magnetic strips. Thus, the overlay will safely be attracted towards the surface of the table regardless of whether or not air is drawn in through the through-holes, and the magnetic strips forming the spacers can be arranged such that they do not close-off the through-holes that are needed for applying underpressure to the media. In a preferred embodiment, it will be, at least among others, the marginal or outer peripheral portions of the overlay that are magnetically drawn against the table. Then, when the print media have a format that is smaller than the size of the support member, the area where underpressure is applied may be limited to the actual area of the print media,

so as to avoid leakage of air through the open through-holes in the marginal portion of the overlay, thereby reducing the energy consumption of the vacuum pump. Nevertheless, the magnetic attraction will prevent the overlay from forming warps.

[0031] The spacer members (or spacers) provided in the peripheral portions of the overlay may be configured as seals for sealing the distribution manifold formed in the gap between the top surface of the table and the bottom surface of the overlay. The spacer members that are distributed over the central part of the overlay may also be formed by magnetic strips. When all spacers are formed by magnetic strips that have exactly the same thickness, the width of the gap between the table and the manifold will be defined with high precision. When the spacer members, i.e. magnetic strips, are detachably secured at the bottom surface of the overlay, the configuration of the spacer array may easily be modified and may thus be adapted to varying sizes of the print media.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032] 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 are thus not limitative of the invention, and wherein:

Fig. 1 is a schematic perspective view showing a top surface of a medium support member according to an embodiment of the present invention;

Fig. 2 is a schematic perspective view showing a bottom surface of a medium support member according to another embodiment of the present invention;

Fig. 3 is an enlarged perspective top view of a section of the medium support member in Fig. 1, which section is indicated as 'B' in Fig. 1;

Fig. 4 is an enlarged perspective bottom view of a section of the medium support member in Fig. 2, which section is indicated as 'D' in Fig. 2;

Fig. 5a is a schematic perspective view showing a vacuum support device according to an embodiment of the present invention with above it a medium support member according to an embodiment of the present invention;

Fig. 5b is a schematic perspective view showing a vacuum support device according to an embodiment of the present invention with mounted on it a medium support member according to an embodiment of the present invention;

Fig. 6 is a schematic side view showing a vacuum support device according to an embodiment of the present invention; and

Fig. 7 is an enlarged side view of a section of the vacuum support device in Fig. 6, which section is indicated as 'F' in Fig. 6.

DETAILED DESCRIPTION OF THE DRAWINGS

[0033] Fig. 1 shows a schematic view of a medium support member according to an embodiment of the present invention. The support member comprises an overlay 1, which may be positioned on top of a table 30 as shown in Figs. 5-7. The overlay 1 is perforated by a plurality of through-holes 5 that are regularly distributed over the top surface 1a of the overlay 1. The through-holes 5 connect the top surface 1a of the overlay 1 to the bottom surface 1b thereof (not visible in Fig. 1), where a distribution manifold is formed to which an underpressure is applied by means of a vacuum pump or source (not shown). The underpressure causes ambient air to be drawn-in through the through-holes 5. As a consequence, when a sheet of a print medium (not shown) is supported on the top surface 1a of the overlay 1, the sheet will be firmly sucked against the top surface 1a of the overlay 1. In this way, the medium or sheet will be kept stationary and flat. A carriage (not shown) comprising one or more printheads (not shown) is controlled to move across the print medium to scan the same with high speed in a main scanning direction and a sub-scanning direction, while ink droplets are jetted out from the printhead and onto the medium to form an image thereon. Preferably, the printhead ejects droplets of UV-curable ink, but it will be clear for the skilled person that other types of marking material such as solvent ink, water based inks or hot melt inks may be used instead. In an alternative embodiment, the printhead may be moved only in the main scanning direction to print a swath of the image while the medium is held stationary, and the medium is intermittently advanced in the sub-scanning direction so as to print successive swathes.

[0034] The dimensions of the overlay 1 and the table 30 may be 3 by 4 meters, for example, and the overlay 1 may be formed by an aluminum sheet having a thickness of not more than 100 to 150 μm , for example. The through-holes 5 are arranged in rows and columns with a row-to-row distance of 20 mm and may have a diameter of 1.5 mm.

[0035] In Fig. 2, it is shown that a spacer array 10 is provided on the bottom surface 1b of the overlay 1, so that a gap 13 with a predetermined height of, e.g., 1.1 mm is formed between the bottom surface 1b of the overlay 1 and the top surface 30a of the table 30 (shown in Figs 5-7). As can be seen in a perspective bottom view in Fig. 2, the spacer members 11, 12' (or spacers for short) of the array 10 are arranged in the form of separated islands, so that the hollow part of the gap 13 not filled by the spacer members 11, 12' forms a contiguous distribution manifold capable of evenly applying the underpressure to all of the through-holes 5. The manifold 10 may be connected to a vacuum duct via internal suction passages of the table 30. The spacer members 11, 12, 12', 12a, 12b, 12c forming the spacer array 10 are shown in detail in Figs. 3 and 4.

[0036] The individual spacer members 11, 12, 12', 12a,

12b, 12c forming the spacer array 10 are formed by magnetic strips 11, 12, 12', 12a, 12b, 12c that are bonded to the bottom surface 1b of the overlay 1 by means of an adhesive. The longitudinal strips 11, 12', 12a, 12b, 12c are provided in between the rows and/or columns of the through-holes 5 at regularly spaced intervals. Some of these strips, designated as 12, 12', 12a, 12b and 12c, extend circumferentially along the periphery 2 of the overlay 1 as a kind of frame structure 12, 12'. Said strips 12, 12', 12a, 12b, 12c positioned along the edges 2 of the overlay 1 form an outermost sealing frame 12, 12', which frame 12, 12' has the function of a seal 12, 12' that limits and seals the gap 13 and/or the manifold. Other, shorter, strips 11 are arranged inside the sealing frame 12, 12' in parallel lines separated by aisles. Thus, the underpressure applied via the vacuum source is distributed over the entire surface 1b of the overlay 1 while the overlay 1 is supported in both the edge portion and the interior portion by the various strips 11, 12, 12', 12a, 12b, 12c of the spacer array 10. The strips 11 may extend in the main scanning direction or the sub-scanning direction. They are arranged in the intervals between every second pair of rows of the through-holes 5 so that, on the one hand, the through-holes 5 are not covered by the strips 11, 12, 12', 12a, 12b, 12c and, on the other hand, the overlay 1 is particularly supported against the suction force acting in the vicinity of the through-holes 5. Thus, the strips 11 have mutual spacings of 40 mm.

[0037] The marginal portions of the overlay 1 which are not perforated by the through-holes 5 are safely attached to the table 30 by means of the frames 12, 12' formed by the magnetic strips 12a-c so that the thin overlay 1 is held in a perfectly flat condition even in the marginal areas where no suction pressure is present or where the suction pressure is reduced because the through-holes 5 are not closed-off by the medium. When print media of a different format are to be used, the spacer array 10 may be modified so as to limit and concentrate the suction pressure to the area that is actually covered by the print medium. In this way, it is possible to reduce the number of through-holes 5 that are not covered by the print medium and thereby to reduce the amount of leakage of air through these through-holes 5. As such, the sealing frame 12, 12' may be dimensioned in correspondence to the dimensions of the medium, such that the sealing frame 12, 12' corresponds to the contours of the medium.

[0038] Such a medium support member is known from EP2580062 (A1).

[0039] Fig. 2 shows the bottom side 1b of the overlay 1 and illustrates the recesses 3 positioned along the edge 2 of the overlay 1. A medium registration element in the form of a pin or strip (now shown) may be received in one or more of the recesses 3. The medium may then be aligned with respect to the overlay 1, table 30, and/or the print head by positioning an edge of the medium against the medium registration element. The medium may then be fixed on the overlay 1 by means of a suction

force by activating the vacuum source.

[0040] Fig. 3 shows in more detail the recess 3 in the edge 2 of the overlay 1. In the embodiment in Fig. 3 the spacer member 12a on the bottom side 1b of the overlay 1 is part of the sealing frame 12, as indicated by the dashed lines in Fig. 3. The sealing strip 12a extends parallel to and along the edge 2 of the overlay 1. This straight sealing strip 12a is spaced apart from the edge 2 by at least the width of the recess 3, as measured in a direction perpendicular to the edge 2. The through-holes 5 are positioned at a distance of at least said width from the edge 2. The through-holes 5 are all positioned above the gap 13 positioned inside the sealing frame 12, as seen from above. The sealing frame 12 is positioned between the recess 3 and the through-holes 5a. The through-holes 5a are adjacent the sealing frame 12.

[0041] A groove 6 extends from each through-hole 5a towards the edge 2 of the overlay 1 and terminates at some distance from the edge 2. The groove 6 has preferably been cut out, punched or milled in the top surface 1a of the overlay 1. As can be seen in Fig. 3, the groove 6 runs along the top surface 1a of the overlay over and above the sealing frame 12, which frame 12 is provided on the bottom surface 1b of the overlay 1. In Fig. 3, the groove 6 is formed as a longitudinal channel 6 extending from the through-hole 5a towards the recess 3 and/or edge 2 of the overlay 1. In Fig. 3 the grooves 6 run transverse to the edge 2, but it may alternatively be provided at an angle thereto. Since the through-hole 5a is in fluid connection with the groove 6, the underpressure from the gap 13 is extended to the groove 6. A depth of the longitudinal groove 6 in Fig. 3 is less than a thickness of the overlay 1. The bottom of the groove 6 may thereby be spaced apart from the bottom surface 1b of the overlay 1. It will be appreciated that the groove 6 may be any shape, but is preferably longitudinal and/or straight. In a preferred embodiment, the groove 6 is punched or milled into the overlay 1 for easy and cheap production of a medium support member according to the present invention.

[0042] The groove 6 terminates or ends in the vicinity of the recess 3, such that a region of the medium positioned against a medium registration element in said recess 3 is prevented from bulging upwards. In Fig. 3, the closed end 6b of each groove 6 is positioned near the edge 2 to extend the underpressure close to the edge 2 for preventing the edges of the medium from wrinkling or curling upwards. During use, a medium may be positioned on the overlay 1 with an edge of the medium pushed against the medium registration element in the recess 3. A fluid connection is then present between the groove 6 and the gap 13. Therefore, air is only able to flow to the through-hole 5a via the open end 6a of the groove 6 to the gap 13, since the groove 6 is effectively sealed in other directions by its closed end 6b and the medium. A medium or sheet atop the groove 6 will experience a local suction force due to the underpressure in the groove 6. The regions of the medium in the vicinity

of the recess 3 (or, when in use, the medium registration element) are then securely held down, preventing bulging of the medium. Similarly, edges of the medium near the edge 2 are held down. The medium is effectively flattened, specifically along its edges. As a result, "head touch" is prevented.

[0043] In Fig. 3 all through-holes 5 comprise a similar or the same diameter or size. It is however within the scope of the present invention to provide through-holes 5a connected to a groove 6 with a larger diameter or size than through-holes 5b to which no groove 6 is connected. As such, the suction force on the sheet medium may be kept constant across the entire sheet surface.

[0044] Fig. 4 illustrates another embodiment of the medium support member of the present invention. Fig. 4 illustrates the bottom surface 1b of the overlay 1 near the recess 3. In the embodiment in Fig. 4, the spacer member 12' comprises the sealing frame members 12b, 12c positioned adjacent the recess 3 and/or edge 2. Frame member 12b is configured as a curved strip 12b partially surrounding the recess 3 in a semi-circular shape. The through-holes 5a are positioned adjacent the spacer member 12b, roughly in an arcuate pattern along the curved sealing strip 12b. The curved sealing strip 12b forms part of the sealing frame 12', which sealing frame 12' extends along the periphery 2 of the overlay 1. The sealing frame 12' defines and seals the gap 13 between the table 30 and the overlay 1. Through-holes 5b, which are not positioned adjacent the sealing frame 12', are not provided with a groove 6, as can be seen in Fig. 3. It is however within the scope of the invention to provide a groove 6 to said through-hole 5b, for example for extending the underpressure of a through-hole 5b over a spacer member 11 adjacent to said through-hole 5b.

[0045] It will be appreciated that within the scope of the present invention a groove 6 may be applied to one or more through-holes 5a adjacent a sealing frame member 12c along the edge 2 of the overlay 1 (straight section 12c of the sealing frame 12' in Fig. 4). The sealing frame member 12c in Fig. 4 extends parallel to the straight part of the edge 2. The through-holes 5a adjacent the sealing frame member 12c are provided with a groove 6, as can be seen in Fig. 3. The groove 6 extends from the through-hole 5a over the sealing frame member 12c in the direction of the edge 2 of the overlay. In Fig. 3, said grooves 6 extend substantially transverse to the edge 2 of the overlay 1.

[0046] Fig. 5a illustrates a vacuum support device 20 according to the present invention. The medium support member with its overlay 1 is positioned above the top surface 30a of the table 30 to illustrate the position of the gap 13. Suction ducts are provided in the top surface 30a of the table 30. The suction ducts are connected to the vacuum source (not shown), which vacuum source is preferably incorporated in the table 30. To seal the gap 13 along the periphery of the overlay 1, the overlay 1 is positioned on the table 30, as illustrated in Fig. 5b.

[0047] The top surface 30a of the table 30 is made of

a magnetically attractable material. The magnetic spacer members 11, 12, 12' on the bottom surface 1b of the overlay 1 adhere releaseably to the table 30 by means of magnetic interaction or forces. The spacer members 11, 12, 12' may be configured in position prior to placing the overlay 1 on the table 30 in correspondence to the dimensions of the sheet medium to be printed. The sheet medium is placed on the top surface 1a of the table 30, and positioned by aligning the medium by means of the medium registration elements in the recesses 3. The medium, for example, is pushed against registration pins positioned along an edge 2 of the overlay 1. The vacuum source is then activated for holding the medium down on the top surface 30a. Since the suction force is extended to the overlay's 1 edges 2 and the recesses 3 with the medium registration elements, the medium is prevented from bulging upwards. For printing the medium, the print-head is moved across the medium. Any contact between the printhead and the medium is prevented, since wrinkling or bulging of the medium is eliminated by means of the grooves 6 according to the present invention.

[0048] 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.

[0049] 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.

Claims**1.** A medium support member, comprising:

- an overlay (1) for being placed on a top surface (30a) of a table (30), wherein the overlay (1) comprises a top surface (1a), a bottom surface (1b), and a plurality of through-holes (5) for applying a suction force to a medium; and
- a spacer array (10), comprising at least one spacer member (11, 12, 12', 12a, 12b, 12c), which spacer array (10) is provided on the bottom surface (1b) of the overlay (1) for positioning the spacer array (10) on the top surface (30a) of the table (30), such that the top surface (30a) of the table (30) is spaced apart from the bottom surface (1b) of the overlay (1) for forming a gap (13) between the table (30) and the overlay (1), wherein the table (30) is arranged for being connected to a vacuum source for providing an underpressure in the gap (13),

characterized in that

- the overlay (1) further comprises a recess (3) for receiving a medium registration element in the recess (3), which recess (3) extends from the top surface (1a) of the overlay (1) to the bottom surface (1b) of the overlay (1),
- the at least one spacer member (12, 12', 12a, 12b, 12c) on the bottom surface (1b) of the overlay (1) is positioned between the recess (3) and a through-hole (5a), and
- a groove (6) is provided in the top surface (1a) of the overlay (1), which groove (6) extends from the through-hole (5a) over the at least one spacer member (12, 12', 12a, 12b, 12c) for applying a suction force to a medium.

2. A medium support member according to claim 1, wherein the groove (6) extends from the through-hole (5a) to a region in a vicinity of the recess (3).**3.** A medium support member according to any of the previous claims, wherein the groove (6) extending from the through-hole (5a) is in fluid communication with the through-hole (5a) for extending an underpressure in the through-hole (5a) to the groove (6).**4.** A medium support member according to any of the previous claims, wherein a first end (6a) of the groove (6) is open-ended for fluid communication with the through-hole (5a) and a second end (6b) of the groove (6) is closed-ended for substantially sealing the groove (6) when a medium is placed over the groove (6).**5.** A medium support member according to any of the

previous claims, wherein the at least one spacer member (12, 12', 12a, 12b) extends at least partially around the recess (3).

6. A medium support member according to any of the previous claims, wherein

- the spacer array (10) comprises a sealing frame (12, 12') provided on the bottom surface (1b) of the overlay (1) and arranged for delimiting and sealing the gap (13) between the bottom surface (1b) of the overlay (1) and the top surface (30a) of the table (30), and
- wherein the groove (6) extends over the sealing frame (12, 12') from a through-hole (5a) positioned adjacent the sealing frame (12, 12').

7. A medium support member according to claim 6, wherein the sealing frame (12, 12') is provided substantially circumferentially on the bottom surface (1b) of the overlay (1).**8.** A medium support member according to any of the previous claims, wherein the spacer array (10) comprises magnetic strips (11, 12, 12', 12a, 12b, 12c) arranged for holding at least portions of the overlay (1) and corresponding portions of the table (30) together by magnetic attraction.**9.** A medium support member according to claim 8, wherein the through-holes (5, 5a, 5b) are regularly arranged in rows and columns, and the magnetic strips (11, 12, 12', 12a, 12b, 12c) are configured as elongated members (11, 12, 12', 12a, 12b, 12c).**10.** A medium support member according to claim 9, wherein the magnetic strips (11, 12, 12', 12a, 12b, 12c) are each disposed in an interval between two neighboring rows of the through-holes (5, 5a, 5b).**11.** A medium support member according to any of the previous claims, wherein a through-hole (5a) from which a groove (6) extends is enlarged with respect to a through-hole (5b) from which no groove (6) extends.**12.** A medium support member according to any of the previous claims, wherein the groove (6) extends from the through-hole (5a) towards an adjacent edge (2) of the overlay (1), and wherein an end (6b) of the groove (6) is positioned spaced apart from the adjacent edge (2) of the overlay (1).**13.** A vacuum support device comprising:

- a table (30); and
- a medium support member according to any of the previous claims positioned on the top sur-

face (30a) of the table (30).

14. A vacuum support device according to claim 13, wherein a top surface (30a) of the table (30) is made of a magnetically attractable material and the spacer array (10) comprises magnetic strips (11, 12, 12', 12a, 12b, 12c) arranged on the bottom side (1b) of the overlay (1) for holding at least portions of the overlay (1) and corresponding portions of the table (30) together by magnetic attraction.

Patentansprüche

1. Medienträger mit:

- einer Auflage (1) zum Auflegen auf eine obere Oberfläche (30a) eines Tisches (30), wobei die Auflage (1) eine obere Oberfläche (1a), eine untere Oberfläche (1b) und eine Vielzahl von durchgehenden Löchern (5) zum Ausüben einer Saugkraft auf ein Medium aufweist; und
- einer Abstandshalteranordnung (10), die wenigstens einen Abstandshalter (11, 12, 12', 12a, 12b, 12c) aufweist, welche Abstandshalteranordnung (10) an der unteren Oberfläche (1b) der Auflage (1) angeordnet ist, zum Positionieren der Abstandshalteranordnung auf der oberen Oberfläche (30a) des Tisches (30) derart, dass die obere Oberfläche (30a) des Tisches von der unteren Oberfläche (1b) der Auflage (1) in Abstand gehalten wird, um einen Spalt (13) zwischen dem Tisch (30) und der Auflage (1) zu bilden, wobei der Tisch (30) dazu ausgebildet ist, mit einer Vakuumquelle zum Bereitstellen eines Unterdruckes in dem Spalt (13) verbunden zu werden,

dadurch gekennzeichnet, dass

- die Auflage (1) weiterhin eine Ausnehmung (3) aufweist, zur Aufnahme eines Medienregistrier-elements in der Ausnehmung (3), welche Ausnehmung (3) sich von der oberen Oberfläche (1a) der Auflage (1) zu der unteren Oberfläche (1b) der Auflage (1) erstreckt,
- der wenigstens eine Abstandshalter (12, 12', 12a, 12b) an der unteren Oberfläche (1b) der Auflage (1) zwischen der Ausnehmung (3) und einem durchgehenden Loch (5a) positioniert ist, und
- eine Nut (6) in der oberen Oberfläche (1a) der Auflage (1) vorgesehen ist, welche Nut (6) sich von dem durchgehenden Loch (5a) über den wenigstens einen Abstandshalter (12, 12', 12a, 12b, 12c) erstreckt, zum Ausüben einer Saugkraft auf ein Medium.

2. Medienträger nach Anspruch 1, bei dem die Nut (6) sich von dem durchgehenden Loch (5a) in einen Bereich in einer Nähe der Ausnehmung (3) erstreckt.

3. Medienträger nach einem der vorstehenden Ansprüche, bei dem die sich von dem durchgehenden Loch (5a) auserstreckende Nut (6) in Fluidverbindung mit dem durchgehenden Loch (5a) steht, um einen Unterdruck in dem durchgehenden Loch (5a) in die Nut (6) weiterzuleiten.

4. Medienträger nach einem der vorstehenden Ansprüche, bei dem ein erstes Ende (6a) der Nut (6) ein offenes Ende ist, für die Fluidverbindung mit dem durchgehenden Loch (5), und ein zweites Ende (6b) der Nut (6) ein geschlossenes Ende ist, um die Nut (6) im wesentlichen abzudichten, wenn ein Medium über der Nut (6) platziert ist.

5. Medienträger nach einem der vorstehenden Ansprüche, bei dem der wenigstens eine Abstandshalter (12, 12', 12a, 12b) sich wenigstens zum Teil um die Ausnehmung (3) herum erstreckt.

6. Medienträger nach einem der vorstehenden Ansprüche, bei dem

- die Abstandshalteranordnung (10) einen dichtenden Rahmen (12, 12') aufweist, der an der unteren Oberfläche (1b) der Auflage (1) vorgesehen und dazu ausgebildet ist, den zwischen der unteren Oberfläche (1b) der Auflage (1) und der oberen Oberfläche (30a) des Tisches (30) gebildeten Spalt (13) zu begrenzen und abzudichten, und
- bei dem die Nut (6) sich von einem durchgehenden Loch (5a) aus, das benachbart zu dem dichtenden Rahmen (12, 12') positioniert ist, über den dichtenden Rahmen (12, 12') erstreckt.

7. Medienträger nach Anspruch 6, bei dem der dichtende Rahmen (12, 12') im wesentlichen am Umfang der unteren Oberfläche (1b) der Auflage (1) vorgesehen ist.

8. Medienträger nach einem der vorstehenden Ansprüche, bei dem die Abstandshalteranordnung (10) magnetische Streifen (11, 12, 12', 12a, 12b, 12c) aufweist, die dazu ausgebildet sind, zumindest Teile der Auflage (1) und entsprechende Teile des Tisches (30) durch magnetische Anziehung zusammen zu halten.

9. Medienträger nach Anspruch 8, bei dem die durchgehenden Löcher (5, 5a, 5b) regelmäßig in Zeilen und Spalten angeordnet sind und die magnetischen Streifen (11, 12, 12', 12a, 12b, 12c) als längliche

Elemente (11, 12, 12', 12a, 12b, 12c) ausgebildet sind.

10. Medienträger nach Anspruch 9, bei dem die magnetischen Streifen (11, 12, 12', 12a, 12b, 12c) jeweils in einem Intervall zwischen zwei benachbarten Zeilen der durchgehenden Löcher (5, 5a, 5b) angeordnet sind. 5
11. Medienträger nach einem der vorstehenden Ansprüche, bei dem ein durchgehendes Loch (5a), von dem eine Nut (6) ausgeht, in Bezug auf ein durchgehendes Loch (5b), von dem keine Nut (6) ausgeht, vergrößert ist. 10
12. Medienträger nach einem der vorstehenden Ansprüche, bei dem die Nut (6) sich von dem durchgehenden Loch (5a) aus in Richtung auf einen angrenzenden Rand (2) der Auflage (1) erstreckt und bei dem ein Ende (6b) der Nut (6) in Abstand zu dem angrenzenden Rand (2) der Auflage (1) positioniert ist. 15 20
13. Vakuum-Tragvorrichtung mit:
 - einem Tisch (30); und 25
 - einem Medienträger nach einem der vorstehenden Ansprüche, der auf der oberen Oberfläche (30a) des Tisches (30) positioniert ist.
14. Vakuum-Tragvorrichtung nach Anspruch 13, bei der eine obere Oberfläche (30a) des Tisches (30) aus einem magnetisch anziehbaren Material gebildet ist und die Abstandshalteranordnung (10) magnetische Streifen (11, 12, 12', 12a, 12b, 12c) aufweist, die an der Unterseite (1b) der Auflage (1) angeordnet sind, um zumindest Teile der Auflage (1) und entsprechende Teile des Tisches (30) durch magnetische Anziehung zusammen zu halten. 30 35 40

Revendications

1. Élément de support de milieu, comprenant :
 - un revêtement (1) destiné à être placé sur une surface supérieure (30a) d'une table (30), dans lequel le revêtement (1) comprend une surface supérieure (1a), une surface inférieure (1b), et une pluralité de trous traversants (5) pour appliquer une force d'aspiration à un milieu ; et 45
 - un réseau d'écarteurs (10), comprenant au moins un élément d'écartement (11, 12, 12', 12a, 12b, 12c), le réseau d'écarteurs (10) étant fourni sur la surface inférieure (1b) du revêtement (1) pour positionner le réseau d'écarteurs (10) sur la surface supérieure (30a) de la table (30), de sorte que la surface supérieure (30a) de la table (30) soit espacée de la surface infé-

rieure (1b) du revêtement (1) pour former un espace (13) entre la table (30) et le revêtement (1), dans lequel la table (30) est agencée pour être raccordée à une source de vide pour fournir une sous-pression dans l'espace (13),

caractérisé en ce que

- le revêtement (1) comprend en outre un évidement (3) pour recevoir un élément d'alignement de support dans l'évidement (3), l'évidement (3) s'étendant depuis la surface supérieure (1a) du revêtement (1) jusqu'à la surface inférieure (1b) du revêtement (1),
 - l'au moins un élément d'écartement (12, 12', 12a, 12b, 12c) sur la surface inférieure (1b) du revêtement (1) est positionné entre l'évidement (3) et un trou traversant (5a), et
 - une rainure (6) est fournie sur la surface supérieure (1a) du revêtement (1), la rainure (6) s'étendant depuis le trou traversant (5a) sur l'au moins un élément d'écartement (12, 12', 12a, 12b, 12c) pour appliquer une force d'aspiration à un milieu.
2. Élément de support de milieu selon la revendication 1, dans lequel la rainure (6) s'étend depuis le trou traversant (5a) jusqu'à une région à proximité de l'évidement (3).
 3. Élément de support de milieu selon l'une quelconque des revendications précédentes, dans lequel la rainure (6) s'étendant depuis le trou traversant (5a) est en communication fluïdique avec le trou traversant (5a) pour étendre une sous-pression dans le trou traversant (5a) jusqu'à la rainure (6).
 4. Élément de support de milieu selon l'une quelconque des revendications précédentes, dans lequel une première extrémité (6a) de la rainure (6) est ouverte à une communication fluïdique avec le trou traversant (5a) et une seconde extrémité (6b) de la rainure (6) est fermée pour sensiblement fermer hermétiquement la rainure (6) lorsqu'un milieu est placé sur la rainure (6).
 5. Élément de support de milieu selon l'une quelconque des revendications précédentes, dans lequel l'au moins un élément d'écartement (12, 12', 12a, 12b) s'étend au moins partiellement autour de l'évidement (3).
 6. Élément de support de milieu selon l'une quelconque des revendications précédentes, dans lequel
 - le réseau d'écarteurs (10) comprend un cadre d'étanchéité (12, 12') fourni sur la surface inférieure (1b) du revêtement (1) et agencé pour

- délimiter et fermer hermétiquement l'espace (13) entre la surface inférieure (1b) du revêtement (1) et la surface supérieure (30a) de la table (30), et
- dans lequel la rainure (6) s'étend sur le cadre d'étanchéité (12, 12') depuis un trou traversant (5a) positionné de manière adjacente au cadre d'étanchéité (12, 12').
- 5
7. Élément de support de milieu selon la revendication 6, dans lequel la cadre d'étanchéité (12, 12') est fourni sensiblement de manière circonférentielle sur la surface inférieure (1b) du revêtement (1). 10
8. Élément de support de milieu selon l'une quelconque des revendications précédentes, dans lequel le réseau d'écarteurs (10) comprend des bandes magnétiques (11, 12, 12', 12a, 12b, 12c) agencées pour tenir au moins des parties du revêtement (1) et des parties correspondantes de la table (30) ensemble par une attraction magnétique. 15 20
9. Élément de support de milieu selon la revendication 8, dans lequel les trous traversants (5, 5a, 5b) sont agencés de manière régulière en rangs et colonnes, et les bandes magnétiques (11, 12, 12', 12a, 12b, 12c) sont configurées en tant qu'éléments allongés (11, 12, 12', 12a, 12b, 12c). 25
10. Élément de support de milieu selon la revendication 9, dans lequel les bandes magnétiques (11, 12, 12', 12a, 12b, 12c) sont chacune disposées dans un intervalle entre deux rangs voisins des trous traversants (5, 5a, 5b). 30 35
11. Élément de support de milieu selon l'une quelconque des revendications précédentes, dans lequel un trou traversant (5a) depuis lequel une rainure (6) s'étend est élargi par rapport à un trou traversant (5b) depuis lequel aucune rainure (6) ne s'étend. 40
12. Élément de support de milieu selon l'une quelconque des revendications précédentes, dans lequel la rainure (6) s'étend depuis le trou traversant (5a) vers un bord adjacent (2) du revêtement (1), et dans lequel une extrémité (6b) de la rainure (6) est positionnée à l'écart du bord adjacent (2) du revêtement (1). 45
13. Dispositif de support de vide comprenant : 50
- une table (30) ; et
 - un élément de support de milieu selon l'une quelconque des revendications précédentes positionné sur la surface supérieure (30a) de la table (30). 55
14. Dispositif de support de vide selon la revendication 13, dans lequel une surface supérieure (30a) de la

table (30) est faite à partir d'un matériau pouvant être attiré magnétiquement et le réseau d'écarteurs (10) comprend des bandes magnétiques (11, 12, 12', 12a, 12b, 12c) agencées sur le côté inférieur (1b) du revêtement (1) pour tenir au moins des parties du revêtement (1) et des parties correspondantes de la table (30) ensemble par une attraction magnétique.

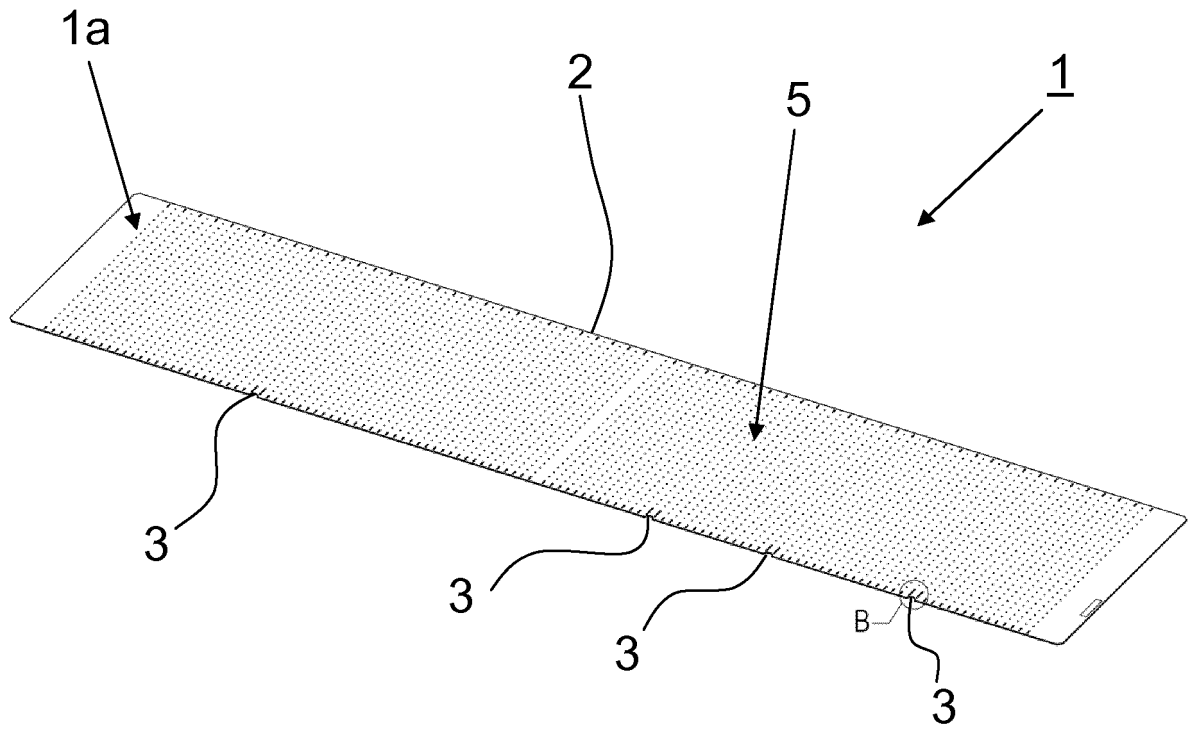


Fig. 1

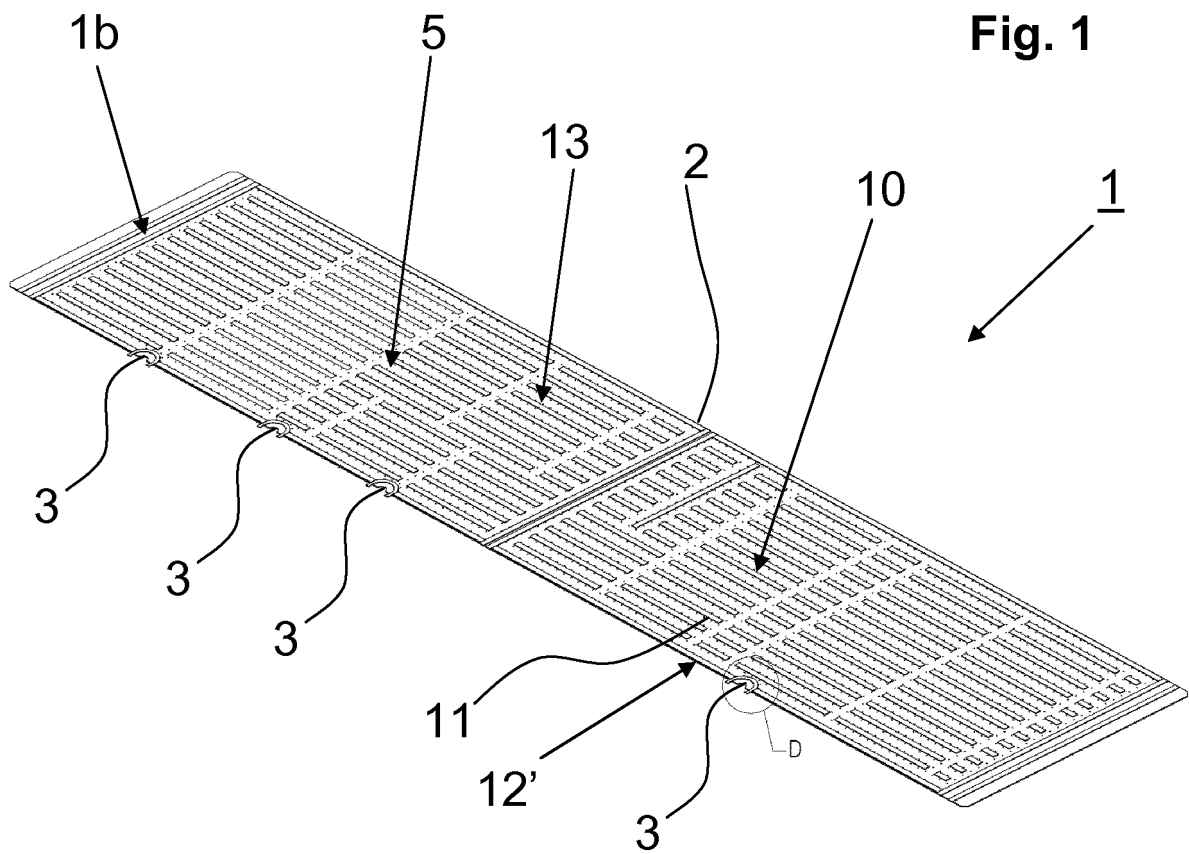
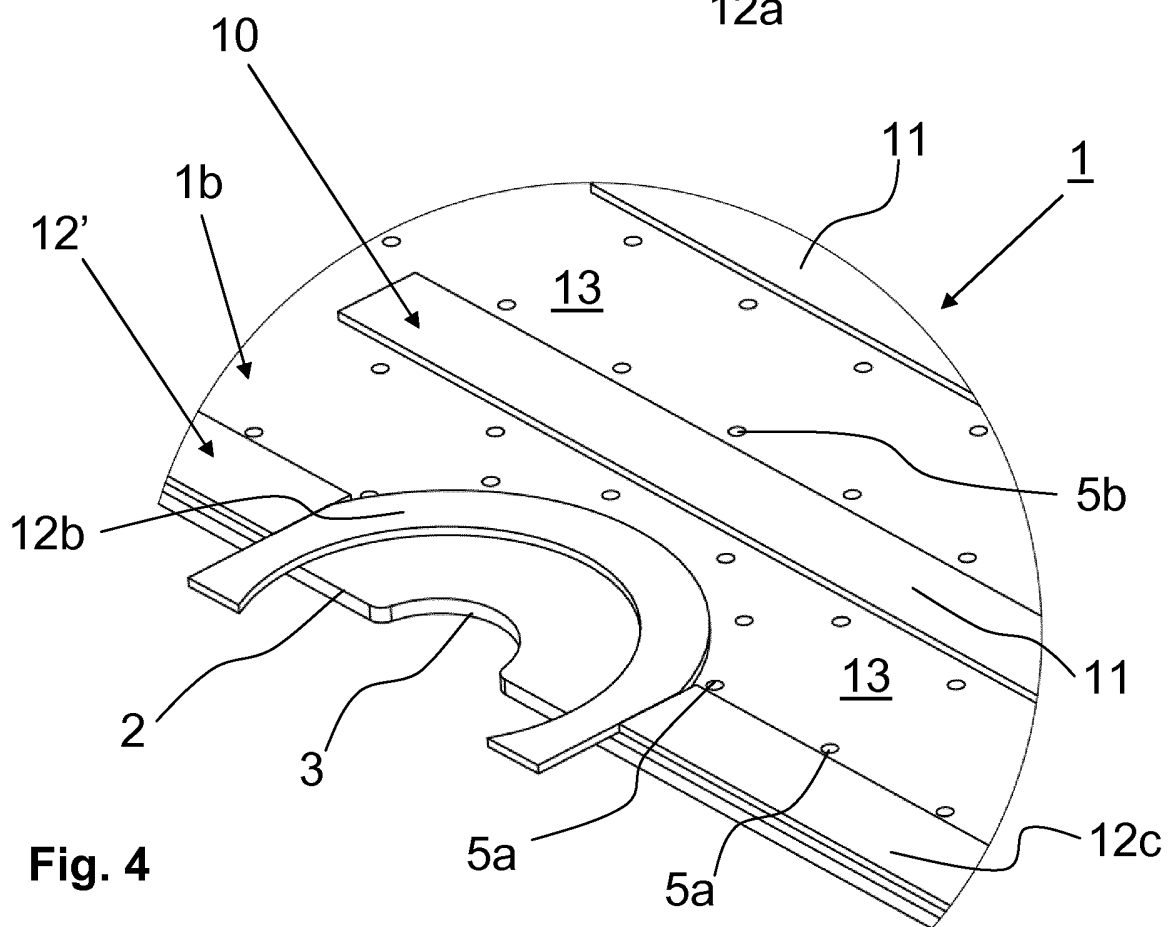
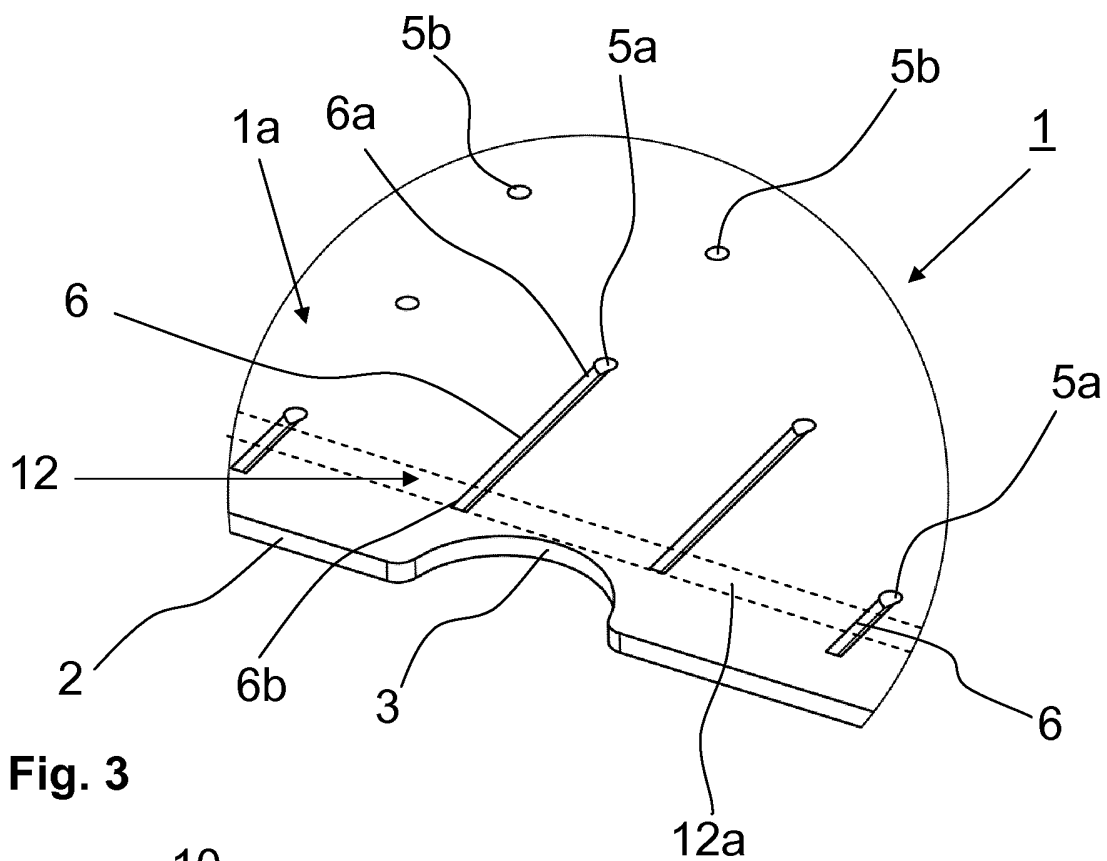


Fig. 2



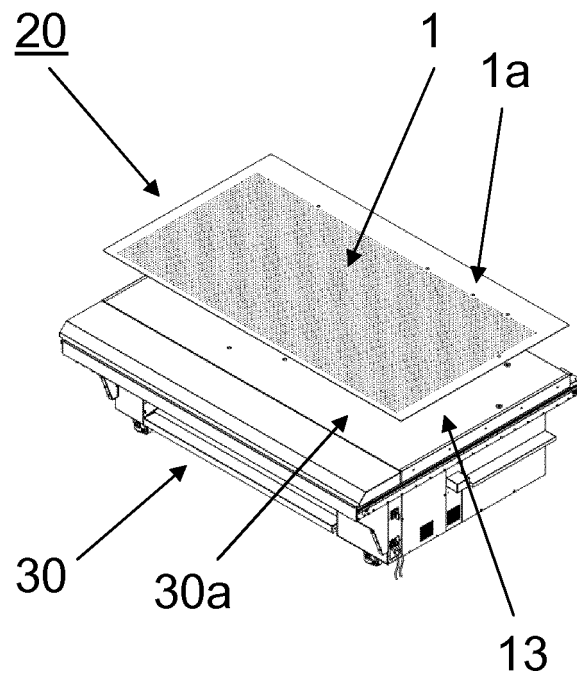


Fig. 5a

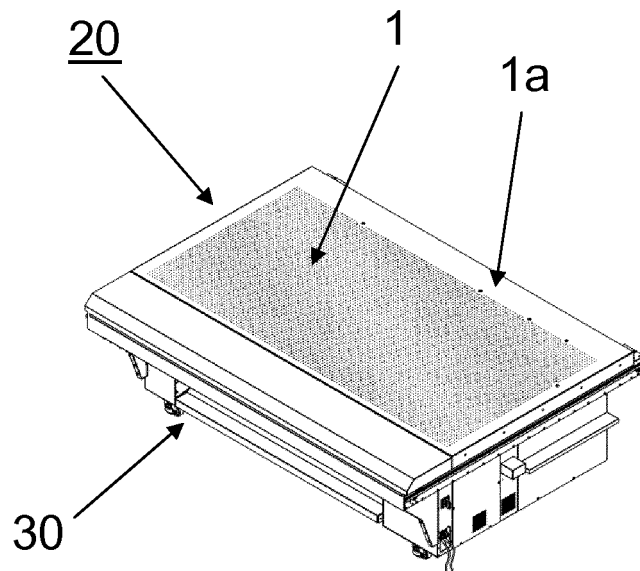


Fig. 5b

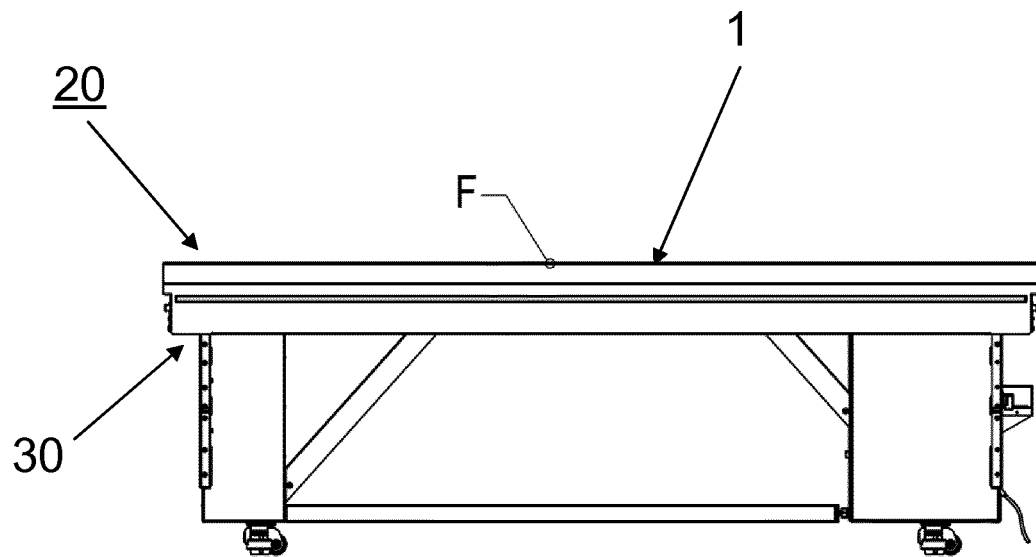


Fig. 6

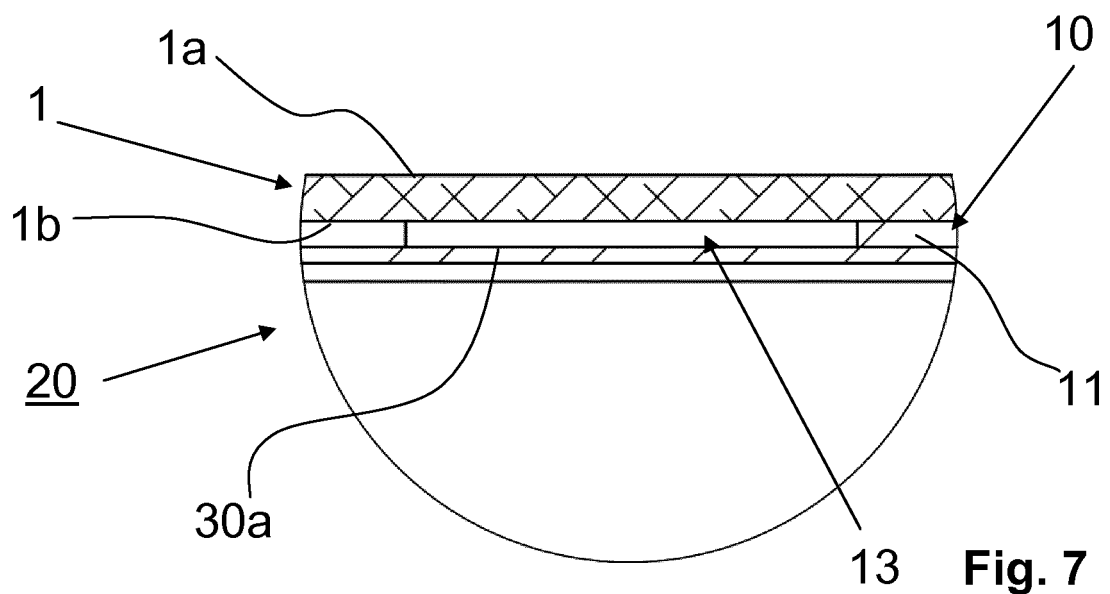


Fig. 7

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

- EP 2580062 A1 [0003] [0038]