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(54) **PRINTING METHOD AND SYSTEM MEANT TO DETECT AND CORRECT PRINTING DEFECTS**

(57) Printing method, comprising processing a real dispensing pattern (Pa'-b') for each printing module (3a-b) of a digital printer, wherein said real dispensing pattern (Pa'-b') is modified with respect to a theoretical dispensing pattern so as to compensate for the deformation undergone by the printing support (S) due to the passage below the previous printing modules (3a).

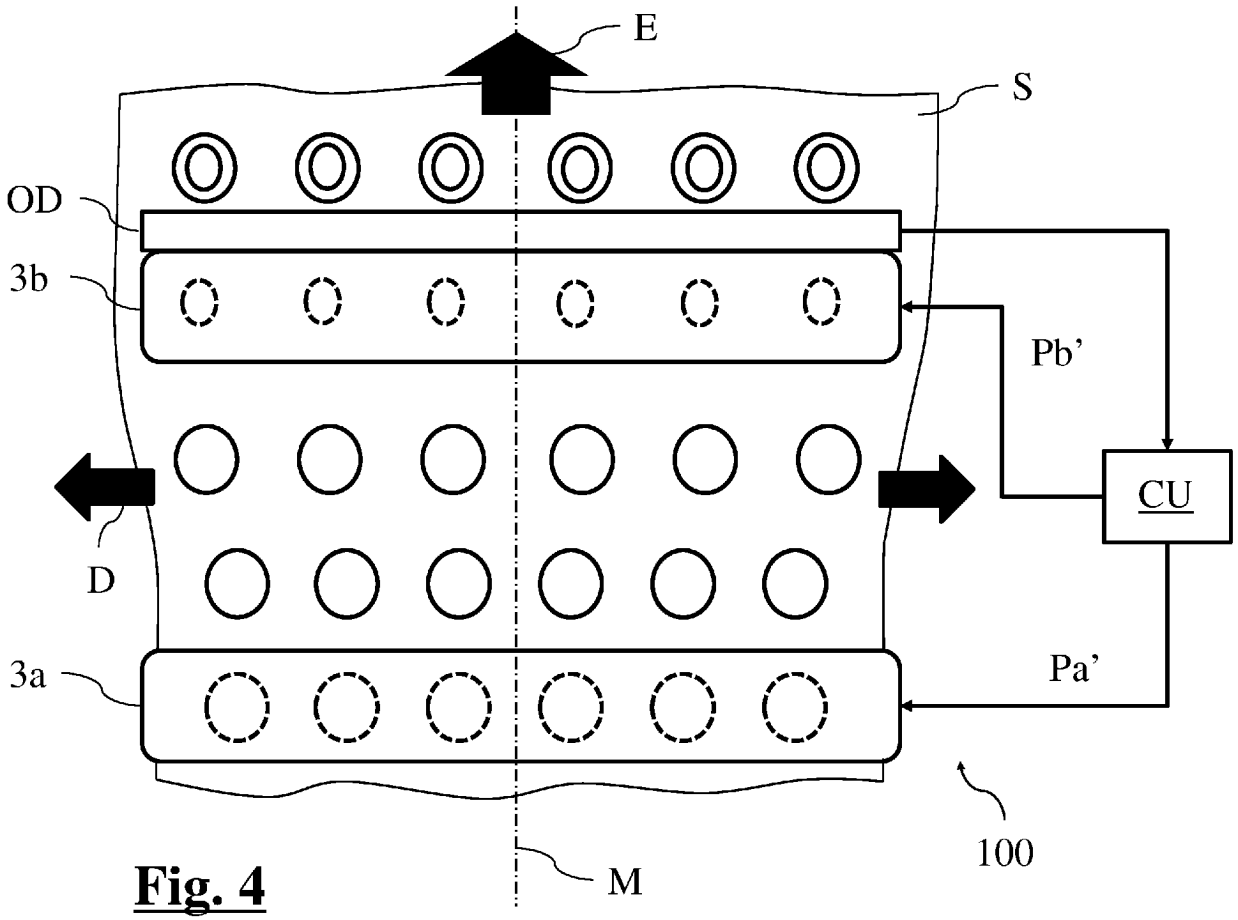

Fig. 4

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Description

Field of application

[0001] The present invention relates to a digital printing method comprising the steps of detecting and correcting printing defects upon the ink deposition on printing surfaces; in particular a digital printing method is dealt with, which allows the control and the phasing of the printing register.

[0002] The invention also relates to a system that carries out said method.

[0003] The invention may find in particular useful application in many technological fields where industrial printing on even large surfaces, for instance in printing on paper, corrugated cardboard, cardboard, plastic film, thermoplastic sheets, ceramics, glass or similar, is required. In particular, the invention finds useful application in the printing of supports that undergo deformation upon the ink deposition or at an intermediate time between two subsequent ink deposition phases.

Prior art

[0004] Digital printing devices of the industrial type generally comprise one or more printing modules equipped with print heads, designed to deposit ink drops above a printing support that proceeds below the printing modules themselves.

[0005] The above printing devices adopt a plurality of printing modules, where the ink tanks are placed. The different modules generally contain at least different colored inks to carry out the four-color printing; other modules may be provided with particular inks, for instance to attribute peculiar characteristics of opacity or brilliance to the decorative pattern.

[0006] The above print heads have a plurality of nozzles, each of which is arranged to release a volume of ink that is imprinted on the printing support, creating an ink dot that cooperates with the others to define an image.

[0007] The print heads are integrally associated on a head-carrier bar, which is included in each printing module. The print heads are arranged, generally alternated on two rows, so as to cover an entire longitudinal printing area below which a printing support slides.

[0008] The release of the ink is driven by at least one control unit that operates the different nozzles based on a printing pattern developed to reproduce a desired image.

[0009] One of the known problems of the digital printing devices herein considered relates to the defects due to the so-called out-of-register printing, namely the loss of alignment between the graphics generated by subsequent printing modules.

[0010] The Applicant noted that, even in the case of a perfect initial alignment between the different modules, the out-of-register printing may occur upon the ink deposition on the printing support and may be in particular due to the interaction of the ink with printing support. In fact, upon the ink deposition and thus its absorption on the printing support, geometric distortions of the support itself may be generated. As a result, the register with respect to the subsequent printing modules is lost and, in the continuation of the printing, chromatic aberrations typically due to the out-of-register are noted.

[0011] In particular, it has been noted how digital printing on paper may lead to deformations of the decorative pattern: when the ink is absorbed, it penetrates the fibers of the paper and may sometimes cause an expansion of the decorative pattern. Said deformation affects the printing of the subsequent modules that do not print in register, thus creating chromatic aberrations.

[0012] The problem is illustrated in the enclosed figure 3, relating to the prior art. The figure illustrates a first colour module 3a arranged to dispense ink according to a first dispensing pattern Pa, and a second colour module 3b following the first and arranged to dispense ink according to a second dispensing pattern Pb. In the image, the pattern formed by the first colour module 3a is schematized by a plurality of circles of larger diameter, the one formed by the second colour module 3b by a plurality of circles of smaller diameter. The two dispensing patterns Pa, Pb, defined by a control unit CU based on a digital image to be printed, should overlap to reconstitute said image. However, it was noted that the paper S undergoes a transversal deformation D, in particular an expansion, due to the ink absorption between the two color modules. For this reason, a chromatic aberration is noted, which is schematized in the drawing as an imperfect overlap of the circles of smaller and larger diameter.

[0013] The Applicant again noted that the substrate tends to deform more markedly close to the edges.

[0014] Obviously, the deformations found in printing on paper may occur in a similar way on other flexible materials.

[0015] It has also been noted that printing defects similar to the one described above may also develop in the printing on rigid substrates, such as ceramic or glass. In particular, the printing process on these materials may provide that after the ink is deposited, there is a drying step, which, due to the high temperatures which the material is subjected to, may deform the decorative pattern, making it smaller or expanding it. This phenomenon may be due both to a non-optimal absorption of the ink, and to a deformation of the material itself.

[0016] The technical problem underlying the present invention is to provide a printing method that may ensure a printing in register even in the presence of the above deformations of the support, thus obtaining a high quality printing of the desired decorative pattern.

Summary of the invention

[0017] The previously identified technical problem is solved by a digital printing method that aims at identifying and correcting the printing defects during the ink depo-

sition, comprising the following steps:

- providing a digital printing device equipped with a plurality of printing modules arranged in sequence along an advancement direction, each printing module comprising a tank for a specific ink and a plurality of dispensing nozzles arranged along a printing area for dispensing said ink;
- moving a printing support below the printing modules according to the advancement direction;
- processing, onboard a control unit of the digital printing device, a digital image to be printed, thus obtaining a specific theoretical dispensing pattern for each single printing module;
- processing a real dispensing pattern for each printing module, correcting the corresponding theoretical dispensing pattern so as to compensate for the deformation undergone by the printing support due to the passage below the previous printing modules;
- operating the dispensing nozzles of the single printing modules based on the processed real dispensing patterns.

[0018] The idea underlying the invention is thus to redefine the classical printing process, which provides for a static processing of the dispensing patterns for the subsequent colour modules, introducing a pattern correction to compensate for the deformation undergone by the paper or by the different printing support between the subsequent modules.

[0019] In the step of processing the real dispensing patterns, the introduced correction may be a simple linear correction along at least one section of the printing area. In this case, the dispensing patterns of the modules subsequent to the first are processed starting from a scaled digital image based on the expansion or shrinkage observed on the printing support.

[0020] For instance, the introduced correction may be a simple scaled linear correction with respect to the distance of the dispensing point from the centerline - or from an axis equidistant from the edges - of the printing su pport.

[0021] Actually, even if the deformations of the support, as previously mentioned, appear more marked at the edges, following a correlation that actually would not be linear with respect to the distance from the centerline of the printing support, it has been noted that a linear correction allows an acceptable correction of defects, thus obtaining on the other hand an easy calibration of the system and a limited computational cost.

[0022] In a possible variant, the corrections may be made according to linear functions, however segmenting the printing area in several subsequent sections. The linear functions will adopt a higher coefficient, for instance with respect to a distance from the centerline, in the printing area sections that are closest to the edges.

[0023] Alternatively, more accurate corrections, which modify the printing pattern in a non-linear manner according to the distortions actually registered on the entire printing area of the support, may be provided.

[0024] In this case, the compensation function may be obtained by interpolating the misalignments found on several control points along the printing area. Obviously, the more control points are used, the more precise the compensation function will be.

[0025] The method may advantageously provide for a step of identifying one or more identification parameters of the deformation undergone by the printing support due to the passage below the printing modules.

[0026] In a variant, this acquisition may take place in a preliminary phase, for instance through a registration printing or through simulations or calculations of another type. In this case, the identified deformation parameters are stored in a memory accessible to the control unit, which will use them for processing the real dispensing patterns.

[0027] In the practical case, an operator may evaluate the misalignments of the several colours found on the registration printing, identifying - based on experience or following guidance feedback on the test printing itself - the deformation parameters to be entered into the system through an appropriate software interface.

[0028] It is noted that the identification of the deformation parameters will be preferably performed before each new printing job, since the Applicant has noted that these parameters depend not only on the characteristics of the printing support, but also on the specific ink deposition pattern along the printing area.

[0029] The identification of the identification parameters of the deformation may also be carried out through one or more optical detection systems adapted to detect the position of the printing support and/or the ink deposited thereonto in the printing modules upstream of said optical detection system.

[0030] In this case, there is a detection - even in real time - of the deposited ink pattern or of the printing support register, which can be used to calculate or modify the real dispensing patterns.

[0031] The optical detection systems may be a plurality and arranged at least upstream of the single printing modules following the first; preferably, however, a single optical detection system will be used, using the data thereby detected - and in particular the misalignment found between the different colours of the printing pattern - to estimate the deformation of the printing support in the subsequent intermediate positions during the advancement.

[0032] The one or more optical detection systems may provide for a plurality of scanning sensors linearly distributed along the printing area.

[0033] Each of said scanning sensors is preferably adapted to identify geometric distortions generated during the ink deposition on the deformed printing support.

[0034] The scanning sensors are preferably CIS sensors.

[0035] In an embodiment of the present invention, the real dispensing patterns are corrected in feedback based on the data acquired by one or more optical detection systems during the printing.

[0036] The method outlined above advantageously allows carrying out a dynamic control of the printing register, adapting the dispensing patterns based on the actual printing conditions in use, linked for instance to the printing support material and to the real operating parameters of the printing device.

[0037] The printing support may be a paper material that undergoes a transversal expansion as a result of the absorption of the ink deposited by the subsequent printing modules.

[0038] However, the adoption of the present invention to non-paper printing supports, for instance glass or ceramic, which, as described in the previous analysis of the prior art, may deform as a result of the expected drying after the deposition of the several inks, is not excluded.

[0039] Preferably, the compensation due to the deformation observed on the support acts on the processing of the image, through the RIP printing, and provides for the modification of the ideal dispensing pattern, for instance by modifying the density of the printing pixels and/or the proportions so as to correct the detected printing defect and restore the printing in register.

[0040] It is noted that the different steps described above may all be performed during at least one production cycle of the digital printing device.

[0041] Optionally the method outlined above may also include a preliminary system for acquiring the deformations of the support, which detects and then processes the error, in order to carry out an error correction process based on preset commands deriving from test trials, which, along with the operating parameters of the printing device, allow processing the necessary corrections to be applied.

[0042] The previously identified technical problem is also solved by a digital printing system comprising:

- a digital printing device equipped with a plurality of printing modules arranged in sequence along an advancement direction, each printing module comprising a tank for a specific ink and a plurality of dispensing nozzles arranged along a printing area for dispensing said ink;

- advancement means for moving a printing support below the printing modules along the advancement direction;

- a control unit of the digital printing device arranged for:

    ◦ processing a digital image to be printed, thus obtaining a specific theoretical dispensing pattern for each single printing module;

    ◦ processing a real dispensing pattern for each printing module, by correcting the corresponding theoretical dispensing pattern so as to compensate for the deformation undergone by the printing support due to the passage below the previous printing modules;

    ◦ operating the dispensing nozzles of the single printing modules based on the processed real dispensing patterns.

[0043] As previously mentioned, the system may further provide a memory accessible to the control unit and containing one or more identification parameters of the deformation undergone by the printing support due to the passage below the printing modules.

[0044] The system may also provide for an interface for the insertion and modification, by the user, of the one or more identification parameters of the deformation undergone by the printing support stored in the memory.

[0045] The system may further comprise one or more optical detection systems adapted to detect the position of the printing support and/or the ink deposited thereonto in the printing modules upstream of said optical detection system.

[0046] In particular, the optical detection systems may be a plurality, arranged at least upstream of the single printing modules following the first.

[0047] The one or more optical detection systems may provide a plurality of scanning sensors linearly distributed along the printing area, for instance CIS sensors.

[0048] Alternatively or in combination, the optical detection systems may provide at least one lateral register sensor of the printing support.

[0049] It should be noted that the control unit may be mounted on board the printing device or be external to it. For instance, it may be an electronic processor interfaced with the digital printing device and with the optical detection system.

[0050] Further features and advantages will become apparent from the following detailed description of two preferred, but not exclusive, embodiments of the present invention, with reference to the enclosed figures given by way of non-limiting example.

Brief description of the drawings

[0051]

Figure 1 represents a printing system comprising a printing device and a control unit arranged to provide a printing method according to the present invention;

figure 2 represents a schematic view of an exemplifying positioning of the print heads and of the dispensing nozzles present on each print head;

figure 3 schematically represents the register error introduced by the deformation of the printing support in a digital printing method according to the prior art;

figure 4 schematically represents the correction introduced into the digital printing method according to the present invention.

Detailed description

[0052] With reference to the enclosed figures 1 and 4, reference number 100 generically identifies a printing system, which detects and corrects the printing defects.

[0053] The system 100 in particular comprises a digital printing device A, preferably for planographic printing, represented in greater detail in figure 1. Said digital printing device A comprises a fixed frame 10, below which advancement means 11 of a paper printing support S are provided - in the preferred embodiment herein illustrated paper - along a printing plane G. The paper printing support S thus moves in an advancement direction E.

[0054] The digital printing device A further comprises a plurality of printing modules 3a-e, also called colour modules, cantilever supported above the printing area G by a support portion 2. The printing modules 3a-e have a lower portion that develops close to the printing plane G and that houses a plurality of print heads H next to each other so as to define a printing area.

[0055] The print heads H, of the type per se known and as visible in the detail of figure 2, have a plurality of dispensing nozzles N arranged to dispense an adjustable volume of ink. The instantaneous dispensing by a single nozzle N on a printing support P locally defines an ink dot; the different ink dots cooperate to define a printing image.

[0056] The system 100 also comprises moving means of the above printing support S, which are arranged to make said printing support P advance in the advancement direction E orthogonal to the printing area.

[0057] In an embodiment, said moving means are a reel-based moving system, wherein the substrate is flexible; alternatively, it is possible to use moving means of another type, for instance a conveyor belt for moving a rigid substrate.

[0058] The system S also comprises a control unit CU. Said control unit CU, which may be made by one or more electronic processors, by one or more microprocessors, or by analogous devices known in the art, is mainly arranged for processing dispensing patterns to the several colour modules 3a-e.

[0059] In particular, the control unit processes, based on an object digital printing, a plurality of dedicated theoretical dispensing patterns Pa-e for each single colour module 3a-e. The theoretical dispensing patterns Pa-e identify the deposition mode of the ink dots by the nozzles N of each single colour module 3a-e. Ideally, the overlapping of the ink deposited by the different modules 3a-3e passed through the printing support S based on the above theoretical dispensing patterns Pa-e returns the object digital image.

[0060] The system 100 also comprises at least one optical detection system OD, aiming at identifying the misalignment of the printing between a colour module 3a-3e and the following, due to the absorption of the ink in the paper.

[0061] In a preferred embodiment, said optical detection system OD comprises one or more scanning sensors, preferably of the CIS type, in case of a plurality linearly next to each other along a direction parallel to the printing area.

[0062] However, it is possible for said optical detection system OD to be of a simpler type, and to be constituted by one or two lateral sensors aimed at measuring the misalignment of the printing support S with respect to an initial reference.

[0063] The optical detection system OD is herein represented arranged downstream of the colour module 3b; i.e., in the exemplified embodiment herein described, downstream of the last colour module. In this way, it may acquire the image printed by the previous colour modules; or alternatively the misalignment of the printing support as a result of the ink absorption of the modules. Analogous optical detection systems OD may be arranged immediately downstream of intermediate colour modules, without this being strictly necessary.

[0064] It is in fact possible to provide for a unique optical detection system OD to globally evaluate the deformation of the paper while passing below the following colour modules 3a-e. This unique optical detection system may be positioned at the end of the printing plane G, or in an intermediate position.

[0065] In both cases outlined above, an optical detection system OD may also be provided upstream of the printing plane G to identify an initial alignment reference of the printing support S.

[0066] The optical detection system OD forwards the acquired data to the control unit CU, which determines, based thereon, the entity of the deformation of the paper between a colour module and the following.

[0067] The deformation may be obtained directly, wherein the system provides for an optical detection system OD for each colour module 3b-e following the first or even a unique optical detection system OD downstream of the colour modules; or indirectly, wherein optical detection systems OD are provided upstream and downstream of the printing plane: in this case the control unit will perform an average to estimate the deformation of the printing support at the entrance of the individual colour modules 3be.

[0068] In light of the above, the control unit CU is anyway able to identify at least one significant parameter relating to the geometric distortion of the printing support S between one colour module and the following. Said identifying parameter may be for instance represented by a simple estimation of the linear deformation D in a transversal sense of the printing support S; otherwise, it

is possible to detect a plurality of parameters that identify in a more detailed manner the deformation - even non-linear - of the printing support along the entire printing area in a more detailed.

[0069] Based on the mapping of the geometric distortion introduced by the deformation of the printing support S, the control unit CU is able to recalculate the theoretical dispensing patterns Pa-e for each color module, processing real dispensing patterns Pa'-e' that have been corrected to adapt the dispensing of the modules following the first to the deformation observed on the printing support.

[0070] In an application example, in which the printing of the first printing module 3a is taken as a reference, the first real dispensing pattern Pa' coincides with the theoretical dispensing pattern Pa, whereas the subsequent ones introduce increasingly substantial compensations. On the other hand, it is of course possible to use a printing module 3a-e subsequent to the first as a reference, or even to modify all the theoretical dispensing patterns based on an ideal reference.

[0071] In an alternative embodiment of the invention, an optical detection system of the misalignment due to the deformation may not be provided. In this case, the real dispensing patterns Pa'-e' may be processed based on data relating to the deformation of the printing support S acquired offline or on other machines.

[0072] Preferably, the data relating to the deformation of the printing support in this casa are identified through analysis by an operator before each printing job and introduced into the system through a specific interface.

[0073] The above system 100 is able to perform a printing method that carries out an automatic compensation of the misalignments between colors due to the deformation of the printing support S.

[0074] In a first step, the digital printing device A is controlled to perform a printing aimed at identifying and correcting the misalignments between colour modules.

[0075] Said printing is preferably made based on a digital image consisting of a matrix of pixels and with a certain proportion.

[0076] The control unit CU thus calculates a theoretical dispensing pattern Pa-e for each printing module 3a-e, in order to reproduce the above digital image.

[0077] Based on said dispensing patterns Pa-e, the print heads H deposit a certain quantity of ink onto the printing support S. However, given the deformation of the printing support S between a printing module and the following, there is a distortion of the decorative pattern: for instance a linear expansion of the printing support S determines a misalignment of the colours, resulting in a chromatic aberration.

[0078] Analyzing the output of the OD optical detection systems, the control unit CU is able to identify or estimate one or more significant parameters of the deformation of the printing support and based on these parameters it re-calculates the real dispensing patterns Pa'-e'.

[0079] In particular, in an embodiment, considering a linear expansion of the printing support S relative to its centerline M, the real dispensing patterns of the modules following the first Pb'-e' may be calculated based on a digital image with increased proportions with respect to the original one. Although the linear expansion with respect to the centerline is an approximation of the real physical behavior - which actually exhibits more marked expansions at the edges - the Applicant has found that this model ensures good results in concrete applications.

[0080] The new real dispensing patterns Pa'-e' are sent to the several printing modules 3a-e, which therefore produce a corrected register printing with respect to the identified deformations.

[0081] Said correction is schematically represented in figure 4. From the comparison with the printing according to the prior art represented in figure 3, it may be noted how the execution of the real dispensing pattern Pb' by the second color module 3b now restores the correct overlap between the larger diameter circles printed by the first color module 3a and the smaller diameter circles printed by the second module, despite the expansion cross section D of the printing support S.

[0082] Afterwards, the control unit CU may continue evaluating the image acquired by the optical detection systems OD to identify residual discrepancies in the alignment of the colours, possibly re-modifying the real dispensing patterns Pa'-e' until an acceptable overlap between the detected image and the desired digital image is reached.

[0083] A feedback control is thus achieved, which advantageously allows achieving an optimal compensation even throughout printing, where a variation of the process parameters leads over time to an alteration of the deformations introduced on the printing support S.

[0084] Obviously, a skilled person can make several changes and variants to the above described invention, in order to meet contingent and specific needs, all of them by the way contained in the scope of protection of the invention as defined by the following claims.

Claims

1. Printing method, comprising the following steps:

- providing a digital printing device (A) equipped with a plurality of printing modules (3a-e) arranged in sequence along an advancement direction (E), each printing module (3a-e) comprising a tank for a specific ink and a plurality of dispensing nozzles (N) arranged along a printing area to dispense said ink;
- moving a printing support (S) below the printing modules (3a-e) along the advancement direction (E);
- processing, on board a control unit (CU) of the digital printing device (A), a digital image to be printed, obtaining a specific theoretical dispens-

ing pattern (Pa-e) for each individual printing module (3a-e);
- processing a real dispensing pattern (Pa'-e') for each printing module (3a-e), correcting the corresponding theoretical dispensing pattern (Pa-e) so as to compensate for the deformation undergone by the printing support (S) due to the passage below the previous printing modules (3a-d);
- operating the dispensing nozzles (N) of the single printing modules (3a-e) based on the processed real dispensing patterns (Pa'-e').

2. Printing method according to claim 1, wherein in the step of processing the real dispensing patterns (Pa'-e'), the introduced correction is a linear correction along at least one section of the printing area.

3. Printing method according to claim 2, wherein in the step of processing the real dispensing patterns (Pa'-e'), the introduced correction is a linear correction with respect to the distance from the centerline (M) of the printing support (S).

4. Printing method according to claim 2, wherein in the step of processing the real dispensing patterns (Pa'-e'), the printing area is divided into a plurality of transversal sections, and the introduced correction is a linear correction on each of said transversal sections.

5. Printing method according to claim 1, wherein in the step of processing the real dispensing patterns (Pa'-e'), the introduced correction is a non-linear correction along the printing area.

6. Printing method according to claim 5, wherein in the step of processing the real dispensing patterns (Pa'-e'), the introduced correction follows a non-linear compensation function obtained by interpolating the deformations found on different points along the printing area.

7. Printing method according to one of the preceding claims, comprising a step of identifying one or more identification parameters of the deformation undergone by the printing support (S) due to the passage below the printing modules (3a-d).

8. Printing method according to claim 7, wherein said step of identifying one or more identification parameters of the deformation is performed in a preliminary manner, and said parameters are preliminarily stored in a memory accessible to the control unit (CU).

9. Printing method according to claim 7, wherein said step of identifying the identification parameters of the deformation is performed by means of one or more optical detection systems (OD) adapted to detect the position of the printing support (S) and/or the ink deposited thereonto in the printing modules (3a-e) upstream of said optical detection system (OD).

10. Printing method according to claim 9, wherein said optical detection systems (OD) are at least two, preferably upstream and downstream of the plurality of the printing modules (3a-e), and wherein the deformation of the printing support is processed indirectly starting from the data acquired by said two optical detection systems (OD).

11. Printing method according to one of claims 9 or 10, wherein said real dispensing patterns (Pa'-e') are corrected in feedback based on the data acquired by the one or more optical detection systems (OD) during the printing.

12. Printing method according to one of the preceding claims, wherein said printing support (S) is a paper material that undergoes a transversal expansion as a result of the absorption of the ink deposited by the subsequent printing modules (3b-e).

13. Printing system (100) comprising:

- a digital printing device (A) equipped with a plurality of printing modules (3a-e) arranged in sequence along an advancement direction (E), each printing module (3a-e) comprising a tank for a specific ink and a plurality of dispensing nozzles (N) arranged along a printing area for dispensing said ink;
- advancement means (11) for moving a printing support (S) below the printing modules (3a-e) along the advancement direction (E);
- a control unit (CU) of the digital printing device (A) arranged for:

  ◦ processing a digital image to be printed, thus obtaining a theoretical dispensing pattern (Pa-e) specific for each single printing module (3a-e);
  ◦ processing a real dispensing pattern (Pa'-e') for each printing module (3a-e), correcting the corresponding theoretical dispensing pattern (Pa-e) so as to compensate for the deformation undergone by the printing support (S) due to the passage below the previous printing modules (3a-d);
  ◦ operating the dispensing nozzles (N) of the single printing modules (3a-e) based on the processed real dispensing patterns (Pa'-e').

14. Printing system (100) according to claim 13, com-

prising an interface for insertion and modification by the user, in a memory accessible to the control unit, of one or more identification parameters of the deformation undergone by the printing support (S) following the passage due to the printing modules (3a-d).

15. Printing system (100) according to one of claims 13 or 14, further comprising one or more optical detection systems (OD) adapted to detect the position of the printing support (S) and/or the ink deposited thereonto in the printing modules (3a-e) upstream of said optical detection system (OD).

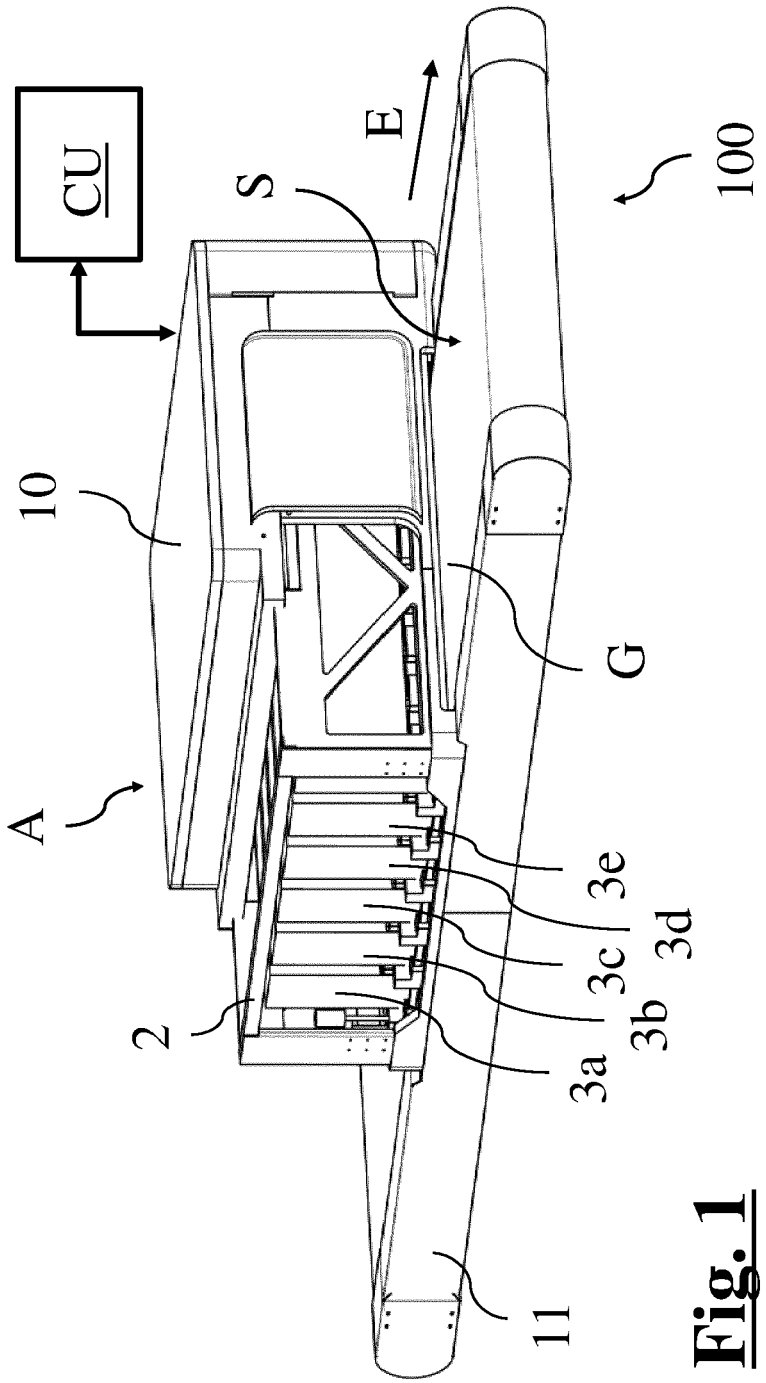


Fig. 1

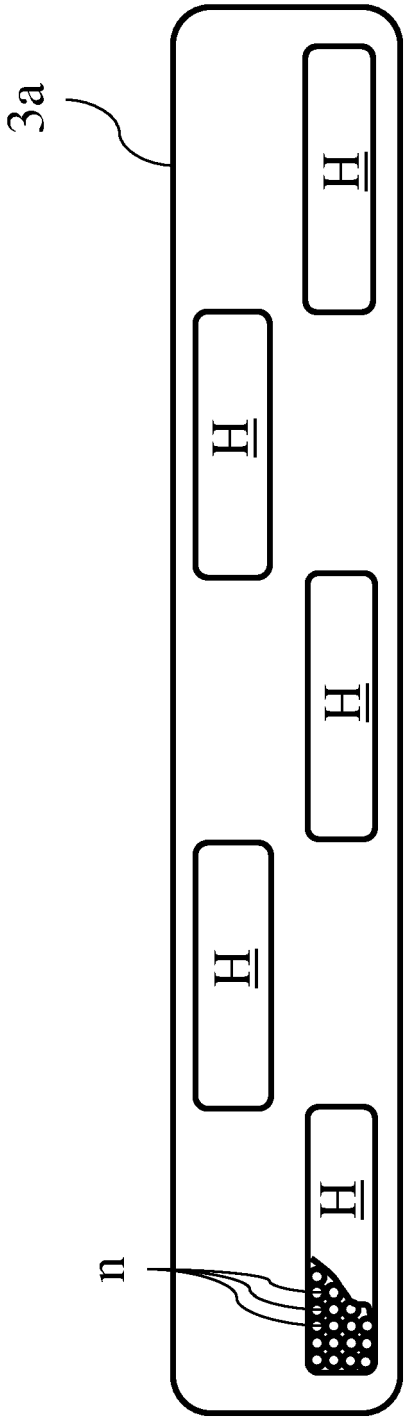
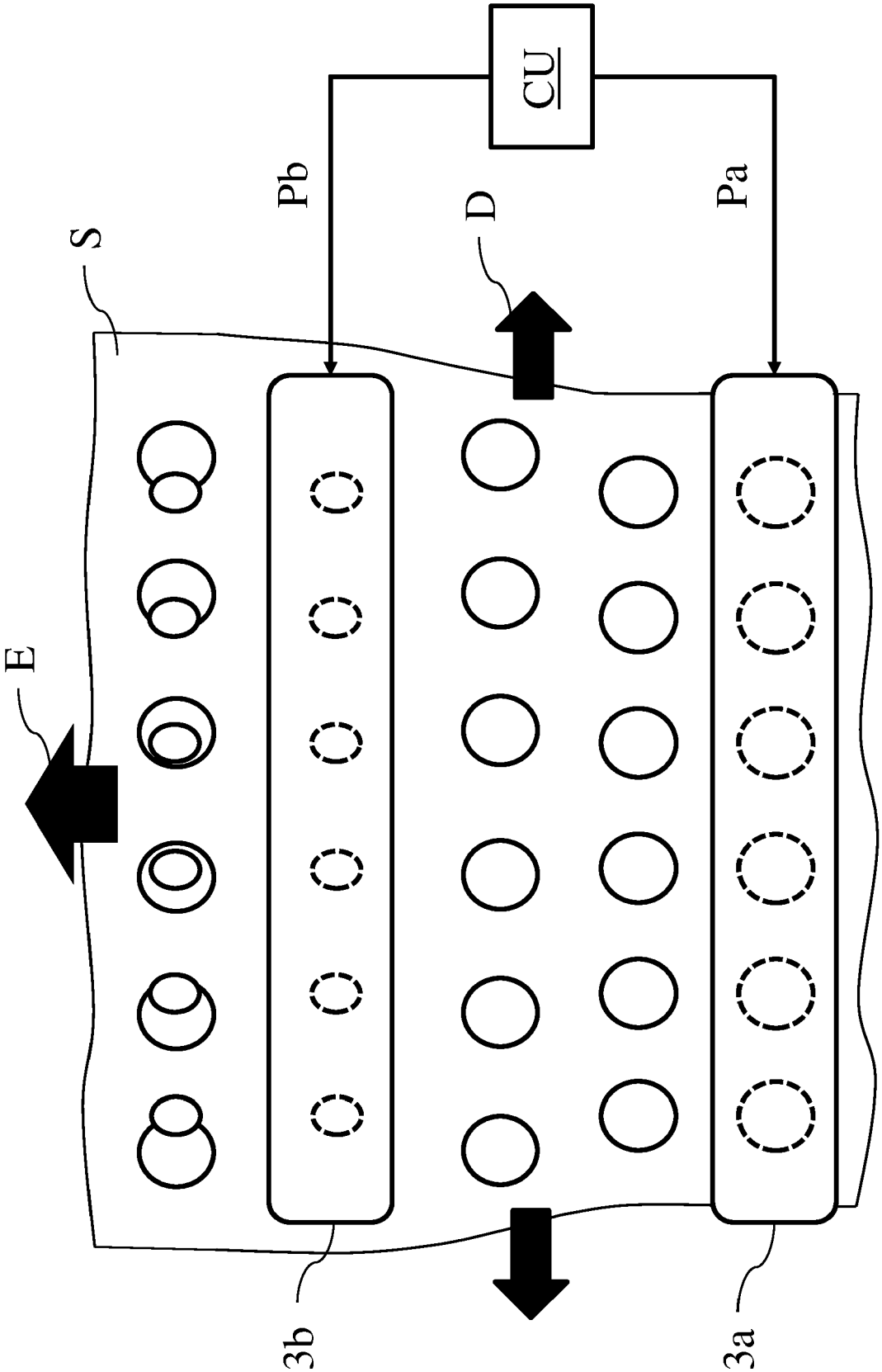


Fig. 2



PRIOR ART

Fig. 3

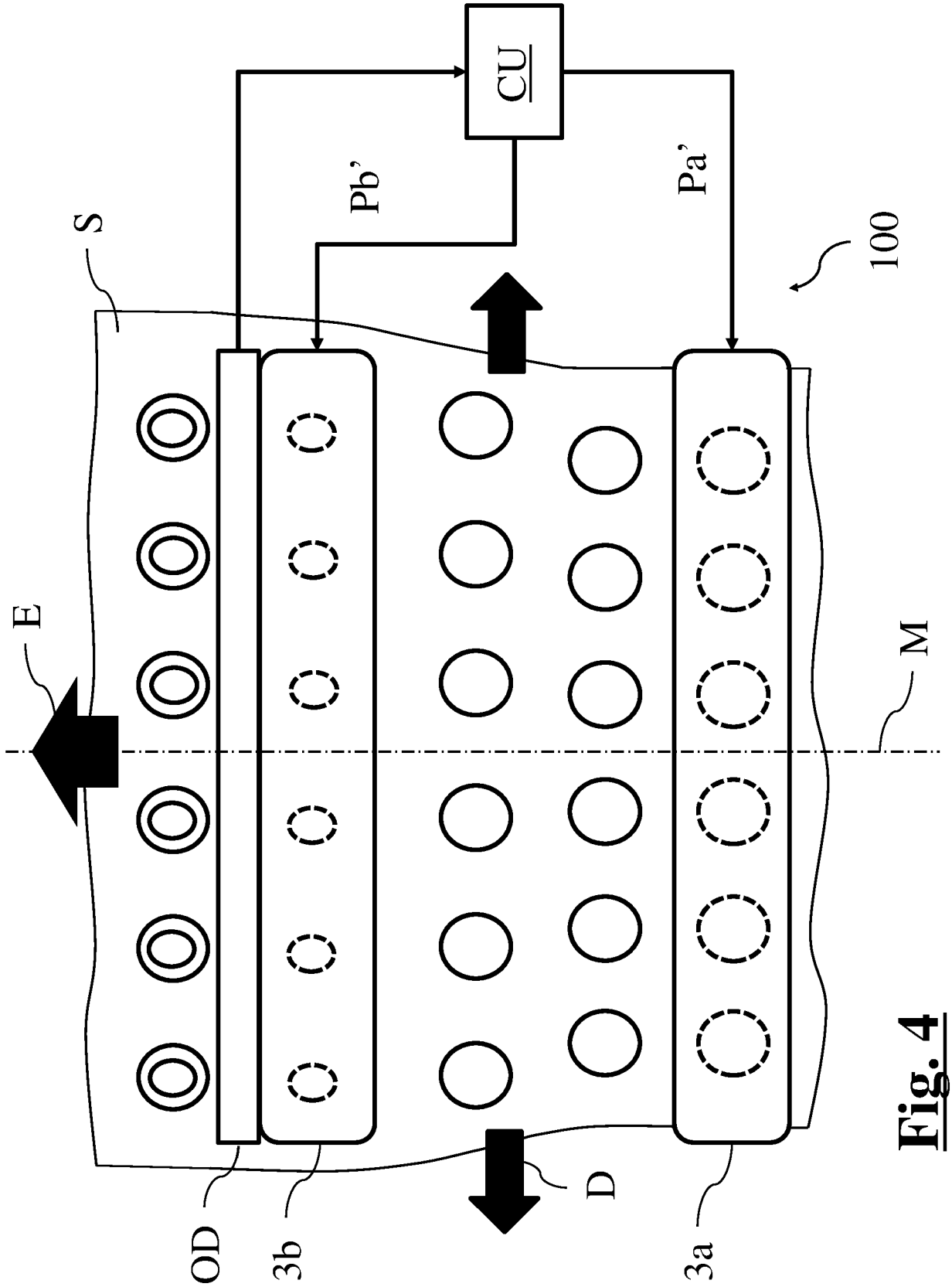


Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 22 17 2326

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2016/167361 A1 (FEMANDEZ ESPASA CESAR [US] ET AL) 16 June 2016 (2016-06-16) * figures 1, 3 * * paragraph [0030] * * paragraph [0033] * * paragraph [0094] * * paragraph [0059] * * paragraph [0102] * * paragraph [0031] * * paragraph [0126] *	1-3,7, 9-15	INV. B41J11/00 B41J2/21
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	7 October 2022	João, César

CATEGORY OF CITED DOCUMENTS

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