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(54) **METHOD AND SYSTEM FOR PROVIDING PRINT TO A PACKAGING MATERIAL**

(57) The present invention relates to a method (200) for providing print to an at least semi-finished packaging material (10) comprising a cellulose-based bulk layer (20) and an outside layer (50) intended to face outside of a packaging container (2) to be formed by the at least semi-finished packaging material (10). The method comprises providing (203) a film (60) on the outside layer (50), wherein the film (60) comprises a coating (64) and ink (62) printed on the coating (64), transferring (206) the ink

(62) and the coating (64) from the film (60) to the outside layer (50) of the at least semi-finished packaging material (10), and separating (208) the film (60) from the at least semi-finished packaging material (10) after transferring (206) the ink (62) and the coating (64) from the film (60) to the outside layer (50); wherein the ink is transferred to the outside layer (50) and the coating (64) is transferred to the outside layer (50) as a coating on the ink (62).

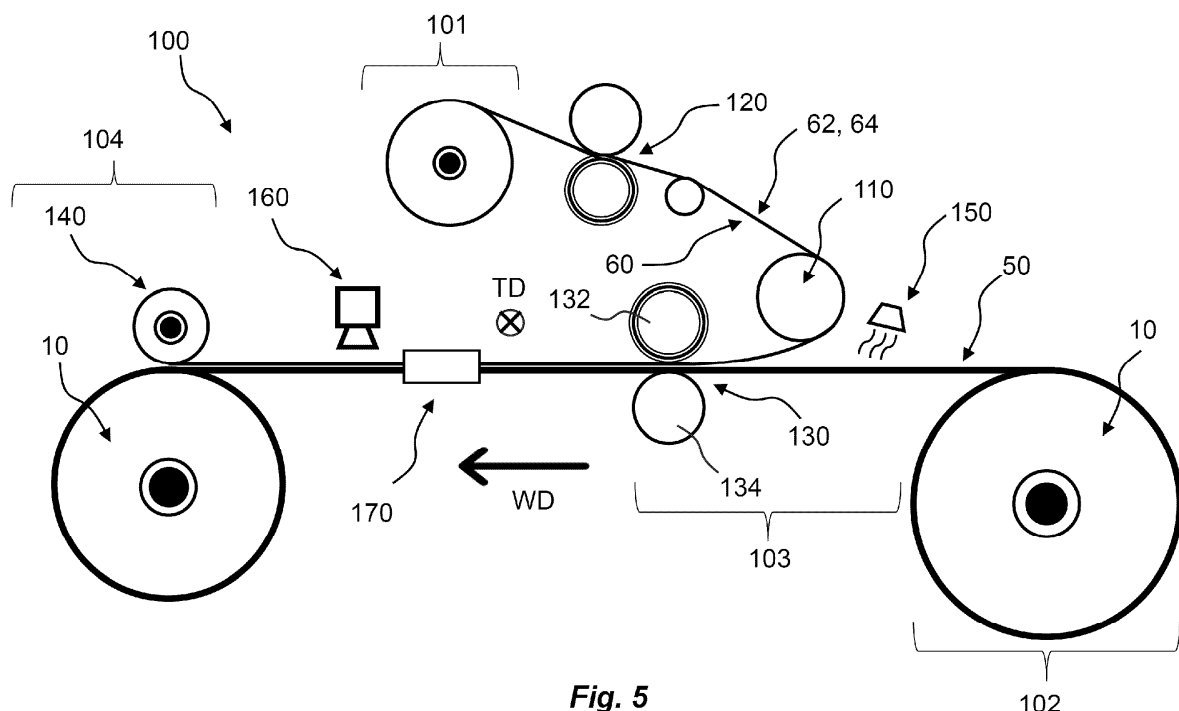


Fig. 5

Description

Technical Field

[0001] The invention relates to a method and system for providing print to a packaging material. The invention further relates to a packaging material, to a liquid food packaging container comprising the packaging material and to a film suitable for providing print to a packaging material. In other words, the invention is also related to a method and system for manufacturing a packaging material.

Background Art

[0002] In many applications, it is desirable to provide print to a packaging material in order to display logos, expiration dates, graphics, barcodes, etc. Printing on packaging material used for liquid food packaging can be performed using different types of printing techniques, such as flexographic printing or digital printing. While flexographic printing is particular useful for static décor, digital printing allows for dynamic patterns to be provided on the packaging material.

[0003] Digital printing is normally provided using inkjet technology and has proven to produce high-quality, variable and custom prints on-demand. This technology works by propelling tiny droplets of liquid ink onto a bulk layer, typically consisting of paper, paperboard, or other cellulose-based materials, of the packaging material. After the print has been applied, the packaging material is laminated to seal and protect the print. For these solutions, a water-based or UV ink can be used. Using a water-based ink and coating can lead to low scratch resistance and poor resistant to peroxide baths that may take place later in the production chain. If a UV ink is used, it is important that all monomers are crosslinked. Another problem with current printing solutions is their inability to print all the way on the edge of the packaging material, which can create a white stripe on the back of the package. Also, using current solutions, the décor layer of the packaging material needs to the surface treated, for example using Corona discharge, to obtain sufficient adhesion. This can impact the sealability of the décor flap sealing.

[0004] To summarize, while the inkjet technology offers many advantages for packaging applications, printing solutions that allow for more flexibility in the production chain and which can provide a more durable print, thus increasing the overall efficiency of package material production, could be beneficial.

Summary

[0005] It is an object of the invention to overcome at least partly one or more of the above-identified limitations of the prior art. In particular, it is an object to provide a more flexible printing solution for packaging materials

that also offers a more resilient print.

[0006] In a first aspect, a method for providing print to an at least semi-finished packaging material comprising a cellulose-based bulk layer and an outside layer intended to face outside of a packaging container to be formed by the at least semi-finished packaging material is provided. The method comprises providing a film on the outside layer, wherein the film comprises a coating and ink printed on the coating, transferring the ink and the coating from the film to the outside layer of the at least semi-finished packaging material, and separating the film from the at least semi-finished packaging material after transferring the ink and the coating from the film to the outside layer. The ink is transferred to the outside layer and the coating is transferred to the outside layer as a coating on the ink. This allows for printing late in the production chain, possibly after lamination and slitting, which can lead to shorter lead times and be beneficial for smaller order quantities. A clean separation of the film from the packaging material may be obtained without requiring a release layer that stays on the film. This may be achieved by the coating on the film being provided in the form of a dispersion coating that allows enough bond to remain on film, while still allowing easy separation from the film after transferring to the outside layer. The transfer can be realized by heat transferring.

[0007] In one embodiment, separating the film comprises reversing the flow direction of the film and the at least semi-finished packaging material and rewinding the film. This is advantageous since it allows cooling of the film and the packaging material, and easy removal of the film. This may also include rewinding of the packaging material to a separate reel. This also makes it possible to remove possible waste on the packaging material and or the film during rewinding. In some embodiments, that may also help to rewind the packaging material in desired orientation for the future use. Although all benefits of reversing the flow direction, in some embodiments the film may be separated after transferring without being wound together with the packaging material.

[0008] In one embodiment, the method further comprises providing the coating and ink on the film prior to transferring the ink and coating to the outside layer, wherein the ink is preferably applied on the coating after the coating has been provided on the film. This is advantageous since it ensures optimal adhesion and quality of the print on the packaging material. The step of providing coating and ink on the film can be performed by a system that also performs other printing steps such as transferring (inline) or in advance by a separate system (offline).

[0009] In one embodiment, transferring the ink and the coating comprises heating up at least the film and pressing the film and outside layer together. This is advantageous since it provides a simple, consistent and even transfer of print onto the packaging material.

[0010] In one embodiment, heating up the film is performed by a heated roller. This is advantageous since it

provides a simple, reliable and consistent way of heating up the film.

[0011] In one embodiment, the method further comprises preheating the outside layer of the at least semi-finished packaging material, preferably using hot air exposure, before transferring the ink and the coating from the film to the outside layer. This is advantageous since it enhances the adhesion of the ink and coating to the packaging material.

[0012] In one embodiment, transferring is performed by fusing the ink and the coating to the outside layer of the at least semi-finished packaging material. This is advantageous since the ink and coating can be efficiently transferred.

[0013] In one embodiment, the ink comprises polyolefin, preferably polyethylene (PE). This is advantageous for durability and compatibility with various packaging materials. For example, it can be easily fused with a PE-based outside layer of a packaging material, eliminating any need for adhesive between the ink and outside layer. Any ink having a resin able to be fused with polyolefins like PE can be beneficial.

[0014] In one embodiment, the ink is a digital printing ink, preferably ink-jet ink. This is advantageous since it is practical to apply and transfer.

[0015] In one embodiment, the outside layer of the at least semi-finished packaging material comprises polyolefin, preferably polyethylene, and more preferably Low-density polyethylene (LDPE). This is advantageous to provide a robust and compatible surface for ink and coating adhesion.

[0016] In one embodiment, the coating is a dispersion, preferably comprising at least one of polyolefin, polyurethane and at least one acrylic polymer; preferably the coating is a polyolefin dispersion. This can be advantageous for transferring without the need of a release layer, because the dispersion can act as a release layer itself while also fusing with a, for instance PE-based, outside layer of the packaging material. The dispersion can also provide advantageous protection against hydrogen peroxide which can be used in sterilization and be beneficial for flap sealing during later package forming.

[0017] In one embodiment, the coating has a thickness of 1-5 micron, more preferably 2-4 micron and even more preferably 3 micron. This can be suitable for efficient transferring and protecting the ink without using an excessive amount of material.

[0018] In one embodiment, the method further comprises positioning the ink provided on the film relative to the at least semi-finished packaging material using a reference object printed on the at least semi-finished packaging material and on the film. This is advantageous since it ensures precise alignment and positioning of the print on the packaging material.

[0019] In one embodiment, positioning the ink relative to the at least semi-finished packaging material comprises controlling the position of the film relative to the at least semi-finished packaging material in a web direc-

tion (in other terms feeding or supplying direction) using a pull- and brake nip. This is advantageous since it allows for simple and accurate control of the print position along the length of the packaging material.

[0020] In one embodiment, positioning the ink relative to the at least semi-finished packaging material comprises controlling the position of the film relative to the at least semi-finished packaging material in a transverse direction using an edge guide, the transverse direction being transverse to a web direction. This is advantageous since it ensures precise lateral alignment of the print on the packaging material.

[0021] In one embodiment, the film is a PET film, preferably a BOPET film, preferably having a thickness of 8-16 microns, more preferably 10-14 microns and even more preferably 12 microns. This is advantageous since PET and BOPET films offer strength and stability during the transfer process.

[0022] In a second aspect, a system for providing print to an at least semi-finished packaging material is provided. The system comprises a film supply providing a film carrying a coating and ink printed on the coating, a packaging material supply providing the at least semi-finished packaging material comprising a cellulose-based bulk layer and an outside layer intended to face outside of a packaging container to be formed by the at least semi-finished packaging material, and a transfer station configured to transfer the ink and the coating from the film to the outside layer of the at least semi-finished packaging material, and a separation unit configured to separate the film from the at least semi-finished packaging material after the ink and the coating has been transferred. The system is configured to transfer the ink to the outside layer and the coating to the outside layer as a coating on the ink. This is advantageous since it offers a comprehensive solution for applying print to packaging materials late in the production chain, possibly after lamination and slitting, which can lead to shorter lead times and be beneficial for smaller order quantities.

[0023] In one embodiment, the transfer station comprises a heated roller configured to heat the film provided with the ink and the coating, and a nip configured to press the film to the outside layer of the at least semi-finished packaging material such that the ink and coating is fused together with the outside layer. This is advantageous since it ensures effective fusion of the print onto the packaging material.

[0024] In one embodiment, the separation unit comprises a winder configured to separate the film from the packaging material after the ink and coating has been transferred. This is advantageous since it enables the efficient removal of the film, allowing for continuous operation.

[0025] In one embodiment, the system is configured to reverse the flow direction of the film and the at least semi-finished packaging material when separating the film. This is advantageous since it facilitates seamless film removal.

[0026] In one embodiment, the system further comprises a hot air nozzle configured for pre-heating the outside layer of the at least semi-finished packaging material before the ink and the coating is transferred from the film to the outside layer. This is advantageous since pre-heating enhances the bonding of the ink and coating to the outside layer of the packaging material.

[0027] In one embodiment, the system further comprises a reference object reader configured to determine a position of the ink relative to the packaging material by reading a reference object printed on the packaging material and on the film, and a pull- and brake nip configured to control a position of the film relative to the packaging material in a web direction thereof, and/or an edge guide configured to control a position of the film relative to the packaging material in a transverse direction being transverse to the web direction. This is advantageous since it provides a reliable alignment of the print, ensuring high precision and consistency.

[0028] In a third aspect, a packaging material is provided. The packaging material is provided with print using any method and/or system described herein.

[0029] In a fourth aspect, a liquid food packaging container is provided. The liquid food packaging container is formed by a packaging material being provided with print using any method and/or system described herein.

[0030] In a fifth aspect, a film comprising a coating and ink printed on the coating, wherein the film is suitable for providing print to an at least semi-finished packaging material according to any method described herein and/or using any system described herein.

[0031] In a sixth aspect, a method for manufacturing a packaging material is provided. The method can comprise any method steps described herein for providing print to a packaging material. The method may alternatively or additionally comprise providing a transfer substrate, the transfer substrate having a first machine dimension and a second transverse dimension, the transverse dimension being much smaller than the machine dimension, the transfer substrate having a first surface extending along the machine dimension and the transverse dimension. A coating layer can be arranged on the first surface and an ink pattern layer can be arranged on the side of the coating layer opposite the transfer substrate. The method may further comprise providing a packaging laminate web, the packaging laminate web having a first machine dimension and a second transverse dimension, the transverse dimension being much smaller than the machine dimension, the packaging laminate web comprising a paperboard layer. The method may further comprise conveying the transfer substrate and the packaging laminate web in a conveying direction, the machine direction of the transfer substrate being aligned with the conveying direction, the machine direction of the packaging laminate web being aligned with the conveying direction, the transfer substrate and the packaging laminate web being conveyed at the same speed in the conveying direction. The method may

further comprise jointly heat transferring the ink pattern layer together with the coating from the transfer substrate to an outside surface of the packaging laminate web.

[0032] Herein, the following terms may correspond to, be similar to and/or be replaceable by one another: transfer substrate and film, ink pattern layer and ink, outside surface and outside layer, packaging laminate web and packaging material, and paperboard layer and bulk layer.

[0033] Still other objectives, features, aspects and advantages of the invention will appear from the following detailed description as well as from the drawings. For instance, printing solutions described herein may have the advantage of being able to print all the way to the edge of packaging materials, and/or reduce the need for surface treatment of the décor layer.

Brief Description of the Drawings

[0034] Embodiments of the invention will now be described, by way of example, with reference to the accompanying schematic drawings, in which:

Fig. 1 is a schematic side view of a machine for producing packaging containers for liquid food products from a laminated packaging material according to one example,

Fig. 2A is a perspective view of a packaging container according to one example,

Fig. 2B is a top view of a packaging material according to another example,

Fig. 2C is a top view of a packaging material according to a further example,

Fig. 3 is an exploded cross-sectional view of a packaging material according to one example,

Fig. 4A is an exploded cross-sectional view of a film provided with coating according to one example,

Fig. 4B is an exploded cross-sectional view of a film provided with coating and ink according to one example,

Fig. 5 is a schematic view of a system for providing print to a packaging material according to one example,

Fig. 6 is a schematic view of a system for providing print to a packaging material according to one example,

Fig. 7 is a schematic view of a method for providing print to a packaging material according to one example.

Detailed description

[0035] Starting in Fig. 1, an example of a machine 1 for producing packaging containers 2 from a laminated (and possibly printed) packaging material 10 is shown. The machine 1 comprises a sterilization section 3 configured to sterilize the laminated packaging material 10 normally being roll-fed into the machine 1. Downstream the ster-

ilization section there is a tube-forming section 4 which seals the longitudinal ends of the laminated packaging material 10 to each other. A filling section 5 is configured to fill the longitudinal tube with the desired content, and a transversal sealing section 6 provides transversal seals and cuts to separate the packaging container 2 from the upstream tube of laminated packaging material 10.

[0036] It should be noted that while the machine 1 shown in Fig. 1 has proven to be very effective in producing individual packaging containers 2, generally the same packaging material 10 can be used for other machines operating according to different principles. For example, the packaging material 10 may be cut into separate blanks being fed into a machine which operates by folding and sealing tubular bodies having one closed end and one open end. After filling the tubular body, the open end is closed in order to form a sealed packaging container 2.

[0037] Examples of a packaging container 2 is shown in Fig. 2A. The packaging container 2 is produced by folding, forming, and sealing a packaging material 10 as is well known in the art. In order to assist in folding and forming, the packaging material 10 has been provided with sets of crease lines 2a (only some being indicated with reference numeral). For improving usability by the consumer, the packaging container 2 may be provided with an opening feature 2b. The opening feature 2b is here represented as an area of the packaging material 10 which is configured to be penetrated for opening the packaging container 2 in order to access the content. In Fig. 2A the opening feature 2b is formed by a laminated through hole in the packaging material 10, which is covered by a tab 2c. When opening the tab 2c for the first time, the opening feature 12 can be subsequently opened.

[0038] The packaging container 2 is provided with a printed pattern 11, on one or more sides. The printed pattern 11 typically comprises a plurality of sub-patterns 12, 13 which may or may not overlap. As will be described further below, each sub-pattern 12, 13 may be provided by a specific printing operation. The packaging container 12 may further be provided with a printed reference object 18 which may be provided as a separate printed object or form part of one or both sub-patterns 12, 13.

[0039] An example of a printed packaging material 10 for use with e.g. the machine 1 shown in Fig. 1, and suitable to form e.g. the packaging containers 2 shown in Fig. 2A, is described with reference to Fig. 2B. The packaging material 10 is provided as a web 14 of consecutive segments 15 arranged in a feeding direction, or web direction, WD. A transverse direction TD is defined as a direction being transverse to the web direction WD. Each segment 15 is designed to form a single packaging container 2, e.g. using a machine 1 of the type described with reference to Fig. 1. In such case the segments 15 are connected until the final packaging container 2 is formed and cut loose from the upstream web 14 of packaging material 10. Optionally, each segment 15 is provided as a

blank before being fed to a forming and filling machine for producing packaging containers 2. As can be seen in Fig. 2B, each segment is provided with a printed pattern 11.

[0040] In Fig. 2C another example of a packaging material 10 is shown. Here, a web 14 of packaging material 10 is formed by a plurality of connected lanes 16. Each lane 16 is formed by consecutive and connected segments 15. The lanes 16 are preferably staggered in a transverse direction TD being transverse to a feed direction, or web direction WD. From the multi-lane web 14 shown in Fig. 2C, a single-lane web 14 (as shown in Fig. 2B) is formed by cutting the web 14 to separate the lanes 16 from each other. The process of cutting a multi-lane web 14 into a single-web lane 14 is often referred to as slitting.

[0041] At least one of the sub-patterns 12, 13 may be applied to a packaging material 10 provided as a single-lane web 14 or a packaging material 10 provided as a plurality of connected lanes 16. In other words, the printing process described herein can be used to apply print either before slitting, after slitting, or both before and after slitting.

[0042] The packaging material 10 is further shown in detail in Fig. 3. The packaging material 10 comprises a bulk layer 20 of paper or paperboard or other cellulose-based material, and a barrier substrate 30. The barrier substrate 30 may be a metal foil such as aluminium foil, or it may optionally be a polymer-based or cellulose-based material provided with a metal coating (not shown) on a side of the barrier substrate 30 facing away from the bulk layer 20. The barrier substrate 30 is laminated to the bulk material 20 by means of a thin lamination film 34. The lamination film 34 can comprise one or more polymers, such as polyethylene.

[0043] In this example, the barrier substrate 30 is provided with a protective inside coating 40, intended to face the interior of a packaging container 3. The inside coating 40 is preferably one or more polymer layers, such as polyethylene.

[0044] The opposite side of the bulk layer 20 is provided with one or more outside layers 50 intended to face the exterior of a packaging container 2 formed by the packaging material 10. A décor print 22 may be provided onto the bulk layer 20, and covered by the one or more outside layers 50. The décor print 22 can be provided by flexographic printing using a suitable ink and/or the décor print may comprise a magnetizable ink distributed in a manner to carry certain information. The outside layer 50, in some contexts referred to as the décor layer 50, can comprise polyethylene and/or other polymers. The décor print 22 typically forms at least one sub-pattern 12, 13 of the print pattern 11 and/or the reference object 18 described above with reference to Fig. 2A.

[0045] A packaging material 10 generally includes the above-described layers, i.e. bulk layer 20, barrier substrate 30 laminated to the bulk layer 20 with a lamination film 34 and provided with an inside coating 40, and an outside layer 50, optionally covering a décor print 14.

[0046] However, using the novel printing techniques described herein, the packaging material 10 can further be provided with ink 62 and coating 64. The ink 62 and coating 64 can be (heat) transferred from a film 60 to an outside layer 50 of an at least semi-finished packaging material 10. This results in the ink 62 and coating 64 being fused together with the outside layer 50. The printing technique will be further described below. An at least semi-finished packaging material 10 can consist of a bulk layer 20, an outside layer 50, and optionally a barrier substrate 30 laminated to the side of the bulk layer 20 opposite the outside layer 50. Additionally, the packaging material may be provided with an inside coating 40 that may be coated over the barrier substrate 30. Alternatively, the barrier substrate 30 and/or inside coating 40 can be provided later in the manufacturing process, i.e. after the ink 62 and coating 64 has been transferred and fused to the outside layer 50. The ink 62 is distributed on the packaging material 10 as a sub-pattern 12, 13 of the print pattern (see Fig. 2A).

[0047] The ink 62 and/or coating 64 can be polymer-based and comprise one or more of polyethylene (PE), polypropylene (PP), other polyolefins, polyvinyl chloride (PVC), polyethylene terephthalate (PET), polystyrene (PS), polylactic acid (PLA), polyhydroxyalkanoates (PHA), ethylene vinyl acetate (EVA) and bio-polyethylene (Bio-PE), one or more acrylic polymers, and polyurethane (PU).

[0048] The coating 64 is preferably a dispersion 64, preferably comprising polyolefin, polyurethane and/or at least one acrylic polymer, and most preferably a polyolefin dispersion. The ink 62 is preferably a polyethylene-based ink 62. If the coating is a polyolefin dispersion, it may contain up to 80 wt% of a polyolefin such as PE. The rest can comprise other additives for obtaining a stable dispersion. Such additives can for example include other polymers, like modified polyolefins, like ethylene-acrylic acid (EAA) or ethylene-vinyl acetate (EVA). To ensure effective dispersion, the polymer may contain some acrylic or acid functionality. The film 60 from which the ink 62 and coating 64 is transferred can be a PET-film, preferably a BOPET-film 60.

[0049] Coating a dispersion 64 such as a polyolefin dispersion on a film 60 such as an untreated PET- or BOPET-film 60 can provide enough surface tension for proper laydown and some degree of adhesion. However, when the dispersion 64 is fused with the outside layer 50 of the at least semi-finished packaging material 10, the bond between the outside layer 50 and the dispersion 64 is stronger than that between the film 60 and the dispersion 64. Accordingly, when the film 60 is removed, the dispersion 64 remains attached to the packaging material 10. The fact that the at least semi-finished packaging material 10 is generally stiff and non-elastic also contributes towards breaking the adhesion to the film 60. A benefit with using a dispersion 64 is accordingly that no additional release layer is needed, since the dispersion 64 acts both as a release layer and as a protective cover

over the ink 62 (which is also transferred to the outside layer 50).

[0050] The materials of the ink 62, coating 64 and outside layer 50 should be chosen such that the ink 62 and coating 64 can fuse together with the outside layer 50, possibly upon heating, thus enabling transferring (possibly heat transferring) of the ink 62 and coating 64 to the outside layer 50. The properties of the ink 62 and coating 64 allows the entire packaging material 10 to withstand hydroperoxide bath (which the printed packaging material 10 may be subjected to later in the manufacturing process for sterilization purpose) and will not hinder future flap sealing of the packaging material 10. However, the outside seal (sometimes referred to as outside finseal) may be excluded from the coating 64. The outside seal runs along an outer edge of a transverse direction TD of the packaging material (as seen from above). The methods and systems described herein provide an efficient way of printing on an at least semi-finished packaging material 10 that is already provided with an outside layer 50, i.e. the printing that can be done after lamination of the outside layer 50. Since the ink 62 and coating 64 is fused to the outside layer 50, no further lamination is needed to seal the print. This allows for printing, preferably digital printing, late in the manufacturing process, which can increase flexibility, lead to shorter lead times and be beneficial for smaller order quantities.

[0051] In addition, having the possibility to apply print at different stages in the manufacturing process (before and after lamination of the outside layer 50) can further increase flexibility and manufacturing efficiency. For instance, if packaging materials having different versions of print is to be produced, common features of the print versions (such as one of the sub-patterns 12, 13 described above) may be printed prior to lamination using the décor print 22, which can be covered or carried by the outside layer 50. Differentiating features (such as the other sub-pattern 12, 13) of the desired print can then be applied after the outside layer 50 has been attached to the packaging material 10.

[0052] Accordingly, any method described herein may further comprise providing a décor print 22 to the packaging material 10. The décor print 22 may be carried by the outside layer 50. Alternatively or additionally, the method can comprise applying the outside layer 50 to an unfinished packaging material 10 (in this case consisting of bulk layer 20 and possibly barrier substrate 30, etc.). Providing a décor print 22 and/or applying the outside layer 50 can be performed before transferring of the ink 62 and coating 62 to the outside layer 50.

[0053] Alternatively or additionally, the bulk layer 20 can be provided with at least one crease line (not shown). The at least one crease line forms a defect in the bulk layer 20 which forms a local reduction of robustness, thereby allowing the packaging material 10 to easily fold around the crease line. Typically, the bulk layer 20 is provided with both crease lines and through holes, such that the same packaging material 10 can be used to form

a single packaging container 2. It should further be noted that the features shown in Fig. 3 are not necessarily to scale but the dimensions of the various layers may be varied depending on material choice and intended applications.

[0054] Figs. 4A and 4B show the film 60 from which the ink 62 and coating 64 can be transferred according to the method described herein. Before transferring, the coating 64 and ink 62 is provided on the film 60. Some of the ink 62 may form a reference symbol 18 (not shown here) which can be used for positioning the film relative to the at least semi-finished packaging material 10, which can also be provided with a corresponding reference symbol 18. When the ink 62 and coating 64 have been provided on the film, they can be transferred to the outside layer 50 of the packaging material 10, allowing the film 60 to be removed while leaving the ink 62 and coating 64 on the outside layer 50. Providing the coating 64 and ink 62 to the film 60 can form part of the printing method or the film 60 may be provided with the ink 62 and coating 64 beforehand. The ink 62 and coating 64 are preferably provided separately, with the ink 62 being printed on the coating 64. First, the coating 64 can be applied to the film 60 (Fig. 4A) and then, the ink 62 may be applied to the coated film 60 in the intended pattern (Fig. 4B). The ink 62 can be provided by printing the coated film 60 with the ink 62 using a printer. Preferably, the printing is digital and performed by a digital printer. That may be, for example, an ink-jet printer, a printer using the HP Indigo Liquid Electrophotographic process, or a printer using Landa Nanographic Printing®.

[0055] A film 60 provided with the ink 62 and coating 64 may be referred to as a printed film 60. The printed film 60 may be rolled up in a roll, allowing easier handling.

[0056] The film 60 preferably comprises or consists entirely of one or more polymers, preferably thermoplastic polymers, or materials having similar properties. For instance, the film may be a Biaxially Oriented Polypropylene (BOPP) film, a Polyamide (Nylon) (BOPA) film, a Polycarbonate (PC) film, a Polyvinylidene Chloride (PVDC), a Polyethylene Naphthalate (PEN) film, a High-Density Polyethylene (HDPE) film, a Fluoropolymer film (e.g., PTFE or ETFE), a Polyimide film (e.g., Kapton), a Biaxially Oriented Polyethylene Terephthalate (BOPET) film or any combination thereof. In a preferred embodiment, the film is a, preferably plain (untreated), Biaxially Oriented Polyethylene Terephthalate (BOPET) film. The film preferably has a thickness of 8-16 micron, more preferably 10-14 micron and even more preferably 12 micron. The thickness of the coating 64, which may be a polyolefin dispersion, is preferably 1-5 micron, more preferably 2-4 micron and even more preferably 3 micron.

[0057] Fig. 5 illustrates a system 100 for providing print to a packaging material 10. The system 100 can comprise any suitable components and be configured to perform any method described herein. The aim of the system 100 is to provide a print from a film 60 to an outside layer 50 of an at least semi-finished packaging material 10. To this

end, the system 100 comprises a film supply 101 providing a film 60 carrying coating 64 and ink 62, a packaging material supply 102 providing an at least semi-finished packaging material 10 comprising an outside layer 50, and a transfer station 103 configured to transfer the ink 62 and coating 64 from the film 60 to the outside layer 50 of the packaging material 10. The transfer station 103 may be a heat transfer station 103 configured to heat transfer the ink 62 and coating and may, as illustrated in Fig. 5, comprise a heated roller 110 for heating the printed film 60 and/or a hot air nozzle 150 for pre-heating the outside layer 50 of the packaging material 10. The heated roller 110 is preferably configured to face a side of the printed film 60 that is not provided with ink 62 and coating 64. The temperature of the heated roller is preferably above 100°C. The heated roller 110 is made of a heat-resistant material and can comprise one or more of steel, steel alloys, iron, nickel, titanium, a soft compressible material, for instance silicone, and/or other materials known as heat resistant. The soft compressible silicone may be a preferred material.

[0058] After heating, the side of the printed film 60 that is provided with ink 62 and coating 64 is pressed against the outer layer 50 of the packaging material 10. This can be done by feeding, preferably roll feeding, the packaging material 10 and the printed film 60 into a nip 130 configured to press the film 60 and outside layer 50 together, resulting in the ink 62 and coating 64 being fused together with the outside layer 50. The nip 130 is typically formed by a nip roller 132 consisting of or being coated with soft rubber, preferably having a hardness of less than 60 shore, and an opposing harder roller 134.

[0059] The packaging material 10 for printing is provided in a roll and fed through the nip 130 in a web direction WD before being rolled up in a new roll. To align the print of the film 60 to the packaging material, the system 100 comprises a reference object reader 160 configured to determine a position of the print on the film relative to the packaging material by reading one or more reference objects 18 printed on the packaging material 10 and on the film 60. Reference objects 18 can be printed on the packaging material using the décor print 22 as described above and on the film 60 using the ink 62. Based on the reference object readings, the system 100 is configured to position the film 60 relative to the packaging material, such that the print aligns with the dimensions and features of the packaging material 10, e.g., crease lines, holes etc. Position control in the web direction WD can be achieved using a pull-and-brake nip 120 controlling the feed rate of the film 60, while the position in a transverse direction TD transverse to the web direction WD can be controlled using one or more edge guides 170.

[0060] After transferring the ink 62 and coating 64, the film 60 can be separated and removed from the packaging material 10. This may be performed by the same system 100 that performs transferring of the ink 62 and coating 64. To separate the film 60, the system 100 can

further comprise a winder 140 or rewinder 140 configured to peel of the film 60 from the packaging material 10. With reference to Fig. 5, the winder 140 could be placed downstream from the nip 130 in the web direction WD such that the film is peeled off before the printed packaging material 10 is rolled up.

[0061] Alternatively, as illustrated in Fig. 6, the system may be configured to reverse the flow direction of the packaging material 10, i.e. the web direction WD, when separating the film 60. In this case, the packaging material 10 may be rolled up together with the film 60 after transferring. Then, when the web direction is reversed and the film 60 has been peeled off, the printed packaging material 10 may be rolled up without the film, possibly at the original position of the packaging material roll 10. In the example of Fig. 6, the winder 140 of the separation unit 104 is arranged to wind the film 60 when travelling in the reversed flow direction. During removal of the film 60, components such as the hot air nozzle 150, reference object reader 160, heated roller 110 may be turned off/-disabled.

[0062] Now turning to Fig. 7, a schematic view of a method 200 for providing print to an at least semi-finished packaging material 10 according to one example is shown.

[0063] At an initial step 202, coating 64 and ink 62 is provided on a film 60. Preferably, the coating 64 is applied before the ink 62.

[0064] At a step 203, the film 60, comprising the coating 64 and the ink 62 printed on the coating 64, is provided on an outside layer 50 of the at least semi-finished packaging material 10.

[0065] At a step 204, the printed film 60 is positioned relative to the packaging material 10 using one or more reference objects 18 printed on the packaging material and on the printed film 60.

[0066] At a step 206, the ink 62 and coating 64 is transferred (possibly heat transferred) from the film 60 to an outside layer 50 of the packaging material 10. Steps 204 and 206 may be performed continuously and simultaneously.

[0067] At a step 208, the film 60 is separated from the packaging material 10. This is done after transferring the ink 62 and coating 64 from the film 60 to the outside layer 50.

[0068] Note that all steps 202, 203, 204, 206, 208 are not necessarily comprised in the method.

[0069] From the description above follows that, although various embodiments of the invention have been described and shown, the invention is not restricted thereto, but may also be embodied in other ways within the scope of the subject-matter defined in the following claims. In addition, it should be noted that any functions described herein as being performed by a system may form part of herein described methods and vice versa.

List of references:

[0070]

5	1	Machine
	2	Packaging container
	2a	Crease line
	2b	Opening feature
	2c	Tab
10	3	Sterilization section
	4	Tube-forming section
	5	Filling section
	6	Transversal sealing section
	10	Packaging material
15	11	Printed pattern
	12	Printed sub-pattern
	13	Printed sub-pattern
	14	Web of packaging material
	15	Segment
20	16	Segment lane
	18	Reference object
	20	Bulk layer
	22	Décor print
	30	Barrier substrate
25	34	Lamination film
	40	Inside coating
	50	Outside layer
	60	Film
	62	Ink
30	64	Coating
	100	System
	101	Film supply
	102	Packaging material supply
	103	Transfer station
35	104	Separation unit
	110	Heated roller
	120	Pull- and brake nip
	130	Nip
	132	Nip roller
40	134	Opposing roller
	140	Winder
	150	Hot air nozzle
	160	Reference object reader
	200	Method
45	202	Providing coating and ink to film
	203	Providing film on outside layer
	204	Positioning ink relative to packaging material
	206	Heat transferring ink and coating from film
	208	Separating film from packaging material
50	TD	Transverse direction
	WD	Web direction

Claims

- 55 1. A method (200) for providing print to an at least semi-finished packaging material (10) comprising a cellulose-based bulk layer (20) and an outside layer (50) intended to face outside of a packaging container (2)

to be formed by the at least semi-finished packaging material (10), the method comprising:

providing (203) a film (60) on the outside layer (50), wherein the film (60) comprises a coating (64) and ink (62) printed on the coating (64), transferring (206) the ink (62) and the coating (64) from the film (60) to the outside layer (50) of the at least semi-finished packaging material (10), and separating (208) the film (60) from the at least semi-finished packaging material (10) after transferring (206) the ink (62) and the coating (64) from the film (60) to the outside layer (50);

wherein the ink is transferred to the outside layer (50) and the coating (64) is transferred to the outside layer (50) as a coating on the ink (62).

2. The method (200) according to claim 1, wherein separating (208) the film (60) comprises reversing the flow direction of the film (60) and the at least semi-finished packaging material (10) and rewinding the film (60).
3. The method (200) according to any of the preceding claims, wherein transferring (206) the ink (62) and the coating (64) comprises heating up at least the film (60); and pressing the film (60) and outside layer (50) together.
4. The method (200) according to claim 3, wherein heating up the film (60) is performed by a heated roller (110).
5. The method (200) according to any of the preceding claims, further comprising preheating the outside layer (50) of the at least semi-finished packaging material (10), preferably using hot air exposure, before transferring (206) the ink (62) and the coating (64) from the film (60) to the outside layer (50).
6. The method (200) according to any of the preceding claims, wherein transferring (206) is performed by fusing the ink (62) and the coating (64) to the outside layer (50) of the at least semi-finished packaging material (10).
7. The method (200) according to any preceding claim, wherein the ink (62) comprises a polyolefin, preferably polyethylene.
8. The method (200) according to any preceding claim, wherein the coating (64) is a dispersion, preferably comprising at least one of polyolefin, polyurethane and at least one acrylic polymer; preferably the coating (64) is a polyolefin dispersion.

9. The method (200) according to any of the preceding claims, further comprising positioning (204) the ink (62) provided on the film (60) relative to the at least semi-finished packaging material (10) using a reference object (18) printed on the at least semi-finished packaging material (10) and on the film (60).

10. A system (100) for providing print to an at least semi-finished packaging material (10), the system comprising:

a film supply (101) providing a film (60) carrying a coating (64) and ink (62) printed on the coating (64),

a packaging material supply (102) providing the at least semi-finished packaging material (10) comprising a cellulose-based bulk layer (20) and an outside layer (50) intended to face outside of a packaging container (2) to be formed by the at least semi-finished packaging material (10), a transfer station (103) configured to transfer the ink (62) and the coating (64) from the film (60) to the outside layer (50) of the at least semi-finished packaging material (10), and

a separation unit (104) configured to separate the film (60) from the at least semi-finished packaging material (10) after the ink (62) and the coating (64) has been transferred, wherein the system (100) is configured to transfer the ink (62) to the outside layer (50) and the coating (64) to the outside layer (50) as a coating on the ink (62).

11. The system (100) according to claim 10, wherein the transfer station (103) comprises:

a heated roller (110) configured to heat the film (60) provided with the ink (62) and the coating (64), and

a nip (130) configured to press the film (60) to the outside layer (50) of the at least semi-finished packaging material (10) such that the ink (62) and coating (64) is fused together with the outside layer (50).

12. The system (100) according to claim 10 or 11, wherein the separation unit (104) comprises a winder (140) configured to separate the film (60) from the packaging material (10) after the ink (62) and coating (64) has been transferred.

13. The system (100) according to claim 12, wherein the system is configured to reverse the flow direction of the film (60) and the at least semi-finished packaging material (10) when separating the film (60).

14. The system (100) according to any of claims 10-13, further comprising a hot air nozzle (150) configured

for pre-heating the outside layer (50) of the at least semi-finished packaging material (10) before the ink (62) and the coating (64) is transferred from the film (60) to the outside layer (50).

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- 15.** The system (100) according to any of claims 10-14, further comprising:
a reference object reader (160) configured to determine a position of the ink (62) relative to the packaging material (10) by reading a reference object (18) printed on the packaging material (10) and on the film (60). 10
- 16.** A packaging material (10) provided with print using the method (200) according to any of claims 1-15 and/or the system (110) according to any of claims 16-21. 15
- 17.** A film (60) comprising a coating (64) and ink (62) printed on the coating (64), wherein the film (60) is suitable for providing print to an at least semi-finished packaging material (10) according to the method (200) of any of claims 1-15 and/or using the system (100) according to any of claims 16-21. 20

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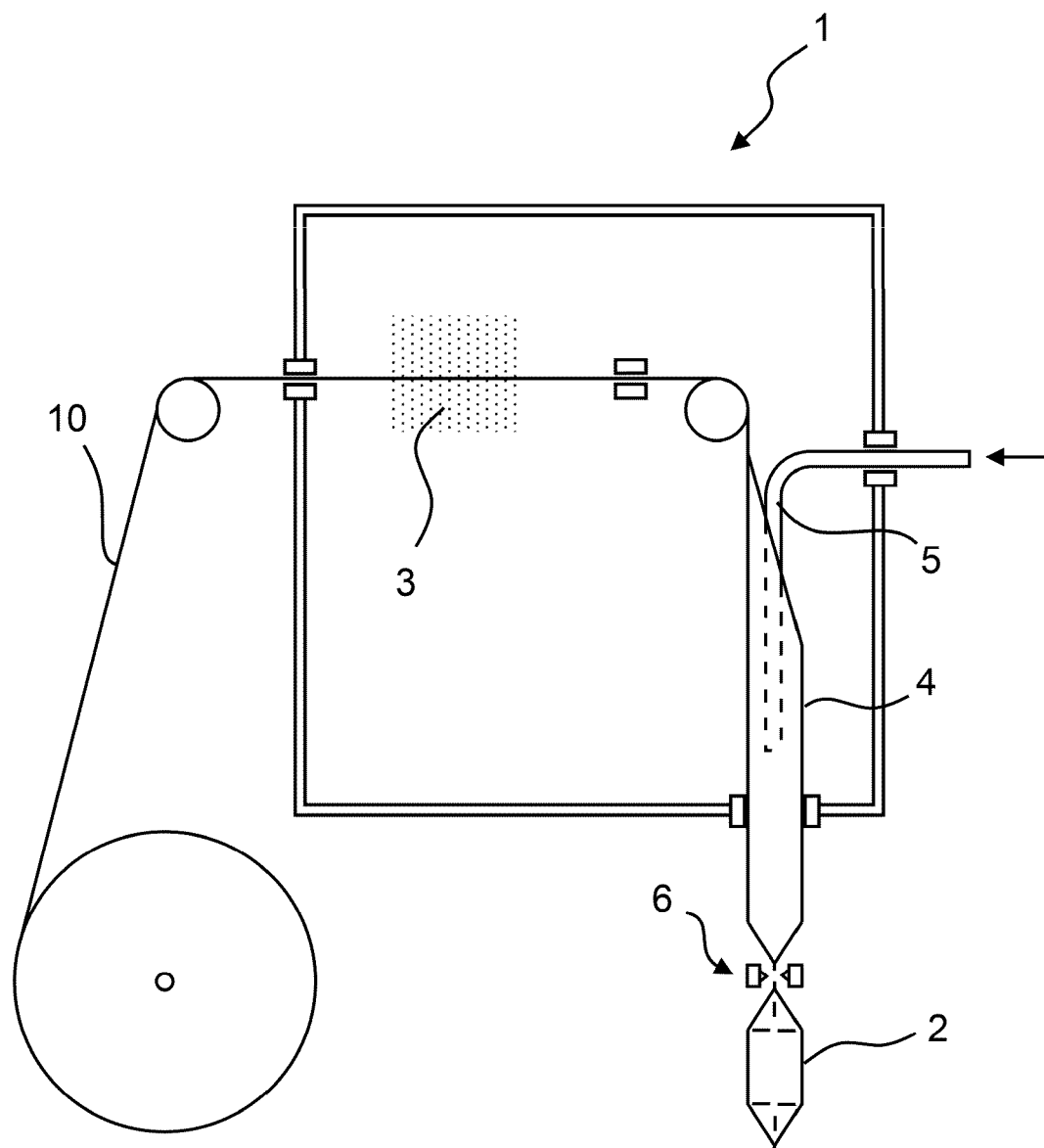
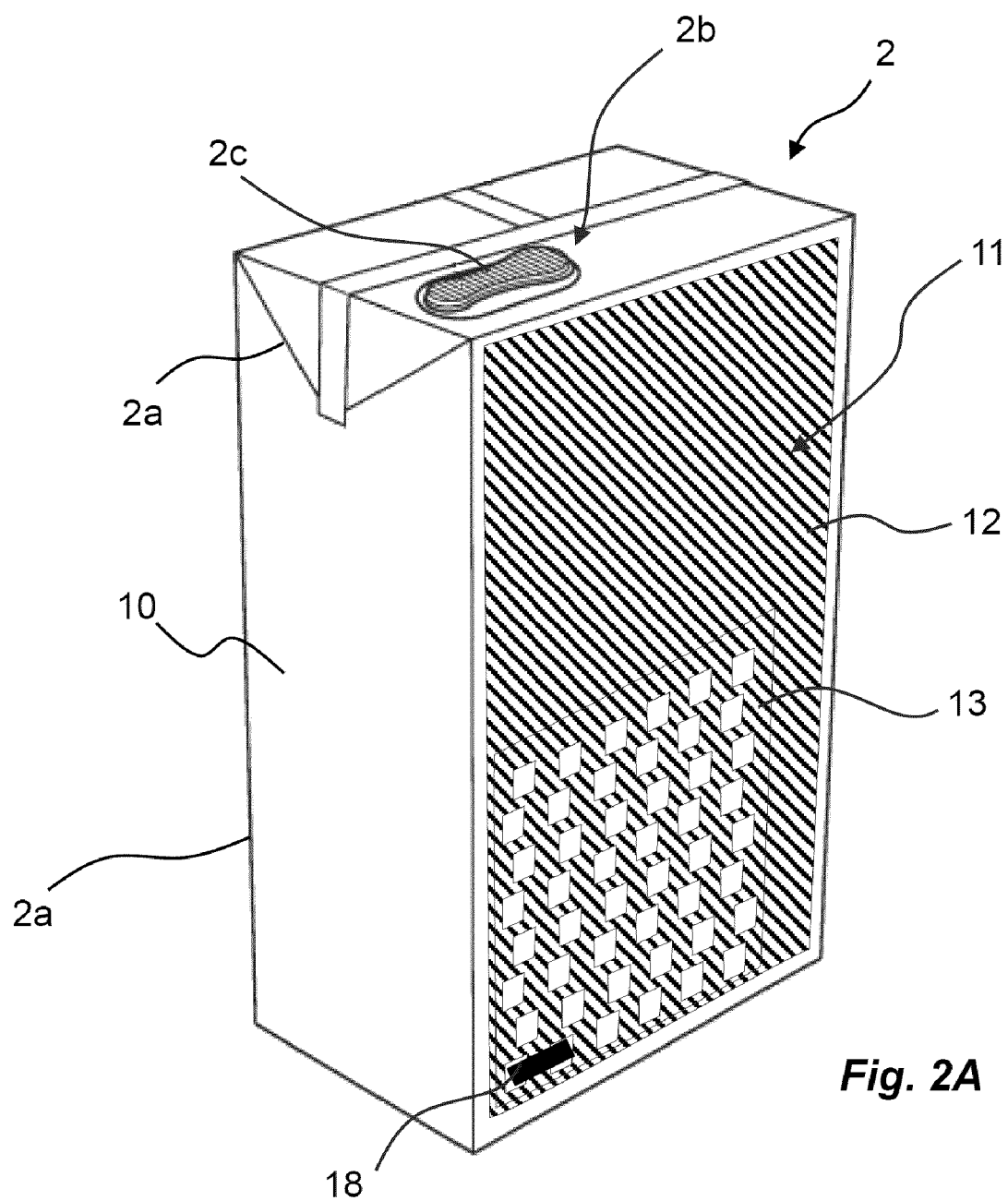


Fig. 1



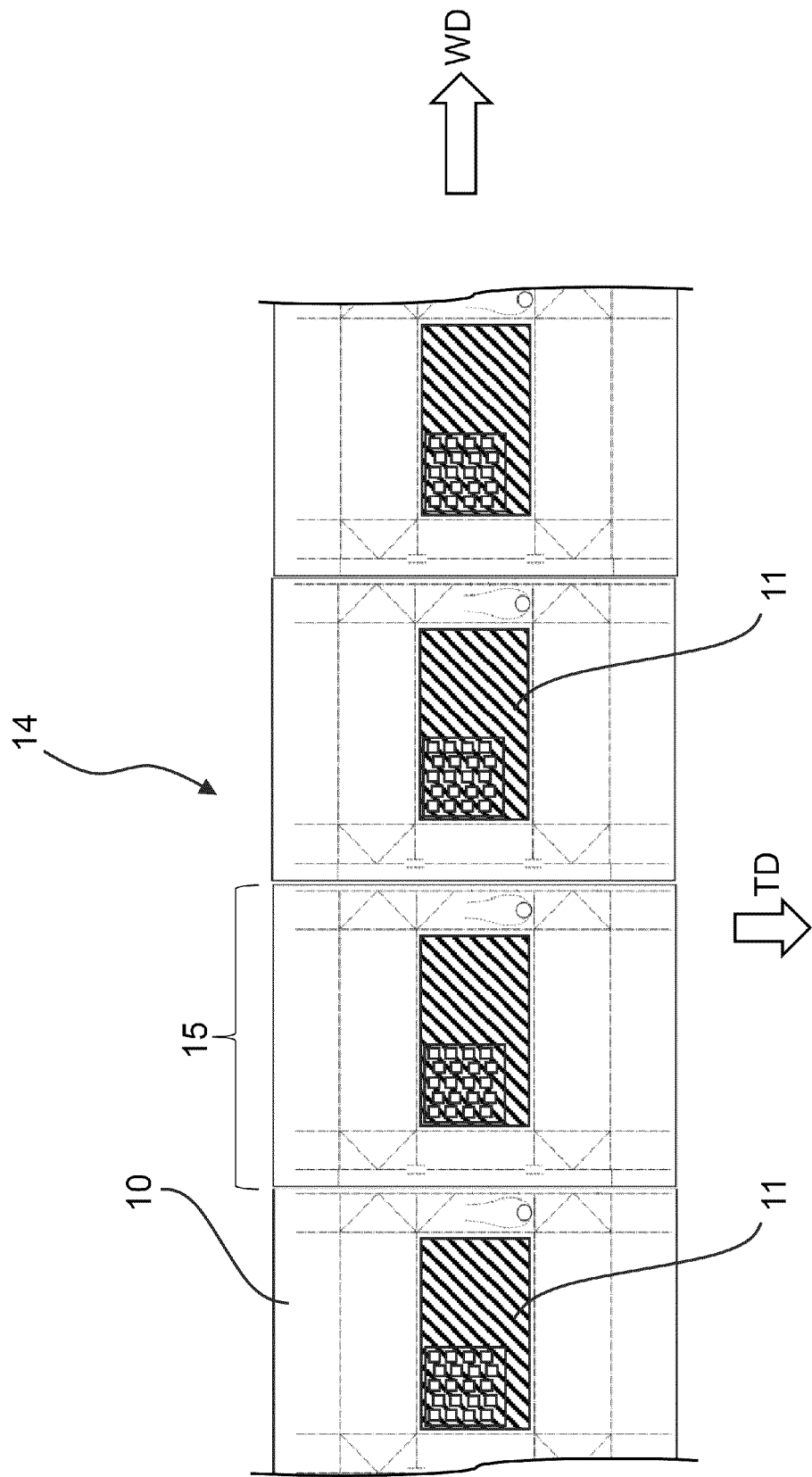


Fig. 2B

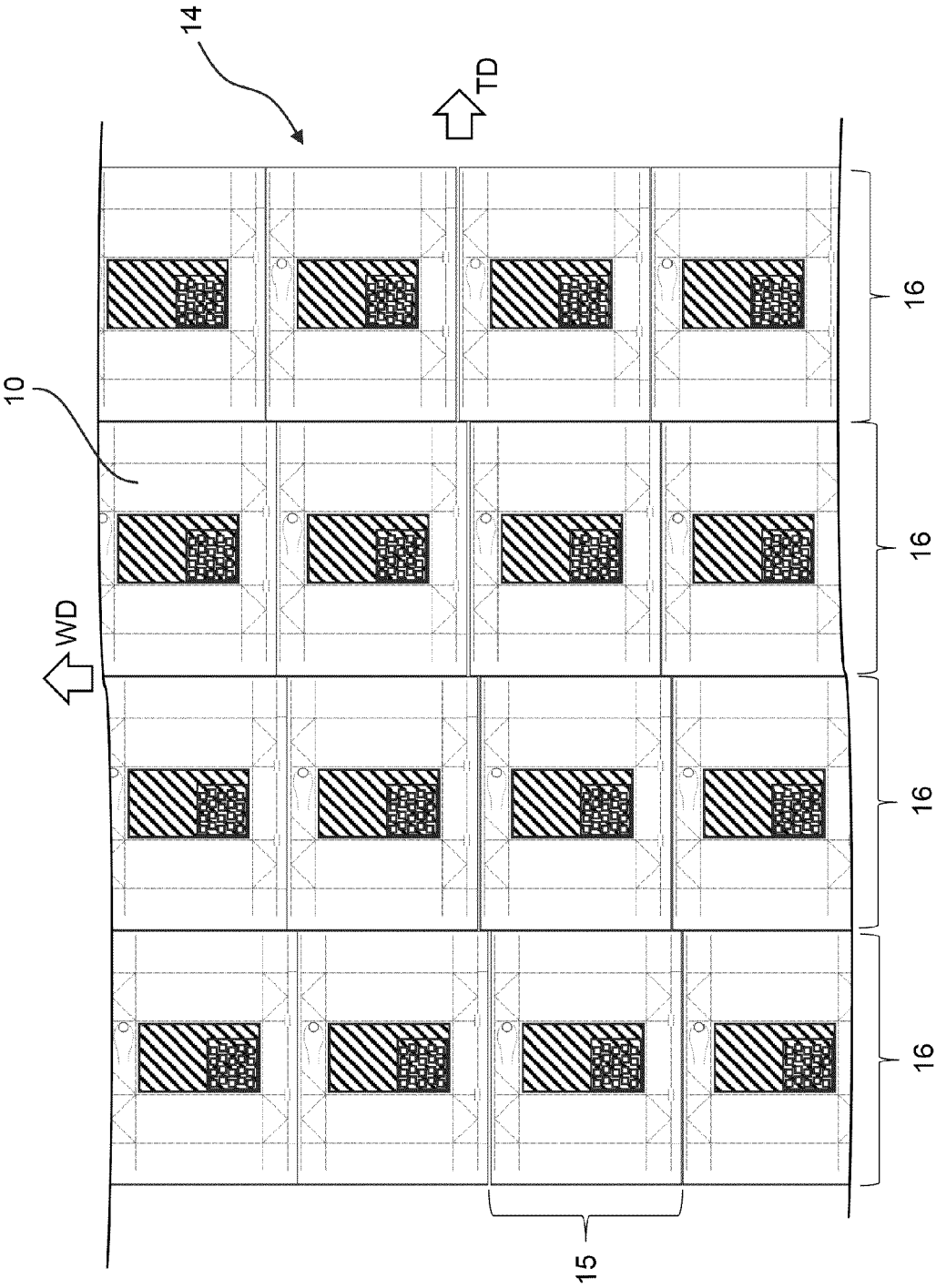


Fig. 2C

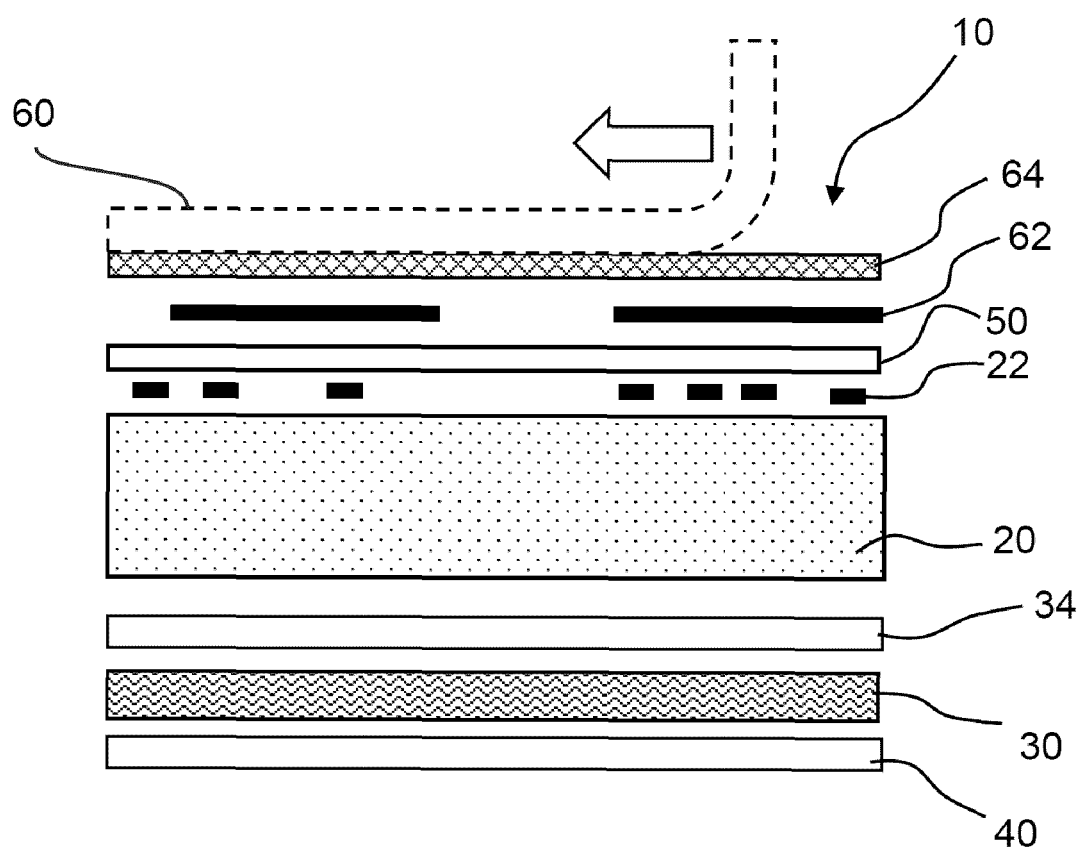


Fig. 3

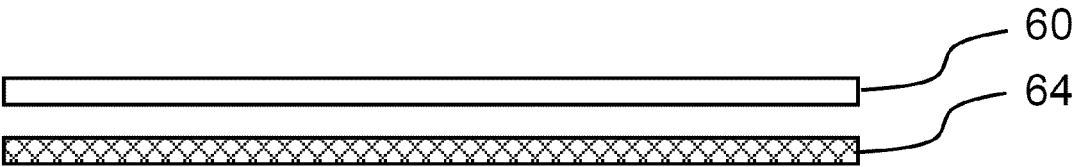


Fig. 4A

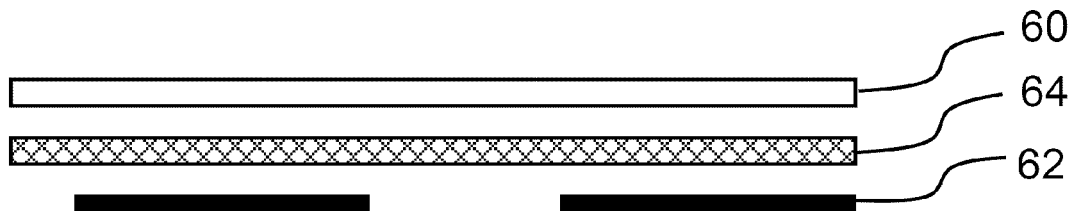
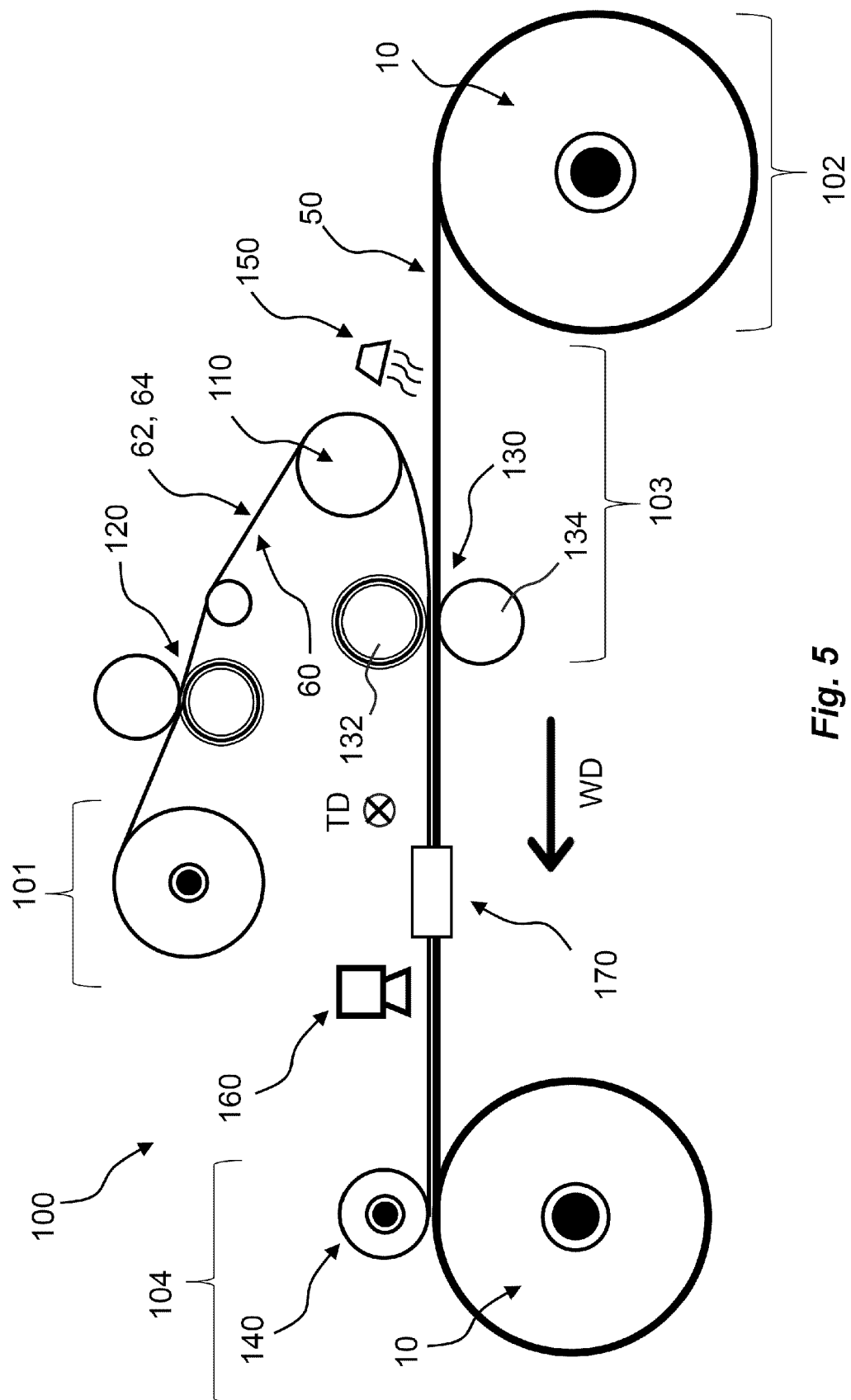


Fig. 4B



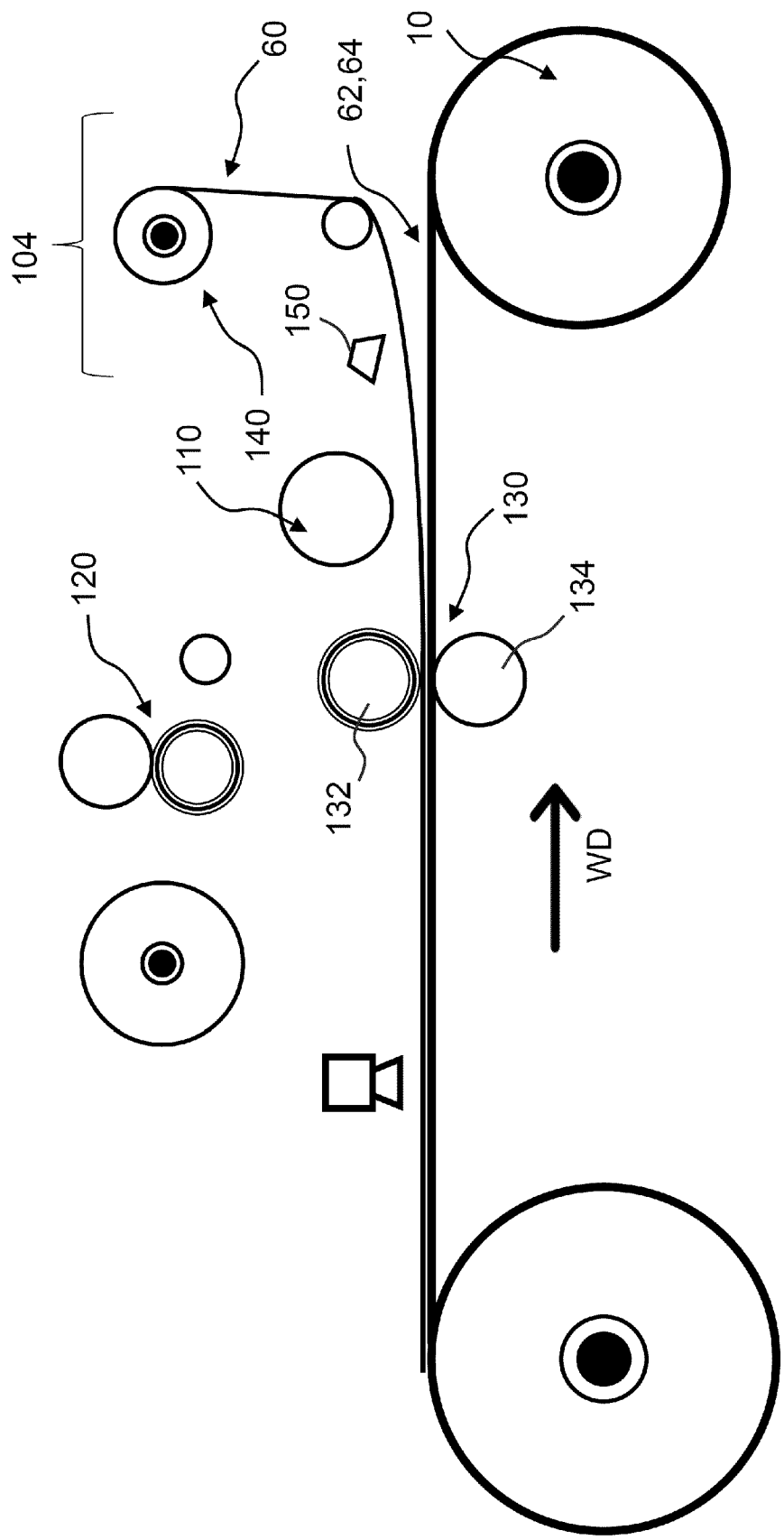


Fig. 6

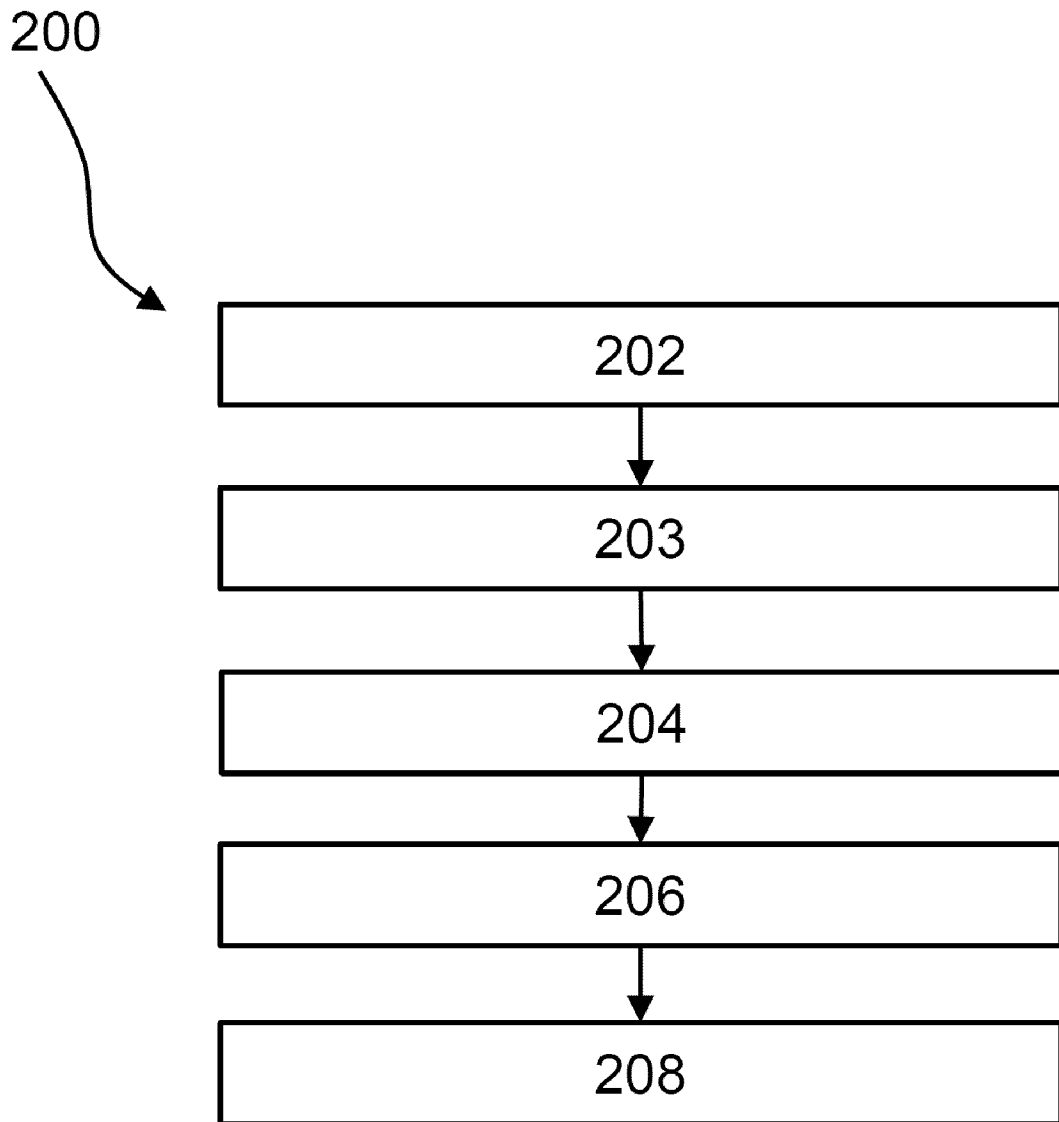


Fig. 7



EUROPEAN SEARCH REPORT

Application Number

EP 25 16 8298

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Munich		18 October 2025	Patosuo, Susanna
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