



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
03.03.2021 Bulletin 2021/09

(51) Int Cl.:
B41J 3/60 ^(2006.01) **B41J 15/04** ^(2006.01)

(21) Application number: **19194955.1**

(22) Date of filing: **02.09.2019**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

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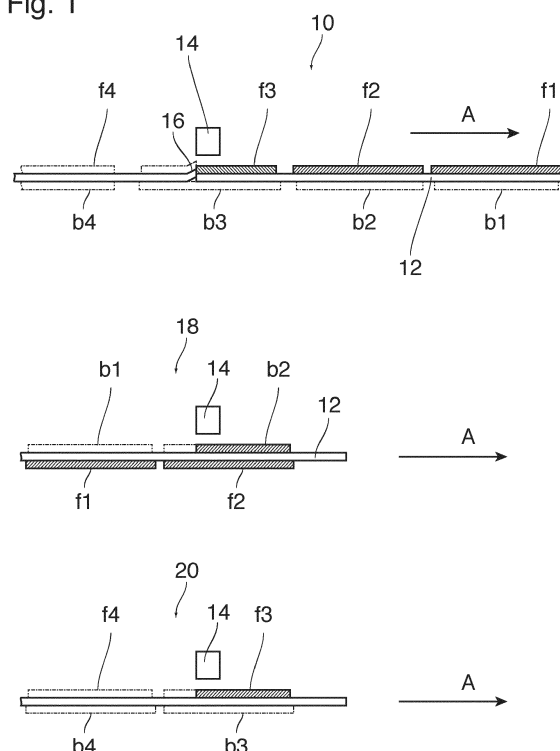
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(54) **METHOD OF PROCESSING A DUPLEX PRINTER**

(57) A method of processing a print job (10) on a duplex printing system wherein a plurality of front side images (f1-f4) are printed on a front side of a print substrate (12) in a first print run and and, in a second print run, back side images (b1-b4) are printed on a back side of the print substrate (12) in positions corresponding to those of the front side images (f1-f4), characterized in that the following steps are performed in response to an error occurring in the first print run and causing a defect (16) in the print substrate:

- dividing the print job (10) into first and second sub-jobs (18, 20), the first sub-job consisting of the front side images (f1, f2) that have already been printed and of the corresponding back side images (b1, b2), and the second sub-job (20) consisting of the front side images (f3, f4) that have not yet been printed and their corresponding back side images (b3, b4); and
- completing the first sub-job (18) and processing the second sub-job (20) separately.

Fig. 1



Description

[0001] The invention relates to a method of processing a print job on a duplex printing system wherein a plurality of front side images are printed on a front side of a print substrate in a first print run and, in a second print run, back side images are printed on a back side of the print substrate in positions corresponding to those of the front side images.

[0002] More particularly, the invention relates to a method of processing a print job on a roll-to-roll duplex printer. An example of such a printer has been described in EP 3 290 367 A1.

[0003] In duplex printing, it is frequently desired that the images on the opposite sides of the print substrate, which takes the form of an endless web, are in registry with one another, in order to assure, for example, that all images have the same position when the printed web is cut into sheets and the sheets are bound into a booklet.

[0004] A method for controlling the front/back register in duplex printing has been described in US 9 266 364 B2.

[0005] EP 3 373 128 A1 discloses a method for processing a duplex print job and focusses on a situation where a print job has to be interrupted and later resumed, for example because a more urgent print job has to be processed in-between or because a roll from which the web-like print substrate was supplied has become depleted.

[0006] EP 3 416 104 A1 is not particularly related to duplex printing but discloses also a method in which a print job is interrupted and resumed. Here, the images to be printed are nested on the web in a particular pattern that is determined before the print process begins. When the print job is interrupted and resumed, a new nesting pattern is determined for the images still to be printed.

[0007] In a high production print process, there is always a certain possibility that a crash, e.g. a collision of the print head with an irregularity in the web, causes damage to the web, so that the print process has to be aborted. In that case, the part of the web on which front side images have already been formed has to be discarded, which results in a waste of print media.

[0008] It is an object of the invention to provide a method that can reduce the waste of print media in such cases.

[0009] In order to achieve this object, the method according to the invention comprises the following steps to be performed in response to an error occurring in the first print run and causing a defect in the print substrate:

- dividing the print job into first and second sub-jobs, the first sub-job consisting of the front side images that have already been printed and the corresponding back side images, and the second sub-job consisting of the front side images that have not yet been printed and their corresponding back side images; and
- completing the first sub-job and processing the second sub-job separately.

[0010] This method has the advantage that the part of the web on which front side images have already been formed does not have to be discarded but can still be utilized in the first sub-job which is completed by performing the second print run for printing the back side images. The remaining front side images and their corresponding back side images constitute the second sub-job which is processed separately in (shortened) first and second print runs. In this way, not only a waste of print substrate material can be avoided but also a waste of time, because the front side images of the first sub-job do not have to be reprinted.

[0011] More specific optional features of the invention are indicated in the dependent claims.

[0012] The order in which the steps of completing the first sub-job and processing the second sub-job are performed is arbitrary.

[0013] Preferably, at least one of the sub-jobs is provided with a label that refers to the other sub-job or original print job, so that it becomes easier to merge the sub-jobs again in a later processing stage such as finishing.

[0014] Embodiment examples will now be described in conjunction with the drawings, wherein:

Fig. 1 is a diagram illustrating a duplex print job that is being divided into two sub-jobs; and

Figs. 2 to 4 are schematic views of a roll-to-roll printer in different stages of a print process according to the invention.

[0015] In Fig. 1, a print job 10 has been symbolized by a sequence of front side images f1-f4 and back side images b1-b4 to be formed on a front side and a back side, respectively, of a print substrate that takes the form of an endless web 12. Images that have been printed already have been symbolized by hatched bars, and images still to be printed have been shown in phantom lines. It is observed that the front side and back side images form pairs of images that are at least roughly in registry with one another. Thus, for example, the images f1 and b1 are formed at the same position on the web 10, although on opposite sides of the web.

[0016] What is shown in the top part of Fig. 1 is a first print run for the print job 10 in which the front side images f1-f4 are being formed by moving the web 10 in the direction of an arrow A past a print head 14 with which the images are printed. For example, the print head 14 may be an ink jet print head.

[0017] In order to achieve a high image quality in ink jet printing, it is desired that the nozzle face of the print head forms only a very narrow gap with the top surface of the print substrate, so that ink droplets jetted out from the print head can be positioned on the substrate with high accuracy. Occasionally, an irregularity in the web 12, e.g. a cockle or a wrinkle, may cause a collision with the print head 14, so that the web 12 gets jammed in the narrow gap formed with the print head 14 or the web is

torn.

[0018] In the situation shown in the top part of Fig. 1, the print head 14 is busy with printing the front side image f3 when such a crash occurs and causes a defect 16 in the web 12.

[0019] Normally, this would mean that the print process has to be aborted and the part of the web 12 on which the front side images f1, f2 have been formed already has to be discarded.

[0020] However, in the method according to the invention, the print job 10 is divided into two sub-jobs 18, 20 which have also been illustrated in Fig. 1.

[0021] The first sub-job 18 consists of the front side images f1 and f2 which had been completed already before the crash occurred, and of the corresponding back side images b1 and b2. In order to process the first sub-job 18, the web 12 is cut at the position between the front side images f2 and f3 and the web is fed past the print head 14 in a second print run, again in the direction A but this time in reverse orientation, so that the front side images f1 and f2 are facing downwards and the back side images b2 and b1 can be printed with the print head 14. In this example, the reversal of the orientation of the web 12 has also resulted in a reversal of the sequence in which the images are moved past the print head. Thus, in the print run for the first sub-job 18, the front side image f2, which has been the last one to be printed in the first run, is the first image to reach the print head 14, and consequently, the first back side image to be printed is the image b2.

[0022] As is shown in the bottom part of Fig. 1, the second sub-job 20 consists of the remaining front side images f3, f4 which had not yet been finished before the crash, and their corresponding back side images b3, b4. For this sub-job 20, Fig. 1 illustrates the first run in which the front side images f3 and f4 are printed. The back side images b3 and b4 will then have to be printed in another second print run which has not been illustrated here.

[0023] Fig. 2 is a schematic view of essential parts of a roll-to-roll printer for processing the print job 10. The printer has a first substrate carrier 22 in the form of a rotatable drum or core carrying a media roll 24 from which the web 12 is withdrawn. The web 12 is guided along a media transport path which, as is well known in the art, is formed by guide plates and pairs of pinch rollers which have not been shown here. The web is moved over a platen 26 above which the print head 14 is disposed. Downstream of the platen 26, the web is wound on another roll 28 on another media carrier 30. Alternatively, a web could also be withdrawn from a roll 32 on yet another media carrier 36. Each of the media carriers 22, 30 and 36 is rotatably and removably supported on a first bearing support 38, a second bearing support 40, and a third bearing support 42, respectively.

[0024] A cutting station 44 is disposed at the media transport path upstream of the platen 26.

[0025] An electronic controller 46, which has only been shown symbolically in Fig. 2, is provided for controlling

all the components of the printer including the printing elements in the print head 14, motor drives for the substrate carriers 22, 30 and 36, and motor drives for the pinch rollers.

[0026] In the situation shown in Fig. 2, the printer is just performing the first print run for the print job 10 and the crash causing the damage 16 is just occurring. Consequently, the printer is stopped, and the substrate carrier 22 is rotated in opposite direction so as to spool the web 12 into a position where the damage 16 is located at the cutting station 44, as has been shown in Fig. 3.

[0027] In the cutting station 44, the web 12 is cut manually or automatically in order to divide the web into a first part 12a and a second part 12b. In practice, the web will be cut twice in order to excise the part that contains the defect 16. The second part 12b is then withdrawn onto the roll 24 whereas the first part 12a, which carries the first side images that have been printed already, is wound onto the roll 28.

[0028] When the trailing edge of the first part 12a reaches the print head 14, the print head is used for printing a label 46 onto the web. This label 26 is visible and readable even when the web is fully wound on the roll 28 and identifies the roll 28 as belonging to the first sub-job 18 of the entire print job 10. The label 46 will also include a reference to the sub-job 20 that belongs to the same print job 10.

[0029] When the first part 12a of the web has cleared the platen 26, the media carrier 22 may be driven in forward direction again in order to feed the second part 12b of the web into the media transport path for performing the first print run for the second sub-job 20. As an alternative, the operator may choose to remove the media carrier 22 and the roll 24 from the bearing support 38 in order to prepare the printer for the second print run for the first sub-job 18. In that case, the media carrier 30 with the roll 28 is removed from the bearing support 40 and mounted on the bearing support 42, as has been shown in Fig. 4, and a new empty substrate carrier 48 is mounted on the bearing support 40. Then, in order to perform the second print run for the first sub-job 18 and the first part 12a of the web, the web is withdrawn from the roll 28 and passed into the media transport path via the empty media carrier 22 on the bearing support 38 so as to feed the web to the platen 26 in the reverse orientation with the back side of the web facing upwards. As the web moves past the print head 14, the backside images are printed and the web is wound on a roll 50 on the media carrier 48.

[0030] Since the label 46 that was shown in Fig. 3 will now be invisible because it is located on the innermost layer of the roll 50, another label may be printed when the second run is completed and the trailing end of the web reaches the print head 14.

[0031] When the first sub-job 18 has been completed, the operator may remove the roll 50 and may then choose to mount the roll 24 which carries the second part 12b of the web 12 on the first bearing support 38 for performing the second sub-job 20. When the second sub-job has

been completed, the web may be cut at the cutting station 44, and when the trailing edge of the web that carries the front side images of the second sub-job reaches the print head 14, the print head may be used for printing another label identifying the part 12b of the web as the part that belongs to the part 12a and constitutes the second sub-job of the print job 10. Similarly as in case of the first sub-job, another label may be printed at the end of the second print run.

Claims

1. A method of processing a print job (10) on a duplex printing system wherein a plurality of front side images (f1-f4) are printed on a front side of a print substrate (12) in a first print run and, in a second print run, back side images (b1-b4) are printed on a back side of the print substrate (12) in positions corresponding to those of the front side images (f1-f4), **characterized in that** the following steps are performed in response to an error occurring in the first print run and causing a defect (16) in the print substrate:

- dividing the print job (10) into first and second sub-jobs (18, 20), the first sub-job consisting of the front side images (f1, f2) that have already been printed and of the corresponding back side images (b1, b2), and the second sub-job (20) consisting of the front side images (f3, f4) that have not yet been printed and their corresponding back side images (b3, b4); and
- completing the first sub-job (18) and processing the second sub-job (20) separately.

2. The method according to claim 1, wherein, when the print job (10) has been divided, the first sub-job (18) is completed before the second sub-job (20) is processed.
3. The method according to claim 1, wherein, when the print job (10) has been divided, at least the first print run of the second sub-job (20) is performed before the first sub-job (18) is completed.
4. The method according to any of the preceding claims, wherein the step of dividing the print job (10) comprises a step of cutting the web (12) into a first part (12a) which carries the front side images of the first sub-job (18), and a second part (12b) on which no images have been printed jet.
5. The method according to claim 4, wherein a label (16) identifying the first sub-job (18) and referring to the second sub-job (20) is formed on the trailing end of the first part (12a) of the web.

6. The method according to claim 5, wherein the label (16) is printed with a print head (14) that is used also for printing the front side and the back side images.

7. The method according to any of the claims 4 to 6, wherein, when the second print run for the first sub-job (18) has been completed, a label (16) identifying the first sub-job (18) and referring to the second sub-job (20) is formed on the end of the first part (12a) of the web that is then the trailing end.

8. The method according to any of the claims 4 to 7, wherein, when the first print run for the second sub-job (20) has been completed, a label (16) identifying the second sub-job (20) and referring to the first sub-job (18) is formed on the trailing end of the web.

9. The method according to any of the claims 4 to 8, wherein, when the second print run for the second sub-job (20) is completed, a label (16) identifying the second sub-job (20) and referring to the first sub-job (18) is formed on the end of the web that is then the trailing end.

Fig. 1

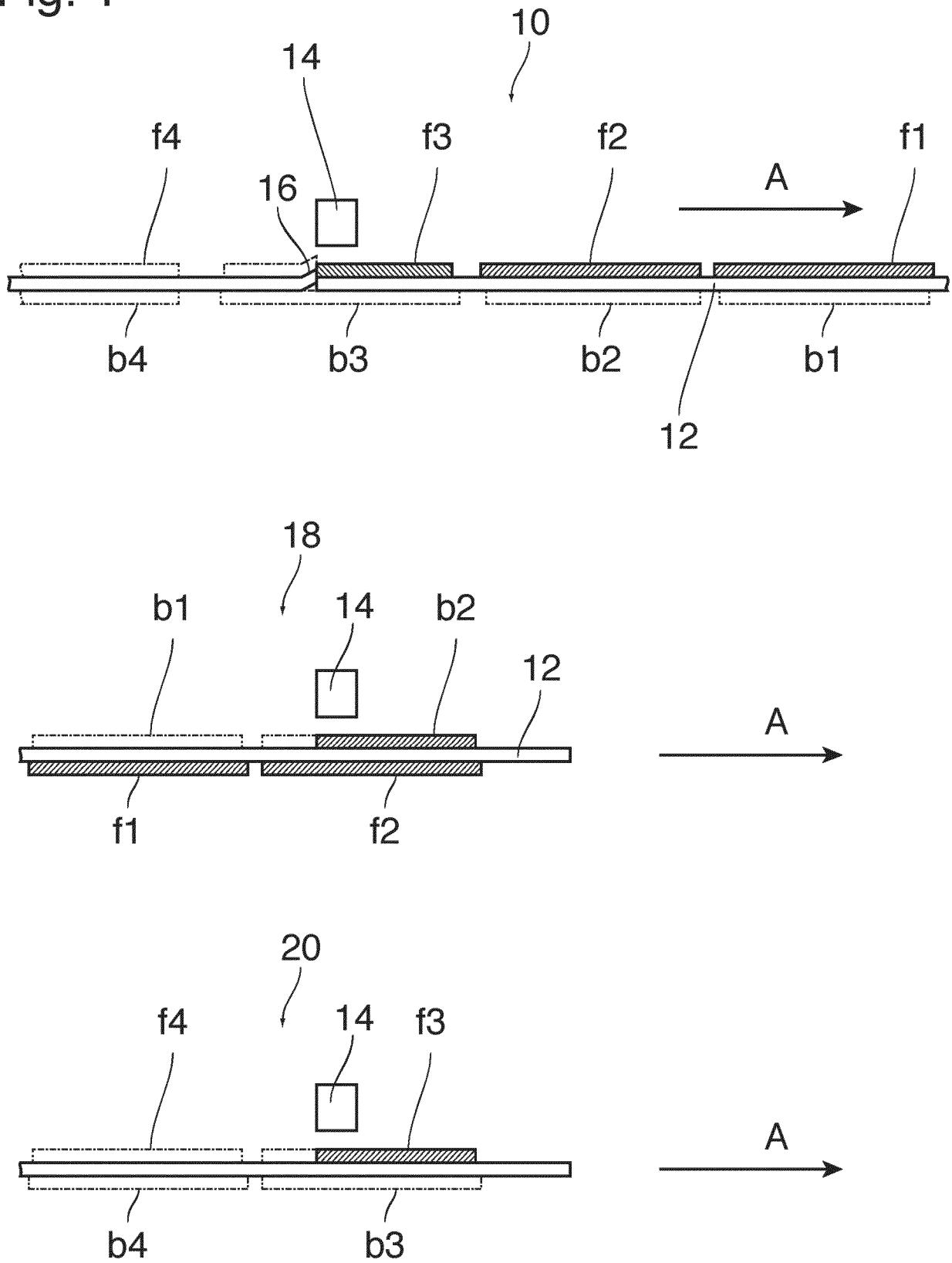


Fig. 2

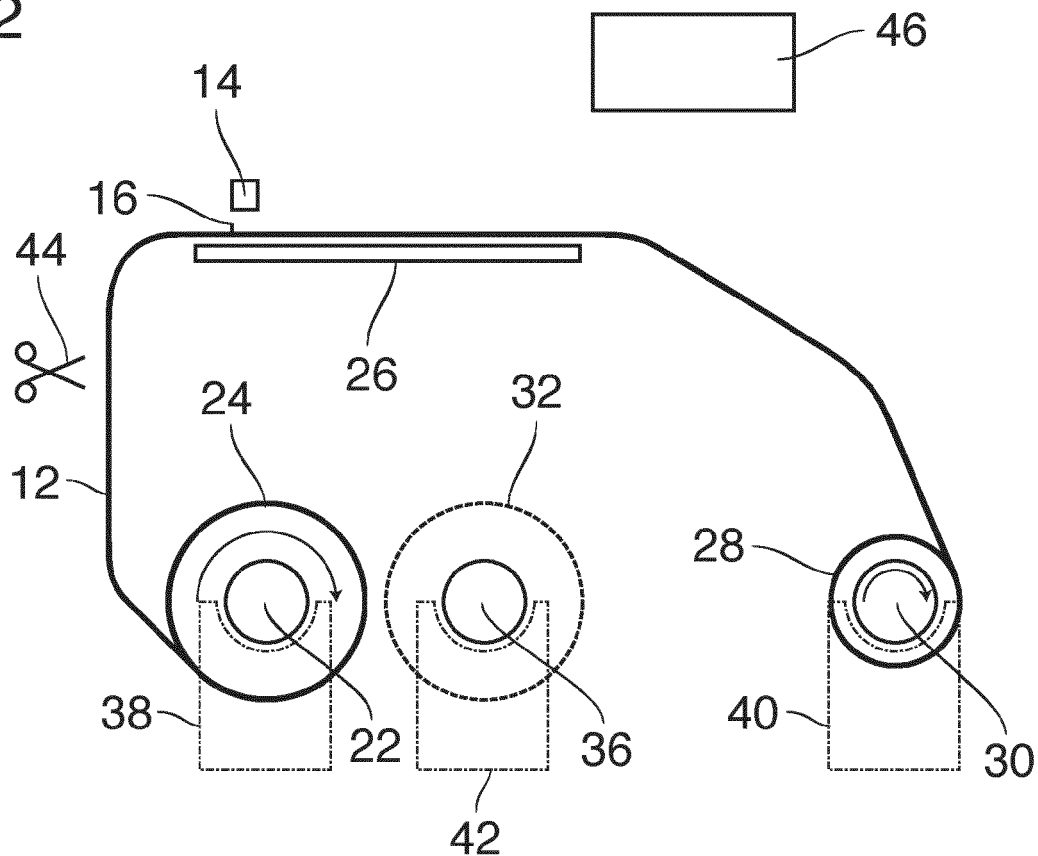


Fig. 3

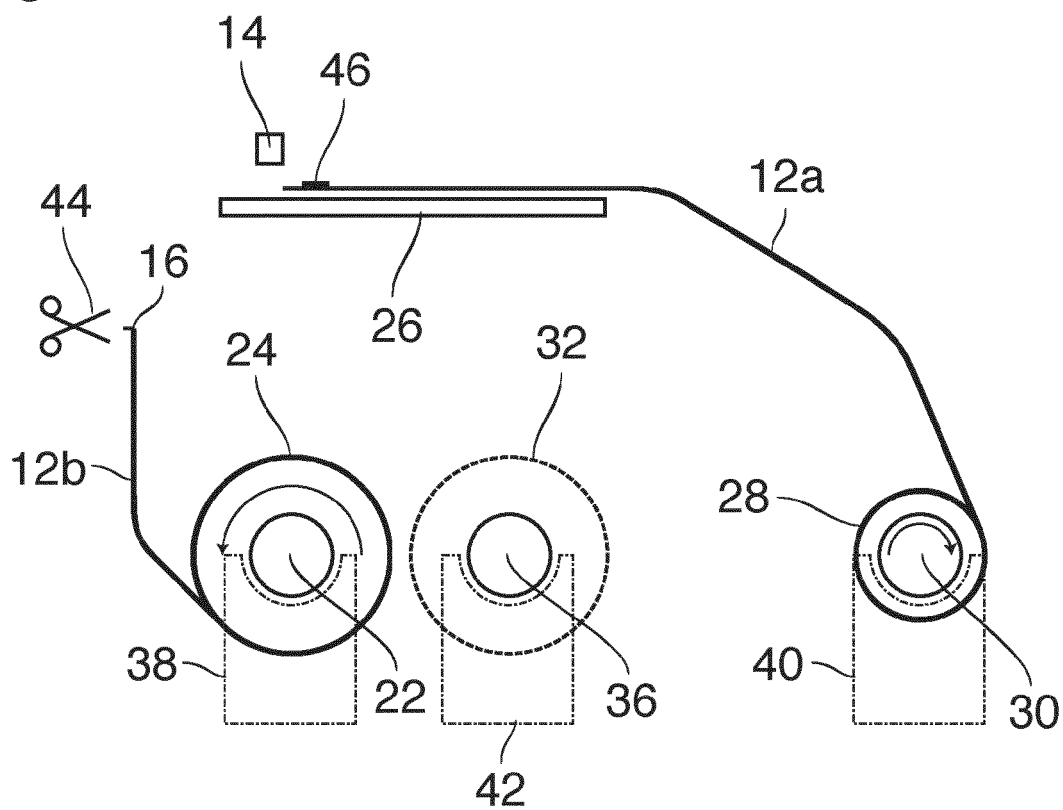
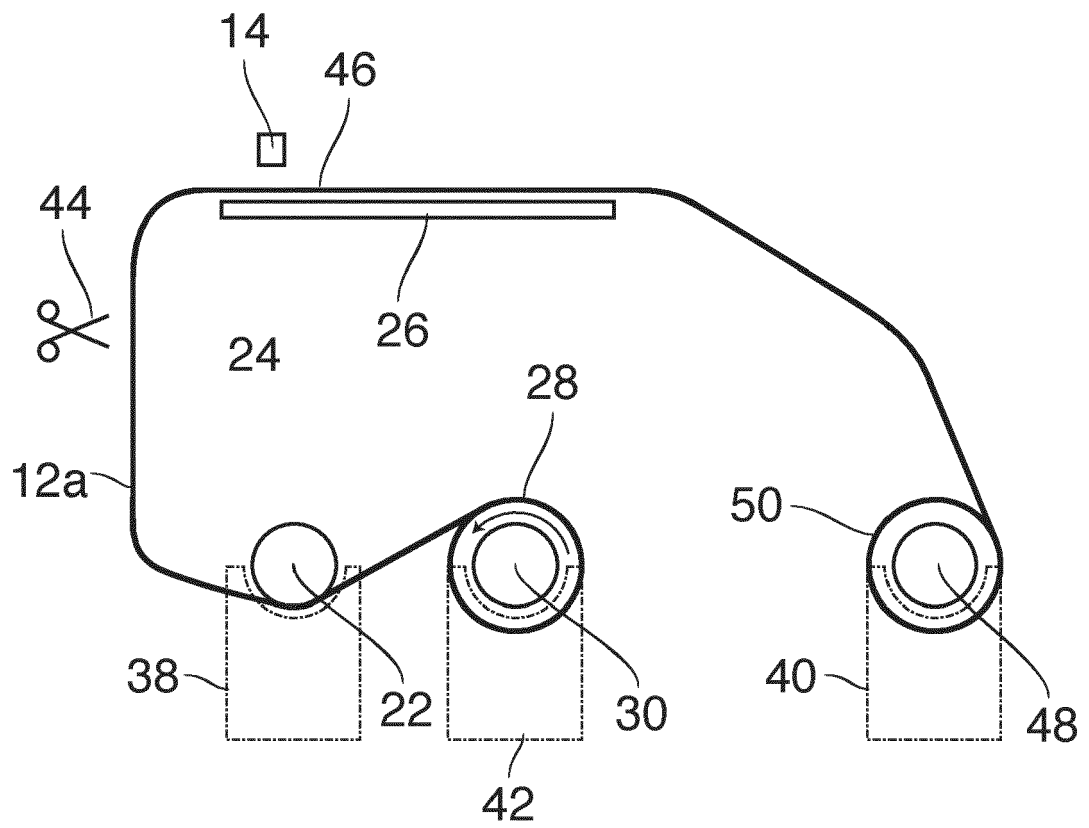


Fig. 4





EUROPEAN SEARCH REPORT

Application Number
EP 19 19 4955

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Place of search		Date of completion of the search	Examiner
The Hague		9 March 2020	Loi, Alberto
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EPO FORM 1503 03/82 (P04C01)

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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