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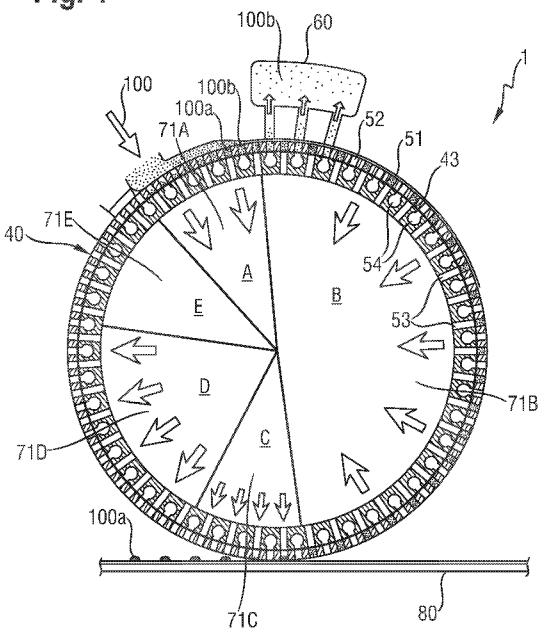
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(54) Title: APPARATUS AND METHOD FOR RECEIVING AND TRANSFERRING SOLID MATERIAL

(57) Abstract: An apparatus and method is claimed with a with receiving zone, for receiving solid material, a transferring zone, for transferring said solid material and optionally a releasing zone for releasing said solid material, e.g. to another moving surface and with a moving endless surface moving in and through said zones, said a moving endless surface has thereto a multitude of primary cavities and secondary cavities receiving said solid material, whereby said primary cavities are connectable/ connected to said vacuum system of said transferring zone, and said secondary cavities are not connectable/connected to said vacuum system of said transferring zone, and whereby thus only said primary cavities transfer said solid material e.g. to said further moving surface; and whereby typically both primary and secondary cavities are connectable/ connected to a vacuum system in said receiving zone.

Fig. 4



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APPARATUS AND METHOD

FOR RECEIVING AND TRANSFERRING SOLID MATERIAL

FIELD OF THE INVENTION

This invention is direction to an apparatus with a receiving zone, for receiving solid material, a transferring zone, for transferring said solid material and optionally a releasing zone for releasing said solid material, e.g. to a further moving surface, and with a moving endless surface moving in and through said zones, which has a multitude of primary cavities and secondary cavities receiving said solid material, whereby said primary cavities are connected to a vacuum system in said transferring zone, and said secondary cavities are not connected to a vacuum system in said transferring zone, and whereby thus only said primary cavities transfer said solid material e.g. to said further moving surface; and whereby typically both primary and secondary cavities are connectable/ connected to a vacuum system in said receiving zone. The invention also relates to a method for receiving and transferring and releasing solid material, by use of the apparatus herein, or as described herein.

BACKGROUND OF THE INVENTION

In the last decades, various processes have been proposed for making absorbent cores with fibers and/or superabsorbent polymer particles (SAP particles), also referred to as absorbent gelling polymer particles (AGM particles), including processes whereby said material is laid down on a moving surface, such as a drum surface, with one or more reservoirs and held onto said surface by vacuum. These approaches include indirect printing methods, whereby the AGM and/or fibers are taken up by a drum from one or more bulk storage(s) of said fibers and /or AGM particles, and whereby the drum then rotates towards a substrate such as a nonwoven, to then release the AGM and/or fibers onto the substrate. The drum may have one ore more cavities, each being in the shape of a diaper core, that is then filled with fibers and/or AGM. However, such a complete diaper core shapes are difficult to transfer completely and accurately at high speed onto a second surface, such as a moving nonwoven web. In more recent years, it has been proposed to deposit fibers and/ or AGM into smaller cavities. Such a multitude of smaller cavities may then together

be in the form of a diaper core, so that when the AGM content of all the cavities is transferred onto a second surface, like a nonwoven web, a core is formed. This is for example described in EP-A- 1621165. With such methods, a more accurate transfer of the solid material can be achieved, so that the resulting absorbent core may have a specific profile or distribution, such as a predetermined pattern, MD-, CD-, or thickness-profile, corresponding to the pattern/ depth of the cavities.

The inventor found that such proposed indirect printing processes are in some instances difficult to run at high speed, for example at speeds of more than 800 or more than 1000 parts (e.g. absorbent cores) per minute, and/or when fine particulate material is used, and/ or when small (and large quantities of) cavities are used. It has been found that in such instances the solid material (such as fibers and/or AGM particles) are not always satisfactorily received by the cavities, resulting in inaccurate filling of the cavities, and hence insufficient transfer of the material and hence inconsistencies in the resulting absorbent cores.

Furthermore, the inventor found that when the process or apparatus is such that vacuum is needed to fill the cavities accurately, it is important that the vacuum/air flow through the cavities and/or solid materials is about constant, and/or that it is important that the vacuum/ air flow per surface area is sufficient and about constant. The inventor found that when the process is very fast, and/ or when the cavities are very small and/ or when the particle material is of fine (particle) size, solid material may build up locally above the cavities, prior to flowing into the cavities, reducing the airflow (vacuum suction) in such areas. This may lead to inaccurate filling and insufficient transfer. The inventor furthermore found that, for example when the cavities are in the form of a pattern and thus having with areas between the cavities, that the vacuum/ airflow may not always be sufficient or not sufficiently constant per surface area.

Furthermore, the inventor found that if the moving surface (such as a print roll or drum) comprises substantial zones (extending in machine direction, MD and cross-machine direction CD) without cavities, for example corresponding to the zones between absorbent cores (of the web of absorbent cores produced by the method or with the apparatus) where for example the cores are to be separated from one another, continuous deposition of the solid material by the apparatus or process may result in build-up of said solid material. Even if a means is present to remove this build-up about immediately, such as a scraper blade, the air flow (vacuum) may already be impeded, and hence inaccurate filling of the cavities may occur.

The inventor now found a new method and a new apparatus to ensure continuous and accurate filling of cavities on a moving surface, resulting in a more consistent transfer, e.g. absorbent core formation, said method and apparatus being suitable even at high speeds and/or when small cavities are used for the transfer and/or even when fine particulate material is transferred.

SUMMARY OF THE INVENTION

The invention relates to an apparatus (1) having a receiving zone (A) for receiving solid material (100), a transferring zone (B) for transferring a first portion of said solid material (100a) and optionally a releasing zone (C) for releasing said first portion of said solid material (100a); and said apparatus comprising:

- a moving endless surface (40), moving through said receiving zone (A), transferring zone (B) and releasing zone (C) of said apparatus and said moving endless surface (40) comprising a multitude of primary cavities (51) for receiving a first portion of said solid material (100a) and with a multitude of secondary cavities (52) for receiving a second portion of said solid material (100b);
- a vacuum system (71B) in said transferring zone (B) for retention of said first portion of solid material (100a) during transfer, whereby said primary cavities (51) are connectable to said vacuum system (71B) of said transferring zone (C), and said secondary cavities (52) are not connectable to a vacuum system (71B) of said transferring zone (B), and;
- a removal means (60) in said transferring zone (B) for removing (in the transferring zone) the second portion of said solid material (100b) from said secondary cavities (52),; and optionally
- optionally, a releasing zone, where the first portion of the solid material (100a) is released from said primary cavities (51.

When used herein, the primary cavities (51) are connectable to said vacuum system (71B) of said transferring zone (C), and this means that the cavities are thus connected to said vacuum system when moving through the transfer zone.

In some embodiments herein, said primary cavities and/ or in some embodiments herein said secondary cavities (52) are connectable to a vacuum system (71A) of said receiving zone (A) (and hence they are connected to said vacuum system when moving through said receiving zone).

In some embodiments herein, the additional secondary cavities (52) connectable to a vacuum system in the receiving zone may thus provide in the receiving zone, additional surface area for vacuum suction/air flow, thus maximizing the vacuum suction/ air flow through the moving endless surface in said receiving zone. This is believed to aid stabilization of the vacuum suction/air flow in said receiving zone; this is also believed to improve the solid material deposition in said primary and secondary cavities in said receiving zone.

The first portion of the solid material (100a) may be released from said primary cavities (51) in a releasing zone, for example released onto a further moving endless surface such as, or comprising a substrate; this may be done by means of an gas-inlet system (71C, 72b) and application of (e.g. pressurized) gas through said primary (and optionally secondary) cavities, onto said solid material. In some embodiments the cavities may comprise a substrate material, e.g. web material, and the solid material is received thereon, and in the releasing zone, the solid material and substrate material is released from said moving endless surface.

Typically, said apparatus has a vacuum chamber (71 B) in the transferring zone (B), that may be connectable (and hence connected; indirectly connectable/ connected, e.g. as described below, via e.g. at least the openings described below; or directly connectable/ connected) to said primary cavities (but not to said secondary cavities (52)); and optionally a vacuum chamber (71A) in the receiving zone A that may be connectable/ connected (indirectly connectable/ connected, e.g. as described below, via e.g. at least the openings described below; or directly connectable/ connected) to said primary cavities and optionally to said secondary cavities (52).

In some embodiments herein, said moving endless surface (40) has an outer shell (41), comprising said primary and secondary cavities (52); and an inner shell (42) comprising a multitude of primary openings (53) and a multitude of secondary openings (54a, 54b), and each of said primary cavities (51) is connected to one or more primary opening (53), and via said openings connectable to said vacuum system (71B) (in the transferring zone (B) and optionally in the receiving zone (A)), and optionally a gas-inlet system in the releasing zone (C); and each of said secondary cavities (52) is connected to one or more secondary opening (54), or a first

part thereof (54 a), connectable (optionally via a second part of said secondary openings (54b)) to said removal means (60) in said transferring zone (B), and optionally to said vacuum system (71B) in said receiving zone (A) and optionally a gas-inlet system in the releasing zone (C); optionally said moving endless surface (40) comprising a screen (43) positioned between said outer shell (41) and said inner shell (42).

"Connected" or "connectable" as used herein includes directly and indirectly connected/connectable, unless stated explicitly otherwise.

"Multitude" as used herein with respect to the cavities (51, 52), or openings (53, 54), means at least 10, but in some embodiments at least 20 or at least 50.

It should be understood that the moving endless surface (40) contains at each moment in time at least: a part that is in the receiving zone (A), a part that is in the transferring zone (B) and optionally a part that is in the releasing zone (C) of the apparatus. Thus, for example, the primary cavities (51) that are *connectable* to said vacuum system (71B) of said transferring zone (B), are *connected* to said vacuum system (71B) *when moving through* (and hence *in*) said transferring zone (B).

The invention also relates to a method for receiving with a moving endless surface (40) solid material (100) form a feeder, transferring said solid material with said moving endless surface (40) and optionally releasing said solid material from said moving endless surface (40) to a further moving surface (80), said method comprising the step of:

a) receiving a first portion (100a) of said solid material in primary cavities (51) of said moving endless surface (40), and a second portion (100b) of said solid material in secondary cavities (52) of said moving endless surface (40);

b) optionally applying during said step a) a vacuum onto said primary and secondary cavities (52);

c) moving said moving endless surface (40) to said further moving surface (80), whilst applying a vacuum to said primary cavities and said first portion (100a) of said solid material therein, and not to said secondary cavities (52) and said second portion (100b) of solid material therein, thereby transferring said first

portion (100a) of said solid material in said primary cavities (51), to said further moving surface (80), and not said second portion (100b) of said solid material;

d) removing said second portion (100b) of said solid material from said secondary cavities (52) with a removal means (60);

e) optionally releasing said first portion (100a) of said solid material onto said further moving surface (80), e.g. by applying positive air pressure onto said primary cavities and said first portion of said solid material (100a) therein.

The invention also relates to a method for receiving with a moving endless surface (40) solid material (100) e.g. form a feeder, transferring said solid material (e.g. a first portion (100a) thereof) with said moving endless surface and releasing said solid material from said moving endless surface (40), e.g. to a further moving surface (80), using the apparatus of the invention.

It should be understood that all aspect described with respect of the apparatus of the invention are applicable to the method of the invention or the method of the invention using such an apparatus, and that all steps to be performed by aspects or components of the apparatus of the invention, are equally applicable to the methods of the invention, and *vise versa*.

BRIEF DESCRIPTION OF THE FIGURES

Figure 1 is a schematic cross-sectional view through an exemplary apparatus of the invention.

Figure 2 is a schematic cross-sectional view through an exemplary apparatus of the invention, and its vacuum systems(s) and gas-inlet systems(s).

Figure 3 is a schematic view of the zones of a moving endless surface (40) at a moment in time.

Figure 4 is a schematic cross-sectional view through an exemplary apparatus of the invention.

Figure 4a is an enlarged view of a section of the schematic cross-sectional view through an exemplary apparatus of Figure 4.

Figure 5 is a schematic (partial) view of an exemplary outer shell (41) of a moving endless surface (40) at a moment in time.

Figure 6a is a schematic (partial) view of an exemplary inner shell (42) of a moving endless surface (40) at a moment in time, showing its outer layer thereof; this may be used in combination with the exemplary outer shell (41) of Figure 5.

Figure 6b is a schematic (partial) view of an exemplary inner layer of the inner shell (42) of a moving endless surface (40) of Figure 6a (at a moment in time).

DETAILED DESCRIPTION OF THE INVENTION

Solid material (100)

The solid material (100) herein may be any material that is processable in the method and apparatus of the invention, e.g. flowable; generally, the solid material is in particulate form, which includes particles, including granules, spheres, agglomerated particles; flakes; fibers; and other forms known in the art; and mixtures thereof. The solid material may be a mixture of fibers and particles.

In some embodiment herein, the solid material may include or consist of fibers, such as cellulose or cellulose-based fibers, including modified cellulose fibers. In some embodiment herein, the solid material (100) comprises or consists of particles, such as detergent particles, medical ingredient particles, etc. In some embodiment herein, the solid material (100) comprises or consists of absorbent or superabsorbent material in the form of particles, e.g. (super) absorbent polymeric material in the form of particles, also known as particulate absorbent gelling material, herein referred to as AGM. This typically refers to polymeric materials in particulate form that can absorb at least 10 times their weight of a 0.9% saline solution, i.e. having a CRC value of at least 10 g/g as measured using the Centrifuge Retention Capacity test of EDANA (European Disposables and Nonwovens Association), test method No. 441.2-02 "Centrifuge retention capacity". The particulate AGM herein may have a higher sorption capacity, e.g. having a CRC of for example at least 20 g/g, or at 30 g/g.

The particulate AGM may have a good permeability for liquid, for example, having a SFC value of at least 10 x 10^{-7} cm^3 s/g; or at least 30 x 10^{-7} cm^3s/g, or at least 50 x 10^{-7} cm^3s/g 10 x 10^{-7} cm^3s/g, or possibly permeability SFC value of at least 100 x10^{-7} cm^3s/g, or at least a SFC of 120 x10^{-7} cm^3sec/g. This SFC is a measure of permeability and an indication of porosity is provided

by the saline flow conductivity of the gel bed as described in U.S. Patent No. 5,562,646, (Goldman et al.) issued Oct. 8, 1996 (whereby however a 0.9% NaCl solution is used instead of Jayco solution). Upper limits may for example be up to 350 or up to 250 (x 10^{-7} cm^3s/g).

In one embodiment herein the polymers of said AGM are internally cross-linked and/ or surface crosslinked polymers. In one embodiment herein, said polymers are polyacrylic acids/ polyacrylates, for example having a neutralization degree of from 60% to 90%, or about 75%, having for example sodium counter ions, as known in the art, e.g. surface crosslinked and/ or internally crosslinked polyacrylic acid/ polyacrylate polymers.

In one embodiment herein, the solid material (100) has, or is in the form of particles with, a mass medium particle size up to 2 mm, or even between 50 microns and 2 mm or to 1 mm, or from 100 or 200 or 300 or 400, to 1000 or 800 or 700µm; as can for example be measured by the method set out in for example EP-A-0691133. In one embodiment of the invention, the solid material (100) is in the form of particles with particle sizes between 50 or 100 µm, and 1200 or 1000 µm. In yet other or additional embodiments of the invention the particulate material (100) has a relatively narrow range of particle sizes, e.g. with the majority (e.g. at least 80% or at least 90% or even at least 95%) of particles having a particle size between 50µm and 1000µm, or between 100µm and 800µm, and or between 200µm and 600µm.

The solid material (100) herein may advantageously comprise less than 15% by weight of water, or less than 10%, or less than 8% or less than 5%. The water-content can be determined by the Edana test, number ERT 430.1-99 (February 1999) which involves drying the solid material (100) at 105°Celsius for 3 hours and determining the moisture content by the weight loss of the solid material (100) after drying.

The particulate AGM herein may be particles of AGM that are surface coated or surface treated (this not including surface-crosslinking, which may be an additional surface-treatment); such coatings and surface treatment steps are well known in the art, and include surface treatment with dusting agents such as inorganic powders, including silicates, phosphates, and/or coloring agents, and/or pigments; and/or a coating of polymeric material, including elastomeric polymeric materials, or film-forming polymeric materials; hydrophilic coating agents, including cationic compounds; and combination thereof.

Apparatus (1)

The apparatus (1) herein has a receiving zone (A) for receiving solid material, a transferring zone (B), for transferring a first part of said solid material and optionally a releasing zone (C) for releasing a first part of said solid material (100 a). Said zones may be defined by the function they have, e.g. receiving of solid material in the receiving zone, e.g. from one or more sources such as a feeder, e.g. a hopper; transfer in the transferring zone (B) of solid material, from said receiving zone (A), where the material is received by said surface (40); it may be transferred to any further processing step, for example it may be be transferred to a zone of the apparatus where it is released from said surface (40), in the releasing zone (C), (e.g. released to a further moving endless surface (80), for example a substrate as described herein after). The method herein has corresponding method steps. The moving endless surface (40) of the apparatus (1) moves through said zones. At each point in time, the moving endless surface (40) thus also has a receiving zone (A), transferring zone (B) and optionally a releasing zone (C) (but this various over time, due to movement of the surface). In some embodiments herein, the apparatus (1) has stationary components, adjacent said moving endless surface (40) and said stationary component define the zones, e.g. the apparatus has a stationary receiving zone component, e.g. vacuum system of chamber (71A), a stationary transfer zone (B) component, e.g. a vacuum system or chamber (71B) and releasing means (60); and a stationary releasing zone component, e.g. gas-inlet system (72 b). In some embodiment herein, the receiving zone (A) has a feeder (30) and said vacuum system/ chamber, the transferring zone (B) has a said vacuum chamber/ system and a removal means (60) for removing solid material including for example one or more gas (air)-inlet systems or chambers, and said optional releasing zone (C) may have a gas (air) inlet system or chamber. The moving endless surface (40) moves for example (e.g. rotates) in and through said zones, adjacent said system/ chambers and removal means (60).

The solid material is received by a moving endless surface (40) in the primary and secondary cavities (52) thereof, described below; a first portion of the solid material (100a) is received by the primary cavities (51) and a second portion of the solid material (100b) is received by said secondary cavities (52). The cavities may comprise a substrate material, for example a web material, and the solid material may be received thereon in the receiving zone, and this substrate material may be released, e.g. together with the solid material, in the releasing zone (C). For example, the cavities may comprise an (e.g. air-permeable) film material, that will form a coating or cover for the solid material, e.g. to form tablets or capsules or pouches etc.

In some embodiments herein, the cavities do not comprise a substrate material that is released/ releasble from the cavities, and the solid material is thus directly received into said cavities.

The solid material (100) may be received from one or more feeders, e.g. present in said receiving zone adjacent the surface. The solid material (100) leaves the feeder (30) and contacts the moving endless surface (40) in the receiving zone. The feeder(s) (30) herein may thus be any feeder, capable of holding the solid material (100), typically in bulk quantities, and capable of letting it flow to said moving endless surface (40). The feeder (30) may have a container portion, to hold the solid material (100), e.g. having a volume of at least 1000 cm^3, and a guiding portion, e.g. a pipe-shaped portion that guides the solid material (100) from the container portion to the moving endless surface (40). In one embodiment it has a funnel shape, as shown for example in Figure 1, having a container portion and a pipe-shaped portion. The feeder (30) has for example an opening (32) having opening edges positioned adjacent the moving endless surface (40), and typically in proximity thereto; hereby the distance from said opening edges to said first moving endless surface (40) may be for example less than 10 cm, or less than 5 cm, and it may for example be less than 2 cm or less than 1 cm, and for example at least 0.1 mm, or at least 1mm. The opening (32) may have any form, including circular or oval; in one embodiment, the opening (32) is rectangular.

In one embodiment, the feeder (30) is positioned above said moving endless surface (40), for allowing gravity to help to "feed" said solid material (100) to said moving endless surface (40). Hereto, (an opening edge of) the feeder (30) may be positioned exactly above the moving endless surface (40) (0°), or, when the moving endless surface (40) is curved, or even for example circular, as shown in the Figures 1 and 4, it may be positioned substantially above said surface, which means at any position between 90° and -90° (e.g. between 9 o'clock and 3 o'clock position), or in one embodiment between 60° and -60°, or between 30° and -30° (measured as angle between an distal edge of the opening (32) and the force line of gravity).

The moving endless surface (40) herein may be any moving endless surface, for example a moving surface that can rotate to provide a moving *endless* surface. It may for example be a transporter belt, or the movable (e.g. outer) surface of a cylinder or drum or roll, as known in the art, which can rotate and thus provide a moving endless surface (40). The moving endless surface with cavities may be covered or partially covered (e.g. overlaid or partially overlaid) or by a further substrate material, e.g. that may line the primary cavities or the primary and

secondary cavities, so that thus the solid material is received onto said substrate material. Hereto, the substrate material is then air permeable, but substantially non-permeable for the solid material.

The moving endless surface (40) has a direction of movement (e.g. rotation), herein referred to as MD. The moving endless surface (40) may be a rotating surface with a certain radius. The radius of the moving endless surface (40) may depend on what structure is produced, and what size of structure is produced, and for example how many structures are produced per cycle of the moving endless surface (40), e.g. drum. For example, the surface and/or drum may have a radius of at least 40 mm, or of at least 50 mm; it may be for example up to 300 mm, or up to 200 mm.

The first moving endless surface (40) may have any suitable width; for example it may have a width (perpendicular to MD) corresponding (substantially) to the width of the structure to be produced; in some embodiment herein the surface has a central zone (46), extending in MD, that corresponds substantially to the width of the structure to be produced, and it has one or two lateral edge zone(s) (45a, 45b), extending in MD, on one or both sides of said central zone (46), that for example not comprise primary cavities (51), or not comprise primary and secondary cavities (52), as described below.

The width of the moving endless surface (40) or central zone (46) thereof, may for example be at least 40 mm, or at least 60 mm, or for example up to 600 mm, or up to 400 mm. If present, the lateral edge zone or zones may for example be between 5 mm and 200 mm, or to 100 mm or to 70 mm

The moving endless surface (40) comprises primary cavities (51) and secondary cavities (52); e.g. protruding through part of said surface (in Z-direction), to have a certain depth to receive said solid material; in other words, the primary and secondary cavities (52) have a void volume that can be filled with solid material (100). A first portion of said solid material is received by said primary cavities (51) and a second portion of the solid material is received by said secondary cavities (52).

In some embodiments, described in more detail below, the moving endless surface (40) has an shell (41) that comprises said primary and/or secondary cavities (52) and an inner shell (42), not

comprising said cavities, but comprising for example the primary and secondary openings (53,54) herein described below.

The surface area between the primary (51) and secondary cavities (52), thus not comprising cavities, is herein referred to as "outer surface area" of said moving endless surface (40). The remaining surface area formed by the cavities is the open surface area of the moving endless surface (40) composed of the total open surface area of the primary cavities (51) and total open surface area of the secondary cavities (52).

Thus, each primary cavity and each secondary cavity has an open surface area, with is the open surface area of a cavity (measured) in the plane of the "outer surface area" of said moving endless surface (40); the ratio of the total open area of all primary cavities (51) to the total open area of all secondary cavities (52) may be for example from 50:1 to 1:10, or for example from 30:1 or 20:1 or 10:1 or 5:1 to 1:10 or to 1:5 or 1:3 or to 1:2,or even about 1:1.

The exact cavity dimensions and/or pattern will depend on the required structure to be formed; it may for example (also) depend on the particle size of the solid material (100), the process speed etc. In some embodiments at least 5% or at least 10% or at least 20%, or in some embodiments, at least 30%, or at least 35%, of the moving endless surface (40) or, in some embodiments, of the central zone (46) thereof, is open area, i.e. comprises said primary (51) and secondary cavities (52); the maximum open area of the moving endless surface (40) or the central zone (46) thereof may for example be 70% or less or 60% or less (said central zone being described below).

Alternatively, or in addition, each primary cavity may have a certain maximum depth, which is at least 1 mm (as described below) and each secondary cavities (52) may have a certain maximum depth, being at least 1 mm, and the total volume of all said primary cavities (51) to the total volume of all said secondary cavities (52) is for example from 50:1 to 1:10, or for example from 30:1 or 20:1 or 10:1 or 5:1 to 1:10 or to 1:5 or 1:3 or to 1:2, or even about 1:1.

The primary and secondary cavities (51, 52) may have any shape, including cubical, rectangular, cylindrical, semi-spherical, conical, or any other shape. In some embodiments herein, the primary and/or secondary cavities are cylindrical. The primary cavities (51) or secondary cavities (52), or both, may be present as identical cavities, or they may vary in dimension(s) or shape.

The primary cavities (51) and/or secondary cavities (52) may have any dimension; in general, each cavity has a maximum depth (in Z-direction; measured from the outer surface of the moving endless surface to the lowest point on the surface that receives the solid material) of at least 1 mm, or for example at least 1.5 mm or at least 2 mm, for example up to 20 mm, or up to 15 mm, or in some embodiment herein, up to 10 mm, or to 5 mm or to 4 mm. Each primary and secondary cavity has a base surface area, which may for example be flat, or curved, or conical shaped, upon which the solid material is deposited, and that comprises said maximum depth point. The depth of the cavities may be uniform per cavity and then the maximum depth equals the depth of the cavity as a whole. In some embodiments, this base surface area of the cavities is substantially flat.

The base surface may for example be partially open to allow gas transfer but not solid material transfer. In some embodiments, the base surface area of the cavities may be open, but adjacent (e.g. overlaid/ superposed by) a screen (43) described herein after, onto which the solid material is received; such a screen may be is gas-permeable but substantially non-permeable for solid material, as for example shown in Figure 4a.

Each primary cavity (51) may have the same (max.) depth; each secondary cavity (52) may have the same (max.) depth; the primary and secondary cavities (51, 52) may have the same (max.) depth. In some embodiment, the primary cavities (51) have a maximum depth that is greater than the maximum depth of the secondary cavities (52).

The distance in MD between the centre point of a primary cavity or of a secondary cavity (said centre point being in the plane of the outer surface of the moving endless surface (40)) and the centre point of a neighboring closest cavity (which may a primary or secondary cavity) may for example be 1 mm or more, or 2 mm or more, and/or for example up to 20 mm or up to 15 mm or up to 10 mm (e.g. between cavities in a line of cavities, extending in MD). This may apply to all such distances between neighboring cavities in MD, or this may be an average over all such distances.

The distance in CD between the centre point of a primary or secondary cavity (said centre point being in the plane of the outer surface of the moving endless surface (40)) and the centre point of a neighboring closest cavity (primary or secondary) may for example be 1 mm or more, or 2 mm or more, and/or for example up to 20 mm or up to 15 mm or up to 10 mm; (in a row of primary

cavities (51), this distance is thus between neighboring primary cavities (51); and in a row of secondary cavities, this is between neighboring secondary cavities (52).

These CD and MD distances may vary over the surface or may be uniform. Furthermore, the CD distance between primary cavities (51) of a row of primary cavities may be different to the CD distance between secondary cavities (52) of a row of secondary cavities.

In one embodiment, the MD dimension of a primary cavity may be (on average over all primary cavities and/ or for each primary cavity; measured over the outer surface of the moving endless surface (40)) at least 1 mm, or at least 2 mm, or at least 4 mm, and for example at the most 20 mm or at the most 15 mm; and equally for the secondary cavities (52).

The CD dimension may be within the same ranges as above, or it may even be the same as the MD dimensions for one or more or each cavity. In some embodiments herein, the primary and/or secondary cavities (52) are cylindrical and the MD/CD dimension is then the diameter of the cavities.

The secondary cavities (52) or part thereof may be in the form of channels, extending in CD. Then, the CD-dimension is significantly more (e.g. at least 2 times, or at least 4 times) than the MD dimension of said channel.

According to some embodiments herein, the primary and/ or secondary cavities are cylindrical, each having a diameter (MD/CD dimension) of from 2 to 8 mm or from 3 mm to 7 mm; and the primary and/or secondary cavities may have a maximum depth and/ or average maximum depth of for example from 1.5 mm to 4 mm, or to 3 mm.

The primary (51) and/or secondary cavities (52) may be present as a pattern, for example of a multitude (e.g. 3 or more) of rows of a two or more, for example 3 or more or 4 or more, primary cavities (51) and a multitude (e.g. 3 or more) of rows of one or more (e.g. 3 or more, or 4 or more) secondary cavities ("row" when used herein being a row extending in CD). For example, the moving surface may have a multitude of CD-extending channel-shaped cavities, and/or, n some embodiments, a multitude of rows of a multitude of cavities, e.g. conical or cylindrical-shaped cavities

For example, at least 10 or at least 15 rows of primary cavities (51) may be present and/ or at least 10 or at least 15 or at least 20 CD-extending rows of secondary cavity (s) may be present

The primary cavities (51) and secondary cavities (52) or part thereof, may be present as a one or more, generally at least 3 or at least 4 lines (in MD) formed by a primary and secondary cavities. For example, at least 3 or at least 4 or at least 5 MD-extending lines of primary cavities (51) and/ or lines of secondary cavities (52) may be present on said surface.

The moving endless surface (40) may comprise a pattern of alternating rows, i.e. a row of primary cavities (51) followed by a row of secondary cavities (52), etc. In some embodiments herein, at least 30% or at least 50% or at least 60% of said rows of said primary cavities (51) and of said rows of said secondary cavities (52) are alternating primary cavities row and secondary cavities rows.

The alternating pattern may be the pattern over the whole moving endless surface (40), or the central zone (46) thereof, or over only a part thereof, or only over a part of said central zone (46). For example, the moving endless surface (40) may have one or more areas comprising a multitude of rows of secondary cavities (52), but not comprising any primary cavities (51) ("secondary cavities row zones"). This may correspond to the areas of the resulting web of structures produced by the apparatus (1) and method herein that is to be cut to separate the web into individual structures. For example, in some embodiment herein, the apparatus (1) and method herein serves to produce a series of articles, e.g. absorbent cores that are not continuous. Then, the areas where no primary cavities (51) are present correspond to the areas between produced articles, to form the discontinuity between two articles. For example, when absorbent cores are produced with the method or apparatus (1) herein, comprising said solid absorbent material transferred and released to a substrate, e.g. nonwoven, then these areas may correspond to the areas of the nonwoven between absorbent structures (cores), where the nonwoven may be cut, to form individual structures (cores). This is for example shown in Figures 5, 6a and 6b.

In some embodiments, at least 10% or at least 20%, but for example up to 40% or up to 30% of said rows of secondary cavities are not alternating, e.g. for example those present in said "secondary cavities row zones".

The primary cavities (51) are connected/ connectable to a vacuum system (71B) of said transferring zone (B). The secondary cavities (52) are not connected/ connectable to a vacuum system (71B) in said transferring zone (B).

The secondary cavities (52) are connected / connectable to a solid material removal means (60) of said transferring zone (B); this may comprise a gas (e.g. air)-inlet system, that allows a gas (air) to enter through the secondary cavities (52), to blow the second portion of the solid material (100b) from said secondary cavities (52), to remove it from the moving endless surface (40), as shown in Figures 1 and 4. The removal mans (60) may thereto comprise a collecting vessel to collect the solid material (100b) thus removed, e.g., blown from the secondary cavities (52), as for example shown in Figure 1.

In some embodiments, no vacuum (system) is present or applied, e.g. no vacuum chamber is present, in said releasing zone (C). In the releasing zone (C), it may be useful to apply positive gas (air) pressure, e.g.by means of introducing/blowing a gas (air), onto said solid material, via said cavities, or part thereof. Thus, in some embodiments herein, the releasing zone (C), if present, comprises a gas-inlet system/ gas (air) chamber, connectable to said primary cavities, to enable or improve release of said first portion of said solid material (100a) from said primary cavities (51), for example onto a further moving surface (substrate). The secondary cavities may also be connected to a or said gas inlet system, in order to further remove solid material of said secondary cavities (52).

The primary and secondary cavities have each a base surface area to receive the solid material on; this may be partially open, allowing gas transfer (permeability), for vacuum suction/ air inlet, but not solid material transfer (permeability) there through; in some embodiment herein the base surface areas of the primary and secondary cavities may be substantially or completely open, but superposed/ overlaid by said screen (43), (that allows gas transfer but not solid material transfer; e.g. a mesh screen), and thus substantially closed by said screen (43). In some embodiments the cavities may comprise a substrate material, e.g. web material, and the solid material is received thereon, and in the releasing zone, the solid material and substrate material is released from said moving endless surface.

The vacuum may be provided by any known vacuum system, connectable to a moving surface. The vacuum system (71B,71A)) comprises typically stationary component. In some embodiment, the method and/or apparatus (1) involves a cylindrical drum or roll, with said rotating, cylindrical moving endless surface (40) and enclosed therein one or more vacuum chambers (71A, 71B). The chambers 71A and 71B may be a single unitary chamber, but in some embodiment herein, they are separate chambers. In some embodiment, the transferring zone (B)

has a first vacuum chamber (B) and said receiving zone a second vacuum chamber (A), e.g. so that different vacuum levels can be applied in said different zones. Each chamber has typically an inlet, for connection to an external (e.g. not adjacent the moving surface, and/ or not inside the drum) vacuum source, for vacuum suction.

In some embodiments herein, the primary and secondary cavities (52) are connectable/ connected to a vacuum system (71A) of said receiving zone. Hereto, the apparatus (1) or method may employ a vacuum chamber adjacent the moving surface in the transferring zone (B), chamber 71B, for example positioned adjacent the central zone (46), and in said receiving zone, chamber 71A, for example positioned under the central zone and optionally under the lateral edge zone9s) (45 a, 45b); the apparatus (1) or method may employ an gas-inlet system in said transferring zone (B), e.g. being part of the removal means (60), and/or said releasing zone (C), e.g. a gas-inlet chamber C, for example positioned adjacent the edge zone(s) 45 a, 45b). The vacuum may be of any vacuum pressure such as for example at least 10 kPa, or at least 20 kPa.

In some embodiments, the vacuum applied in the receiving zone is different to, for example less than, the vacuum applied in the transferring zone (B).

As for example shown in Figures 5, 6 and 6A, each primary cavities (51) may be connectable/ connected to said vacuum system (71B,or optionally 71A) via primary openings (53) in said moving surface, for example present in the inner shell (42) of said moving surface, so that thus said primary openings form the connection between the primary cavities (51) and the vacuum system (71B; optionally 71A). Hereto, the moving surface may for example have an outer shell (41) comprising said primary cavities (51) and an inner shell (42) comprising said primary openings. In some embodiment, said primary openings are through-openings, through said inner shell (42) of said moving surface; however, alternative connections of the cavities to the vacuum system (71B) by use of said openings are envisaged herein. In some embodiment, the secondary cavities (52) may be connectable / connected to said vacuum system (71A) of said receiving zone (but not in said transferring zone (B)), and/or connectable/ connected to a gas-inlet system (60;72b) of said transferring zone (B), via secondary openings (54 a, 54b) in said moving surface, e.g. in said inner shell (42) thereof, that form the connection between the secondary cavities (52) and a vacuum system (71B)/ gas-inlet system (60; 72b). Hereto, the moving surface may have an outer shell (41) comprising said secondary cavities (52) and an inner shell (42)

comprising said secondary openings (54 a, 54b). Thus, the base surface area of each of the cavities may thereto be connected to the top surface area of an opening.

Some or all of the primary cavities (51) may be connected/ connectable to said vacuum system (71B; optionally 71A) or gas-inlet system by connecting each primary cavity to a single primary opening, or alternatively a 2 or more, or a multitude, of primary cavities (51) are connected to a shared primary opening. Alternatively, or in addition, some or all of the secondary cavities (52) may be connectable/ connected to said vacuum system (71A) of the receiving zone (A) by connecting each secondary cavity to a single secondary opening, or alternatively 2 or more, or a multitude of, secondary cavities (52) are connected to a shared secondary opening.

The primary openings (53) and secondary openings (54), or first part thereof (54a) may for example have shape/dimensions/open area (ratio's)/positioning (e.g. rows) as described above for the primary and/or secondary cavities; the primary cavities may for example have the same dimensions/positioning/shape as the primary openings; and/or the secondary cavities may have the same dimensions as the secondary openings, or first part thereof.

As mentioned above, a screen (43) may be placed adjacent the cavities, for example between said inner shell (42) and outer shell (41), so that the screen is present between said cavities and said openings. Said screen may be a material, that allows a gas to pass, but substantially no solid material, for example a mesh screen with a mesh opening size of less than 100 microns, or less than 50 microns or less than 20 microns, or less than 10 microns. In some embodiment, the base surface of some or all of said primary cavities (51) is formed by said screen. In some embodiment, the top surface of some or all of said primary openings is formed by that screen.

In some embodiments, and as for example shown in Figures 1, 4, 4a, 5, 6a and 6b, said moving surface (40) has an outer shell (41), comprising said primary and secondary cavities and an inner shell (42) comprising a multitude of primary openings (53) and a multitude of secondary openings (54 a, b), and each of said primary cavities (51) is connected to a (e.g. different) primary opening (53), and via said openings connectable to said vacuum system (71B); and each of said secondary cavities (52) is connected to a (e.g. different) secondary opening, or for example to a first part of said secondary openings (54 a), connectable (optionally via a second part (54b) of said secondary openings (54 a, 54b)- see below) to: a vacuum system (71A) (e.g. when moving through or in said receiving zone); and/or to gas (air) inlet system (e.g. when

moving through or in said transferring zone (B)); said moving surface for example comprising a screen (43) positioned between said outer shell (41) and said inner shell (42).

As for example as shown in Figures 4, 4a, Figure 6a and 6b, said inner shell (42) may have a first outer layer (42a) and a second inner layer (42b). In some embodiments herein, said moving endless surface (40) is a rotating cylindrical drum (or roll), having thus a rotating cylindrical inner shell (42) and rotating cylindrical outer shell (41),that are connected and typically joined to one another.

The first part of said secondary openings (54 a)),or all said secondary openings (and said primary openings) may be present in said first outer layer (42 a) of said inner shell (42), but whereby said first part of said secondary openings are not present in said second inner layer (42b) of said inner shell (42), whilst said second part of said secondary openings and said primary openings are present in said second inner layer (42b) of the inner shell (42), to be connectable to said vacuum and/or gas-inlet system. In some embodiments herein, and as for example as shown in Figures 4, 4a, Figure 6a and 6b, said first part of said secondary openings (54 a) or all of said secondary openings (54 a,54b) is (are) present in said first outer layer (42 a) of said inner shell (42) and said second part (54b) of said secondary openings is present in said inner layer (42 b) of said inner shell (42), and each secondary cavities (52) is connected to a secondary opening of said first part of said secondary openings (54a), which is then further connected to a secondary opening of said second part of said secondary openings (54b), which is then connectable to said removal means (60) in the transferring zone (B) and optionally to said vacuum system (71A) in the receiving zone.

As set out above, the moving endless surface (40) may have a first and optionally a second lateral edge zones (45a, 45b) (each extending in MD) on one or either side of a central zone (46) (extending in MD), and then, said first part (54a) of said secondary openings may be present in said central zone (46) and in connected to (and for example in contact with) said secondary cavities (52) in said central zone(46), and said second part of said secondary openings (54b) may be present in one or both lateral edge zones, said lateral edge zones being for example also free of said primary cavities (51) and/or free of primary openings, and optionally free of secondary cavities (52).

Thus, in some embodiments herein, and for example shown in Figures 5,6a and 6b, said primary cavities (51) and said secondary cavities (52) are present only in said central zone (46), said

primary openings (53) are present only in said central zone (46), and said secondary openings of said first part of said secondary openings (54a) are present only in said central zone (46), and whereby said secondary openings of said second part of said secondary openings (54b) are present only in one or both lateral edge zones (45a, 45b), and whereby each of said secondary openings of said first part of the secondary openings (54a) is connected to a secondary opening of said second part of said secondary openings (54b), which is connectable to said removal means (60) in the transferring zone (B), but not connectable to said vacuum system (71B) in said transferring zone (B), and that is optionally connectable to said vacuum system (71A) in the receiving zone. For example the secondary opening(s) of said first part of secondary openings (54a) are positioned in a row ((56); in CD) or multitude of rows in said central zone (46), and that each of said openings 54(a) is connected to one or more secondary cavities of said second part (54b) that is positioned in the same CD row (56), but in the lateral edge zone(s) (and not in the central zone (46)), as shown for example in the Figures 6a and 6b.

It should be understood that said secondary openings (54 or 54a), but also or alternatively said primary opening (53), may alternatively be CD-extending channel(s) in said inner shell (42) (not shown in the Figures).

The gas (e.g. air) inlet system, (e.g. forming part of removal means (60) herein, and/or present in said releasing zone (C), and having for example an gas inlet (72b)) of the apparatus (1) and method herein may be any system suitable to introduce/ blow a gas with an adjustable/ controlled pressure through a multitude of (primary and secondary) openings/ cavities. In some embodiments, the apparatus (1) has an air chamber in close proximity or adjacent to the moving surface, e.g. adjacent the inner layer (42a) thereof, in said releasing zone (C), and optionally in said lateral edge zones of the transferring zone (B).

In some embodiments herein, said gas (air) is blown through said primary openings (53) and cavities when moving through said releasing zone (C), but substantially not through said secondary cavities (52) and secondary openings. Then, the gas (air) chamber may be present only in the central zone (46) of said releasing zone (C), and not in said lateral edge zones.

Thus, as shown in Figure 3 for example, the vacuum chamber in the transfer zone (71B) may be adjacent only the central zone (46) of the moving endless surface (40) or inner layer thereof; the vacuum chamber in the receiving zone (71A) may be adjacent the central zone (46) and edge zones (45 a, b) of the moving endless surface (40) or inner layer thereof; the gas-inlet chamber

(s) (60a, b) in the transfer zone (71B) may be adjacent only the edge zone or zones (45 a, b) of the moving endless surface (40) or inner layer thereof; the gas-inlet chamber (71C) in the releasing zone may be adjacent only the central zone (46) of the moving endless surface (40) or inner layer thereof; or alternatively adjacent eh central and edge zone(s).

In some embodiments herein, said apparatus (1) and/or method herein may comprise one or more further zones or method steps, respectively, for cleaning the cavities and/ or said screen when present. This zone(s) or step(s) may follow the release step/ zone (C), if present. For the optional cleaning zone (D, optionally E) or step, the apparatus may have a gas-inlet system/ chamber or the method may have a gas (air) blowing step, of blowing a gas (air) through some or all (typically all) of the primary, and/or secondary cavities e.g. via said primary and/or secondary openings, or part thereof, using a gas-inlet connection (72b). For example, a gas (air) may be blown through said primary openings (53) and said secondary openings, or the second part thereof, and then through the optional screen and through said cavities. This ensures that any residual solid material is removed from the cavities and/or from the optional screen, or from the moving surface as a whole (prior to receiving solid material in the next cycle of the apparatus (1)/ method.

This may have a higher pressure than the gas (air) used in the releasing zone (C) / release step, if present.

The apparatus may comprise additional components or units, as for example describe below; the method may comprise additional method steps, as for example describe below; one advantageous step would be to recycle the second portion of the solid material (100b) back into the receiving zone/ step (A), e.g. to the hopper, with said removal means and additional recycling steps/components. The apparatus/method may in addition comprise a scraper blade or doctor blade to remove excess solid material from the moving endless surface (40) in the receiving zone/ step.

Another advantageous additional apparatus component/method step, is the use of a3-D plate (10) that guides the solid material into the cavities during the receiving step (A) and/or that keeps the first portion of the solid material (100A) in the primary cavities during transfer in transfer zone (B).

The solid material (100a) may be transferred by the moving endless surface (40) to a further process step, to a further apparatus component or unit, or to a further moving surface or substrate; it may be transferred to for example a second moving (e.g. endless) surface (80). The solid material (100a) transfers for example from the moving endless surface (40) (i.e. the primary cavities (51) thereof) to said further surface (e.g. substrate) (80) in the releasing zone (C). The further surface (80) may be for example a belt or drum, or this may for example be a moving substrate, such as a film (e.g. film web) or such as, in some embodiments herein, a nonwoven (e.g. nonwoven web). It may for example be a substrate carried on a moving endless surface (80) such as a belt or a drum. In one embodiment herein, the further moving endless surface (80) is a substrate carried on moving endless support, such as a roll, drum or belt. This support may comprise vacuum means and openings, through which the vacuum can be applied to said substrate, to retain the substrate on said support. The substrate/ surface may have the same surface speed as the first moving endless surface (40), or it may have a different speed. In one embodiment, it has a speed of at least 1000 part per minute and/ or a speed of at least 4.5 m/s, or at least 6 m/s, or at least 8 m/s.

In one embodiment, the moving endless surface (40) moves, e.g. rotates and the further surface (80) is for example placed positioned substantially under the first moving endless surface (40) so that the solid material (100a) can be released to said surface/ substrate to by gravity. The releasing zone C may thus be at or around the parallel to the line of gravity, or under an angel therewith from 60° to -60°, or from 30° to -30°.

In one embodiment, the further moving endless surface (80) comprises a web of a substrate with another component, such as another or further solid material (100); and/or such as an adhesive, e.g. in order to, at least partially, adhere the solid material (80) to the substrate. In order to better allow vacuum to be applied on the substrate with adhesive, the adhesive may be applied in a pattern, whereby parts of the substrate do not comprise adhesive and parts of the substrate do comprises adhesive. The pattern may correspond to the pattern of the primary cavities (51) of the moving endless surface (40).

After transfer of the material (100a) to the moving substrate/ surface (80), said surface/substrate may move the solid material (100a) to further additional method step(s) or apparatus unit(s), to apply further materials to the solid material (100a) and/ or the substrate. This may include one or further adhesive(s), for example applied by a further (downstream) adhesive unit, and/ or a

further substrate, applied for example by a further (downstream) substrate application unit, e.g. a rotating support carrying a further substrate, and/or a cutting unit etc.

In one embodiment, the substrate with said solid material (100a) moves to a unit that applies an adhesive material, and/ or a thermoplastic material and/ or an adhesive thermoplastic material, for example in fibrous form, to cover the solid material (100a), or part thereof. In another or additional embodiment, the substrate with solid material moves to a unit that applies a further substrate onto the material (100a), or optionally onto said adhesive and/ or thermoplastic and/ or thermoplastic adhesive material.

Said further substrate may comprise adhesive on the side that contacts the solid material (100a) (or optionally said thermoplastic and/ or adhesive and/ or thermoplastic adhesive material), to better adhere said substrate to said solid material (100a). In one embodiment, the substrate with solid material (e.g. as a layer) is moved to a further unit, where a second substrate with solid material (100a) (e.g. as a layer), e.g. made by an apparatus (1) of the invention in the manner described herein, is superposed thereon, for example such that substrate and further substrate sandwich said solid material (100a), e.g. said two solid material "layers". In one embodiment, the substrate with solid material made with an apparatus (1) of the invention and/or the method of the invention, is moved to a further apparatus (1) or method of the invention, that transfers further solid material (100a) onto said substrate with solid material (optionally onto said thermoplastic and/ or adhesive and/ or thermoplastic adhesive material).

The resulting substrate with solid material may thus be a web of articles (absorbent core or precursors thereof) herein (optionally combined with any of the further materials described above) and it may then move to a cutting unit, that cuts the substrate with solid material into individual articles, e.g. absorbent cores for absorbent articles, or precursors therefore. Such absorbent cores or partial absorbent articles may then be combined with further absorbent article components, described herein below, to form a final absorbent article.

The substrate may be joined to itself to or to an additional substrate (e.g. coversheet) by any means, for example by ultrasonic bonding, thermo-bonding or adhesive-bonding, e.g. for example sprayed adhesive bonding. The bonding region between the coversheet and the substrate, or may for example be at least 1 %, or at least 2 %, or for example at least 5%, but for example not more than 50 % or no more than 30% of the surface area of the substrate. Suitably, the bonding region comprises essentially no solid material (100a).

As mentioned above, an adhesive, and/ or thermoplastic or thermoplastic adhesive material may serve to at least partially cover and at least partially immobilize the solid, e.g. particulate, material (100a, for example an adhesive and/ or thermoplastic or thermoplastic adhesive material in fibrous form, e.g. fibrous layer which is at least partially in contact with the solid material (100a) and optionally partially in contact with the substrate. The thermoplastic material may be a hot melt adhesive material. In accordance with certain embodiments, the thermoplastic (adhesive) material may comprise a single thermoplastic polymer or a blend of thermoplastic polymers, having for example a softening point, as determined by the ASTM Method D-36-95 "Ring and Ball", in the range between 50 °C and 300 °C, or alternatively the thermoplastic adhesive material may be a hot melt adhesive comprising at least one thermoplastic polymer in combination with other thermoplastic diluents such as tackifying resins, plasticizers and additives such as antioxidants. The thermoplastic polymer may have a molecular weight (Mw) of more than 10,000 and a glass transition temperature (Tg) usually below room temperature or -6 °C > Tg < 16°C. In certain embodiments, typical concentrations of the polymer in a hot melt are in the range of about 20 to about 40% by weight. In certain embodiments, thermoplastic polymers may be water insensitive. Exemplary polymers are (styrenic) block copolymers including A-B-A triblock structures, A-B diblock structures and (A-B)n radial block copolymer structures wherein the A blocks are non-elastomeric polymer blocks, typically comprising polystyrene, and the B blocks are unsaturated conjugated diene or (partly) hydrogenated versions of such. The B block is typically isoprene, butadiene, ethylene/butylene (hydrogenated butadiene), ethylene/propylene (hydrogenated isoprene), and mixtures thereof. Other suitable thermoplastic polymers that may be employed are metallocene polyolefins, which are ethylene polymers prepared using single-site or metallocene catalysts. Therein, at least one comonomer can be polymerized with ethylene to make a copolymer, terpolymer or higher order polymer. Also applicable are amorphous polyolefins or amorphous polyalphaolefins (APAO) which are homopolymers, copolymers or terpolymers of C2 to C8 alpha olefins. In exemplary embodiments, the tackifying resin has typically a Mw below 5,000 and a Tg usually above room temperature, typical concentrations of the resin in a hot melt are in the range of about 30 to about 60%, and the plasticizer has a low Mw of typically less than 1,000 and a Tg below room temperature, with a typical concentration of about 0 to about 15%.

In certain embodiments, the thermoplastic (adhesive) material may be in the form of fibers of an average thickness of about 1 to about 50 micrometers or about 1 to about 35 micrometers and an average length of about 5 mm to about 50 mm or about 5mm to about 30 mm.

The cover layer may comprise the same material as the substrate, or may comprise a different material. In certain embodiments, suitable materials for the cover layer are the non-woven materials, useful for the substrate.

Methods of the invention

The present invention also relates to a method employing the steps, apparatus (1) or components thereof, described above.

Some embodiments of the invention, thus relates to a method for receiving, transferring and releasing solid material (100) using the apparatus (1) as described herein.

Alternatively, or in addition, the invention relates to a method for receiving with a moving endless surface (40) solid material (100) form a feeder, transferring said solid material with said moving surface and optionally releasing said solid material from said moving surface, e.g. to a further moving surface (80), said method comprising the step of:

f) receiving a first portion (100a) of said solid material in primary cavities (51) of said moving endless surface, and a second portion (100b) of said solid material in secondary cavities (52) of said moving endless surface;

g) optionally applying during said step a) a vacuum onto said primary and secondary cavities;

h) moving the moving endless surface towards a further moving surface, whilst applying a vacuum onto only said primary cavities (51) and said first portion (100a) of said solid material therein, and not onto said secondary cavities and said second portion (100b) of solid material therein, thereby transferring said first portion (100a) of said solid material in said primary cavities (51), to said further moving surface, and not said second portion (100b) of said solid material, preferably said method step c) comprising the step of removing said second portion (100b) of said solid material from said secondary cavities(51) with a removal means (60);

i) optionally releasing said first portion (100a) of said solid material, for example to said further moving surface (80), by applying positive air pressure onto said primary cavities (51) and said first portion of said solid material (100a) therein.

Thus, any of the above described features of the apparatus (1) and functions and method steps described herein apply the method of the invention.

The method and apparatus (1) herein may produce for example at least 800 parts per minute (ppm) or at least 1000 ppm, or at least 1100 ppm or at least 1200 ppm; said "parts" being the individual structures described herein, e.g. for example tablets, pouches, capsules, absorbent structures (cores) etc.

Said moving endless surface (40) may have for example a surface speed of at least 2.0 m/s, or at least 3 m/ s or at least 4.5 m/s, or at least 6.0 m/s, or at least 7.0 m/s, or at least 7m/s. Alternatively, or in addition, the first surface area may have a speed defined by parts per minute, of for example at least 800 parts per minute, or at least 1000 parts per minute.

The method herein may be useful to make individual articles, such as capsules with solid material(100), tablets with said solid material (100)l, pouches with solid material (100); it may be particularly useful to make absorbent cores (including: a web thereof that may then be divided, e.g. cut, into individual absorbent cores), whereby said solid material (100) is an solid absorbent material, e.g. for example particulate AGM, for example with a mass median particle size of from 150 to 1000 microns, or from 200 or 300 to 700 microns.

The method may employ the step to add a thermoplastic material, and/ or adhesive material and/ or thermoplastic adhesive material to said substrate (110) prior to transfer of said solid material (100) and/ or to the said solid material (100) and/ or substrate (110) after said transfer, and / or the step to add further substrate (s) or covering sheet(s) and/or to fold the substrate (110) and close the substrate (110) over said solid material (100) and/ or the step to add a further substrate with solid material (100) as described above.

The absorbent cores producible with the apparatus /method herein are typically for acquisition and/or storage of liquids (such as urine, blood) for absorbent articles, or precursors thereof, or partial absorbent articles.

"Absorbent article" refers to devices that can absorb and contain body exudates, and, more specifically, refers to devices that are placed against or in proximity to the body of the wearer to absorb and contain the various exudates discharged from the body. Absorbent articles may include diapers, including fastenable diapers and (refastenable) training pants; adult incontinence undergarments (pads, diapers) feminine hygiene products (sanitary napkins, panty-liners), breast pads, care mats, bibs, wound dressing products, and the like. "Diaper" refers to an absorbent article generally worn by infants and incontinent persons about the lower torso so as to encircle the waist and legs of the wearer and that is specifically adapted to receive and contain urinary and fecal matter. As used herein, the term "body fluids" or "body exudates" includes, but is not limited to, urine, blood, vaginal discharges, breast milk, sweat and fecal matter.

The absorbent core is typically sandwiched between at least a backsheet and a topsheet. Absorbent articles herein may comprise a topsheet, facing the wearer in use, for example a nonwoven sheet, and/ or an apertured sheet, including apertured formed films, as known in the art, and a backsheet, an absorbent core, having optionally a core coversheet facing the wearer in use. The backsheet may be liquid impervious, as known in the art. In some embodiments, the liquid impervious backsheet comprises a thin plastic film such as a thermoplastic film having a thickness of about 0.01 mm to about 0.05 mm. Suitable backsheet materials comprise typically breathable material, which permit vapors to escape from the diaper while still preventing exudates from passing through the backsheet. Suitable backsheet films include those manufactured by Tredegar Industries Inc. of Terre Haute, IN and sold under the trade names X15306, X10962 and X10964. The backsheet, or any portion thereof, may be elastically extendable in one or more directions. The backsheet may be attached or joined to a topsheet, the absorbent core, or any other element of the diaper by any attachment means known in the art.

The absorbent core, and optionally the absorbent article, may be "substantially cellulose free which means herein that it contains less than 10% by weight cellulosic fibers, or less than 5% cellulosic fibers, or less than 1% cellulosic fibers, or no cellulosic fibers.

In certain embodiments, the absorbent core herein may comprise an absorbent core content (so excluding the substrate or core cover or core wrap) of said particulate absorbent (polymeric) material (AGM) and a further material, such as the thermoplastic adhesive material; the weight ratio of the AGM to the further material may be at least 2:1, and of example up to 200:1, or for example at least 5:1 or at least 10:1 or at least 20:1.

Diapers herein may comprise leg cuffs and / or barrier cuffs; the article then typically has a pair of opposing side flaps and/ or leg and/ or barrier cuffs, each of a pair being positioned adjacent one longitudinal side of the absorbent core, and extending longitudinally along said core, and typically being mirror images of one another in the Y-axis (in MD) of the article; if leg cuffs and barrier cuffs are present, then each leg cuffs is typically positioned outwardly from a barrier cuff. The cuffs may be extending longitudinally along at least 70% of the length of the article. The cuff(s) may have a free longitudinal edge that can be positioned out of the X-Y plane (longitudinal/ transverse directions) of the article, i.e. in z-direction. The side flaps or cuffs of a pair may be mirror images of one another in the Y-axis (longitudinal axis; MD axis) of the article. The cuffs may comprise elastic material.

The diapers herein may comprise a waistband, or for example a front waistband and back waist band, which may comprise elastic material.

The diaper may comprise side panels, or so-called ear panels. The diaper may comprise fastening means, to fasten the front and back, e.g. the front and back waistband. Exemplary fastening systems comprise fastening tabs and landing zones, wherein the fastening tabs are attached or joined to the back region of the diaper and the landing zones are part of the front region of the diaper.

The absorbent article may also include a sub-layer disposed between the topsheet and the absorbent core, capable of accepting, and distributing and/ or immobilizing bodily exudates. Suitable sublayers include acquisition layers, surge layers and or fecal material storage layers, as known in the art.

The absorbent article herein may comprise in addition one or more side flaps or cuffs. The topsheet or cuffs or side flaps may comprise a skin care composition or lotion or powder, known in the art, panels, including those described in U.S. 5,607,760; U.S. 5,609,587; U.S. 5,635,191; U.S. 5,643,588.

The (absorbent) core formed herein comprises in one embodiment a substrate with said solid material, whereby said substrate (110) is C-folded to enclose said solid material (100). In other words, the solid material (100) may be deposited unto the substrate (110) and the substrate (110) may then be folded to cover the solid material (100). Alternatively, or in addition, a separate sheet material, or cover sheet, may be placed over the solid material (100) after it is deposited

onto said substrate (110), to cover the solid material (100). Such a coversheet may be any of the material described herein above as substrate (110) material, e.g. a nonwoven sheet or web.

Alternatively, or in addition, two or more of the substrates with solid material deposited thereon may be produced and placed onto one another, to cover one another. Hereby, an additional coversheet may be placed first onto the solid material (100) on said substrate, and then a further substrate with solid material (may be placed thereon, typically such that said latter solid material (100) contacts said coversheet.

Document referred to herein are hereby incorporated by reference. The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as “40 mm” is intended to mean “about 40 mm”.

CLAIMS

What is claimed is:

1. An apparatus (1) having a receiving zone (A) for receiving solid material (100), a transferring zone (B) for transferring a first portion of said solid material (100a) and optionally a releasing zone (C) for releasing said first portion of said solid material (100a); and said apparatus comprising:

   - a moving endless surface (40), moving through said receiving zone (A), transferring zone and releasing zone of said apparatus and said moving endless surface comprising an outer shell (41) with a multitude of primary cavities (51) for receiving a first portion of said solid material (100a) and with a multitude of secondary cavities (52) for receiving a second portion of said solid material (100b);

   - a vacuum system (71B) in said transferring zone (B) for retention of said first portion of solid material (100a) during transfer, whereby said primary cavities (51) are connectable to said vacuum system (71B) of said transferring zone, and said secondary cavities (52) are not connectable to said vacuum system (71B) of said transferring zone, and;

   - a removal means (60) in said transferring zone for removing in the transferring zone the second portion of said solid material (100b) from said secondary cavities.

2. An apparatus (1) as in claim 1, whereby each primary cavity defines an open surface area and each secondary cavity defines an open surface area, and the ratio of the total open surface area of the primary cavities (51) to the total open surface area of the secondary cavities (52) is from 50:1 to 1:10.

3. An apparatus (1) as in claim 1, whereby each primary cavities (51) has a maximum depth, this being at least 1 mm and each secondary cavities (52) has a maximum cavity depth, this being at least 1 mm, and the total volume of said primary cavities to the total volume of the secondary cavities is from 50:1 to 1:10.

4. An apparatus (1) as in any preceding claim, whereby said receiving zone has a vacuum system (71A) and said primary cavities (51) and said secondary cavities are connectable to said vacuum system (71A) of said receiving zone (A).

5. An apparatus (1) as in any preceding claim, whereby aid removal means (60) comprises a gas-inlet system, and whereby the secondary cavities (52) each have a base surface area and whereby in said transferring zone B, or part thereof, said base surface area of the secondary cavities (52), or part thereof, are connectable to said gas-inlet system, which blows a gas through said base surface areas and through said cavities (52), to remove said second part (100b) of said solid material from said secondary cavities.

6. An apparatus (1) as in any preceding claim, whereby said moving endless surface (40) has an outer shell (41), comprising said primary and secondary cavities; and an inner shell (42) comprising a multitude of primary openings (53) and a multitude of secondary openings (54; 54a and 54b), and each of said primary cavities (51) is connected to a primary opening (53), and via said openings connectable to said vacuum system (71B); and each of said secondary cavities (52) is connected to a secondary opening, or a first part thereof (54 a), connectable (optionally via a second part of said secondary openings (54b)) to said removal means (60) in said transferring zone, and optionally to said vacuum system (71A) in said receiving zone; optionally said moving endless surface (40) comprising a screen (43) positioned between said outer shell (41) and said inner shell (42).

7. An apparatus (1) as in claim 6, whereby said inner shell (42) has a first outer layer (42a) and an second inner layer (42b), whereby said first part of said secondary openings (54 a) or all of said secondary openings (54 a, 54b) is present in said first outer layer (42 a) of said inner shell and said second part (54b) of said secondary openings is present in said inner layer (42 b) of said inner shell, and each secondary cavities (52) is connected to a secondary openings of said first part of said secondary openings (54a), which is further connected to a secondary opening of said second part of said secondary openings (54b), which is connectable to said removal means (60) of the transferring zone and optionally to said vacuum system (71A) of the receiving zone (A).

8. An apparatus (1) as in claim 6 or 7, whereby said moving endless surface (40) has a first and second lateral edge zones (45a, 45b) (each extending in MD) and therein between a central zone (46) (extending in MD), whereby said primary cavities (51) and said

secondary cavities (52) are present only in said central zone, and said primary openings (53) are present only in said central zone (46), and said secondary openings of said first part of said secondary openings (54a) are present only in said central zone (46), and whereby said secondary openings of said second part of said secondary openings (54b) are present only in one or both lateral edge zones (45a, 45b), and whereby each of said secondary openings of said first part of the secondary openings (54a) is connected to a secondary opening of said second part of said secondary openings (54b), which is connectable to said removal means (60) of the transferring zone, but not connectable to said vacuum system (71B) of said transferring zone, and that is optionally connectable to said vacuum system (71A) of the receiving zone (A).

9. An apparatus (1) as in any preceding claim, whereby said moving endless surface (40) (moving in MD) comprises said primary cavities (51) and secondary cavities (52) in the form of a pattern of a multitude of rows of primary cavities (51) (each row extending in CD, perpendicular to MD) and a multitude of rows of secondary cavities (52) (each extending in CD, perpendicular to MD); and said moving endless surface (40) comprises said primary openings (53) and secondary openings (54a, 54b), or only said first part thereof (54a), in the form of a pattern of a multitude of rows of primary openings (51) (each row extending in CD, perpendicular to MD) and a multitude of rows of secondary cavities (54a,b), only said first part thereof (54a) (each extending in CD, perpendicular to MD).

10. An apparatus (1) as claim 9, whereby at least 30% of said rows of said primary cavities (51) and at least 30% of said rows of said secondary cavities are alternating primary cavities row and secondary cavities rows, and at least at least 30% of said rows of said primary openings and at least 30% of said rows of said secondary openings (54; 54 a) are alternating primary and secondary openings rows.

11. An apparatus (1) as in any preceding claim, whereby said moving endless surface (40) has one or more areas (extending in MD and CD) comprising a multitude of rows of said secondary cavities and being free of primary cavities (51).

12. An apparatus (1) as in any preceding claim, having a releasing zone (C), comprising a gas-inlet system (72b), for example an air-pressure application means, for applying pressurized air through said primary openings (53) and primary cavities (51) onto said first portion of

said solid material (100a), and optionally through said secondary openings (54 a, b) and through said secondary cavities (52).

13. An apparatus (1) of any preceding claim, whereby said removal means (60) includes means for recycling said second portion of said solid material (100b) to said receiving zone (A) of said apparatus.

14. A method for receiving, transferring and releasing solid material (100) using the apparatus of any of the preceding claim.

15. A method for receiving with a moving endless surface (40) solid material (100) form a feeder, transferring said solid material with said moving endless surface and optionally releasing said solid material, optionally from said moving endless surface to a further moving surface (80), said method comprising the step of:

a) receiving a first portion (100a) of said solid material in primary cavities (51) of said moving endless surface, and a second portion (100b) of said solid material in secondary cavities (52) of said moving endless surface;

b) optionally applying during said step a) a vacuum onto said primary and secondary cavities;

c) moving said moving endless surface (40) to said further moving surface (80), whilst applying a vacuum to said primary cavities and said first portion (100a) of said solid material therein, and not to said secondary cavities (52) and said second portion (100b) of solid material therein, thereby transferring said first portion (100a) of said solid material in said primary cavities (51), to said further moving surface (80), and not said second portion (100b) of said solid material;

d) removing said second portion (100b) of said solid material from said secondary cavities (52) with a removal means (60);

e) optionally releasing said first portion (100a) of said solid material, optionally to a further moving surface (80).

16. A method as in claims 14 and 15.

17. A method as in claim 15 or 16, whereby said method is a continuous method, whereby steps a) to e) form a method-steps-cycle that is continuously repeated, and whereby in step d) of a cycle the removed second portion (100b) of said solid material is recycled to step a) of a subsequent cycle.

18. A method as in claim 17, whereby from 10% to up to 60% of the total amount of said solid material is said second portion (100b).

19. A method as in any of claim 14 to 17, whereby said moving endless surface (40) has a surface speed of at least at least 1000 part per minute and/ or a surface speed of at least 4.5 m/s, or at least 6 m/s, or at least 8 m/s.

20. A method as in any of claims 14 to 19, whereby said solid material comprises particles, and said particles have a mass medium particle size between 100 and 1000 microns.

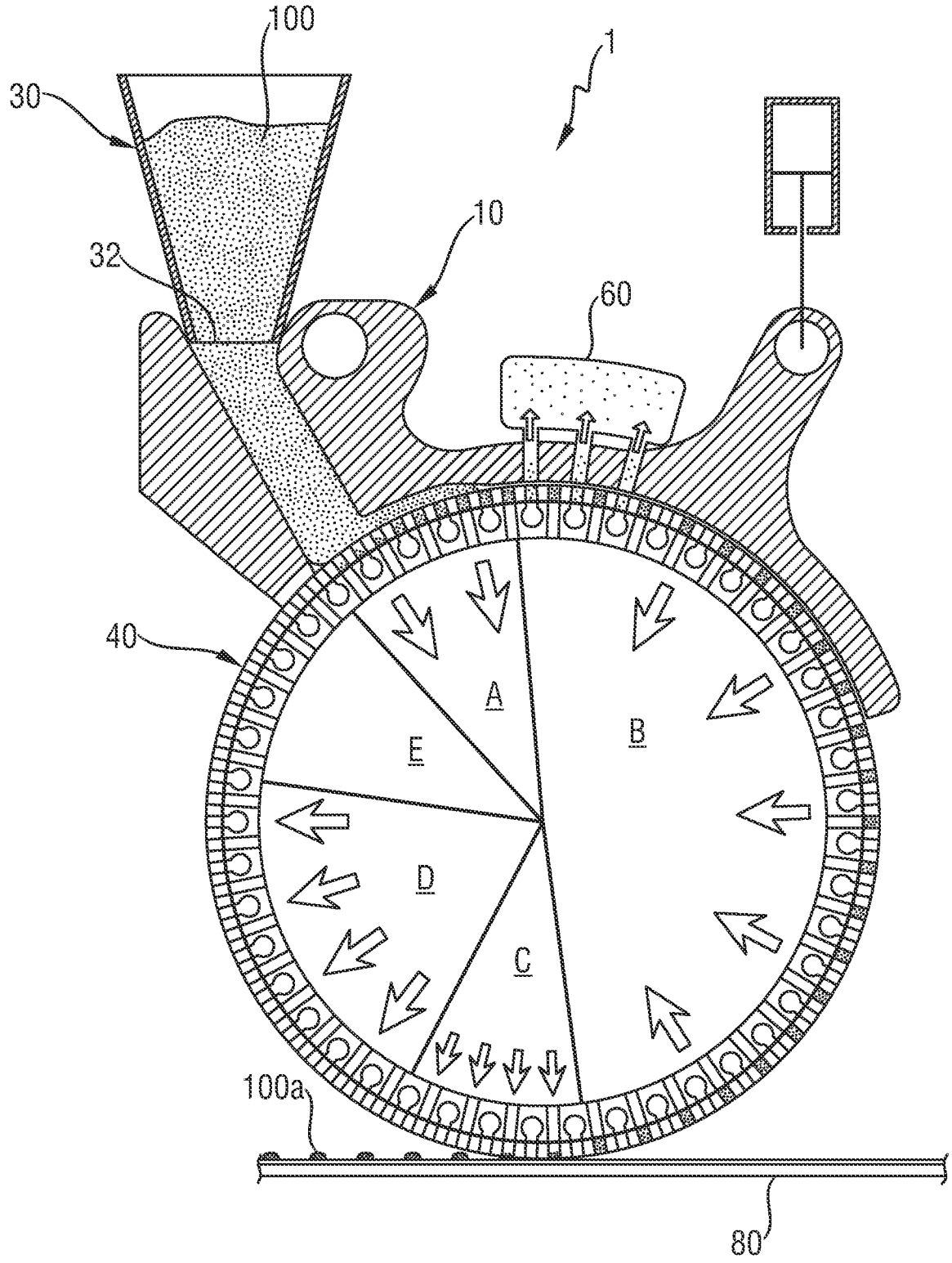


Fig. 1

Fig. 2

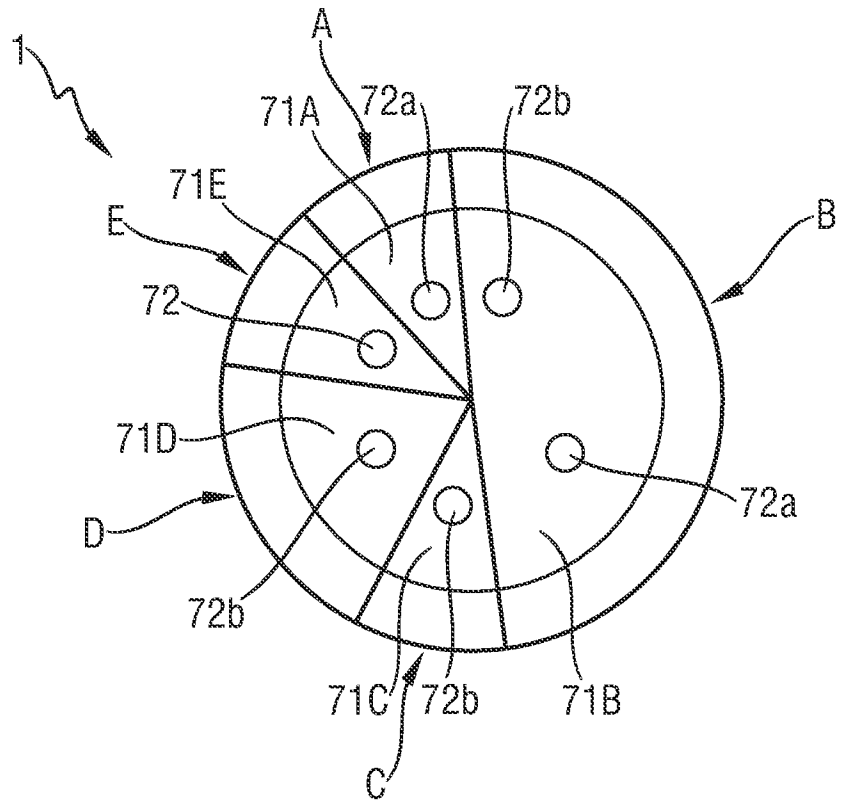


Fig. 3

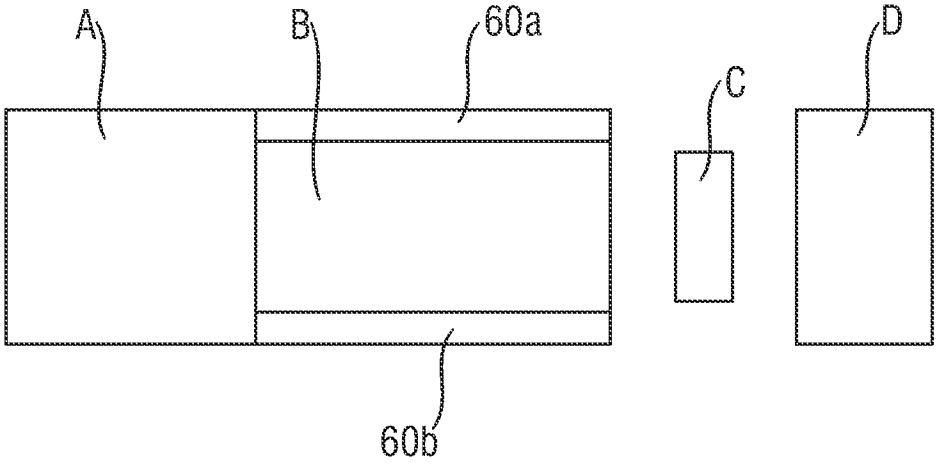


Fig. 4

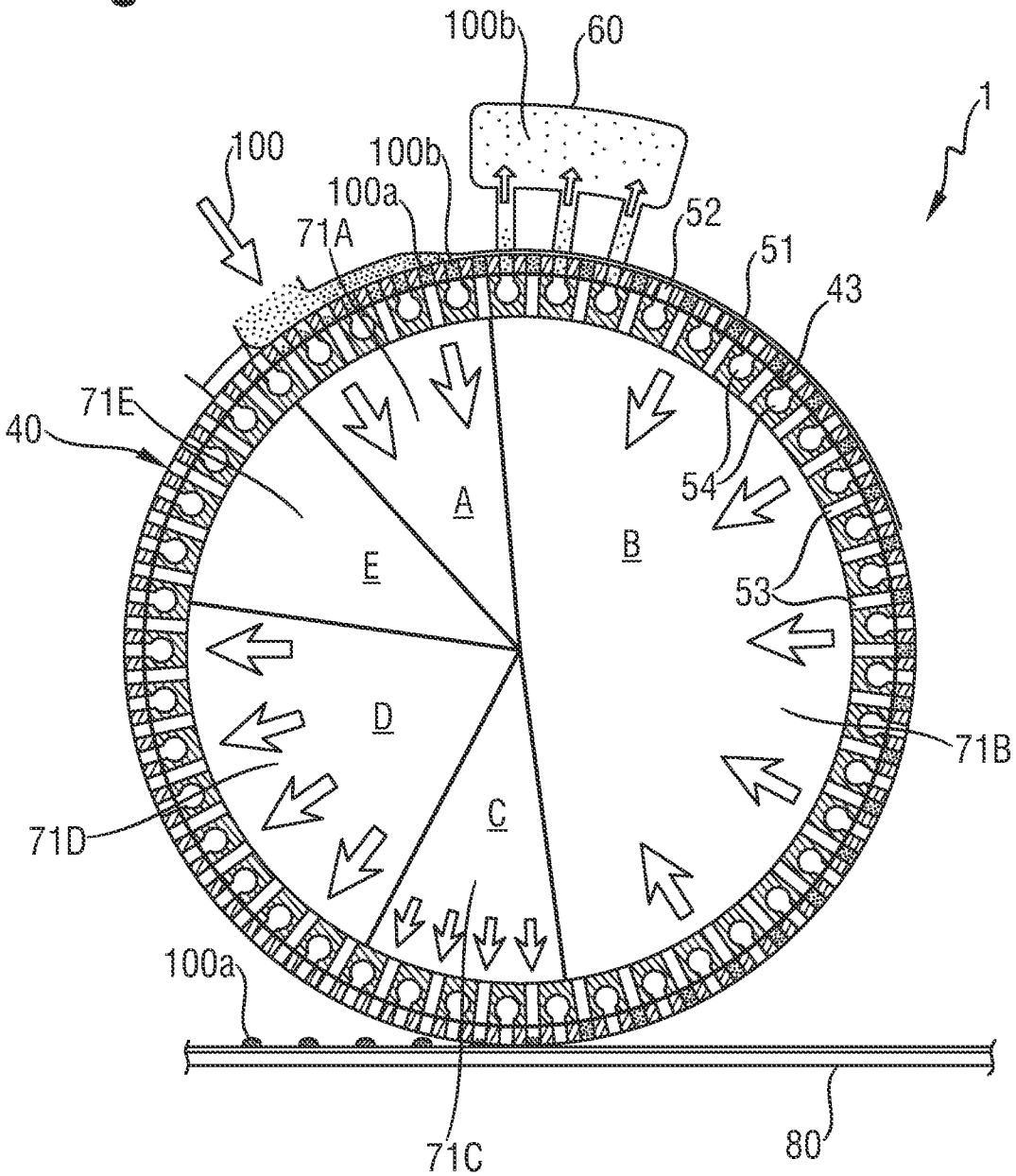
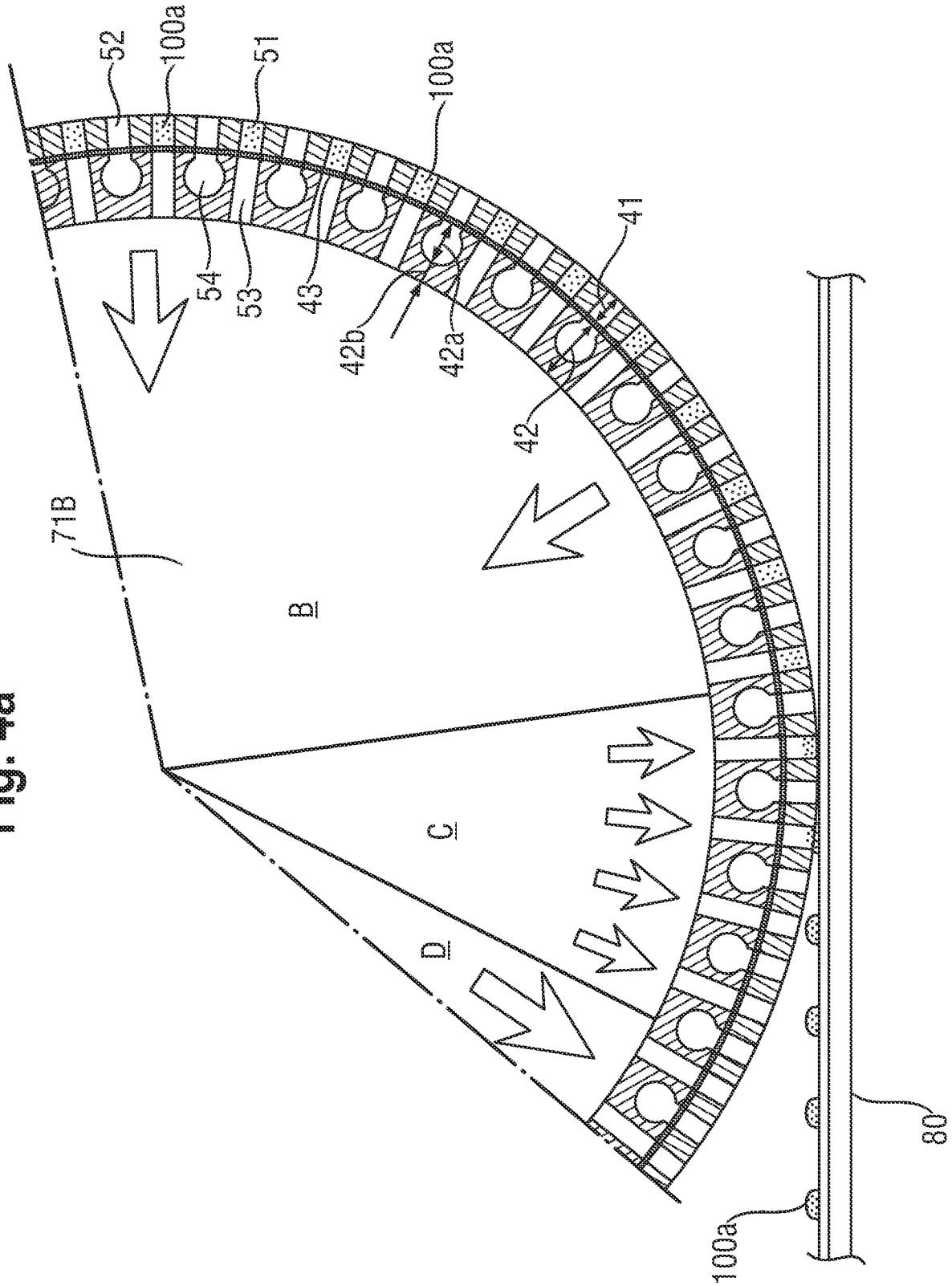

100b
60
1
100
100b
100a
71A
52
51
43
71E
40
54
A
B
E
53
D
71B
71D
C
100a
71C
80

Fig. 4a



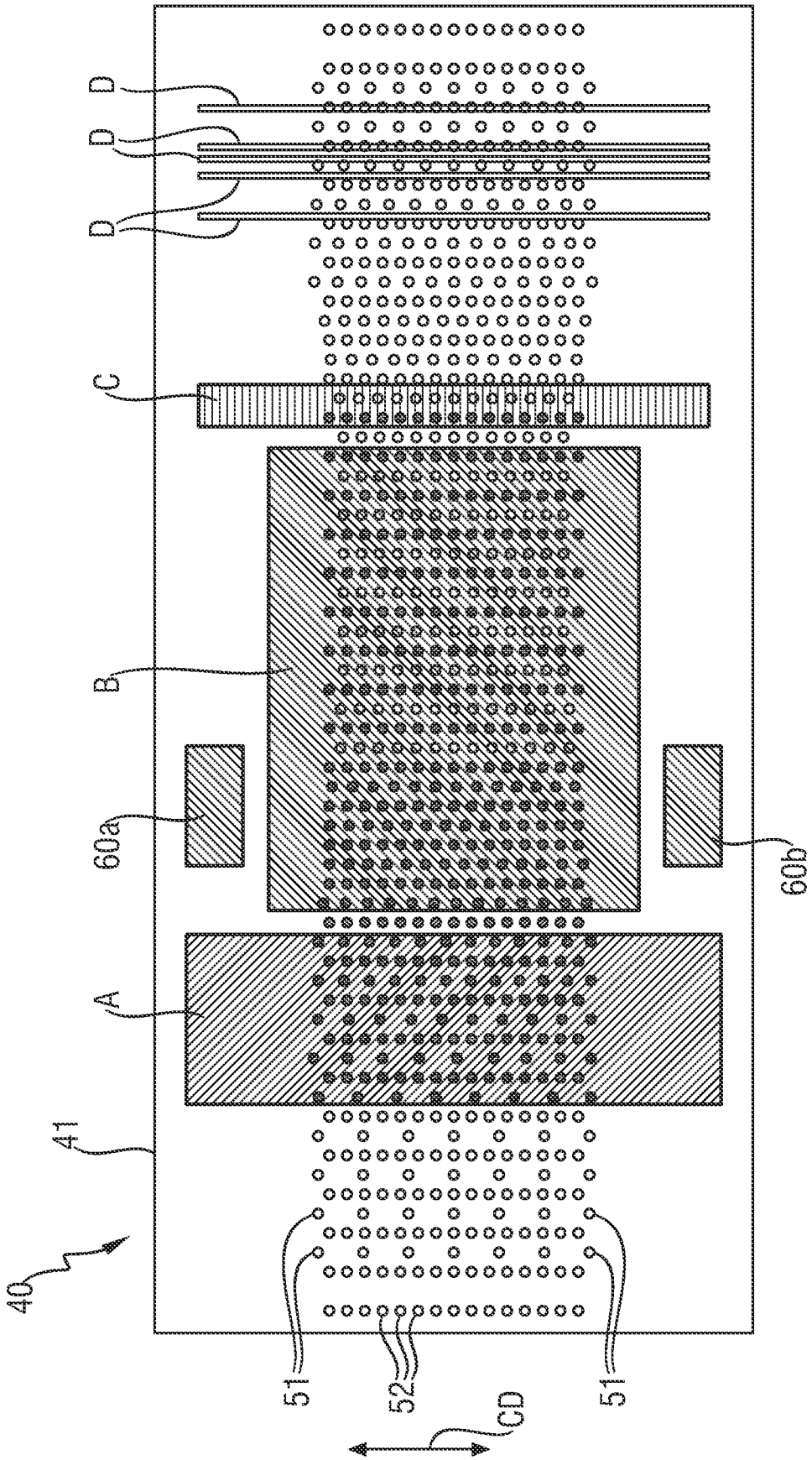


Fig. 5

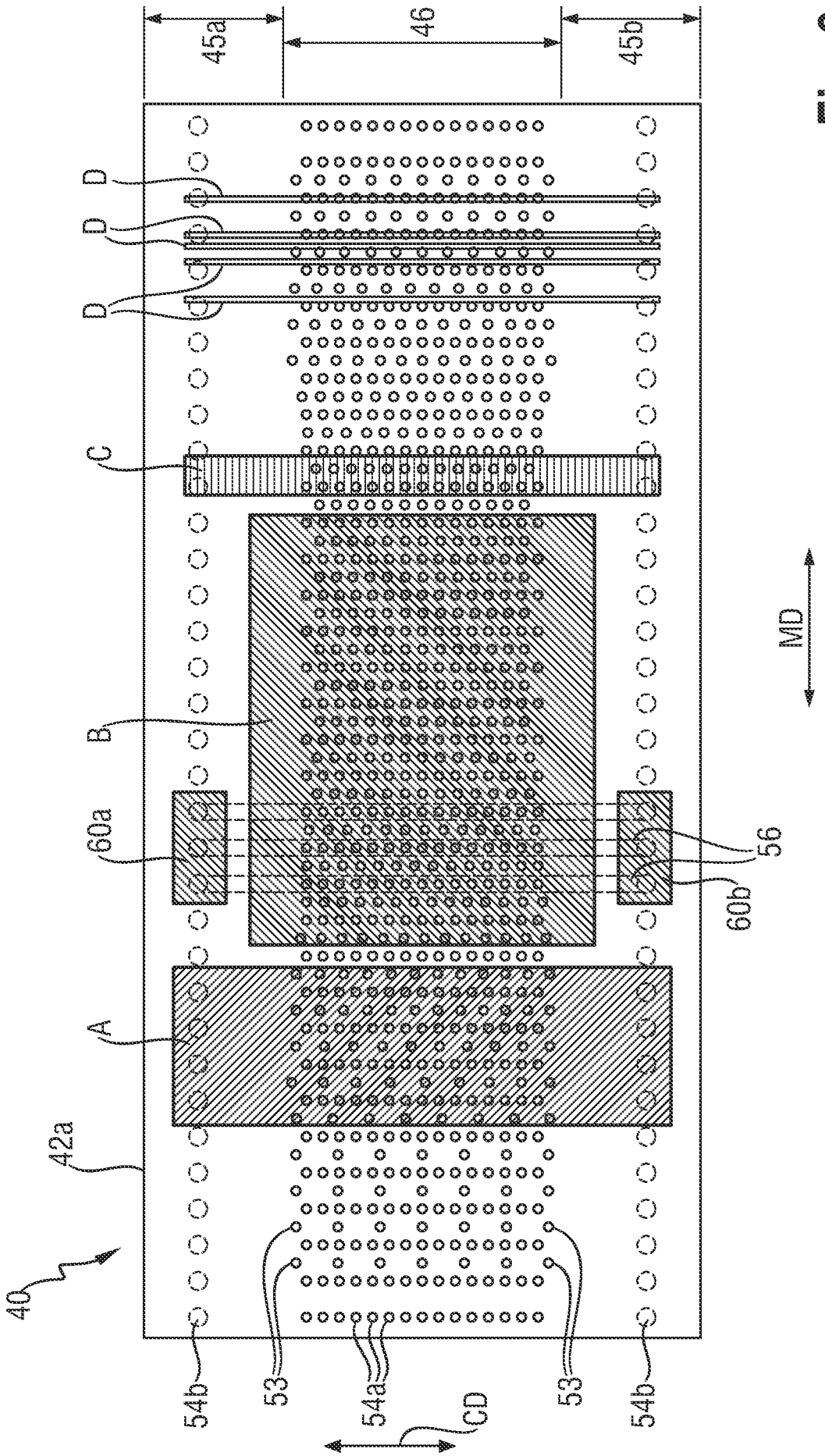


Fig. 6a

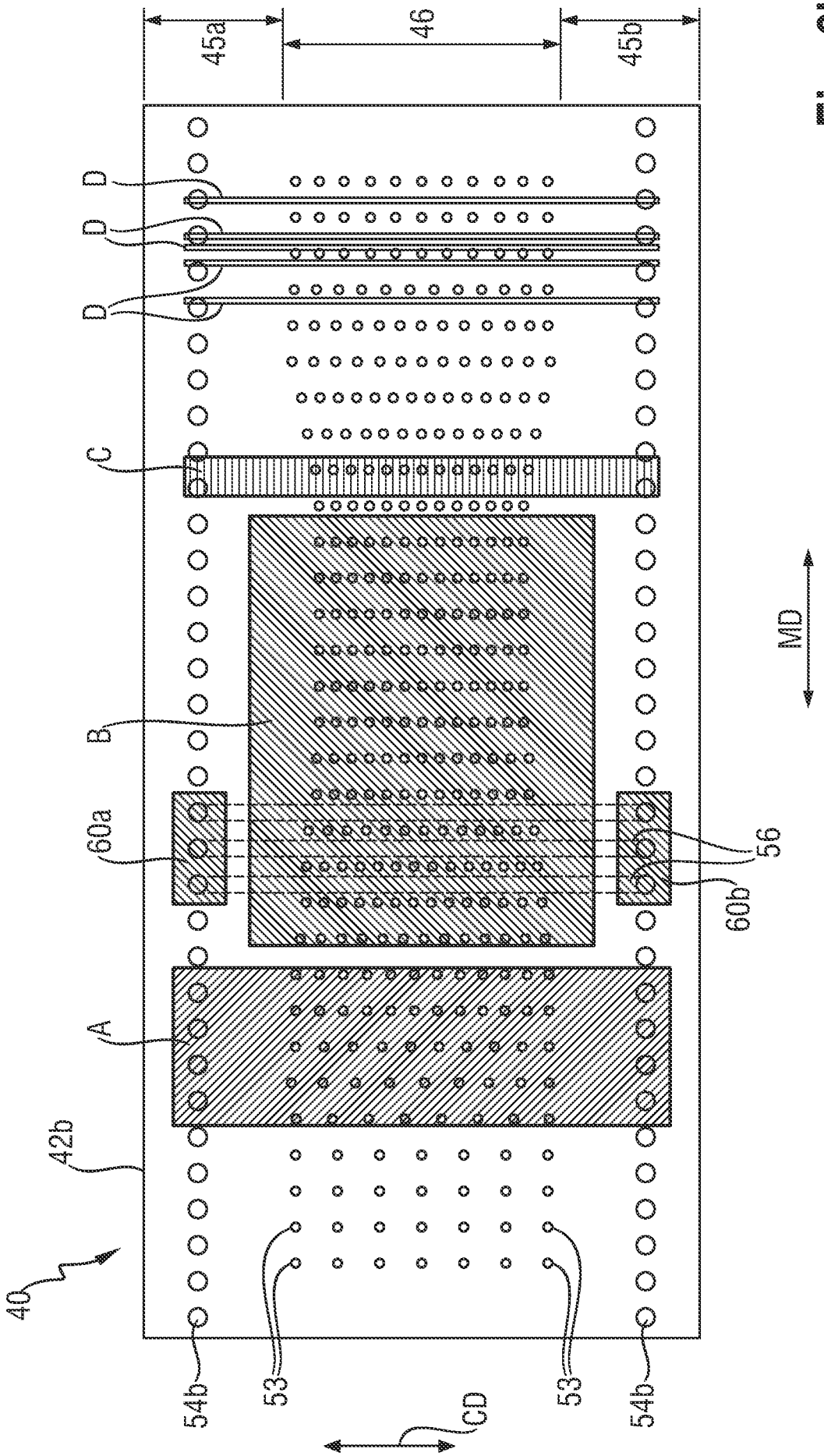


Fig. 6b

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2011/032876

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61F13/15 B05C19/04
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61F B05C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 May 2011	27/05/2011

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Gennari, Silvia

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