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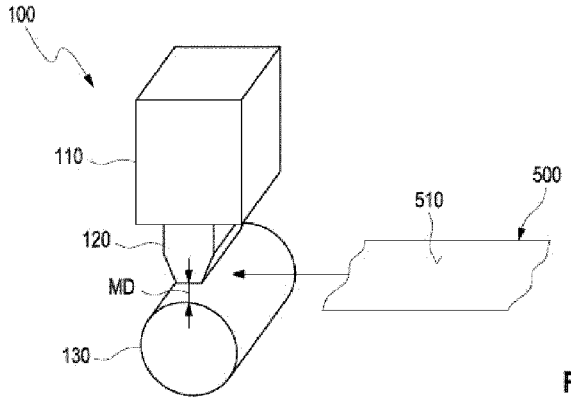


Fig. 1

(57) Abstract: The present invention refers to a printing device for printing a pattern on a surface of a target, wherein the printing device comprises at least an inkjet printing unit with at least a print head and a support, wherein the support defines the position of the target relative to the print head, wherein a minimum distance between the support and the print head is variable by movement of the support. The present invention also refers to a process of printing a pattern on a surface of a target whereby the aforementioned printing device is used.

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INK JET PRINTER WITH PRINT HEAD PROTECTION MEANS

Technical field of the invention

The present invention refers to a printing device for printing a pattern on a surface of a target, wherein the printing device comprises at least an inkjet printing unit with at least a print head and a support, wherein the support defines the position of the target relative to the print head, wherein a minimum distance between the target and the print head is variable by movement of the support. The present invention also refers to a process of printing a pattern on a surface of a target whereby the aforementioned printing device is used.

Background of the invention

Industrial printing processes of printing a design or an information on a target, such as a sheet like web, are known. A recent development is digital printing which provides floor for printing individualized design and information, also in an industrial scale. Nowadays, digital printing processes are used for various printing tasks. Nevertheless, digital printing is often a relatively slow process compared with non-digital printing processes. Thus, use in high-throughput printing applications, like printing on packaging of convenience goods, e.g. containers for drinks and foodstuff remains a challenge. In particular, ink jet printing remains of disadvantage when high quality colored images, high printing throughput and high accuracy of the printed images are required.

Summary of the invention

In general terms, it is an object of the present invention to at least partly overcome one disadvantage which arises from the prior art.

An object of the invention is to provide a printing device based on inkjet technology which can process feed materials of unequal thickness.

Another object of the invention is to provide a printing device based on inkjet technology which can be run on high throughput.

Another object of the invention is to provide a printing device based on inkjet technology which allows to print high quality graphics.

Another object of the invention is to provide a printing device based on inkjet technology which allows to print high quality graphics with high throughput and on feed materials of unequal thickness.

Another object of the invention is to provide a printing device based on inkjet technology which needs little maintenance and has a long operational lifetime.

Another object of the invention is to provide a printing process based on ink jet printing technology, which allows to run on high throughput.

Another object of the invention is to provide a printing process based on ink jet printing technology, which allows to run on high throughput, also when printing on fed materials of unequal thickness.

Another object of the invention is to provide a printing process based on ink jet printing technology, where the changeover time is short.

Another object of the invention is to provide a printing process based on ink jet printing technology, where the changeover time is short and/or simple compared with known processes, preferably employing the same printing technology.

Another object of the invention is to provide a printing process based on ink jet printing technology, which allows to print high quality graphics.

Another object of the invention is to provide a printing process based on ink jet printing technology, which allows to print high quality graphics in high throughput.

Another object of the invention is to provide a printing process based on ink jet printing technology, which allows to print high quality graphics in high throughput on feed materials of unequal thickness.

Another object of the invention is to provide a printing process based on inkjet technology which needs little maintenance and supports a long operational lifetime of the machines on which it runs.

A contribution to at least partial achievement of at least one of the above objects is made by the independent claims. The dependent claims provide preferred embodiments which contribute to at least partial achievement of at least one of the objects.

A contribution to the achievement of at least one of the objects of the invention is made by an embodiment |1| of a printing device for printing a pattern on a surface of a target,

wherein the printing device comprises at least an inkjet printing unit with at least a print head and a support,

wherein the support defines the position of the target relative to the print head,

wherein a minimum distance between the support and the print head is variable by movement of the support.

The target is preferably sheetlike. A treatment path of a target is defined to extend from upstream to downstream of a process. With regard to a configuration of a device, e.g. a printing device, a treatment path indicates the path a sample follows from feed to the finished good. In a printing device, e.g., the treatment path begins at a feeder of substrate, e.g. a roll, goes possibly through a pre-treatment unit, an inkjet printing unit which can comprise one or more print heads and one or more supports, one or more curing units, possibly through another pre-

treatment, printing and curing unit via cutting and creasing until a coloured and/or printed substrate leaves the printing device.

In an embodiment |2| according to the printing device of the invention, the printing device further comprises

a. a control unit,
b. at least an actuator A1 which is connected to the support, and
c. at least a sensor S1,

wherein the sensor S1 is configured and positioned to detect a change in the thickness of the target and generates a signal,

wherein the sensor S1 is configured to convey the signal to the control unit, and

wherein the control unit is configured to trigger the actuator A1 to move the support from a position P1 into a position P2 when the thickness of the target, as determined by sensor S1, deviates from a pre-defined value V1.

In a preferred embodiment thereto, the control unit triggers the actuator A1 to move the support from a position P1 into a position P2 when the thickness of the target, as determined by sensor S1, is larger than the pre-defined value V1.

In a preferred embodiment thereto, the pre-defined value V1 is in the range from 0.2 to 0.8mm, for example in the range from 0.3 to 0.7mm, yet more preferred in the range from 0.3 to 0.4 mm.

In an embodiment |3| according to the embodiment |1| of to the printing device of the invention, the printing device further comprises

a. a control unit,
b. at least an actuator A1 which is connected to the support (130), and
c. at least a sensor S1,

wherein the sensor S1 is configured and positioned to detect a change in the thickness of the target and generates a signal,

wherein the sensor S1 is configured to convey the signal to the control unit, and
wherein the control unit is configured to trigger the actuator A to move the support from a position P1 towards or away from the print head,
so that a predefined distance D between the target and the print head is maintained.

In an embodiment |4| according to the printing device of the invention, the support is selected from one of: a table, a cushion of air, a roll.

In an embodiment |5| according to the printing device of the invention, the distance D between the support and the print head is in the range of from 0.3 to 2.0 mm, preferably in the range from 0.4 to 1.5 mm, for example in the range from 0.5 to 1.0 mm, and most preferred 0.5 mm.

In an embodiment |6| according to the printing device of the invention, the at least one sensor S1 is arranged in the range from 0.1 to 3.0 m, preferably in the range from 0.3 to 2.0 m, for example from 0.3 to 1.0 m, further preferred in the range from 0.3 to 0.7 m upstream of the print head.

In an embodiment |7| according to the printing device of the invention, the at least one further sensor S2 is arranged 0.1 to 3.0 m downstream of the print head.

In an embodiment |8| according to any one of embodiments |2| to |7| of the printing device of the invention, the control unit is configured to trigger the actuator to move the support to position P2 when the sensor S1 indicates a section of target with a thickness which deviates from the pre-defined value V1.

In an embodiment |9| according to embodiment |8| of the printing device of the invention, the control unit is configured to trigger the actuator to move the support back to position P1 at a delay DS after the sensor S1 has indicated that the section of the target with a thickness, which deviates from the pre-defined value V1, has passed the sensor S1.

In an embodiment |10| according to any one of embodiments |2| to |8| of the printing device of the invention, the control unit is configured to trigger the actuator A1 to move the support to position P1 when the sensor S2 indicates that the section of "increased" thickness has passed the sensor S2. In a preferred mode, the control unit is configured to trigger the actuator A1 to move the support to position P1 when the sensor S2 indicates that the section of "increased" thickness has passed the sensor S2.

In an embodiment |11| according to any one of the preceding embodiments of the printing device of the invention, the support is mounted to guiding means that are configured to control the position of the support upon movement. Preferably, the guiding means are configured to control the position of the support so that the support can be moved back and forth only in the direction towards of and away from the print head.

In an embodiment |12| according to any one of the preceding embodiments of the printing device of the invention, the printing device is configured to print on a continuous target. A continuous target in the context of the present invention is a target which has an aspect ratio, i.e. a ratio of length to width of 500:1 or more. It often has an aspect ratio of 1000:1 or more, e.g. an aspect ratio of 5000:1 or more, or 9000:1 or more. Often, an aspect ratio of 10000:1 is not exceeded.

Preferably, a continuous target is conveyed throughout the printing device and in particular under the print head. The target can be supplied from a storage roll. The printing device might stop conveying the target in order to join an end of a target of an emptying storage roll with an end of a target from another, loaded storage roll. After joining the two ends of target, the printing process and conveying the target can be resumed.

In an embodiment |13| according to any one of the preceding embodiments of the printing device of the invention, the target is a composite.

In an embodiment |14| according to any one of the preceding embodiments of the printing device of the invention, the target material is a sheet of from 80 to 400 mm in width and from 100 to 400 mm in length, or a web of 1000 to 2000 mm in width, e.g. from 1380 to 1780 mm, most preferred from 80 to 100 mm, and of 3000 to 10000 m in length, e.g. from 5000 to 7500m. Such a web can be stored on and supplied from a roll.

A contribution to the achievement of at least one of the objects of the invention is made by an embodiment |1| of a process of printing a pattern on a surface of a preferably sheetlike target whereby a printing device according to any one of the embodiments of the printing device of the invention is used.

A contribution to the achievement of at least one of the objects of the invention is made by an embodiment |1| of a process of printing a pattern on a surface of a preferably sheetlike target, wherein the process comprises these steps:

a) providing a target to a printing device;
b) feeding the target to the print head of the printing device,
thereby passing a first sensor S1, which is upstream of the print head;
wherein the sensor S1 detects a change in the thickness of the target and conveys this information to a control unit;
wherein the control unit triggers the actuator A1, which is connected to the support to adjust the position of the support carrying the target;
c) printing a pattern on the surface of the target which faces the print head;
d) Fixing the printed pattern on the surface;
whereby a target is received which carries a printed pattern.

The position of the support is adjusted in a way that at least a distance D is maintained between the target and the print head. This safeguards the target, the print head and ensures the functionality of the whole printing machine.

Preferably, all items and feature referred to in embodiment |1| of this process can have the same meaning and can comprise the same preferred further embodiments and variants as described for the printing device of the invention.

Providing the target can be done by any means known to and considered appropriate for carrying out the present invention by the skilled person. Examples of providing the target are: unrolling the target from a roll on which it is stored and feeding sheets from a pile. If sheets are fed from a pile, a means of conveying the sheets through the printing machine during the printing process is required. This could be, e.g. a conveyor belt and the like. If the target is unrolled from a roll, the target must be inserted into the mechanism of the printing machine. One way is to join an end of the target from a new roll with an end of a target where printing onto is in process and which still not has passed the feed section of the printing machine.

Printing is done in an ink jet printing unit which contains one or more print heads. The print heads can be aligned to "lines of service" when using more than one print head. One or more supports can be positioned vis-à-vis each print head. Preferably, one support serves all print heads of one "line of service", e.g. if there are three print heads in one line of service, one single support can serve the three print heads; if there are 5 print heads in two lines of service, one line with 2 and the other with 3 print heads, two supports will serve the 5 print heads in the two lines of service.

Fixing the printed pattern can be obtained by any means and processes known to and considered appropriate for fixing an ink printed pattern by the skilled person. Fixing of an ink can be obtained by solidification or absorption, or both. Solidification can be achieved by a chemical reaction or loss of liquid constituents of the ink like evaporation, or both.

In a preferred embodiment to the process of the invention, an ink is employed for printing which can be fixed by chemical reactions which are driven by radiation; in this case at least a part of the fixing is effected by radiation, which is preferably selected from the group consisting of: UV radiation; IR radiation; radioactive irradiation; x-rays; electron beam (e-beam) and

combinations of two or more thereof. A preferred combination of different fixing processes is combined UV radiation of the ink and evaporation of the contained solvent. Such combined fixing processes can be used for e.g. mailings and job printing.

In an embodiment |2| of the process of the invention, the process is configured according to embodiment |1|, wherein a continuous target is fed to the print head.

In an embodiment |3| of the process of the invention, the process is configured according to embodiment |2| of the process, wherein the continuous target is formed by a plurality of sheets which are joined edge to edge, preferably by using one or more adhesive tapes. An adhesive tape in the present context is a strip of metal, cloth or plastic which has a surface of the strip covered with an adhesive.

In this event, exemplary values for P2 are shown in the table below.

Example	P2	Sectional view
Edge to edge I	≥ thickness of target + 1x thickness of tape	Figure 7a)
Edge to edge II	≥ thickness of target + 2x thickness of tape	Figures 7b), c)

As a rule, an additional safety gap is added to the values mentioned for P2 in order to make sure that no contact is established during operations.

In an embodiment |4| of the process of the invention, the process is configured according to embodiment |3|, wherein the continuous target is formed by a plurality of sheets, wherein at least two sheets of the plurality of sheets are joined by overlapping, preferably by using one or more adhesive tapes. An adhesive tape in the present context is a strip of metal, cloth or plastic which has a surface of the strip covered with an adhesive. The meaning of overlapping in the

present context is that the surfaces of two sheets are at least partially facing each other and are in contact.

In this event, exemplary values for P2 are shown in the table below.

Example	P2	Sectional view
Overlapping I	≥ 2x thickness of target + 1x thickness of tape	Figure 8a)
Overlapping II	≥ 2x thickness of target + 2x thickness of tape	Figure 8c)
Overlapping III	≥ 2x thickness of target + 3x thickness of tape	Figure 8b)

As a rule, an additional safety gap is added to the values mentioned for P2 in order to make sure that no contact is established during operations.

In an embodiment |5| of the process of the invention, the process is configured according to any one of the preceding embodiments of the process, wherein the sensor S1 is passed by the continuous target when being fed to the print head in a distance of between 0.3 to 3.0m up-stream of the print head.

In an embodiment |6| of the process of the invention, the process is configured according to any one of the preceding embodiments of the process, wherein the sensor S2 is passed by the continuous target in a distance of between 0.3 to 3.0m downstream of the print head.

In an embodiment |7| of the process of the invention, the process is configured according to any one of the preceding embodiments of the process, wherein the target is selected from a foil, a composite, a layered structure, paper, carton and a textile.

In an embodiment |8| of the process of the invention, the process is configured according to any one of the preceding embodiments of the process, wherein a printing device according to any one of the embodiments of the printing device of the invention is used.

Pattern

The pattern according to the invention may be any pattern which the skilled person may consider appropriate in the context of the invention. The pattern of the invention is printed on the surface S of the target, which preferably is also an outer surface. In principle, the pattern may comprises information which can be read by a human or by a machine. The pattern may comprise information which is stored in the pattern as a 1D-, 2D or 3D-code. An example of a 1D-code is a line of dots.

Ink jet printing unit

An ink jet printing unit according to the invention may be any ink jet printing unit which the skilled person may consider appropriate in the context of the invention. Preferably, the inkjet printing unit comprises one or more, e.g. 2, 3, 4, 5, 6, 7, 8 print heads. Each print head is configured to apply an ink composition to a target.

When using more than one print head, the print heads can be arranged in a direction substantially perpendicular to the treatment path of the target. In such an arrangement one or more of the print heads of the ink jet printing unit can be positioned at a permanent position or a moved along a part of the width of the target and the treatment path of the target. An arrangement of two or more print heads on a means which is substantially perpendicular to the treatment path of the target is sometimes also referred to as a “line of service”. A configuration of more than one print head in one line of service may serve for different purposes. In a first alternative, employing two or more movable print heads instead of one could improve print speed. In such a configuration, each print head only prints a fraction of the total width of the target. Distances to be covered are reduced, accordingly the speed of target could be enhanced. In a first alternative, the two or more print heads can be moved but each print head moves only little around a position during operation. That way, a target which has a repetitive pattern with respect to the width of the target, can be printed more efficiently. For example, the target could be a compo-

site material designed for use as a foodstuff storage container. Typically, the size of the target exceeds the size of the container and two or more, e.g. 3, 4, 5, 6 or 7 designs are printed in parallel. Afterwards, the target could be cut into the number of designs thus giving the appropriate number of designs.

Furthermore, the print heads could be at least partially arranged in direction of the treatment path of the target. Then, a second print head is positioned downstream of the first print head, both within the same ink jet printing unit. In this scenario, the area which is printed onto by the first print head is also be printed onto by a second print head, and by a third print head etc. Such configuration may serve for different purposes. In a first alternative, employing two or more print heads in downstream direction could be used to improve print speed pattern which have more than one color. In this event, the print heads would be filled with ink compositions of different color. In a second alternative, the print heads could be filled with ink compositions of the same color. Employing two or more print heads in downstream direction could be used to increase printing speed. For example, this could be achieved if the first print heads applies the first and then every second droplet to the target, whereas the second print head applies the second and then every second droplet to the target in the spaces left from applying droplets by the first print head.

Furthermore, the print heads could be arranged in an array. The configuration of an array according to the invention is a combination of the two aforementioned configurations. In an array, a number of print head is arranged, whereby some print heads line up in a direction substantially perpendicular to the treatment path of the target and some other print heads line up substantially in downstream direction. That way, arrays of e.g. 3 x 2, 3 x 3, 4 x 2, 2 x 4 and so on can be formed. In another alternative, an array could be formed by print heads which are lined up perpendicular to the treatment path of the target in two lines, i.e. two lines of service, but staggered with respect to downstream alignment.

Support

A support according to the invention may be any support which the skilled person may consider appropriate in the context of the invention. The support of the invention defines the position of a target relative to a print head. The target which is to be printed by the print head is positioned or runs between the support and the print head. Usually, the target is in physical contact with the support, preferably, at the place where the ink is applied from the print head to the target. So, a minimum distance between the print head and the target can be adjusted by adjusting the relative position of the support with regard to the print head. The minimum distance is determined between the print head and the target. The minimum distance is the path from the print head where the ink is jetted from to the target. It equals most often to a virtual line or plane going through the print head and being perpendicular to the target.

The support can be an item of any shape which is known to the skilled person and may be considered appropriate by him in the context of the invention. Preferred examples of a support are selected from the group consisting of: a roll, a table and a cushion of air.

The support can be moved at least in a direction of and away from the print head. The minimum distance decreases if the support is moved in direction of the print head. The minimum distance increases if the support is moved in direction away from the print head. The support may be moved either when the printing device is stopped or during operation of the printing device. Preferably, the support can be moved in both stages, i.e. when the printing device is stopped but also when the printing device is running.

The support may be used for any purpose which the skilled person may consider and find appropriate in the context of the present invention. Particularly preferred, the support is used to maintain a defined distance D between the print head and the target. This could be useful if the target is of a varying thickness. Another scenario implies that a continuous target is used which is fed from a supply, such as a roll. When the end of the target unwinding from the roll is reached, the roll is switched and a new roll bearing another target is placed in the feeder. Then the end of the target and an end of the other target can be combined, e.g. glued or taped. At the

place of combination of the two ends of the two targets, the target may exhibit an increased thickness. Using a support which is not repositionable would lead to a change of distance between the print head and the target where two target overlap. By using a support which can be moved as described above, damages to the print heads caused by a reduced distance between the target and the print head can be avoided. It is even possible to continue printing while a target overlap passes under the print head. Furthermore, the support may contribute to the tension of the target when being part of a feed process. In this embodiment, the support positions the target under tension to ensure an exact position at the place of printing.

The support can be moved by an actor. Then the actor acts on the support and induces a motion. The support itself can be guided by guiding means in direction of or away from the print head. The guiding means contribute in the support is repositioned in a defined way. Each guiding means may comprise, independently from other guiding means, stoppers. A stopper is configured and positioned to limit a movement of the support in the guiding means at a defined position. Two stoppers in one guiding means can define a maximum path of movement of a support. This can be used to secure the support and to avoid potential harm to the print head, the target or the printing device as such. An example of a guiding means are rails.

Control unit, actuators and sensors

The printing device may further comprise a control unit, at least an actuator A1 and at least a sensor S1. The control unit, actuator A1 and sensor S1 can be any control unit, actuator A1 and sensor S1, which the skilled person may consider appropriate in the context of the invention.

Preferably, the printing device comprises a control unit, at least an actuator A1 and at least a sensor S1. The actuator A1 can be connected with and configured to move the support, preferably by a mechanical connection. Further, the actuator A1 can be connected with the control unit by a signal guide. In such a configuration, the actuator can trigger an action when receiving a signal sent by the control unit. The control unit can be further connected with a sensor S1, preferably by a signal guide. So, the control unit can process the signals which are conveyed by the sensor S1 to the control unit via the signal guide. A common signal guide is an

electrical wire or a light guide. By preference, the sensor S1 is positioned upstream of the print head. One variant of sensor S1 can be configured and positioned to measure the thickness of a target. Another variant of sensor S1 can be configured and positioned to detect any change in the thickness of the target. A change in the thickness can occur, e.g., if the target is provided from rolls and the thickness of the target varies at different positions on the unrolled target. In the first variant, the sensor S1 might generate a signal containing information regarding the thickness, in the second variant the sensor S1 might generate a signal containing information regarding the change of the thickness. In a third variant, the sensor S1 is set to a pre-defined value V1 of the thickness. In this case, the sensor produces a signal if the thickness of the target deviates from the value V1, preferably if the thickness of the target is larger than the value V1. For example, the sensor S1 sends a signal "1" in case a thickness of the target exceeding the value V1 is determined, and a signal "0", or no signal, if the thickness of the target does not exceed V1. Either way, the signal can be conveyed to the control unit which triggers the actuator S1 to move the support from a position P1 towards or away from the print had to maintain the predefined distance D between the target and the print head. In an alternative, the signal can be conveyed to the control unit which then triggers the actuator A1 to move the support from a position P1 into a Position P2. In this alternative, P1 refers to a position of the support in which the target is in a minimum distance D from the print head. Position P2 then refers to a safety position, in which the support is moved from the printing position P1 in order to avoid damage of the print head or of the target because of the deviation in the thickness of the target.

In another variant, the printing device has at least a control unit, a sensor S1 and an actuator A1. As before, at least the actuator A1 and the sensor S1 are connected with the control unit by a signal guide. Further, the control unit can trigger actuator A1 to move the support from a position P1 into a Position P2 when having received a signal containing information regarding a change of the thickness of the target from sensor S1. In this variant, the support is moved from position P2 into position P1 after a delay DS which had begun when sensor S1 has produced a signal information regarding the change of the thickness of the target. The DS delay can be calculated by the following formula:

Delay DS = Distance b/w sensor S1 and print head / speed of target + x [s],

wherein x is a safety add-on, e.g. from 0.04 to 0.06 s

In the following table, an example is provided for delay times D1.

Example	Distance (S1; print head)	Speed of target [m/min]	DS [s]
A	2.0m	350	0.4

In another variant, a further sensor S2 is positioned downstream of the print head. The sensor S2 can be operated the same way as the variants described for sensor S1. Sensor S2 is connected via a signal guide with the control unit. Sensor S2 conveys a signal to the control unit when the thickness of the target exceeds a defined value. In this event, the control unit processes the signal and triggers the actuator A1 to move the support back into position P1. Should the support be already in position P1, the control unit will not trigger the actuator for any change of the position of the support.

The sensor S1 may be any sensor S1 which the skilled person may consider appropriate in the context of the invention. It can be useful in many cases to mount two or more sensor S1 to detect the thickness of the target, or the change of the thickness of the target at more than one position. For example, it can be preferred to position a number of 2, 3, 4, 5, 6 or 7 preferably identical sensors S1 in a line perpendicular to the target to detect the value at various spots over the width of the target. If two or more sensors S1 are positioned, the control unit could be configured to trigger the actuator A1 when one of the sensors S1 send a signal. For example, the sensor S1 can be a capacitive sensor, a photoelectric sensor or an ultrasonic sensor.

The signal can be any signal which the skilled person may consider appropriate in the context of the invention. It can vary over a range or be binary. Preferred examples are binary signals,

where either a “0” or a “1” is conveyed. Other preferred examples comprise signals where the absolute or relative value of the target’s thickness is conveyed. It is within the skill set of the skilled person to adopt the signals of the sensor S1 to the requirements of the control unit, further to adopt the signal from the control unit to the requirements of the actuator A1.

The sensor S2 may be any sensor S2 which the skilled person may consider appropriate in the context of the invention. Preferably, the sensor is selected from the same kind as sensor S1. Yet more preferred, sensor S1 and sensor S2 are of the same type, and even of the same model. Accordingly, signals generated and conveyed by sensor S2 are of same kind as signals generated and conveyed by sensor S1.

In another variant which can be used with any variant discussed before, a further sensor S0 is positioned upstream of sensor S1 and configured to . The sensor S0 can be operated the same way as the variants described for sensor S1. Sensor S0 is connected via a signal guide with the control unit. Sensor S0 conveys a signal to the control unit when the thickness of the target exceeds a pre-defined value V1. In this event, the control unit processes the signal and reduces temporarily the velocity of the target. This procedure could reduce tension of the target, vibrations of the target or provides extra time which could be needed to move the support upon a signal generated by sensor S1. After a delay DS2 or upon a signal of a sensor, e.g. sensor S2 downstream of the print head, the control unit triggers actuator A1 to move the support into printing position, e.g. a position P1. If this motion of the support into printing position is triggered by a delay DS, then the delay DS is selected long enough for the part of the target of exceeding thickness to pass the print head. The sensor S0 is positioned and configured to measure the thickness or to detect a change in the thickness of a target passing the sensor S0. The sensor S0 may be any sensor S0 which the skilled person may consider appropriate in the context of the invention. Preferably, the sensor is selected from the same kind as sensor S1. Yet more preferred, sensor S1 and sensor S0 are of the same type, and even of the same model. Accordingly, signals generated and conveyed by sensor S0 are of same kind as signals generated and conveyed by sensor S1.

The actuator A1 can be any actuator which the skilled person may consider appropriate in the context of the invention. The actuator can be a hydraulic or a pneumatic valve, or be driven by a motor, e.g. a linear motor. The motor is, by preference, powered by pneumatic valve.

Target

The target according to the invention may be any target which the skilled person may consider appropriate in the context of the invention. Preferably, the target is sheetlike. It can be flat or curved. In the context of the present invention, the term "sheetlike" refers to an object, which is much smaller in one direction than in the other two directions. The three directions are defined by the 3D rectangular space. For example, a "sheetlike" object extends about 20 cm in a direction a, perpendicular thereto about 30 cm in a direction b, and about 0.1 cm in a direction c, wherein direction c is perpendicular to the plane defined by the vectors of directions a and b. Preferred examples of a sheetlike target are sheets, a web, sleeves, foil or film.

A sheetlike, target can be stored e.g. on stack in form of sheets. A sheetlike flat target can be stored e.g. on a roll when being a web. When being stored on the rolled, the sheetlike target is curved. When unrolled for processing, the sheetlike target might become flat. A sheetlike target which is stored on a roll can be a continuous target, e.g. have a length of 5000 m or 7500 m and a width of 1.5 m to 2.0 m.

Preferably, the target is a sheetlike composite. The sheetlike composite according to the invention can be any kind of sheetlike composite which is known to and considered appropriate for carrying out the present invention by the skilled person. The preferred sheetlike composite comprises as layers of a layer sequence in a direction from an outer surface of the sheetlike composite to an inner surface of the sheetlike composite

a) an outer polymer layer,
b) a carrier layer, and
c) a barrier layer.

The sheetlike composite can further comprise one or more a colour applications, each superimposing the outer polymer layer on the side of the outer polymer layer which is facing away from the inner surface of the sheetlike composite. Preferably, the sheetlike composite comprises at least a first colour application.

The sheetlike composite may be a pre-cut for the production of a single closed container. However, the sheetlike composite may alternatively be suitable for the production of a plurality of closed containers. In this case, the sheetlike composite is preferably at least partly present in form of a roll.

Colour application

Generally, a colour application is a solid material on a surface, wherein the solid material comprises at least one colourant. According to DIN 55943:2001-10, colourant is the collective term for all colouring substances, especially for dyes and pigments. A preferred colourant is a pigment. A preferred pigment is an inorganic pigment or an organic pigment or both, wherein the organic pigment is particularly preferred. Pigments that are notable in connection with the invention are especially the pigments mentioned in DIN 55943:2001-10 and those mentioned in "Industrial Organic Pigments, Third Edition" (Willy Herbst, Klaus Hunger Copyright © 2004 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim ISBN: 3-527-30576-9). However, other pigments may be considered as well. For example, the following are further notable suitable pigments:

i. red or magenta pigments: pigment red 3, 5, 19, 22, 31, 38, 43, 48:1, 48:2, 48:3, 48:4, 48:5, 49:1, 53:1, 57:1, 57:2, 58:4, 63:1, 81, 81:1, 81:2, 81:3, 81:4, 88, 104, 108, 112, 122, 123, 144, 146, 149, 166, 168, 169, 170, 177, 178, 179, 184, 185, 208, 216, 226, 257, pigment violet 3, 19, 23, 29, 30, 37, 50 and 88;
ii. blue or cyan pigments: pigment blue 1, 15, 15:1, 15:2, 15:3, 15:4, 15:6, 16, 17-1, 22, 27, 28, 29, 36 and 60;
iii. green pigments: pigment green 7, 26, 36 and 50;

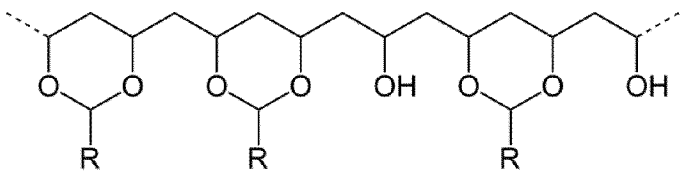
iv. yellow pigments: pigment yellow 1, 3, 12, 13, 14, 17, 34, 35, 37, 55, 74, 81, 83, 93, 94, 95, 97, 108, 109, 110, 128, 137, 138, 139, 153, 154, 155, 157, 166, 167, 168, 177, 180, 185 and 193 and

v. white pigments: pigment white 6, 18 and 21.

A first colour application preferably comprises at least 1 colourant, or at least 2 colourants, or at least 3 colourants, or at least 4. In a particularly preferred embodiment, the first colour application comprises exactly 1 colourant, which is preferably a black pigment. An example of a black pigment is soot. A preferred first colour application is obtainable from a first ink composition, as described herein in the context of the process according to the invention, by fixing an ink composition as described below. Furthermore, a preferred first colour application forms a pattern, which preferably is a plurality of graphic elements of a 2D-code. Preferably, the first colour application comprises a crosslinked polymer, which is preferably a poly-addition product.

Polyvinyl acetal

Polyvinyl acetals are thermoplastics which are prepared by reaction of polyvinyl alcohol with aldehydes or ketones. According to the aldehyde used, for example formaldehyde, acetaldehyde or butyraldehyde, a distinction is made between various polyvinyl acetals. Preferred polyvinyl acetals are polyvinyl formal and polyvinyl butyral. A particularly preferred polyvinyl acetal is polyvinyl butyral (PVB).



Polyvinyl formal (R = H)
Polyvinyl butyral (R = *n*-C_3H_7)

Poly-addition product

As poly-addition product of the first colour application, all those poly-addition products known to the person skilled in the art which to him seem to be suitable for the sheetlike composite according to the invention come into consideration. In contrast to chain polymerisates, monomers of the poly-addition products are able to react with each other to form di-, tri- or oligomers without the need for an initiator which, as with radical polymerisation, starts a reaction of a monomer which then successively reacts with other monomers. The di-, tri- or oligomers which are formed at the start of the poly-addition are additionally able to react with each other to form larger units. Typical poly-addition products are polyamides, polycarbonates, polyesters, polyphenylenoxides, polysulphones, polyepoxides or polyurethanes or a combination of at least two thereof, particularly preferred poly-addition products being those composed at least 50% by weight, preferably at least 70% by weight and particularly preferably 90% by weight of polyurethane, in each case based on the poly-addition product. It is further preferred that the first colour application comprises at least 50% by weight, preferably at least 70% by weight and at particularly preferably at least 90% by weight, in each case based on the weight of the first colour application, of the poly-addition product. However, the first colour application generally comprises no more than 99% by weight of the poly-addition product in order to be able to comprise further materials as well.

Ink compositions

The ink compositions referred to in the context of the process according to the invention are preferably liquids. Preferred liquids are solutions or slurries or both. A first ink composition preferably comprises at least one, preferably at least 2, more preferably at least 5, more preferably at least 10, more preferably at least 15, most preferably at least 20, crosslinking initiators; at least 2 components which can react with each other, wherein this reaction can preferably be started by at least one of the preceding crosslink initiator; a solvent; and a colourant. Preferably, the at least two components are suitable for forming a poly-addition product, preferably a polyurethane. At least one of the crosslinking initiators, preferably a combination of at least two, more preferably all, of the crosslinking initiators, is suitable for initiating the reaction of the at least two components, wherein the reaction is preferably a crosslinking reaction. A pre-

ferred crosslinking initiator is a photo-initiator, which may preferably be activated by irradiation with UV-light.

Further, it is preferred in the process according to the invention that the first ink composition has a viscosity in the range from 0.05 to 0.3 Pa·s and preferably in a range from 0.1 to 0.2 Pa·s during application of this first ink composition onto the outer surface.

Solvent

Materials with a melting point lower than 10 °C are considered as solvent. In principle, all solvents known to the person skilled in the art and which are suitable for the process according to the invention come into consideration. Polar solvents are preferred. Here, protic and aprotic solvents are suitable, of which aprotic polar solvents are preferred, of which esters and ketones, acetone for example, are particularly preferred. As ester, above all ethylacetate, N-propylacetate or methoxypropylacetate come into consideration. A preferred solvent is ethanol. Ethanol particularly preferred as solvent for the first or any further ink composition.

Outer surface

The outer surface of the sheetlike composite is a surface of the sheetlike composite which is intended to be in contact with the environment of the container to be produced from the sheetlike composite. This does not mean that, in individual regions of the container, outer surfaces of various regions of the composite are not folded against one another or joined to one another, for example sealed to one another.

Inner surface

The inner surface of the sheetlike composite is a surface of the sheetlike composite which is intended to be in contact with the contents of the container, preferably a foodstuff, in a container to be produced from the sheetlike composite.

Layers

Unless otherwise stated, the layers in a layer sequence can follow one another indirectly, i.e. with one or at least two intermediate layers, or directly, i.e. without intermediate layer. This is in particular the case with wording wherein there is a layer superimposed on another layer. Wording wherein a layer sequence includes a list of layers means that at least the stated layers are present in the stated sequence. This wording does not necessarily mean that these layers follow one another directly. Wording wherein two layers are adjoin one another means that these two layers follow one another directly and therefore without intermediate layer.

Carrier layer

Material used as carrier layer can be any suitable material which is known to the person skilled in the art for this purpose and which has strength and stiffness sufficient to provide the container with stability to such an extent that the container in essence retains its shape in the presence of its contents. This document also uses the term dimensionally stable to describe a container of this type. In particular, bags and containers made of foils without carrier layer are not dimensionally stable. Preferred materials for the carrier layer are not only several plastics but also plant-based fibre materials, in particular chemical pulps, preferably glued, bleached and/or unbleached chemical pulps, particular preference being given here to paper and paperboard. The weight per unit area of the carrier layer is preferably in the range from 120 to 450 g/m^2, particularly preferably in the range from 130 to 400 g/m^2 and most preferably in the range from 150 to 380 g/m^2. A preferred paperboard generally has a single- or multilayer structure and can have been coated on one or both sides with one or more covering layers. The residual moisture content of a preferred paperboard is moreover less than 20% by weight, preferably from 2 to 15% by weight and particularly preferably from 4 to 10% by weight, based on the total weight of the paperboard. A particularly preferred paperboard has a multilayer structure. It is further preferable that the paperboard has, on the surface facing towards the environment, at least one, but particularly preferably at least two, sublayers of a covering layer known to the person skilled in the art as “paper coating”. The Scott Bond value of a preferred paperboard is moreover in the range from 100 to 360 J/m^2, preferably from 120 to 350 J/m^2 and particularly preferably from 135 to 310 J/m^2. Use of the abovementioned ranges allows provision of a

composite from which it is easily possible to fold a highly leakproof container with narrow tolerances. A preferred carrier layer includes on at least one surface, preferably on each of two mutually opposite surfaces, a covering layer. Except where this is expressly excluded, it is preferable that each carrier layer includes a covering layer on each surface. It is preferable that the carrier layer is of one-piece design.

The carrier layer has a bending resistance which can be determined according to the standard ISO 2493:2010 using a bending measurement device. As a bending measurement device an L&W Bending Tester - code 160 of Lorentzen & Wettre, Sweden has been applied in making the present invention. The bending resistance is determined by deflecting the sample by 15°. In a first direction, the carrier layer preferably has a bending resistance in the range from 80 to 550 mN. In the case of a carrier layer having a plurality of fibres, the first direction is preferably a direction of orientation of the fibres. In the field of paper and cardboard making this direction of orientation of fibres is also known as running direction. In a second direction which is perpendicular to the first direction, a carrier layer having a plurality of fibres further preferably has bending resistance in the range from 20 to 300 mN. Samples used to determine the preceding bending resistances with the bending measurement device mentioned above have a width of 38 mm and a clamping length of 50 mm. A preferred sheetlike composite having the carrier layer is characterised by a bending resistance in the first direction in the range from 100 to 700 mN. Further preferably, this sheetlike composite has a bending resistance in the second direction in the range from 50 to 500 mN. Therein, the bending resistance measurements of the sheetlike composite have been performed using the same measuring device as mentioned above for the carrier layer. Furthermore, measurement samples of the sheetlike composite also had a width of 38 mm and a clamping length of 50 mm.

Barrier layer

Material used as barrier layer can be any material which is known for this purpose to the person skilled in the art and which exhibits adequate barrier action in particular in relation to oxygen. It is preferable that the barrier layer is selected from

a. a plastics barrier layer;
b. a metal layer;
c. a metal oxide layer; or
d. a combination of at least two of a. to c.

It is preferable that the barrier layer is of one-piece design.

If, according to alternative a., a barrier layer is a plastics barrier layer, this preferably includes at least 70% by weight, particularly at least 80% by weight and most preferably at least 95% by weight, of at least one plastic which is known for this purpose to the person skilled in the art, in particular on account of aroma properties or, respectively, gas-barrier properties that are suitable for packaging containers. Plastics, in particular thermoplastics, that can be used here are N- or O-containing plastics, either as such or else in mixtures of two or more. A melting point of the plastics barrier layer in the range from more than 155 to 300°C, preferably in the range from 160 to 280°C and particularly preferably in the range from 170 to 270°C can prove advantageous according to the invention. A preferred electrically insulating barrier layer is a plastics barrier layer.

It is further preferable that the weight per unit area of the plastics barrier layer is in the range from 2 to 120 g/m^2, preferably in the range from 3 to 60 g/m^2, particularly preferably in the range from 4 to 40 g/m^2 and with further preference from 6 to 30g/m^2. It is further preferable that the plastics barrier layer can be obtained from melts, for example via extrusion, in particular layer extrusion. It is further preferable that the plastics barrier layer can be introduced into the sheetlike composite by way of lamination. Preference is given here to incorporation of a foil into the sheetlike composite. According to another embodiment it is also possible to select plastics barrier layers which can be obtained via deposition from a solution or dispersion of plastics.

Suitable polymers are preferably those whose weight-average molar mass, determined by gel permeation chromatography (GPC) using light scattering, is in the range from $3 \cdot 10^3$ to

$1 \cdot 10^7$ g/mol, preferably in the range from $5 \cdot 10^3$ to $1 \cdot 10^6$ g/mol and particularly preferably in the range from $6 \cdot 10^3$ to $1 \cdot 10^5$ g/mol. Suitable polymers that in particular can be used are polyamide (PA) or polyethylene vinyl alcohol (EVOH) or a mixture thereof.

Among the polyamides, it is possible to use any of the PAs that appear to a person skilled in the art to be suitable for the inventive use. Particular mention should be made here of PA 6, PA 6.6, PA 6.10, PA 6.12, PA 11 or PA 12 or a mixture of at least two thereof, particular preference being given here to PA 6 and PA 6.6, and further preference being given here to PA 6. PA 6 is obtainable commercially by way of example with the trademark Akulon®, Durethan® and Ultramid®. Other suitable materials are amorphous polyamides such as MXD6, Grivory®, and also Selar® PA. It is further preferable that the density of the PA is in the range from 1.01 to 1.40 g/cm^3, preferably in the range from 1.05 to 1.30 g/cm^3 and particularly preferably in the range from 1.08 to 1.25 g/cm^3. It is further preferable that the viscosity number of the PA is in the range from 130 to 185 ml/g and preferably in the range from 140 to 180 ml/g.

EVOH that can be used is any of the EVOHs that appear to the person skilled in the art to be suitable for the inventive use. Examples here are obtainable commercially inter alia with the trademark EVAL™ from EVAL Europe NV, Belgium in a plurality of different embodiments, examples being the grades EVAL™ F104B and EVAL™ LR171B. Preferred EVOHs have at least one, two, a plurality of, or all of, the following properties:

- ethylene content in a range from 20 to 60 mol%, preferably from 25 to 45 mol%;
- density in the range from 1.0 to 1.4 g/cm^3, preferably from 1.1 to 1.3 g/cm^3;
- melting point in the range from above 155 to 235°C, preferably from 165 to 225°C;
- MFR (210°C/2.16 kg if $T_{M(EVOH)}$<230°C; 230°C/2.16 kg, if 210°C<$T_{M(EVOH)}$<230°C) in the range from 1 to 25 g/10 min, preferably from 2 to 20 g/10 min;
- oxygen permeation rate in the range from 0.05 to 3.2 cm$^3 \cdot$20 µm/m$^2 \cdot$day$\cdot$atm, preferably in the range from 0.1 to 1 cm$^3 \cdot$20 µm/m$^2 \cdot$day$\cdot$atm.

According to alternative b. the barrier layer is a metal layer. A suitable metal layer is in principle any of the layers using metals which are known to the person skilled in the art and which can provide high impermeability to light and to oxygen. According to a preferred embodiment the metal layer can take the form of a film or of a deposited layer, e.g. after a physical gas-phase deposition process. It is preferable that the metal layer is an uninterrupted layer. According to another preferred embodiment, the thickness of the metal layer is in the range from 3 to 20 μm, preferably in the range from 3.5 to 12 μm and particularly preferably in the range from 4 to 10 μm.

Metals preferably selected are aluminium, iron or copper. A preferred iron layer can be a steel layer, e.g. in the form of a foil. It is further preferable that the metal layer is a layer using aluminium. The aluminium layer can advantageously consist of an aluminium alloy, for example AlFeMn, AlFe1.5Mn, AlFeSi or AlFeSiMn. Purity is usually 97.5% or higher, preferably 98.5% or higher, based in each case on the entire aluminium layer. In a particular embodiment the metal layer consists of an aluminium foil. The extensibility of suitable aluminium foils is more than 1%, preferably more than 1.3% and particularly preferably more than 1.5%, and their tensile strength is more than 30 N/mm^2, preferably more than 40 N/mm^2 and particularly preferably more than 50 N/mm^2. Suitable aluminium foils exhibit a droplet size of more than 3 mm in the pipette test, preferably more than 4 mm and particularly preferably more than 5 mm. Suitable alloys for the production of aluminium layers or aluminium foils are obtainable commercially as EN AW 1200, EN AW 8079 or EN AW 8111 from Hydro Aluminium Deutschland GmbH or Amcor Flexibles Singen GmbH. A preferred electrically conductive barrier layer is a metal barrier layer, particularly preferably an aluminium barrier layer.

When a metal foil is used as barrier layer, there can be an adhesion-promoter layer provided on one or both sides of the metal foil between the metal foil and the closest polymer layer. According to a particular embodiment of the container of the invention, however, there is no adhesion-promoter layer provided on any side of the metal foil between the metal foil and the closest polymer layer.

It is further preferable to select a metal oxide layer as barrier layer according to alternative c. Metal oxide layers that can be used are any of the metal oxide layers that are familiar to the person skilled in the art and that appear suitable for achieving a barrier effect in relation to light, water vapour and/or gas. In particular, preference is given to metal oxide layers based on the abovementioned metals aluminium, iron or copper and also to metal oxide layers based on compounds of titanium or silicon oxide. A metal oxide layer is produced by way of example via deposition of a metal oxide from a vapour onto a plastics layer, for example an oriented polypropylene film. A preferred process for this is physical gas-phase deposition.

According to another preferred embodiment the metal layer or the metal oxide layer can take the form of a layer composite made of one or more plastics layers with a metal layer. This type of layer can be obtained by way of example via vapour deposition of a metal onto a plastics layer, for example an oriented polypropylene film. A preferred process for this is physical gas-phase deposition.

Polymer layers

The following specifications are preferably valid for any of the inner polymer layer, the outer polymer layer and the intermediate polymer layer, or for combinations of at least two of those. However, the sheetlike composite may comprise further polymer layers for which the following specifications are also valid. The polymer layer can comprise further constituents. It is preferable that these polymer layers are introduced or, respectively, applied into the layer sequence in an extrusion process. The further constituents of the polymer layers are preferably constituents which do not adversely affect the behaviour of the polymer melt when applied as layer. The further constituents can by way of example be inorganic compounds, such as metal salts or further plastics, for example further thermoplastics. However, it is also conceivable that the further constituents are fillers or pigments, for example carbon black or metal oxides. Suitable thermoplastics that can be used for the further constituents are in particular those that are easily processable by virtue of good extrusion properties. Materials suitable in this context are polymers obtained via chain polymerisation, in particular polyesters or polyolefins, particular preference being given here to cyclic olefin copolymers (COC), and polycyclic olefin co-

polymers (POC), and in particular polyethylene and polypropylene, and very particular preference being given here to polyethylene. Among the polyethylenes, preference is given to HDPE, MDPE, LDPE, LLDPE, VLDPE and PE, and also to mixtures of at least two thereof. It is also possible to use mixtures of at least two thermoplastics. Another preferred polyolefin is an m-polyolefin. The melt flow rate (MFR) of suitable polymer layers is in the range from 1 to 25 g/10 min, preferably in the range from 2 to 20 g/10 min and particularly preferably in the range from 2.5 to 15 g/10 min, their density being in the range from 0.890 g/cm^3 to 0.980 g/cm^3, preferably in the range from 0.895 g/cm^3 to 0.975 g/cm^3, and more preferably in the range from 0.900 g/cm^3 to 0.970 g/cm^3; or in the range from 0.910 g/cm^3 to 0.935 g/cm^3, preferably in the range from 0.912 g/cm^3 to 0.932 g/cm^3, and more preferably in the range from 0.915 g/cm^3 to 0.930 g/cm^3. The polymer layers preferably have at least one melting point in the range from 80 to 155°C, with preference in the range from 90 to 145°C and particularly preferably in the range from 95 to 135°C. A preferred polymer layer is a polyolefin layer, preferably a polyethylene layer or a polypropylene layer or both.

m-Polyolefin

An m-polyolefin is a polyolefin produced by means of a metallocene catalyst. A metallocene is an organometallic compound in which there is a central metal atom arranged between two organic ligands, for example cyclopentadienyl ligands. A preferred m-polyolefin is an m-polyethylene (mPE) or an m-polypropylene or both. A further preferred m-polyethylene is one selected from the group consisting of an mLDPE, an mLLDPE, and an mHDPE, or a combination of at least two thereof.

Inner polymer layer

In a preferred embodiment the inner polymer layer includes from 10 to 50% by weight, preferably 15 to 45% by weight, more preferably from 20 to 40% by weight, most preferably from 25 to 35% by weight, based in each case on the total weight of the inner polymer layer, of a polymer produced by means of a metallocene catalyst. In another preferred embodiment the inner polymer layer includes from 20 to 90% by weight, preferably from 30 to 90% by weight, more preferably from 40 to 90% by weight, more preferably from 50 to 90% by weight, more

preferably from 60 to 90% by weight, most preferably from 70 to 85% by weight, based in each case on the total weight of the inner polymer layer, of a polymer produced by means of a metallocene catalyst.

It is preferable that the inner polymer layer consists of the polymer blend including an mPE and a further polymer. A preferred further polymer is one selected of a PE, am LDPE and an LLDPE or a combination of those. In a preferred embodiment the polymer blend includes from 10 to 50% by weight, preferably from 15 to 45% by weight, more preferably from 20 to 40% by weight, most preferably from 25 to 35% by weight, of an mPE and at least 50% by weight, preferably at least 55% by weight, more preferably at least 60% by weight, most preferably at least 65% by weight, of a further polymer, based in each case on the total weight of the polymer blend. In another preferred embodiment the polymer blend includes from 20 to 90% by weight, preferably from 30 to 90% by weight, more preferably from 40 to 90% by weight, more preferably from 50 to 90% by weight, more preferably from 60 to 90% by weight, most preferably from 70 to 85% by weight, of an mPE and at least 10% by weight, preferably at least 15% by weight, of a further polymer, based in each case on the total weight of the polymer blend. The proportions of mPE and of further polymer in the polymer blend here are preferably combined in such a way that the sum of the proportions is 100% by weight. In each case the preferred proportions of mPE and of further polymer in the polymer blend are combined in such a way that the sum of the proportions is not more than 100% by weight. It is preferable that the inner surface of the sheetlike composite is a surface of the inner polymer layer that faces away from the barrier layer. The innersurface of the sheetlike composite here preferably is the surface which in a container to be produced from the sheetlike composite faces predominantly inwards, i.e. in particular is in direct contact with a food contained in the container.

Outer polymer layer

The outer polymer layer preferably comprises a polyethylene or a polypropylene or both. Here, preferred polyethylenes are LDPE and HDPE or mixtures of those. A preferred outer polymer layer comprises at least 50 & by weight, preferably at least 60 % by weight, more preferably

70 % by weight, more preferably 90 % by weight, most preferably 90 % by weight, in each case based on the weight o fthe outer polymer layer, of an LDPE.

Melting points

A preferred m-polyolefin is characterised by at least one first melting point and one second melting point. It is preferable that the m-polyolefin is characterised by a third melting point in addition to the first and the second melting point. A preferred first melting point is in the range from 84 to 108°C, preferably from 89 to 103°C, more preferably from 94 to 98°C. A preferred further melting point is in the range from 100 to 124°C, preferably from 105 to 119°C, more preferably from 110 to 114°C.

Adhesion/adhesion-promoter layer

There can be an adhesion-promoter layer located between layers of the sheetlike composite which do not adjoin each other. In particular, there can be an adhesion-promoter layer located between the barrier layer and the inner polymer layer or the carrier layer and the barrier layer. Plastics which can be used as adhesion promoters in an adhesion-promoter layer are any of those which, by virtue of functionalisation by means of suitable functional groups, are suitable to produce a secure bond via formation of ionic bonds or covalent bonds to a surface of a respective adjacent layer. The materials are preferably functionalised polyolefins obtained via copolymerisation of ethylene with acrylic acids such as acrylic acid or methacrylic acid, crotonic acid, acrylates, acrylate derivatives or carboxylic anhydrides containing double bonds, for example maleic anhydride, or at least two thereof. Among these, preference is given to polyethylene-maleic anhydride graft polymers (EMAH), ethylene-acrylic acid copolymers (EAA) or ethylene-methacrylic acid copolymers (EMAA), which are marketed by way of example with the trademarks Bynel® and Nucrel®0609HSA by DuPont or Escor®6000ExCo by ExxonMobil Chemicals.

According to the invention it is preferable that the adhesion between a carrier layer, a polymer layer or a barrier layer and the respective closest layer is at least 0.5 N/15 mm, preferably at least 0.7 N/15 mm and particularly preferably at least 0.8 N/15 mm. In an embodiment of the

invention it is preferable that the adhesion between a polymer layer and a carrier layer is at least 0.3 N/15 mm, preferably at least 0.5 N/15 mm and particularly preferably at least 0.7 N/15 mm. It is further preferable that the adhesion between a barrier layer and a polymer layer is at least 0.8 N/15 mm, preferably at least 1.0 N/15 mm and particularly preferably at least 1.4 N/15 mm. In the event that a barrier layer follows a polymer layer indirectly by way of an adhesion-promoter layer it is preferable that the adhesion between the barrier layer and the adhesion-promoter layer is at least 1.8 N/15 mm, preferably at least 2.2 N/15 mm and particularly preferably at least 2.8 N/15 mm. In a particular embodiment the adhesion between the individual layers is so strong that the adhesion test leads to tearing of a carrier layer, the term used in the event of paperboard as carrier layer being paperboard fibre tear.

Container

The closed container of the invention can have a plurality of different shapes, but preference is given to a structure that is in essence a rectangular parallelepiped. It is moreover possible that the entire area of the container is composed of the sheetlike composite, or that the container has a two- or multipart structure. In the case of a multipart structure it is conceivable that other materials are also used alongside the sheetlike composite, an example being plastic, which in particular can be used in the top or base regions of the container. However, it is preferable here that at least 50%, particularly at least 70% and more preferably at least 90%, of the area of the container is composed of the sheetlike composite. The container can moreover comprise a device for the discharge of the contents. This can by way of example be formed from plastic and applied to the external side of the container. It is also conceivable that this device has been integrated into the container via “direct injection moulding”. According to a preferred embodiment the container of the invention has at least one folded edge, preferably from 4 to 22, or even more folded edges, particularly preferably from 7 to 12 folded edges. For the purposes of the present invention the expression folded edge applies to regions produced when an area is folded. Examples of folded edges that may be mentioned are the longitudinal regions where two respective wall areas of the container meet. The container walls in the container are preferably the areas of the container, surrounded by the folded edges. It is preferable that the

closed container includes no base that is not of single-piece design with the sheetlike composite or no lid that is not of single-piece design with the sheetlike composite, or both.

Foodstuff

A preferred closed container of the invention includes a foodstuff. Materials that can be regarded as foodstuff are any of the solid or liquid foodstuffs known to the person skilled in the art for human consumption, and also those for consumption by animals. Preferred foodstuffs are liquid above 5°C, examples being dairy products, soups, sauces, and non-carbonated drinks. In this procedure it is also possible to use less sterile foodstuffs and containers.

2D-Code

The 2D-code according to the invention may be any 2D-code which the skilled person may consider appropriate in the context of the invention. Preferably, the 2D-code comprises a plurality of graphic elements and a plurality of gaps between these graphic elements. Preferred graphic elements are lines, preferably straight lines; rectangles, preferably squares; circles; and dots; and combinations of these. Further preferably, data may be encoded into the 2D-code along two axes of a 3-dimensional system of coordinates, hence in 2 dimensions which span an a plane. These two axes of the system of coordinates are also referred to as 2 dimensions. In this context the 2D-code is preferably a 2-dimensional reproduction of data in form of the graphic elements, wherein these graphic elements are arranged in a predetermined 2-dimensional area, thereby encoding the data in 2 dimensions. Therein, pieces of information which are stored in the 2 dimensions are preferably independent from each other. In this context preferred systems of coordinates are a Cartesian system of coordinates and a polar system of coordinates. A preferred 2D-code is machine-readable, wherein preferably the 2D-code is readable by an optoelectronic sensor. Preferably, the 2D-code is readable by a 2D-code reader. Therein, the 2D-code reader may be a device, having an optoelectronic sensor; or a scanner software; or both. A preferred optoelectronic sensor is a laser scanner or a CCD-camera, for example of a smartphone.

A preferred 2D-code is one selected from the group consisting of a matrix code, a 2D-barcode and a dot-code or a combination of at least two thereof. Therein, a matrix code is particularly preferred. A preferred 2D-barcode comprises a plurality of stacked 1D-barcodes. Further preferred 2D-barcodes are Codablock, Code 49, Code 16k and PDF417. Preferred matrix codes are Aztec code, Code 1, ColorCode, Color Construct Code, CrontoSign, CyberCode, Data Matrix, DataGlyphs, Datastrip Code, EZcode, High Capacity Color Barcode, Hax Xin Barcode, HieCode, InterCode, MaxiCode, NexCode, Qode, QR code, ShotCode, SPARQCode, VOICEYE, wherein QR code and SPARQCode are preferred, wherein QR code is particularly preferred. Preferred dot-codes are Dot Code A, Snowflake ode and BeeTagg. A further preferred 2D-code has an area of not more than 40 cm^2, preferably not more than 30 cm^2, more preferably not more than 25 cm^2, even more preferably not more than 20 cm^2, more preferably not more than 15 cm^2, more preferably not more than 10 cm^2, still more preferably not more than 8 cm^2, most preferably not more than 5 cm^2.

Test methods

The following test methods were used for the purposes of the invention. Unless otherwise stated the measurements were made at ambient temperature 25°C, ambient air pressure 100 kPa (0.986 atm) and relative humidity 50%.

MFR value

The MFR value is measured in accordance with the standard ISO 1133-1:2012-03 (unless otherwise stated at 190°C with 2.16 kg).

Density

Density is measured in accordance with the standard ISO 1183-1:2012-05.

Melting point

Melting point is determined according to the DSC method of ISO 11357-1 and -5. The equipment is calibrated in accordance with the manufacturer's instructions with reference to the following measurements:

- indium temperature – onset temperature,
- enthalpy of fusion of indium,
- zinc temperature – onset temperature.

Viscosity number of PA

The viscosity number of PA is measured in accordance with the standard ISO 307 in 95% sulphuric acid.

Oxygen permeation rate

Oxygen permeation rate is determined in accordance with the standard ISO 14663-2 Annex C at 20°C and 65% relative humidity.

Paperboard moisture content

Paperboard moisture content is measured in accordance with the standard ISO 287:2009.

Adhesion of layers

Adhesion between two adjacent layers is determined by fixing these onto 90° peel test equipment, for example a "German rotating wheel fixture" from Instron, on a rotating roll which rotates at 40 mm/min during the measurement. The samples were cut to size in advance, into strips of width 15 mm. At one side of the sample the sublayers are separated from one another, and the separated end is clamped into a vertically upwards oriented tensile apparatus. The tensile apparatus has attached measurement equipment for determining the tensile force. During the rotation of the roll, the force required to separate the sublayers from one another is measured. This force corresponds to the adhesion between the layers, and is stated in N/15 mm. The separation of the individual layers can be achieved by way of example mechanically, or via a

specific pretreatment, for example via softening of the sample for 3 min in 30% acetic acid at 60°C.

Molecular weight distribution

Molecular weight distribution is measured by gel permeation chromatography, using light scattering: ISO 16014-3/-5.

Detection of colourants

Detection of organic colourants can be conducted in accordance with the methods described in "Industrial Organic Pigments, Third Edition" (Willy Herbst, Klaus Hunger Copyright © 2004 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim ISBN: 3-527-30576-9).

Surface tension

In order to determine a surface tension of a polymer layer and/or of an outer surface, first a contact angle of wetting with water ("water contact angle") is determined according to the standard ATSM D5946 – 09. Therein, samples of dimension 30 mm × 35 mm are cut from the laminate using a scalpel. 10 measurements are performed at each sample, from which the arithmetic mean is calculated. The samples are prepared as given in section 10.2 of the standard. Further, measurement conditions are chosen in accordance with section 10.4 of this standard. Using the arithmetic mean of the measured water contact angle, the surface tension in dyne/cm (dyne/cm = mN/m) is read from table X2.1 of the annex X2 of the standard.

The invention is described in more detail below via Examples and drawings, wherein the Examples and drawings do not imply any restriction of the invention. The drawings are moreover diagrammatic and not true to scale.

Examples

For the inventive samples and the comparative samples (non-inventive), laminates with the following layer sequence were produced by means of an extrusion coating system which is standard in laminar extrusion processes.

Example I

This example describes the printing device of the invention 100 and the process 600 for printing a pattern 400 on a surface 510 of target 500. Here, the target 500 is a laminate and the surface 510 is formed by the interface between air and the outer polymer layer.

Table 1: layer sequence used in the laminates of the example

layer	**material**	**grammage [g/m²]**
outer polymer layer	LDPE 19N430 of Ineos GmbH, Cologne, Germany	15
carrier layer	paper board: Stora Enso Natura T Duplex, double coating layer, Scott-Bond 200 J/m^2, residual moisture 7,5 %	210
intermediate polymer layer	LDPE 19N430 of Ineos GmbH, Cologne, Germany	18
barrier layer	aluminium foil EN AW 8079 of Hydro Aluminium Deutschland GmbH	here: thickness 6 µm
adhesion promoter layer	co-extrudate (1) Escor 6000 HSC of Exxon Mobil Corporation and (2) LDPE 19N430 of Ineos GmbH, Cologne, Germany	(1) – 4 (2) – 22
inner polymer layer	blend of (1) 65 wt.-% LDPE 19N430 of Ineos GmbH, Cologne, Germany and (2) 35 wt.-% Eltex 1315 AZ of Ineos GmbH, Cologne, Germany	10

Laminates as described in Table 1 are processed as follows. First the surface of the outer polymer layer which is facing away from the carrier layer is corona treated. Power and voltage of the corona treatment are adjusted to obtain the surface tensions after the corona treatment as given in Table 2 below. Therein, the surface tension needs to be measured immediately after the corona treatment. Immediately after the corona treatment, a QR-code is printed via an

inkjet printer by Konika Minolta of the firm Industrial Inkjet Ltd., Great Britain onto the outer polymer layer. Black ink of the type Sunjet ULM from Sun Chemical, USA is used for printing the QR-code. In a next step the inkjet-printed ink is cured by irradiation with UV-light.

Table 2: Values of surface tension measured immediately after corona treatment

	surface tension after corona treatment [dyne/cm]
sample 1	48
sample 2	46
sample 3	44
sample 4	42.5
comparative sample 1	38
comparative sample 2	/

The process of printing was conducted as follows:

First, a supply roll carrying the laminate was mounted at the feed side of the printing device. The laminate had a specified thickness. The laminate is guided via a propelled deflector roll, passes the print head and is collected afterwards by a product roll. On its way from the propelled deflector roll to the print head, a section of laminate passes a first sensor comprising parts LR-W500C, MU-N11, MU-CB8 and OP88029 (available from Keyence Deutschland GmbH, Deutschland), which detects any deviation of the thickness of the laminate passing by as compared with the specified thickness. This first sensor is positioned between 0.5 and 1.0 m upstream of the print head.

The section of laminate runs over a supporting roll when being printed by the print head. In the example, the print head is an ink jet print head model KM1024 IMHE of Konica Minolta using as ink a UV curable ink labelled Sunjet ULM Amphora of Sun Chemical Corporation (Parsippany, USA). The supporting roll on the one hand controls the position of the section of laminate with regard to the print head at the place of printing, on the other hand the supporting roll sets the section of laminate under tension so that it is not vibrating or flattering because of its velocity. The supporting roll can be moved in direction of the print head and vice versa. This

motion is driven by a pneumatic valve. The direction of the motion of the supporting roll is further controlled by guiding rails which asserts the accuracy of the motion (not shown in the figure). Downstream of the print head, the section of laminate passes a second sensor of comprising parts LR-W500C, MU-N11, MU-CB8 and OP88029 (available from Keyence Deutschland GmbH, Deutschland), in a distance of 0.5 to 1.0 m, which again detects any deviations in the thickness of the section of laminate as compared with the specified thickness. The distance of the print head from the supporting roll can be selected in consideration of the specified thickness of the laminate and of the throughput of laminate in the printing machine. Further downstream, the section of laminate passes a fixation unit. In the example, the fixation unit is a UV curing unit model FireEdge FE300 of Phoseon Technology Inc. (Hillsboro, USA). Upon use of another type of ink, e.g. a water-based ink, another type of fixation unit, e.g. a thermal drying unit, could be used. Further downstream, the section of laminate passes another deflector roll and is stored on a product roll.

The first sensor and the second sensor are connected with a control unit which is further connected with an actuator that controls the pneumatic valve which controls the position of the supporting roll. The first sensor is configured to detect any deviation of the thickness of the laminate passing by compared with the specified thickness of the laminate. In the example, the first sensor is a capacitive sensor composed of the parts LR-W500C, MU-N11, MU-CB8 and OP88029 (available from Keyence Deutschland GmbH, Deutschland). If a section of laminate passes the first sensor which has an increased thickness, the sensor generates a signal which is conveyed to the control unit. Then, the control unit triggers the actuator that controls the pneumatic valve to increase the distance between the print head and the supporting roll. In a variant, the supporting roll is removed from the print head to a safety position P2. The second sensor works in a similar manner and is composed as the first sensor. If both, the first and the second sensor signalize that the running laminate has the specified thickness, then the control unit triggers the actuator move the supporting roll into a predefined position for printing. The above mentioned variation in thickness of the passing laminate as compared with the specified thickness can be caused by irregularities in the laminate material. The main cause is irregularities which arise from changing rolls of supply laminate. When changing rolls, the unrolled end

of the processed laminate is joined with an rolled-up end of supply laminate. Adhesive tape is used for joining the ends which creates a build-up in the laminates thickness. Furthermore, the laminates could be joined in an overlapping fashion which creates another build-up in the laminate thickness. Using a supporting roll which can be moved as described above ensures that the print head and the laminate is not damaged upon changing supply rolls.

Examples II

In a variant of Example I, a third sensor S0 was positioned upstream of the print head, also composed as the first sensor. Examples no. A-D was conducted again as A'-D' where sensor S0, same type as sensor S1, was positioned 15 m upstream of the print head. When sensor S0 detected any deviation in the thickness of the laminate passing by, the control unit lowered the velocity of the laminate to 10% of the pre-set throughput. In addition to the mechanism described for example I, the control unit increased the velocity of the laminate back to 100 % when sensor S2 signalized that the deviation in thickness of the laminate has passed by the sensor. See Table 4.

Drawings

Figure 1	Printing device
Figure 2	Printing device
Figure 3	Printing device
Figure 4	Pattern
Figure 5	Target
Figure 6	Process claim 15
Figure 7	Edge-to-edge – claim 17
Figure 8	Overlapping – claim 18
Figure 9	Printing device as in Example 1

Description of the Drawings

Figure 1 shows a printing device 100 of the invention with which a pattern 400 can be printed on a surface 510 of a target 500. The printing device 100 comprises an inkjet printing unit 110 with a print head 120 and a support 130. The support 130 can be moved in direction of the print head 120 and also in opposite direction. The position of support 130 relative to the print head 120 determines a minimum distance MD between the support 130 and the print head 120. The target 500 is passed between the support 130 and the print head 120 so that the support sets the distance between the target 500 and the print head 120.

Figure 2 shows an embodiment of the printing device 100 (identical feature not shown in part), further equipped with a control unit 210, which is in signal guiding connection 220 with an actuator A1 230 and in another signal guiding connection 240 with a sensor S1 250. Once the control unit 210 receives a signal "1" from sensor S1 250, the support 130 is moved by the actuator A1 230 from a position P1 to a position P2. In a further embodiment actuator A1 230 moves support 130 back to position P1 after a delay in time DS.

Figure 3 shows another embodiment of the printing device 100 (identical features not shown in part), further equipped with a control unit 210, which is in signal guiding connection 220 with

an actuator A1 230, another signal guiding connection 240 with a sensor S1 250 and a further signal guiding connecting 260 with a sensor S2 270. Once the control unit 210 receives a signal "1" from sensor S1, the support 130 is moved by the actuator A1 230 from a position P1 to a position P2. Once the control unit 210 receives a signal "0" from sensor S1 and sensor S2, the support 130 is moved by the actuator A1 230 from position P2 into position P1.

Figure 4 shows for examples 1) – 4) of a pattern 400. Pattern 400, variant 1) is a combination of letters, numerals and the like; variant 2) is a bar code, variant 3) is a 2D code.

Figure 5 shows a target 500 which has a surface 510. After printing a pattern 400 on the surface 510 using the process of the invention, the surface 510 further comprises the pattern 400.

Figure 6 shows a flow diagram of a process 600 of the invention. The process 600 comprises a process step a) 601 of proving the target 500 of figure 5 to the printing device 100. In a process step b) 602 the target 500 is fed to the print head 120. Thereby the target 500 passes a first sensor S1 250 which is positioned upstream of the print head 120 and configured to detect any change in the thickness of the target 500 passing by. The sensor 250 conveys this information to a control unit 210 via a signal guide 220. The control unit 210 then triggers the actuator A1 230 which is connected to the support 130 and configured to move the position of the support 130 which carries the target 500. In a step c) 603 a pattern 400 is printed on the surface 510 of target 500 which surface 510 faces the print head 120. In this example, the pattern is printed with an inkjet print head 120. In a process step d) 604 the printed patter 400 is fixed on the surface 510. That way, a target 500 is obtained which has a printed pattern. The fixing in step d) 604 comprises irradiating the printed pattern 400 mJ/cm^2 with UV-light to activate a photoinitiator comprised by the ink composition. Hence, this hardening comprises a crosslinking reaction. During the process steps b) 602 to e) 604, the target 500 is moved with a velocity of about 300 m/min via propelled rollers and deflecting rollers (not shown in this figure).

Figure 7 shows variants of two sheets of target 500', 500'' joined edge-to-edge. In Figure a), the two sheets 500', 500'' are positioned edge-to-edge and a strip of adhesive tape 701 is ap-

plied over the gap 703 between the two sheets. In Figure 7b) two sheets of target 500', 500'' are positioned as in Figure 7a). Two strips of adhesive tape 701, 702 are applied over the gap 703 between the two sheets 500', 500'' on both flat sides of the sheets. In Figure 7c)) two sheets of target 500', 500'' are positioned as in Figure 7a). A strip of adhesive tape 701 is applied over the gap between the two sheets 500', 500'' on one flat side of the target 500 and surrounds the edges of the sheets 500', 500'' to be applied also to the other flat side of the sheets 500', 500''.

Figure 8 shows variants of two sheets of the target 500', 500'' joined by overlapping. In Figure 8a) two sheets of target 500', 500'' are positioned so that an end of a first sheet 500' overlaps an end of a second sheet 500''. In the overlapping region 801 a strip of double stick adhesive tape 802 is positioned between the two sheets of target 500', 500''. In Figure 8b) two sheets of target 500', 500'' are positioned as in Figure 8a). In the overlapping region 801 a strip of double stick adhesive tape 802 is positioned between the two sheets of target 500', 500''. Moreover, a strip of adhesive tape 803 is wrapped around the overlapping region 801 of the two sheets 500', 500''. In Figure 8c) two sheets of target 500', 500'' are positioned as in Figure 8a). No double stick tape is positioned between the overlapping parts in the overlapping region 801 of the two sheets 500', 500'', but only a strip of adhesive tape 803 is wrapped around the overlapping region 801 of the two sheets 500', 500''.

Figure 9 shows a printing device 100. A target 500 in form of a web is supplied from a supply roll 901 at a speed of 300 m/min and conveyed via a propelled deflector roll 903 and an unpropelled deflector roll 904 to a support roll 130 where the target 500 is in physical contact with the support roll 130. Downstream of support roll 130, the web is conveyed via further deflector rolls 905 and 906, of which 906 is propelled, and stored on a product roll 902. Where the target 500 is in physical contact with the support roll 130, an ink jet printing unit 100 comprising a print head 120 is positioned on the opposite site of the target 500 in a distance of about 0.5 mm to 1.0 mm. A fixation unit 910 is positioned downstream of support roll 130', in the figure positioned between deflector rolls 905 and 906. Here, the fixation unit is a UV lamp. Support roll 130 can be can be moved in direction of the print head 120 and in opposite direc-

tion. The position of support 130 relative to the print head 120 determines a minimum distance MD between the support 130 and the print head 120. Since the target 500 is passed between the support 130 and the print head 120, the position of support 130 determines the distance between the target 500 and the print head 120. Further, the position of deflector roll 903 can be adjusted during operation. This has an effect on the tension of the web in the printing device 100, in particular at the support 130 where the printing is conducted. The printing device 100 further comprises a control unit 210, which is in signal guiding connection 220 with an actuator A1 230 which is configured to move support 130 forth and back with respect to print head 120. Control unit 210 is also connected to another signal guide 240 which connects sensor S1 250. This sensor S1 250 is located upstream of print head 120. Once the control unit 210 receives a signal from sensor S1 250 that the thickness of target 500 is increased, the support 130 is moved by the actuator A1 230 from a position P1 to a position P2. P1 is the position where printing is conducted. P2 is a position, where the distance between print head 120 and support 130, thus target 500, is increased. Actuator A1 230 moves support 130 back to position P1 when sensor S2 270 sends a signal to control unit 210 that the target 500 with increased thickness has passed by sensor S2 270, an thereby left the area near print head 120. Sensor S2 270 is positioned downstream of print head 120.

List of Reference Numerals

100	Printing device
110	Ink jet printing unit
120	Print head
130	Support
210	Control unit
220	Signal guide
230	Actuator A1
240	Signal guide
250	Sensor S1
260	Signal guide
270	Sensor S2
400	Pattern
500	Target
500', 500''	Sheet
510	Surface
600	Process of printing a pattern on a surface of a target
601	Step a)
602	Step b)
603	Step c)
604	Step d)
701,702	Strip of adhesive tape
703	Gap
801	Overlapping region
802	Double stick tape
803	Strip of adhesive tape
901	Supply roll
902	Product roll
903	Deflector roll, optionally propelled

904, 905, 906	Deflector rolls
910	Fixation unit
MD	Minimum distance
D	Predefined distance
P1, P2	Positions of support 130

Claims

1. A printing device (100) for printing a pattern (400) on a surface (510) of a target (500),
wherein the printing device (100) comprises at least an inkjet printing unit (110) with at least a print head (120) and a support (130),
wherein the support (130) defines the position of the target (200) relative to the print head (120),
wherein a minimum distance (MD) between the support (130) and the print head (120) is variable by movement of the support (130).

2. The printing device (100) of claim 1 wherein the printing device (100) further comprises
a) a control unit (210),
b) at least an actuator A1 (230) which is connected to the support (130), and
c) at least a sensor S1 (250),
wherein the sensor S1 (250) is configured and positioned to detect a change in the thickness of the target (500) and generates a signal,
wherein the sensor S1 (250) is configured to convey the signal to the control unit (210), and
wherein the control unit (210) is configured to trigger the actuator A1 (230) to move the support (130) from a position P1 into a position P2 when the thickness of the target (500) deviates from a pre-defined value V1.

3. The printing device (100) of claim 1 wherein the printing device (100) further comprises
a) a control unit (210),
b) at least an actuator A1 (230) which is connected to the support (130), and
c) at least a sensor S1 (250),
wherein the sensor S1 (250) is configured and positioned to detect a change in the thickness of the target (500) and generates a signal,

wherein the sensor S1 (250) is configured to convey the signal to the control unit (210), and

wherein the control unit (210) is configured to trigger the actuator A1 (230) to move the support (130) from a position P1 towards or away from the print head (120),

so that a predefined distance D between the target (500) and the print head (120) is maintained.

4. The printing device (100) of any one of the preceding claims, wherein the support (130) is selected from one of: a table, a cushion of air and a roll.

5. The printing device (100) of any one of the preceding claims, wherein the distance D between the support (130) and the print head (120) is in the range of from 0.3 to 2.0 mm

6. The printing device (100) of any one of the preceding claims, wherein the at least one sensor S1 (250) is arranged in 0.1 to 3.0 m upstream of the print head (120).

7. The printing device (100) of any one of the preceding claims, wherein the at least one further sensor S2 (270) is arranged 0.1 to 3.0 m downstream of the print head (120).

8. The printing device (100) of any one of the preceding claims, wherein the control unit (210) is configured to trigger the actuator A1 (230) to move the support (130) to position P2 when the sensor S1 (250) indicates a section of target (500) with a thickness which deviates from the pre-defined value V1.

9. The printing device (100) of claim 8, wherein the control unit (210) is configured to trigger the actuator A1 (230) to move the support (130) back to position P1 at a delay DS after the sensor S1 (250) has indicated that the section of the target (500) with a thickness, which deviates from the pre-defined value V1, has passed the sensor S1 (250).

10. The printing device (100) of any one of claim 2 to 8, wherein the control unit (210) is configured to trigger the actuator A1 (230) to move the support (130) to position P1 when the sensor S2 (270) indicates that the section of "increased" thickness has passed the sensor S2 (270).

11. The printing device (100) of any one of the preceding claims, wherein the support (130) is mounted to guiding means that are configured to control the position of the support (130) upon movement.

12. The printing device (100) of any one of the preceding claims, wherein the printing device (100) is configured to print on a continuous target (500).

13. The printing device (100) of any one of the preceding claims, wherein the target (500) is a composite.

14. A process (600) of printing a pattern on a surface (510) of a target (500) whereby a printing device (100) according to any one of claims 1 to 13 is used.

15. A process (600) of printing a pattern on a surface (510) of a target (500), comprising these steps:

a) providing a target (500) to a printing device (100);

b) feeding a target (500) to a print head (120) of the printing device (100),

thereby passing a first sensor S1 (250), which is upstream of the print head (120);

wherein the sensor S1 (250) detects any change in the thickness of the target (500) and conveys this information to a control unit (210);

wherein the control unit (210) triggers an actuator A1 (230), which is connected to an support (130) to adjust the position of the support (130) carrying the target (500);

c) printing a pattern (400) on the surface (510) of the target (500) which faces the print head (120);

d) Fixing the printed pattern (400) on the surface (510);

whereby a target (500) is received which carries the printed pattern (400).

16. The process of claim 15, wherein a continuous target (500) is fed to the print head (120).

17. The process of claim 16, wherein the continuous target (500) is formed by a plurality of sheets which are joined edge to edge.

18. The process of claim 16, wherein the continuous target (500) is formed by a plurality of sheets wherein least two sheets (500', 500'') of the plurality of sheets of the plurality of sheets are joined by overlapping.

19. The process of any one of claims 15 to 18, wherein the sensor S1 (250) is passed by the continuous target (500) when being fed to the print head (120) in a distance of between 0.3 to 3.0m upstream of the print head (120).

20. The process of any one of claims 15 to 19, wherein the sensor S2 (270) is passed by the continuous target (500) in a distance of between 0.3 to 3.0m downstream of the print head (120).

21. The process of any one of claims 15 to 20, wherein the target (500) is selected from a foil, a composite, a layered structure.

22. The process of any one of claims 15 to 21, wherein a printing device (100) according to any one of claims 1 to 11 is used.

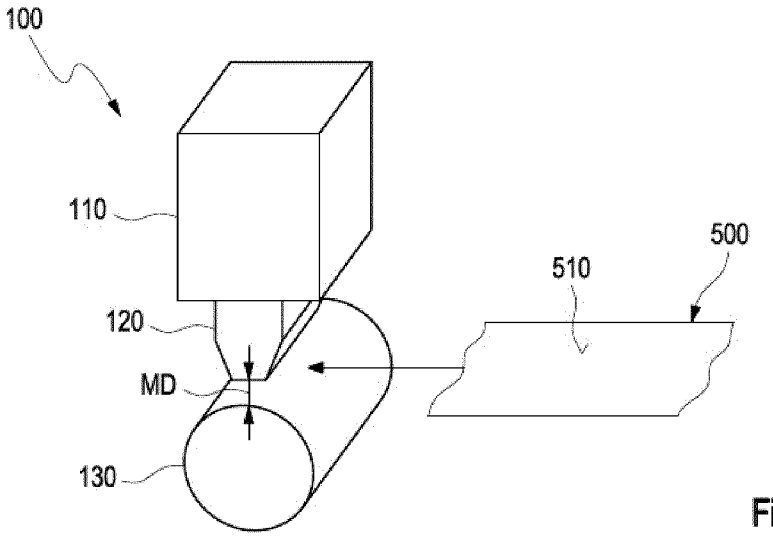

100
110
500
510
120
MD
130

Fig. 1

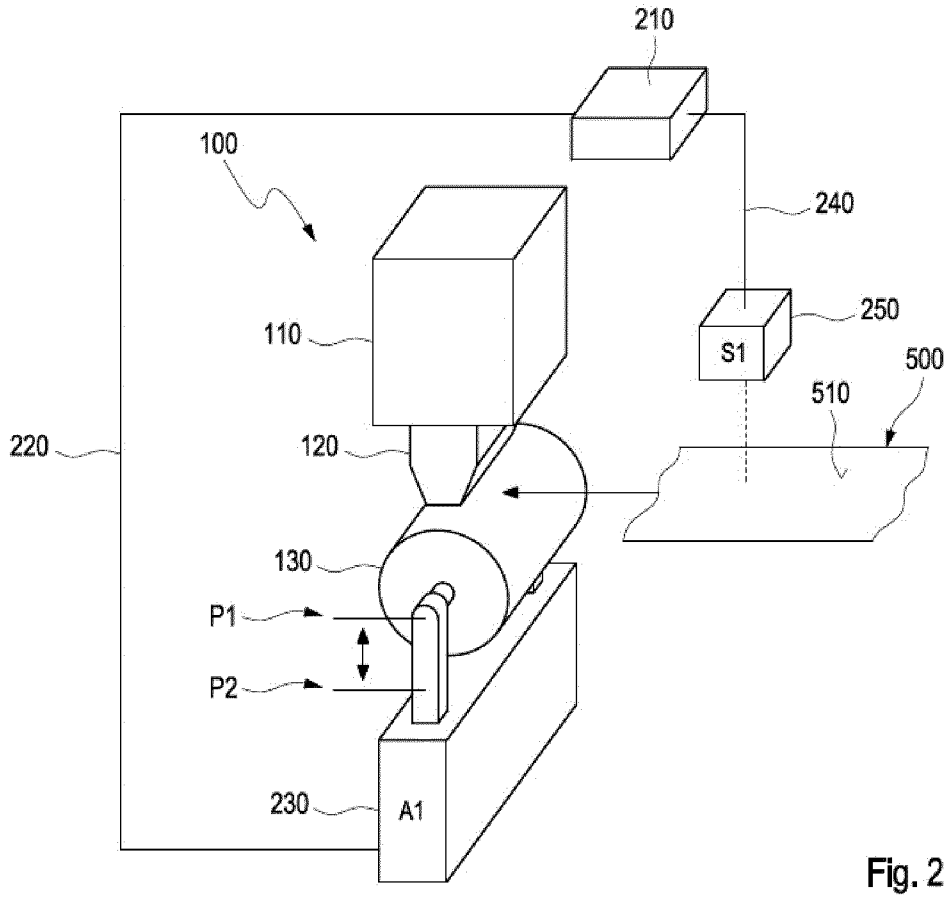

210
100
240
110
250
S1
500
510
220
120
130
P1
P2
230
A1

Fig. 2

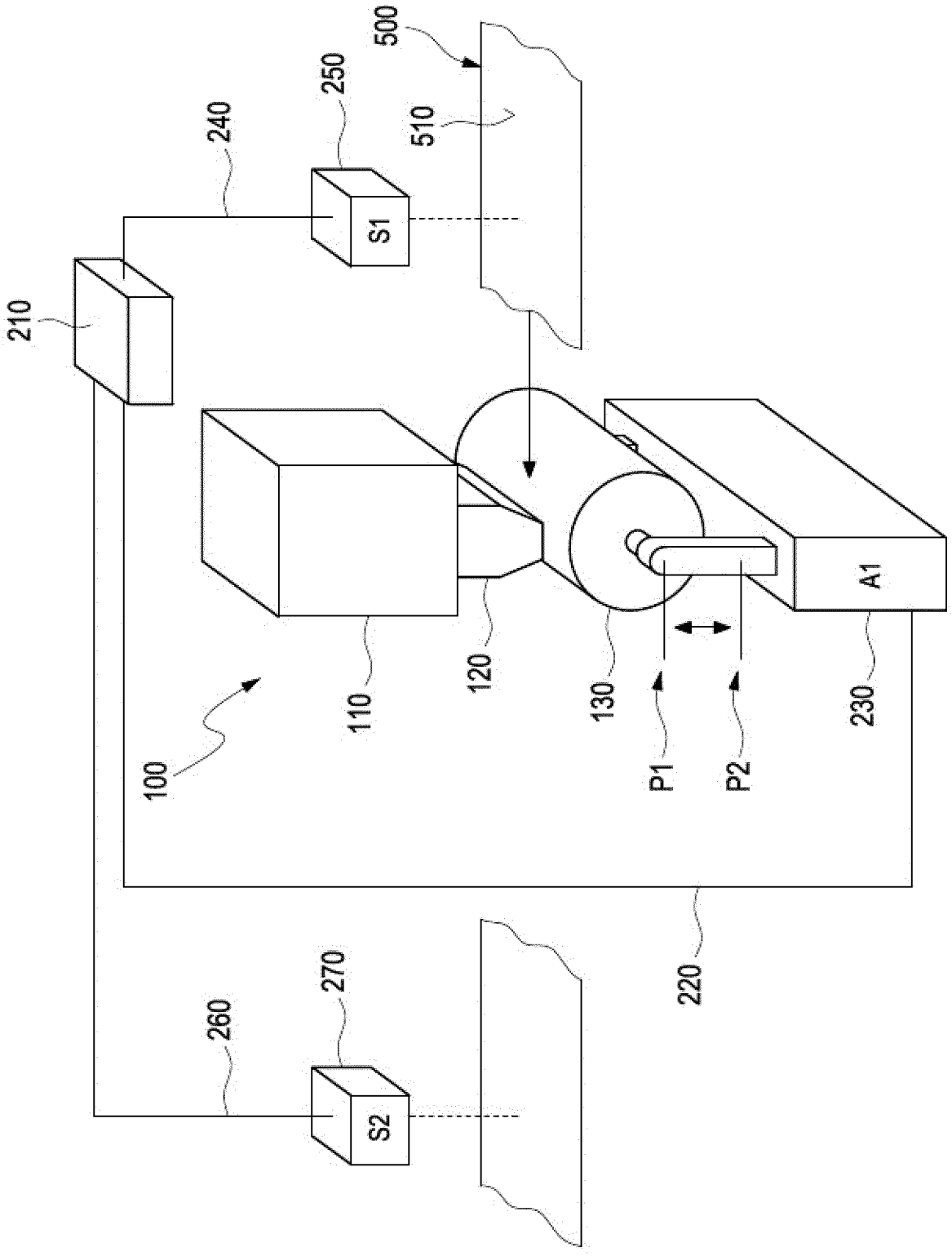


Fig. 3



Fig. 4

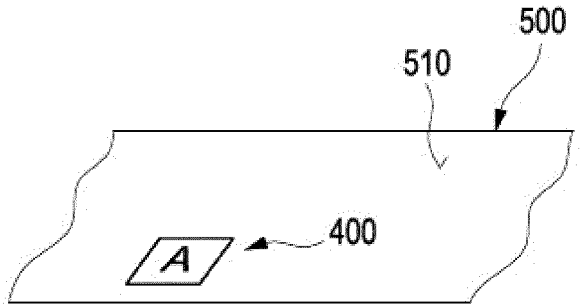


Fig. 5

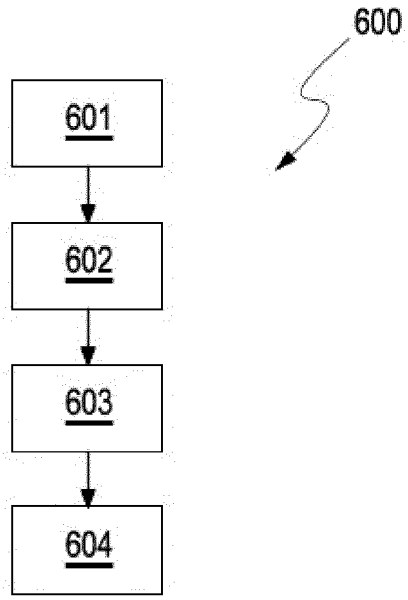


Fig. 6

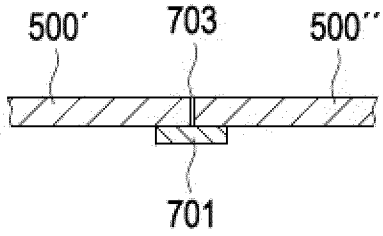


Fig. 7 a

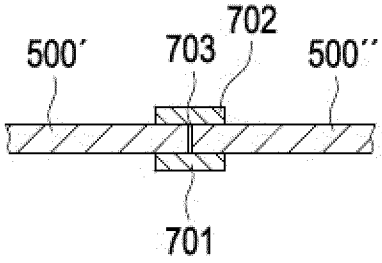


Fig. 7 b

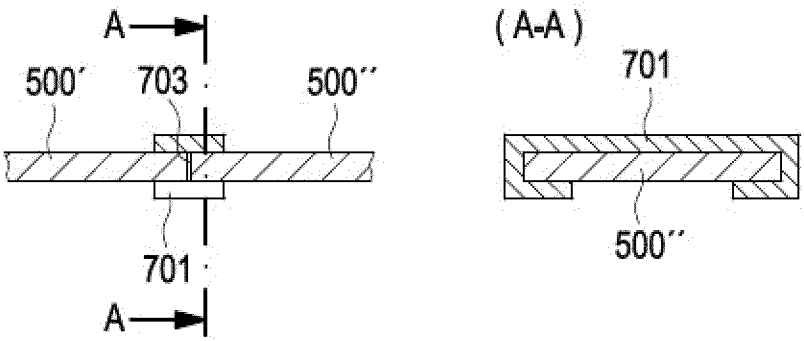


Fig. 7 c

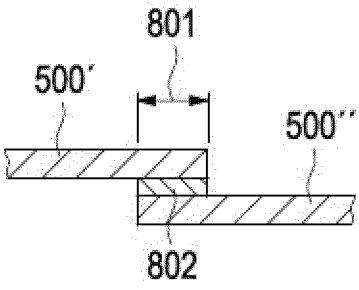


Fig. 8 a

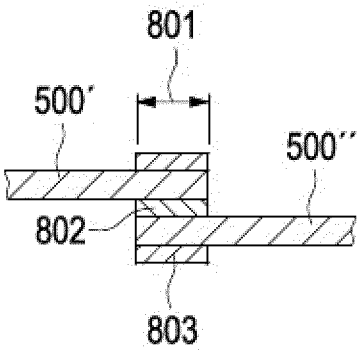


Fig. 8 b

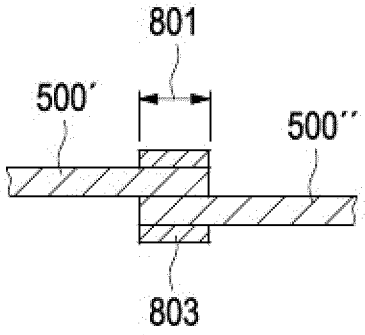


Fig. 8 c

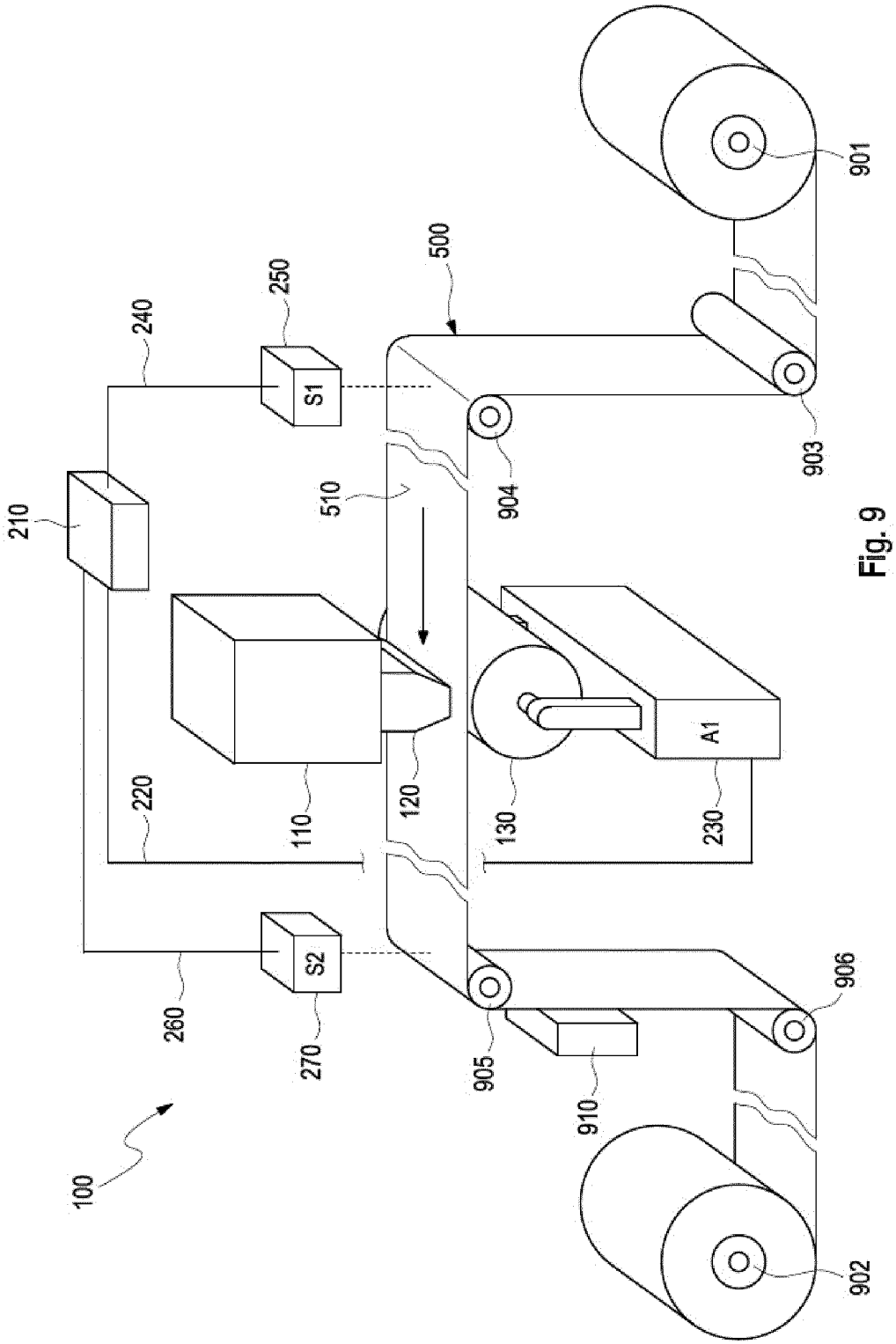

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Fig. 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2018/067990

A. CLASSIFICATION OF SUBJECT MATTER
INV. B41J11/20 B41J11/00 B41J11/04
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)
B41J

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 practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2016/347099 A1 (ERNST TRAVIS K [US] ET AL) 1 December 2016 (2016-12-01) figures 7-8 paragraph [0083] paragraph [0049] paragraph [0096] paragraph [0176] -----	1-5,7-22
X	US 2004/017456 A1 (OBERTEGGER FRANZ [IT] ET AL) 29 January 2004 (2004-01-29) figures 1, 7 paragraph [0078] paragraph [0106] paragraph [0115] ----- -/--	1-4,6, 8-14

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
1 October 2018	09/10/2018

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	João, César

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INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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X	US 2013/286126 A1 (HOEPNER BERND [DE] ET AL) 31 October 2013 (2013-10-31) figure 1 paragraph [0027] paragraph [0034] - paragraph [0035] -----	1-3, 8-11,14
A	US 2001/010771 A1 (NAGAI MIKIO [JP] ET AL) 2 August 2001 (2001-08-02) figure 6 paragraphs [0054], [0057], [0066] -----	1-22

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