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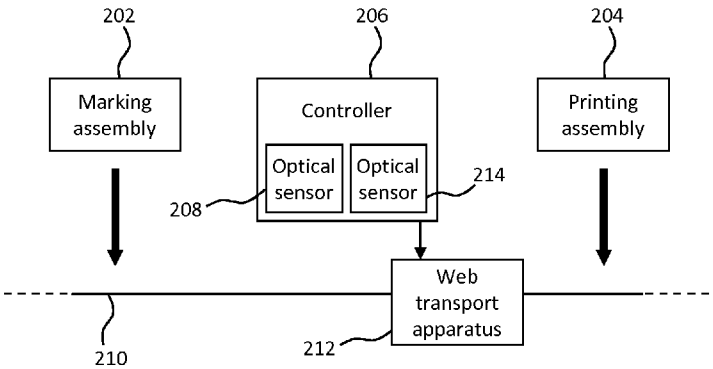


FIG. 2

(57) Abstract: In an example, an apparatus includes a marking assembly to print a mark on a web, a printing assembly to apply an image to the web, and a controller to detect the mark and to control a web transport parameter based on the detection of the mark.

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PRINTING APPARATUS

BACKGROUND

[0001] Printing systems such as liquid electro photographic (LEP) printers may form images on a photoconductive member using liquid toner and the like. The images may be transferred to an intermediate member on which they are dried. The images may then be transferred to media.

BRIEF DESCRIPTION OF DRAWINGS

[0002] Examples will now be described, by way of non-limiting example, with reference to the accompanying drawings, in which:

[0003] Figure 1 is a simplified schematic of an example of a printing apparatus;

[0004] Figure 2 is a simplified schematic of an example of a printing device;

[0005] Figure 3 shows an example of a substrate;

[0006] Figure 4 is a flowchart of an example of a method of printing;

[0007] Figure 5 is a flowchart of an example of a method of printing; and

[0008] Figure 6 is a simplified schematic of an example of a printing device.

DETAILED DESCRIPTION

[0009] Printing systems such as liquid electro photographic (LEP) printers include a printing assembly that transfers an image to a substrate. An image formed on the substrate may comprise multiple layers of print agent. The substrate is manipulated in the vicinity of the printing assembly whilst the image is being applied to the substrate. For example, the tension of the substrate, which affects the length of a section of substrate, and/or the velocity of the substrate may be varied. This may affect the size of images on the substrate, and image size may differ from an intended image size.

[0010] Figure 1 shows an example of an apparatus 100 that includes a marking assembly 102, a printing assembly 104 and a controller 106. The marking assembly 102 prints a mark on a substrate 108. In some examples, the marking assembly applies the mark to the substrate 102 in a mechanical manner, such as for example using a stamp to transfer print agent and/or a deformation to the substrate 108. Providing a mechanical assembly may assist in achieving a consistent placement of marks as it may be unaffected

or less affected by changes in speed, movement direction and/or tension of other parts of the substrate, such as for example a region of the substrate near the printing assembly.

[0011] In some examples, the marking assembly 102 prints a mark on the substrate 108 as the substrate 108 moves past the marking assembly 102. In some examples, the velocity and/or tension of a section the substrate 108 to which the marking assembly 102 applies the mark is regulated, such that for example the velocity and/or tension is substantially constant with little variation. As a result, the mark may be applied to the substrate 108 in an accurate manner. In an example, the size of the mark, and/or the distance between the mark and another mark that may be on the substrate 108, is substantially constant and may be known.

[0012] As noted above, in some examples, a property of a section of the substrate 108 to which the mark is applied is controlled in a well-defined manner. The substrate may pass between a pair of rollers and the rollers may be controlled to impart a certain velocity and/or tension to the substrate. In some examples, one roller in a pair of rollers that controls velocity and/or tension may also include a marking assembly to apply the mark to the substrate. The tension of the substrate may be kept relatively high (i.e. the substrate is held at a tight tension) to assist in providing consistent placement. In some examples, a "dancer assembly" comprising a plurality of relatively repositionable rollers may be used to control the tension of the section of substrate.

[0013] The printing assembly 104 applies an image to the substrate 108. The image may be applied to the same side of the substrate as the mark, or the opposite side. The controller 106 detects the mark and controls a substrate transport parameter based on the detection of the mark. In some examples, the substrate transport parameter comprises at least one of the velocity, position and tension of a section of the substrate 108 in the vicinity of the printing assembly 104. In some examples, the controller 106 corrects the velocity, position and/or tension of the section of the substrate in the vicinity of the printing assembly 104 such that the image applied to the substrate 108 by the printing assembly 104 is at a certain position on the substrate 108 and/or of a certain size on the substrate 108.

[0014] In some examples, the marking assembly is to apply a further mark to the substrate, and the controller arrangement is to detect the mark and the further mark and to control the transport parameter based on the detection of the mark and the detection of the further mark. Therefore, for example, the printing assembly 104 may print further images, such as repeat images, and the substrate transport parameter may be controlled such that the position and/or size of at least one of the images on the substrate 108 may be controlled. In some examples, the further mark may be a repeat occurrence of the mark. The mark may be repeated one or more times on the substrate 108 in a direction along which the substrate

108 moves through the printing apparatus 100. Providing multiple marks allows the relative spacing of the marks to be monitored. In addition, for example, multiple parts of the substrate may be monitored, and/or the substrate may be monitored on an ongoing basis as the substrate moves through a printing device.

[0015] In some examples the controller 106 may include a sensor such as for example an optical sensor or a camera to detect the absolute position of the mark on the substrate. The absolute position can be used to correct the velocity, tension and/or position of a section of the substrate to which the image is applied. In some examples, the controller 106 may include a sensor, such as for example an optical sensor or camera, to determine the relative positions of the mark and the image. For example, the controller may determine the distance between the mark and the image. If the distance is not the expected distance or is not within a certain tolerance of the expected distance, this may be provided by way of a feedback signal such that the controller 106 may adjust the web transport parameter to ensure that the distance tends towards the expected distance in subsequent prints and hence the images on the substrate have the expected position and/or size. In some examples, the controller 106 may include a first sensor that is used by the controller 106 to determine the absolute position of the mark, and a second sensor to determine the relative positions of the mark and the image, and the controller uses data from both sensors to control the substrate transport parameter.

[0016] In some examples, multiple marks may be applied to the substrate by the marking assembly 102 and detected by the controller 106. Detection of multiple marks can be used to control the substrate transport parameter. For instance, in some examples, the marks are detected by the controller 106 over a period of time and can therefore be used to control the web transport parameter over a period of time. In some examples, properties of multiple marks, such as for example the distance between marks or the frequency of detection of the marks, can be used by the controller 106 to control the substrate transport parameter.

[0017] Figure 2 shows an example of an apparatus 200 that may be a printing device. The apparatus 200 includes a marking assembly 202, a printing assembly 204 and a controller 206. The controller 206 includes a first optical sensor 208 and a second optical sensor 214 to optically detect the mark on a web 210. The controller 206 controls a web transport apparatus 212 to control a web transport parameter based on detection of the mark by the optical sensor 208. The first optical sensor 208 may be positioned upstream of the printing assembly and the second optical sensor 214 may be positioned downstream of the printing assembly.

[0018] As noted above, the marking assembly 202 may print a mark on the web 210, and the printing assembly 204 may apply an image to the web 210. In some examples, the controller 206 controls at least one of the velocity, position and tension of a section of the web 210 in the vicinity of the printing assembly 204.

[0019] As noted above, the controller 206 using the optical sensor 208 may sense the absolute position of the mark, the relative positions of the mark and the image and/or a property of multiple marks such as frequency to control the web transport parameter using the web transport apparatus 212. In some examples, a single sensor may sense the marks. In some examples, multiple sensors may sense the mark, and/or other features. For example, a first sensor may detect the mark, whereas a second sensor may detect the image, or the mark and the image, and provide a feedback signal to the controller. Figure 2 shows a first optical sensor 208 and a second optical sensor 214 accordingly.

[0020] Figure 3 shows an example of a substrate 300. The substrate 300 has printed thereon a plurality of images 302. These images may be different or may be the same image repeated multiple times. The substrate 300 also includes a plurality of marks 304. The marks 304 may be different or may be identical. In the example shown, the marks 304 are identical and repeated at fixed intervals in a direction along which the substrate 300 moves through a printing apparatus.

[0021] In some examples, the substrate moves through a printing device generally in a direction illustrated by arrow 306 in Figure 3, though in some examples the direction may be reversed at times during printing. The marks 304 are arranged along a line in the direction 306. The images 302 are also aligned along this direction, adjacent to the marks 304. In some examples, a detector may determine the frequency at which the marks 304 move past a sensor and/or may determine the distance between marks 304 to determine a property of substrate movement through a printing device. For example, if the velocity is known, the distance between or frequency of the marks may indicate substrate tension. In some examples, the marks can be used to determine substrate velocity. Information from detection of the marks 304 can be used by a controller to adjust a substrate transport parameter, for example to control substrate velocity and/or tension to a predetermined value.

[0022] In some examples, it may be intended that a part of an image may be aligned with a mark. For example, the intended relative positions of a part of a mark and a part of an image may be fixed. By detecting the mark prior to printing, and controlling the transport of the media, the intended relative positions may be achieved. As an additional measure. the mark could be detected subsequent to printing, and the media may be manipulated to ensure that subsequently printed images are suitably positioned and/or aligned. In some examples, the detection of a mark may allow an edge of an image such as the leading edge

may be aligned in a direction perpendicular to the movement direction with an edge of a mark such as the leading edge. This may also be the case for multiple images on a substrate, each of which have the same edge aligned in the same manner with an edge of a mark. In some examples, the end of an image may be aligned with a mark. In some examples, multiple parts of an image may each be aligned with a respective mark. In some examples, the images are not aligned with the marks, and the marks are used to determine substrate properties such as position, velocity and tension.

[0023] Figure 4 shows an example of a method 400, which may be a method of printing on a substrate. In block 402 of the method 400, a mark is transferred to a substrate using a first image forming apparatus. In block 404, the substrate is monitored to detect the mark. In block 406, the substrate is manipulated based on detection of the mark. In block 408, an image is transferred to the substrate using a second image forming apparatus. In some examples, the substrate is manipulated such that the image on the substrate has a well-defined size and/or position.

[0024] As noted above, the substrate may be manipulated such that the image on the substrate has a desired size and/or position. Therefore, for example, the absolute position of the mark, and/or the relative positions of the mark and the image, may be used to manipulate the substrate (prior to printing the image and/or as part of a feedback loop) to ensure that the image on the substrate is at a desired position and/or has a desired size, or the size and/or position are within defined tolerances. In some examples, the velocity and/or tension of the substrate may be manipulated.

[0025] Figure 5 shows an example of a method 500, which may be a method of printing on a substrate. The method includes block 500, in which a mark is transferred to a substrate using a first image forming apparatus by stamping the mark onto the substrate. Using such a mechanical system to apply the mark to a substrate may in some examples ensure that the mark is transferred accurately, with an accurate position and/or size. In some examples, the mark is transferred using a pair of rollers that pinch the substrate, with a stamp shape being located on an outer surface of one of the rollers.

[0026] In block 504 of the method 500, the substrate is monitored to detect the mark, and in block 506, the substrate is manipulated based on detection of the mark by varying at least one of a velocity, position and tension of the substrate. In block 508, a further mark is transferred to the substrate, and the substrate is monitored the substrate to detect the further mark, and the substrate is manipulated based on the position of the mark and the position of the further mark. Therefore, in some examples, the size and/or position of multiple images on the substrate may be based on detection of the marks, and/or the size and/or position of a single image on the substrate may be based on detection of the marks.

[0027] In block 510, an image is transferred to the substrate using a second image forming apparatus. In some examples, the substrate is manipulated by manipulating a section of the substrate, and an image may be transferred to this section.

[0028] Figure 6 shows an example of a printing device 600. The printing device 600 includes a marking stamp that stamps at least one mark on print media 604. Monitoring apparatus 606 may monitor the print media for presence of the mark. A control system 608 may manipulate the print media based on detection of the mark by the monitoring apparatus 606. A print agent transfer engine 610 may transfer a layer of print agent to the print media 604. In some examples, the marking stamp 602 may apply a consistent mark to the print media, that is, a mark that has an accurate and well-defined position and/or size. The marking stamp 602 may stamp multiple marks on the print media 604. In some examples, the control system may manipulate a property of the print media, such as velocity or tension, in at least a region of the print media to which the print transfer engine is to apply the image. Such manipulation may ensure that the image applied to the substrate has a consistent position and/or size on the print media.

[0029] Examples in the present disclosure can be provided at least in part as methods, systems or machine readable instructions, such as any combination of software, hardware, firmware or the like. Such machine readable instructions may be included on a computer readable storage medium (including but is not limited to disc storage, CD-ROM, optical storage, etc.) having computer readable program codes therein or thereon.

[0030] The present disclosure is described with reference to flow charts and/or block diagrams of the method, devices and systems according to examples of the present disclosure. Although the flow diagrams described above show a specific order of execution, the order of execution may differ from that which is depicted. Blocks described in relation to one flow chart may be combined with those of another flow chart. It shall be understood that each flow and/or block in the flow charts and/or block diagrams, as well as combinations of the flows and/or diagrams in the flow charts and/or block diagrams can be realized at least in part by machine readable instructions.

[0031] The machine readable instructions may, for example, be executed by a general purpose computer, a special purpose computer, an embedded processor or processors of other programmable data processing devices to realize the functions described in the description and diagrams. In particular, a processor or processing apparatus may execute the machine readable instructions. Thus functional modules of the apparatus and devices may be implemented by a processor executing machine readable instructions stored in a memory, or a processor operating in accordance with instructions embedded in logic circuitry. The term ‘processor’ is to be interpreted broadly to include a

CPU, processing unit, ASIC, logic unit, or programmable gate array etc. The methods and functional modules may all be performed by a single processor or divided amongst several processors.

[0032] Such machine readable instructions may also be stored in a computer readable storage that can guide the computer or other programmable data processing devices to operate in a specific mode.

[0033] Such machine readable instructions may also be loaded onto a computer or other programmable data processing devices, so that the computer or other programmable data processing devices perform a series of operations to produce computer-implemented processing, thus the instructions executed on the computer or other programmable devices realize functions specified by flow(s) in the flow charts and/or block(s) in the block diagrams.

[0034] Further, the teachings herein may be implemented in the form of a computer software product, the computer software product being stored in a storage medium and comprising a plurality of instructions for making a computer device implement the methods recited in the examples of the present disclosure.

[0035] While the method, apparatus and related aspects have been described with reference to certain examples, various modifications, changes, omissions, and substitutions can be made without departing from the spirit of the present disclosure. It is intended, therefore, that the method, apparatus and related aspects be limited only by the scope of the following claims and their equivalents. It should be noted that the above-mentioned examples illustrate rather than limit what is described herein, and that those skilled in the art will be able to design many alternative implementations without departing from the scope of the appended claims.

[0036] The word “comprising” does not exclude the presence of elements other than those listed in a claim, “a” or “an” does not exclude a plurality, and a single processor or other unit may fulfil the functions of several units recited in the claims.

[0037] The features of any dependent claim may be combined with the features of any of the independent claims or other dependent claims.

CLAIMS

1. An apparatus comprising:

a marking assembly to print a mark on a web;

a printing assembly to apply an image to the web; and

a controller to detect the mark and to control a web transport parameter based on the detection of the mark.

2. The apparatus of claim 1, wherein the web transport parameter comprises at least one of a velocity, position and tension of the web.

3. The apparatus of claim 1, comprising a web transport apparatus, and wherein the controller is to control the web transport apparatus.

4. The apparatus of claim 1, wherein the controller is to control a web transport parameter of a section of the web to which the printing assembly is to apply the image.

5. The apparatus of claim 1, wherein the controller is to detect a position of the mark.

6. The apparatus of claim 1, wherein the marking assembly is to apply the mark to a first side of the web and the printing assembly is to apply the image to a second side of the web opposite the first side.

7. The apparatus of claim 1, wherein the marking assembly comprises a stamp system to stamp the mark on the web.

8. The apparatus of claim 1, further comprising an optical sensor to detect the mark.

9. The apparatus of claim 1, comprising:

a first optical sensor to detect the mark and to provide a signal to the controller to control a web transport parameter of a section of the web to which the printing assembly is to apply the image; and

a second optical sensor to detect the image applied by the printing assembly and to provide a feedback signal to the controller.

10. The apparatus of claim 1, wherein the marking assembly is to apply a further mark to the web, and the controller arrangement is to detect the mark and the further mark and to control the web transport parameter based on the detection of the mark and the detection of the further mark.

11. A method comprising:

transferring a mark to a substrate using a first image forming apparatus;

monitoring the substrate to detect the mark;

manipulating the substrate based on detection of the mark; and

transferring an image to the substrate using a second image forming apparatus.

12. The method of claim 11, wherein manipulating the substrate comprises varying at least one of a velocity, position and tension of the substrate.

13. The method of claim 11, wherein transferring a mark to the substrate using the first image forming apparatus comprises stamping the mark onto the substrate.

14. The method of claim 11, comprising transferring a further mark to the substrate, monitoring the substrate to detect the further mark, and manipulating the substrate based on the position of the mark and the position of the further mark.

15. A printing device comprising:

a marking stamp to stamp a mark onto print media;

a monitoring apparatus to monitor the print media;

a control system to manipulate the print media based on detection of the mark by the monitoring apparatus; and

a print agent transfer engine to transfer a layer of print agent to the print media.

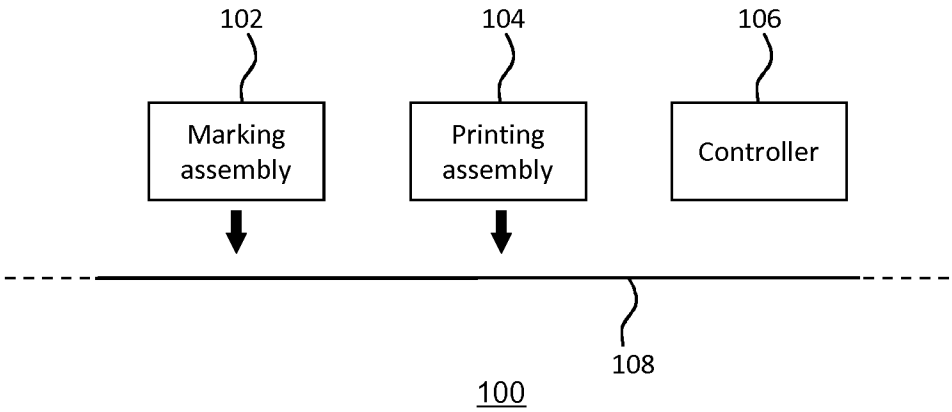

102
104
106
Marking assembly
Printing assembly
Controller
108
100

FIG. 1

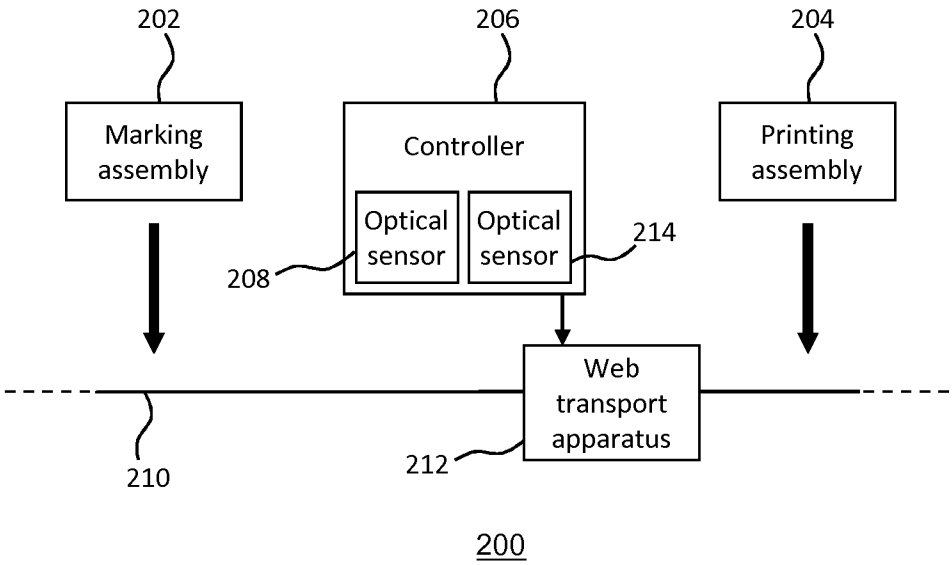

202
206
204
Marking assembly
Controller
Optical sensor
Optical sensor
214
208
Printing assembly
Web transport apparatus
210
212
200

FIG. 2

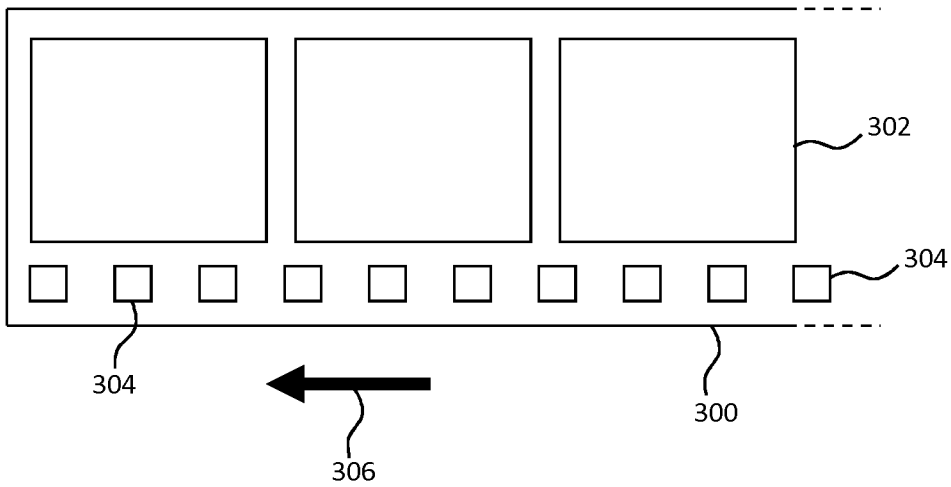
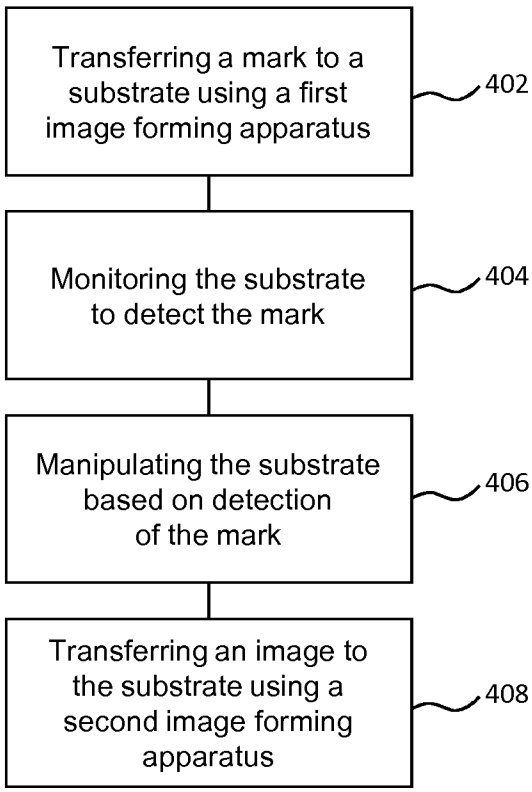


FIG. 3



400

FIG. 4

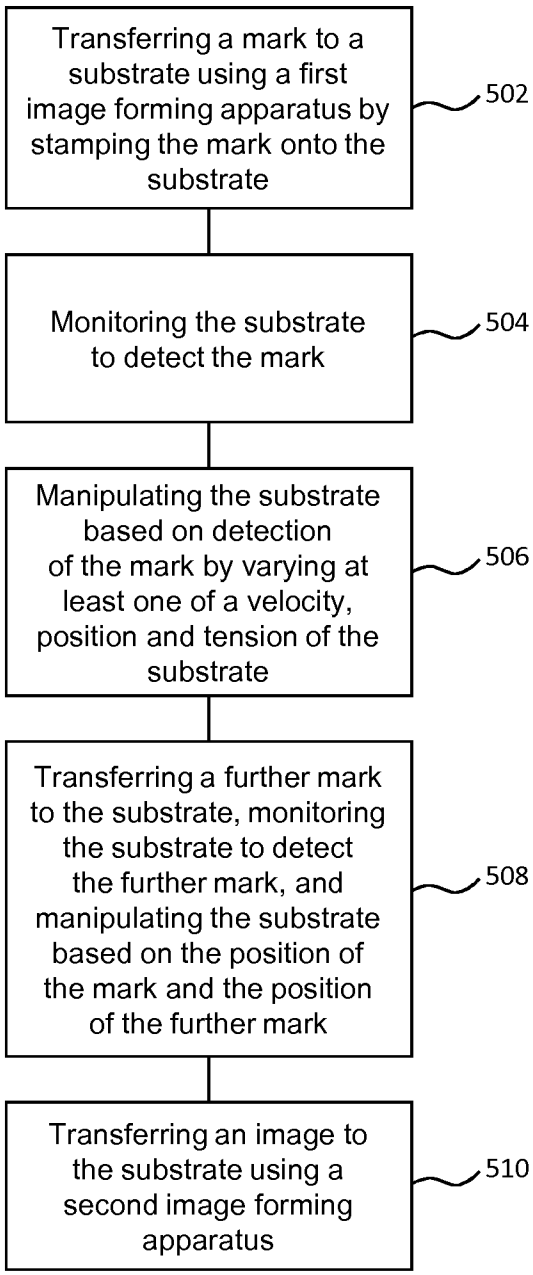

Transferring a mark to a substrate using a first image forming apparatus by stamping the mark onto the substrate
502
Monitoring the substrate to detect the mark
504
Manipulating the substrate based on detection of the mark by varying at least one of a velocity, position and tension of the substrate
506
Transferring a further mark to the substrate, monitoring the substrate to detect the further mark, and manipulating the substrate based on the position of the mark and the position of the further mark
508
Transferring an image to the substrate using a second image forming apparatus
510
500

FIG. 5

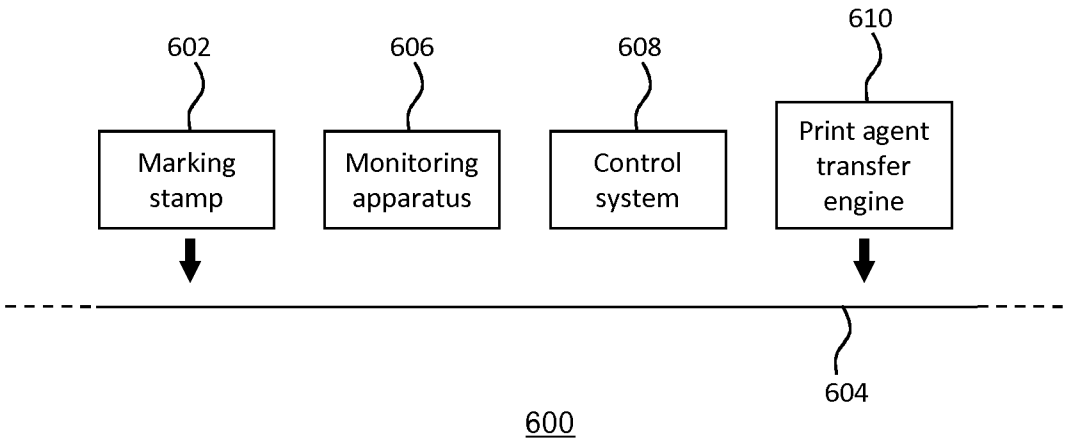

602
606
608
610
Marking stamp
Monitoring apparatus
Control system
Print agent transfer engine
604
600

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/058701

A. CLASSIFICATION OF SUBJECT MATTER
INV. G03G15/00
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)
G03G

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 Y	US 2017/057213 A1 (FERNANDEZ CESAR [US] ET AL) 2 March 2017 (2017-03-02) paragraphs [0022] - [0028]; figures 1-6	1-6,8, 10-12,14 7-9,13
X Y	CN 103 612 477 A (CHEN ERYU) 5 March 2014 (2014-03-05) pages 3-4; figure 1	15 7,13
Y	US 9 387 670 B1 (KELLY III GERALD L [US] ET AL) 12 July 2016 (2016-07-12) columns 9, 11; figures 1-8	8,9
A	US 9 044 974 B1 (MO SONG-FENG [US]) 2 June 2015 (2015-06-02) the whole document	1-15
A	US 2014/085368 A1 (MO SONG-FENG [US]) 27 March 2014 (2014-03-27) the whole document	1-15

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 November 2017	29/11/2017

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	Schwarz, Cornelia

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2017/058701

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2017057213 A1	02-03-2017	US 2017057213 A1	02-03-2017
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