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(71) Applicant: **Canon Production Printing Holding B.V.**
**5914 HH Venlo (NL)**

(72) Inventors:
- **VULPE, Radu**
  **Venlo (NL)**
- **MURESAN, Alexandru, I.**
  **Venlo (NL)**

(74) Representative: **Canon Production Printing IP Department**
**Canon Production Printing Netherlands B.V.**
**Van der Grintenstraat 10**
**5914 HH Venlo (NL)**

(54) **ROLL-FED PRINTER, SOFTWARE MEDIUM AND METHOD FOR DOUBLE-SIDED PRINTING ON A WEB**

(57) When printing on a frontside of a web is completed and an error occurs when printing on a backside of the web, a remaining part of the images is determined which were intended to be printed on the backside but which have not yet been printed due to the print stop. The web is fed forward towards the output holder until the web is completely wound up at the output holder. The web is inserted again at the input holder in order to allow a start of printing the remaining part of the images in a reverse order on the remaining part of the backside of the web.

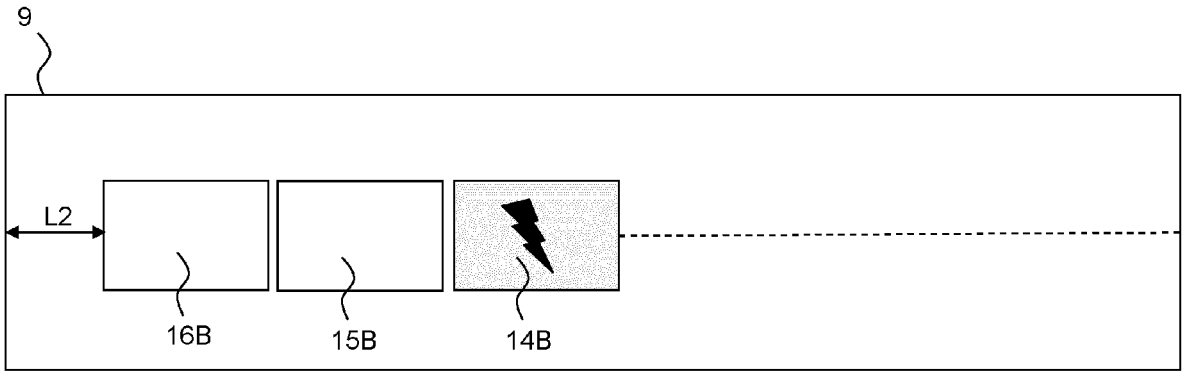


FIG. 2B

EP 4 119 353 A1

## Description

### FIELD OF THE INVENTION

**[0001]** The present invention generally pertains to a method for double-sided printing on a web by means of a roll-fed printer comprising an input holder for the web, an output holder for the web, a print head assembly on a paper path from the input holder to the output holder, a print controller to control the printing of digital images on the web and a user interface, the method comprising the steps of scheduling first images to be printed on a first side of the web and second images to be printed on a second side of the web, printing the first images on the first side of the web fed from the input holder towards the output holder, receiving a first signal that the one-sided printed web is inserted at the input holder in order allow a start of printing on the second side of the web, starting printing the second images on the second side of the web fed from the input holder and receiving an error signal or a user interface signal causing a print stop leaving a remaining part of the second side of the web unprinted. The present invention also pertains to a software medium comprising executable code configured to, when executed, perform a method for controlling the roll-fed printer. The present invention also pertains to a roll-fed printer configured to execute the method according to the present invention.

**[0002]** The term "printing" is used herein as a general term for any marking of a web with any marking material. As a synonym, the term "image forming" may be used. Webs may comprise paper, flexible plastic, metal foils, textiles and so on. Marking materials may comprise ink, metal, varnish, toner and so on. "Marking" may be any process by which the marking material is applied to the web.

**[0003]** The term "double-sided printing" is used herein as a general term for any marking of a web with any marking material wherein the web has two sides, a front side and a back side and the printing subsequently occurs on the front side and the back side. When a front side of the web has been printed, the one-sided printed web is unloaded and put again on the input holder in order to print on the back side of the web. Mechanisms are known in the art to achieve that the one-sided printed web is inserted in the paper path in such a way that the back side is positioned to receive marking material from nozzles of the print head assembly. Such a mechanism is for example described in patent EP3290367.

### BACKGROUND ART

**[0004]** Roll-fed printers are a well-known type of printers. In roll-fed printers, a web such as paper is wound up on an input roll and then fed into, and guided along, a path through the printer, unwinding the input roll by and by along the process. In this way, the web is roll-fed (i.e. taken from a roll and fed) to a marking unit of the printer which applies a marking material (prints) onto the web,

**[0005]** Roll-fed printers are a common type of roll-fed printers and are characterized in that the web is, after images have been printed on it, wound up on an output holder of an output roll by and by along the process.

**[0006]** Roll-fed printers are very efficient devices for forming a large number of images requiring a large amount of the web, as the wound-up input rolls are comparatively easy to handle by both the printers and their operating personnel. Accordingly, little or no supervision by personnel is needed for roll-fed printers, especially for roll-fed printers, as the marked web is automatically stored on the output roll.

**[0007]** When any problems arise during the printing of the image of the web, this may result in a considerable loss of resources such as time (because the printing process might be, or might have to be, stopped until a person can solve the problems) or web and marking material (because a started larger image might be irreparably botched and has to be started anew).

**[0008]** In particular, when printing has already been completed on the front side and the problem occurs on the back side of the web, the loss of resources may be even more, since there may be a considerable number of images on the front side which do not yet have an image printed at the back side of the web.

**[0009]** Some failures might need operator intervention before the roll-fed printer is able to print again correctly, e.g. nozzle cleaning. In the eventuality of a paper jam that does not tear the paper and does mess with the media alignment printing cannot be continued respecting the front-back alignment. In some cases where defective nozzles are involved or some other hardware issues continuing to print does not guarantee the quality of the print (even if the error is initially on a small part of the printed images).

**[0010]** It is desirable to have a method for double-sided printing on a web which mitigates the loss of web or loss of print quality when an error occurs when printing images on the backside of the web and images on the front side of the web have been completely printed. It is also desirable to have a roll-fed printer capable of executing such a method.

### SUMMARY OF THE INVENTION

**[0011]** According to the present invention, the method further comprises the steps of determining a remaining part of the second images not yet printed on the second side of the web due to the print stop, feeding the web forward towards the output holder until the web is completely wound up at the output holder, receiving a second signal that the web is inserted at the input holder in order to allow a start of printing the remaining part of the second images in a reverse order on the remaining part of the second side of the web, and printing the remaining part of the second images in the reverse order on the remaining part of the second side of the web.

**[0012]** By doing so, as much web as possible is recovered after the print error occurs in the double-sided print job.

**[0013]** According to an embodiment the method comprises the steps of determining at least one image of the first images adversely affected due to the print stop, and rescheduling by the print controller of the at least one image of the first images which are adversely affected due to the print stop and at least one image of the second images being scheduled to be printed on the back side of the at least one adversely affected image of the first images, for printing on another web.

**[0014]** According to an embodiment the method comprises the steps of registering the start position of a first image on the first side of the web and using the registered start position at the beginning of the printing of the remaining part of the second images in the reverse order on the remaining part of the second side of the web. In order to have a correct front-back registration a leading and trailing edge have a same length. The leading and trailing edge have to be sufficiently long to be able to have the web be picked up from the outgiving input holder and by the receiving output holder. The leading and trailing edge maybe marked with a printed line if a manual cut can be done.

**[0015]** If the print issue is an error which can be detected automatically during printing, the markers are strictly not necessary, as the print controller knows what part of the images was being printed when the error occurred, i.e. the web location of the error is also known. Space may be allocated on a side of the printed images for a length marker so that the operator knows how much of the printed images has been completed. The length marker may be added after each individual image or a predefined distances and may be numbers or combinations numbers and letters.

**[0016]** The present invention also relates to a roll-fed printer comprising an input holder for the web, an output holder for the web, a print head assembly on a paper path from the input holder to the output holder, a print controller to control the printing of digital images on the web and a user interface, wherein the print controller is configured to perform the steps of the method according to the invention.

**[0017]** The present invention also relates to a software medium comprising computer executable program code which, when executed by a computer, causes the computer to perform the steps of the method according to the invention. The software medium may, specifically, be formed as a CD or a CD-ROM, a DVD or a DVD-ROM, a BluRay disc or a BluRay-ROM disc, a magnetic hard drive, a solid state disk (SSD) hard drive, a USB memory device and so on.

**[0018]** Additional advantages, and the solution of additional problems, will be apparent from the subject-matter of the dependent claims as well as from the description and the drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0019]** The present invention will become more fully understood from the detailed description given hereinbelow and the accompanying schematic drawings which are given by way of illustration only, and thus are not limitative of the present invention, and wherein:

| | |
|---|---|
| FIG. 1 | schematically shows a roll-fed printer according to the invention; |
| FIG. 2A - 2C | schematically shows a scenario wherein the method according to the invention is applicable; and |
| FIG. 3A - 3B | show a schematic flow diagram illustrating a method according to the invention. |

## DETAILED DESCRIPTION OF THE DRAWINGS

**[0020]** The present invention will now be described with reference to the accompanying drawings, wherein the same reference numerals have been used to identify the same or similar elements throughout the several views, and in some instances throughout the several embodiments.

**[0021]** FIG. 1 shows a roll-fed printing system 51 connected to a network N. The roll-fed printing system 51 is available for a user working with one of workstations 8A - 8C and intending to send a digital image from one of the workstations 8A - 8C to a print controller 13 inside of the roll-fed printing system 51. The roll-fed printing system 51 is connected to the network N via wired or wireless connecting means 6 and suited for receiving digital images from the workstations 8A - 8C. The network N may be wireless. The roll-fed printing system 51 comprises one input holder 1a for a web 1 and one output holder 3d for the printed web 3. The roll-fed printing system 51 comprises a user interface 16 suitable for displaying the digital image queue according to the invention by means of digital images to be printed.

**[0022]** The workstations 8A - 8C may be replaced by mobile devices like tablets, notebooks, laptops, etc.

**[0023]** The print controller 13 comprises a scheduler 19 for scheduling the digital images submitted to the roll-fed printing system 51 in the digital image queue according to the invention. The digital image queue is stored in digital storage 7 in the print controller 13. The print controller 13 comprises a data controller 15 for controlling the printing process and data transfer between the print controller 13 and the user interface 16.

**[0024]** In another embodiment the control unit of the roll-fed printing system 51 is integrated in one of the workstations 8A - 8C wired or wireless connected to roll-fed printing system 51. In another embodiment a user interface is provided as a network web site or intranet site that is accessible with a browser on a client computer.

**[0025]** The print controller 13 is suited to store a set of digital images, to check whether or not the digital images can be printed and to submit a digital image to a print

head assembly 18 of the roll-fed printing system 51 in order to be printed on the web 9. Image data of a digital image are stored in digital storage 7 contained in the print controller 13 at least for the time period that the digital image is printed by the print head assembly 18. Image data may be composed and also stored in memory of at least one of the workstations 8A - 8C.

**[0026]** The roll-fed printing system 51 processes at least part of the web 9 of the input holder 1a. The wound web 1b has a length which is defined as a largest dimension of the web when unrolled. Web material may be paper, textile, transparent sheet material, plastic or any other kind of material or substrate suitable for winding up at the input holder 1a. The wound web 1b is placed in the input holder 1a.

**[0027]** Individual digital images will be printed on the unwound web 9 given out of the input holder 1a. The individual digital images are printed by the print head assembly 18 of the roll-fed printing system 51 according to the digital image queue. The unwound web 9 is guided along the print head assembly 18. The printed web 9 is guided to and wound up on the output holder 3d.

**[0028]** FIG. 2A - 2C show a scenario in which the method according to the invention is applied.

**[0029]** In FIG. 2A, a schematic view of a web 9 with a number of 16 images 1A - 16A planned to be printed on the first side of the web 9. The number of 16 images is only chosen as an example; it should be understood that less, or more, individual images may be printed on the web 9. The leading edge has a predetermined length L1 and the trailing edge has a predetermined length L2. The leading edge may have a same length as the trailing edge.

The roll-fed printer 51 prints the plurality of images 1A - 16A on the web 9. The printing of the first side of the web 9 completes without errors.

**[0030]** When the first side is finished, the printed web 9 is inserted as a feed roll in the input holder 1a again to print the second side of the web 9. The second side is intended to be printed with images 1B - 16B. What was originally the trailing edge is the free edge on the web 9 and becomes the leading edge. Therefore, the images 1B - 16B on the second side are printed in reverse order relative to the first side. It is noted that the images 1B - 16B have to be rotated upside-down (180 degrees) before printing can start. Such a rotation may be performed by an image editing program installed in the print controller. An error occurs after printing a couple of images as shown in FIG. 2B. For example image 14B is not completed correctly as indicated by the lighting icon in image 14B.

**[0031]** Printing stops. The web 9 is now fed forward until it is completely on the output holder 3d. which acts as a pickup holder. The web 9 is then inserted again as the feed roll in the input holder 1a. Now a second attempt can be made to print the second side, but now starting from the other side of the roll. What was originally the leading edge when printing the first side, is now again the leading edge as the web 9 has been reversed twice. The remaining images, in this example the images 1B-13B, are now printed with the order reversed from the first attempt as shown in FIG. 2C. In order to get the front-back registration correct the start of the first image on the first side should be known, for example as the distance L1 of the start of this image from the leading edge. The distance L1 may be entered via the user interface 16 or may be predetermined as an initializing print parameter and stored in memory of the print controller 13.

**[0032]** Now, printing of the web 9 has completed. Only the image 14B directly affected by the printing error was not printed correctly. The other images (images 1B-13B and 15B-16B) have all printed correctly and correctly registered with the images on the other side (images 1A-13A and 15A-16A). Only the images 14A-B need to be rescheduled for printing.

**[0033]** FIG. 3A-3B show a schematic flow diagram illustrating a method according to the invention. The method is suitable for controlling the roll-fed printer according to the invention for double-sided printing images on the web 9.

**[0034]** The method start in starting point A in FIG. 3A which leads to a first step S1.

**[0035]** In the first step S1 first images are scheduled to be printed on a first side of the web and second images to be printed on a second side of the web. The scheduling takes place in the print controller 13 or even outside the print controller 13 on one of the workstations 8A -8C.

**[0036]** In a second step S2 the first images are printed on the first side of the web fed from the input holder towards the output holder.

**[0037]** In a third step S3 a first signal is received that the one-sided printed web is inserted at the input holder in order allow a start of printing on the second side of the web. The first signal may come from a sensor in the input holder or from user input at the user interface of the roll-fed printer.

**[0038]** In a fourth step S4 the second images are started to be printed on the second side of the web fed from the input holder. Before printing, the second images are digitally and automatically rotated upside-down (180 degrees) by an ordinary image editing program installed in the print controller.

**[0039]** In a fifth step S5 an error signal or a user interface signal is received causing a print stop leaving a remaining part of the second side of the web unprinted. The error signal may come from a sensor in the paper path of the roll-fed printer. The user interface signal may come from user input at the user interface of the roll-fed printer.

**[0040]** In a sixth step S6 a remaining part of the second images is determined which is not yet printed on the second side of the web due to the print stop.

**[0041]** The method proceeds to an intermediate point B which leads to a seventh step S7 as shown in FIG. 3B.

**[0042]** In the seventh step S7 the web is fed forward towards the output holder until the web is completely

wound up at the output holder. During the feed forward no images are printed on the web.

**[0043]** In an eight step S8 a second signal is received that the web is inserted at the input holder in order to allow a start of printing the remaining part of the second images in a reverse order on the remaining part of the second side of the web.

**[0044]** In a ninth step S9 the remaining part of the second images is printed in the reverse order on the remaining part of the second side of the web.

**[0045]** The method ends in an end point C.

**[0046]** While detailed embodiments of the present invention are disclosed herein, it is to be understood that the disclosed embodiments are merely exemplary of the invention, which can be embodied in various forms. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to variously employ the present invention in virtually any appropriately detailed structure. In particular, features presented and described in separate dependent claims may be applied in combination and any advantageous combination of such claims are herewith disclosed.

**[0047]** Further, the terms and phrases used herein are not intended to be limiting; but rather, to provide an understandable description of the invention. The terms "a" or "an", as used herein, are defined as one or more than one. The term plurality, as used herein, is defined as two or more than two. The term another, as used herein, is defined as at least a second or more. The terms including and/or having, as used herein, are defined as comprising (i.e., open language).

**[0048]** It will be evident that the described embodiments may be varied in many ways. All such modifications as would be evident to one skilled in the art starting from what is explicitly described are intended to be included.

## Claims

1. Method for double-sided printing on a web by means of a roll-fed printer comprising an input holder for the web, an output holder for the web, a print head assembly on a paper path from the input holder to the output holder, a print controller to control the printing of digital images on the web and a user interface, the method comprising the steps of

   - scheduling first images to be printed on a first side of the web and second images to be printed on a second side of the web,
   - printing the first images on the first side of the web fed from the input holder towards the output holder,
   - receiving a first signal that the one-sided printed web is inserted at the input holder in order allow a start of printing on the second side of the web,
   - starting printing the second images on the second side of the web fed from the input holder,
   - receiving an error signal or a user interface signal causing a print stop leaving a remaining part of the second side of the web unprinted,
   - determining a remaining part of the second images not yet printed on the second side of the web due to the print stop,
   - feeding the web forward towards the output holder until the web is completely wound up at the output holder,
   - receiving a second signal that the web is inserted at the input holder in order to allow a start of printing the remaining part of the second images in a reverse order on the remaining part of the second side of the web, and
   - printing the remaining part of the second images in the reverse order on the remaining part of the second side of the web.

2. Method according to claim 1, wherein the method comprising the steps of determining at least one image of the first images adversely affected due to the print stop, and rescheduling by the print controller of the at least one image of the first images which are adversely affected due to the print stop and at least one image of the second images being scheduled to be printed on the back side of the at least one adversely affected image of the first images, for printing on another web.

3. Method according to any of the preceding claims, wherein the method comprises the steps of registering the start position of a first image on the first side of the web and using the registered start position at the beginning of the printing of the remaining part of the second images in the reverse order on the remaining part of the second side of the web.

4. Roll-fed printer comprising an input holder for the web, an output holder for the web, a print head assembly on a paper path from the input holder to the output holder, a print controller to control the printing of digital images on the web and a user interface, wherein the print controller is configured to perform the steps of the method according to any of the claims 1 - 3.

5. Software medium comprising computer executable program code which, when executed by a computer, causes the computer to perform the steps of the method according to any of the claims 1 - 3.

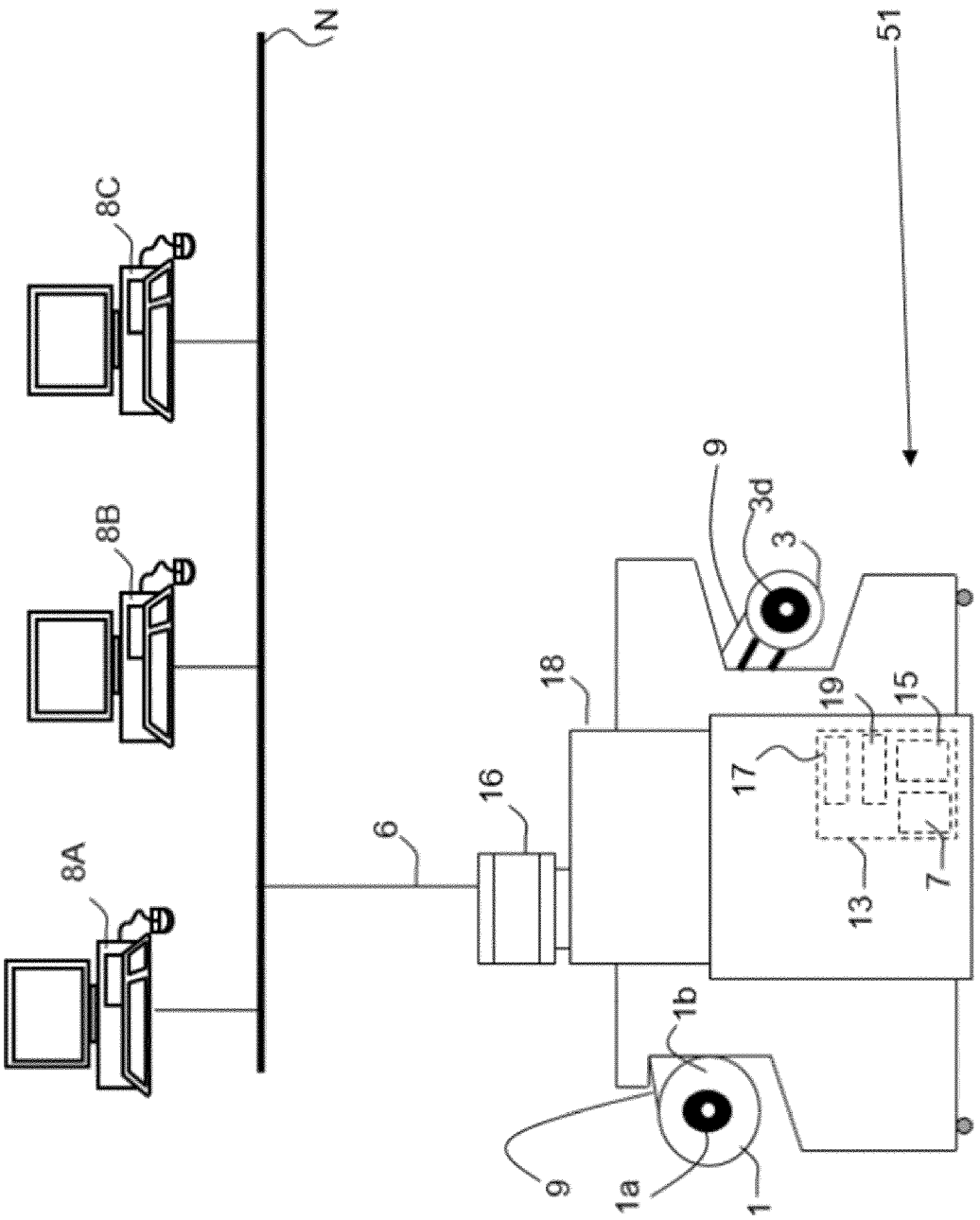


FIG. 1

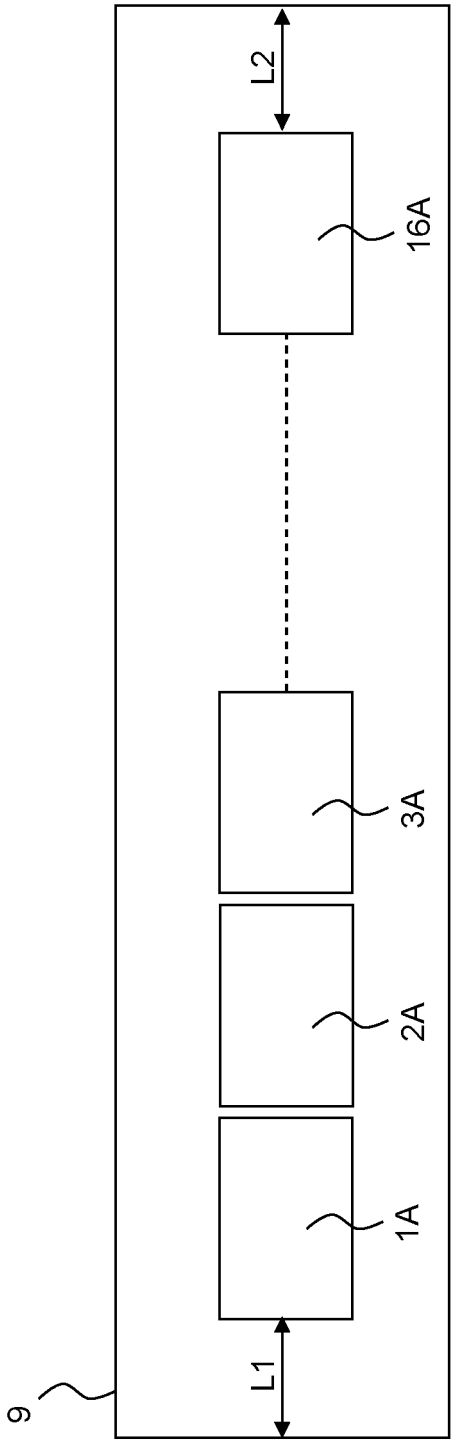


FIG. 2A

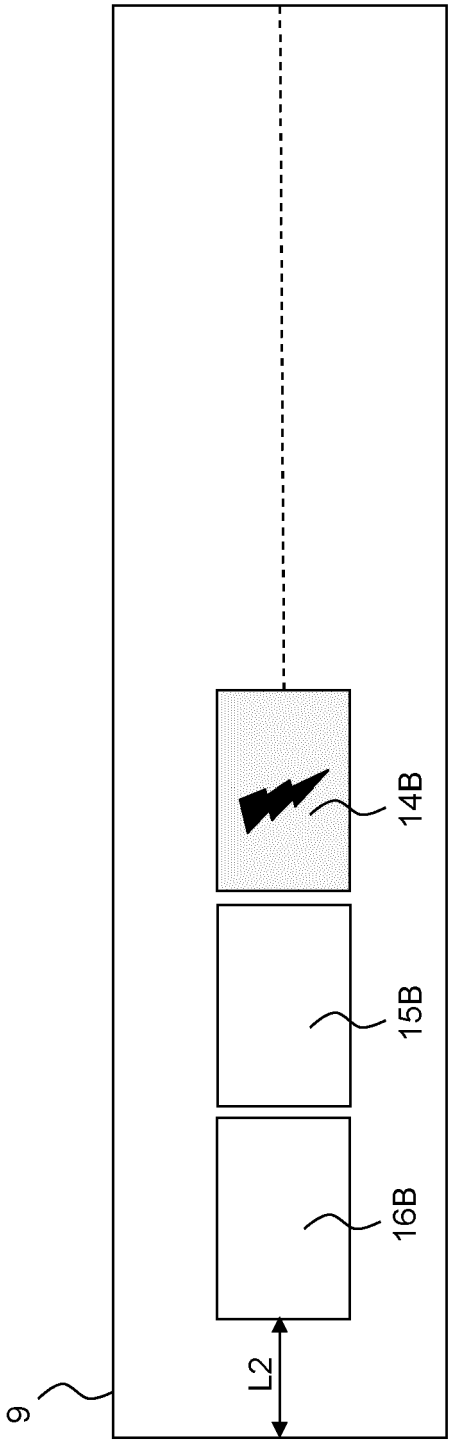


FIG. 2B

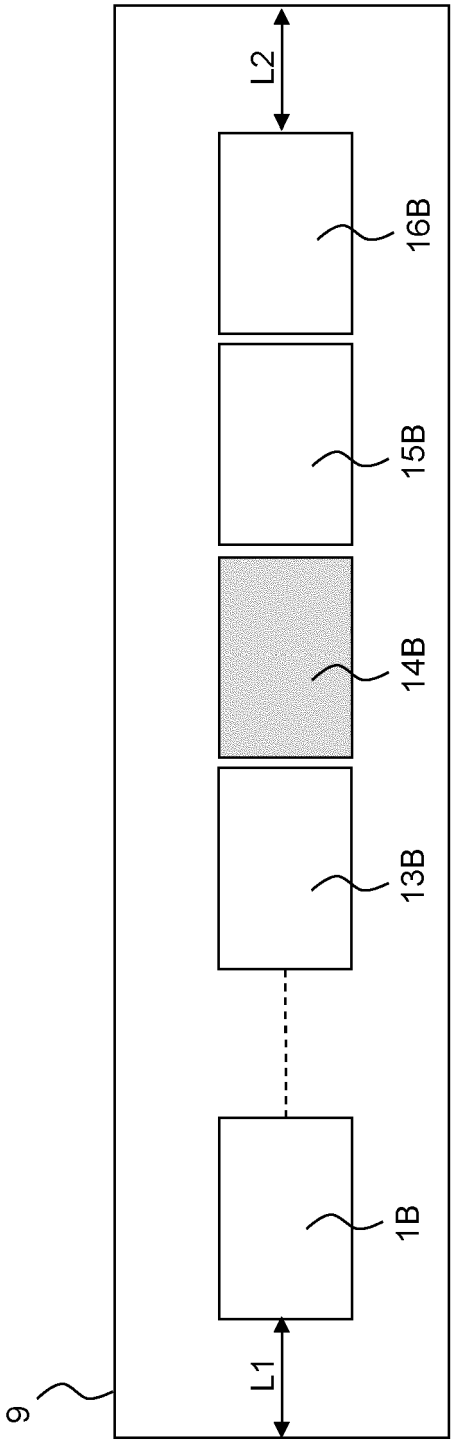


FIG. 2C

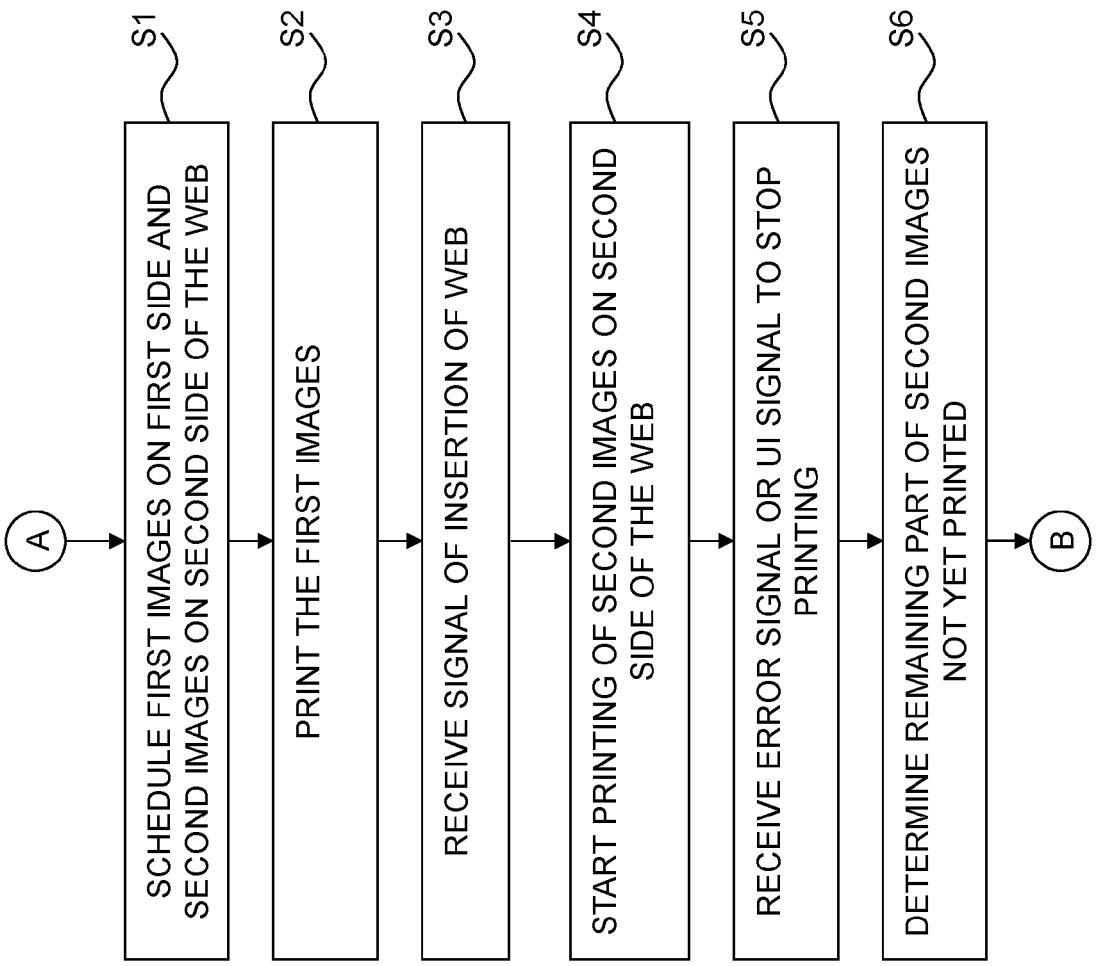
A
S1
SCHEDULE FIRST IMAGES ON FIRST SIDE AND SECOND IMAGES ON SECOND SIDE OF THE WEB
S2
PRINT THE FIRST IMAGES
S3
RECEIVE SIGNAL OF INSERTION OF WEB
S4
START PRINTING OF SECOND IMAGES ON SECOND SIDE OF THE WEB
S5
RECEIVE ERROR SIGNAL OR UI SIGNAL TO STOP PRINTING
S6
DETERMINE REMAINING PART OF SECOND IMAGES NOT YET PRINTED
B

FIG. 3A

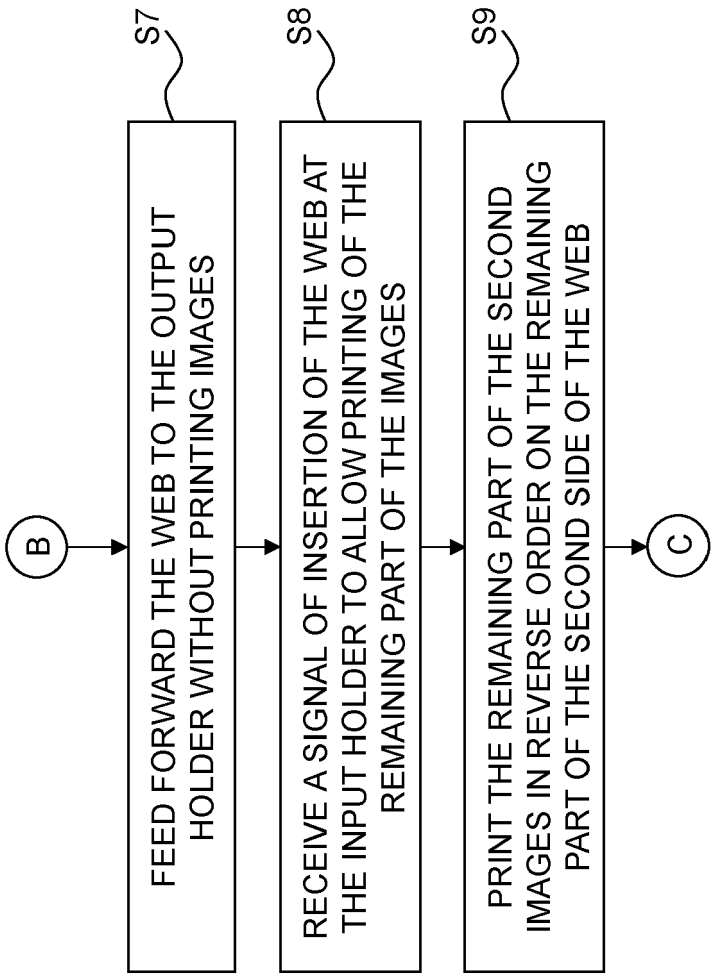
B
S7
FEED FORWARD THE WEB TO THE OUTPUT HOLDER WITHOUT PRINTING IMAGES
S8
RECEIVE A SIGNAL OF INSERTION OF THE WEB AT THE INPUT HOLDER TO ALLOW PRINTING OF THE REMAINING PART OF THE IMAGES
S9
PRINT THE REMAINING PART OF THE SECOND IMAGES IN REVERSE ORDER ON THE REMAINING PART OF THE SECOND SIDE OF THE WEB
C

FIG. 3B

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# EUROPEAN SEARCH REPORT

Application Number
EP 21 18 5151

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
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| A | US 2011/002721 A1 (YAMAZAKI MASATAKA [JP]) 6 January 2011 (2011-01-06) * paragraphs [0021] - [0039], [0053] - [0073]; figures 6-9 * | 1-5 | |
| A | US 2011/211003 A1 (KUSAKABE TAKETOSHI [JP]) 1 September 2011 (2011-09-01) * paragraphs [0021] - [0072] * | 1-5 | |

TECHNICAL FIELDS SEARCHED (IPC)
B41J

1 The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| The Hague | 6 December 2021 | Bitane, Rehab |

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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E : earlier patent document, but published on, or after the filing date
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## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 21 18 5151

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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06-12-2021

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

## REFERENCES CITED IN THE DESCRIPTION

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