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Remarks:

Amended claims in accordance with Rule 86 (2) EPC.

(54) **A method for printing on media, a media backing apparatus for inkjet printers, and an inkjet printer for printing on media**

(57) In the method, the media is fed once through an inkjet printer (1); the method comprises the steps of:

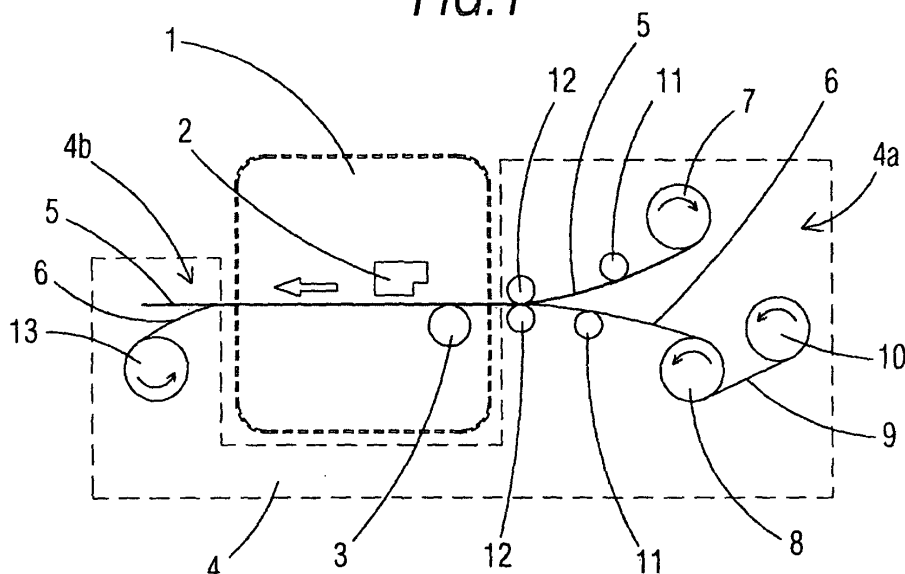
- a) feeding a web of removable stiffening backing (6; 16) to the printer;
- b) applying the media (5) on said removable stiffening backing (6;16) web immediately prior to printing; and
- c) printing on said media, on the side opposite to

the backing.

The media backing apparatus (4;14) is attached or incorporated to an inkjet printer (1) and comprises means (4a;14a) for applying a stiffening backing (6;16) to the media at the media inlet of the printer.

The invention allows to print any desired media, such as fabric, in an inkjet printer, avoiding the problems arising from wrinkles or deformations of the media.

FIG.1



Description

[0001] The present invention relates to a method and apparatus for printing on media such as fabric in inkjet printers.

BACKGROUND OF THE INVENTION

[0002] Traditionally, printing on fabric has been carried out by means of printers designed especially for fabric; however, these machines are bulky and expensive, and generally they are suitable only for printing large quantities of fabric.

[0003] There is thus a need for alternative methods and apparatus for printing on fabric, more simple and with the possibility of printing small batches of fabric at a reasonable cost.

[0004] Suitable apparatus for this purpose could be inkjet printers, which are already used for a wide range of printing media.

[0005] However, inkjet printing apparatus, and inkjet printers and plotters in particular, are designed to print on paper, and don't usually obtain satisfactory results when attempting to print on fabric, due to the poor stiffness of this medium.

[0006] This reduced stiffness causes the printing to be irregular and of poor quality, because the distance between the printhead and the media cannot be maintained constant. The wrinkles of the fabric cause defects in the printing, and, in some cases, printhead crashes may occur.

[0007] Printhead crash occurs when the printhead comes into contact with the media being printed, e.g. due to a wrinkle of the media; it may cause ink smearing, breakage of the media being printed or even damage to the printhead itself.

[0008] Some manufacturers market paper-backed fabric, which is fed to the printer like any other media; however, this has an important drawback in that the set of paper-backed fabrics available is necessarily limited, while it would be desirable to be able to print on any selected fabric.

[0009] US-5410958 describes a lithographic or screen printing method for printing on silk, which includes applying a backing to the silk fabric before printing it. There is no disclosure in this document on how the backing is applied or removed, and the printing process is a multi-part printing process, in which the fabric is fed several times to the printer in order to complete the desired colour pattern.

DESCRIPTION OF THE INVENTION

[0010] According to the present invention, there is provided a method for printing on media, in which the media is fed once through an inkjet printer, comprising the steps of:

- a) feeding a web of removable stiffening backing to the printer;
- b) applying the media on said removable stiffening backing web immediately prior to printing; and
- c) printing on said media, on the side opposite to the backing.

[0011] The stiffening backing avoids wrinkles in the media and thus prevents defects in the prints as well as printhead crash; by carrying out the backing operation just before printing, any desired media, such as fabric, can be printed in the inkjet printer.

[0012] The method can be carried out automatically: the backing is fed to the printer and the media is applied on it, such that the media is automatically backed and fed to the printer in a continuous operation.

[0013] Advantageously, the method further comprises the step of removing said stiffening backing from the media immediately after printing; the printed media may then be wound and stored as usual.

[0014] According to one embodiment, said stiffening backing web is supplied continuously from a feed reel.

[0015] In this case, the method may comprise the step of loading said backing feed reel to the inkjet printer.

[0016] The backing web may be made of paper and attached to the media with a non-permanent adhesive.

[0017] According to an alternative embodiment, said stiffening backing may comprise a continuous web arranged to form a closed loop which has a portion travelling in a printing zone of said inkjet printer; there is therefore no consumption of material for the stiffening backing.

[0018] In this case, the continuous web may be attached to the media by means of hook and loop fasteners or by electrostatic effect, or it may be provided with a non-permanent adhesive.

[0019] According to another aspect, the invention provides a media backing apparatus for inkjet printers, comprising means for applying a removable stiffening backing to a media and means for attachment to the media inlet of an inkjet printer.

[0020] This apparatus may further comprise means for removing said stiffening backing from the media and means for attachment to the media outlet of said inkjet printer.

[0021] In one embodiment of the apparatus, said removable stiffening backing comprises a continuous web arranged to form a closed loop which has a portion travelling in a printing zone of said inkjet printer.

[0022] Preferably, said apparatus is built as a kit which can be attached to an inkjet printer. The apparatus can thus be sold separately from the printer, and can be applied to existing inkjet printers.

[0023] Advantageously, the power drive for the advance of said stiffening backing is taken from the printer.

[0024] Also advantageously, said stiffening backing is driven through the printer by a media drive roller of said inkjet printer.

[0025] According to another aspect, the present invention also provides an inkjet printer comprising means for applying a removable stiffening backing to a media, and printing means for printing on said media provided with said stiffening backing.

[0026] Preferably, the printer further comprises means for removing said stiffening backing from the media after printing.

[0027] In one embodiment of the printer, said stiffening backing comprises a continuous web arranged to form a closed loop which has a portion travelling in a printing zone of said inkjet printer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] A particular embodiment of the present invention will be described in the following, only by way of nonlimiting example, with reference to the appended drawings, in which:

figure 1 is a diagram showing an inkjet printer fitted with a fabric backing apparatus according to a first embodiment of the invention;

figure 2 shows the printer of figure 1, further incorporating winding means for the fabric and backing;

figure 3 is diagram showing an inkjet printer fitted with a fabric backing apparatus according to a second embodiment of the invention; and

figure 4 shows the printer of figure 3 incorporating winding means for the fabric.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0029] Figure 1 shows diagrammatically an inkjet printer 1, having a printhead 2 and a roller 3 for driving a fabric media to be printed. To the printer is associated an apparatus 4 for applying a removable stiffening backing 6 on the fabric 5 to be printed.

[0030] With reference to this figure, an embodiment of the method for printing fabric according to the invention involves:

in the first place, applying to the fabric 5 a removable stiffening backing 6 by means of a first unit 4a of the backing apparatus 4, immediately before feeding the fabric to the printer 1;

subsequently, printing the fabric with the applied stiffening backing 6 in the inkjet printer 1; and

finally, removing the stiffening backing 6 from the fabric 5, in a second unit 4b of the backing apparatus.

[0031] In the present specification, the expressions 'immediately before feeding the fabric to the printer', 'immediately prior to printing', or the like, are construed to mean that the backing of the fabric is carried out continuously, constituting a step associated with the printing operation itself and performed by an accessory incorpo-

rated or coupled to a printer; this is different from a method in which a batch of backed fabric is first prepared and thereafter, in a different operation which can be spaced in time from the first, the backed fabric is fed to a printer.

[0032] The printing operation is carried out on a fabric that is maintained flat, without wrinkles, folds or the like by virtue of the backing, thus avoiding the risk of poor printing quality or printhead crash.

[0033] The second unit 4b that removes the backing 6 is optional; the removal the backing could be performed in a separate operation, after the printing of a batch of fabric is completed.

[0034] As can be seen, the fabric may be fed from a fabric reel 7, and the stiffening backing 6 is here, for example, a web of adhesive paper, supplied continuously from a paper feed reel 8. A protecting layer 9 of the adhesive paper web 6 is withdrawn before the latter is applied to the fabric 5, and it is wound on a first take-up reel 10.

[0035] In other embodiments the stiffening backing may be an adhesive web without a protective layer, e.g. similar to a Scotch® tape.

[0036] In order to ensure a proper positioning of the fabric on the backing, the two materials run along paths that get progressively closer, e.g. the fabric 5 and the adhesive paper web 6 are brought together by guiding rollers 11.

[0037] A pair of pressure rollers 12 are provided to apply the backing on the fabric avoiding bubbles or similar defects.

[0038] To ensure the tension of the backing web and the fabric, in order to guarantee good adherence of the fabric on the backing and avoid any kind of buckling that may derive in bubbles between fabric and backing, friction pads (not shown) are provided on the spindles that hold the backing reel 8 and the fabric reel 7. These friction pads may be adjustable depending on the type of media to load.

[0039] The drive roller 3 of the printer pulls from both the backing web 6 and the fabric 5, and therefore no extra motor is needed in the backing unit 4a.

[0040] In unit 4b, the backing web 6 is removed from the fabric 5 and wound on a second take-up reel 13.

[0041] It is important to have a certain level of tension in the backing and the fabric, in order to avoid media jams or disoriented winding.

[0042] A motored system is used to remove the backing web 6 automatically, as shown in figure 2, simply by rotating the backing take-up reel 13.

[0043] The reel 13 may have its own motor, or it can be driven by the media take-up reel 20 that belongs to the printer, for example by adapting a belt 21 as shown in the figure. The media take-up reel is a device already available commercially, which is used for winding up the printed media using a sensor at the bottom of the printer that detects the media movement.

[0044] Figure 3 shows an alternative embodiment of a fabric backing apparatus, in this case identified with

the reference number 14, applied to the inkjet printer 1.

[0045] Elements that are common to the embodiment of figure 1 have been indicated with the same reference numbers.

[0046] In a first unit 14a, the backing apparatus 14 applies a stiffening backing web 16 to the fabric 5 to be printed, then the printing operation is carried out, and finally the backing web 16 is separated from the fabric 5 in a second unit 14b.

[0047] The difference with the embodiment of figure 1 is that here the backing web 16 is arranged to form a closed loop around a number of rollers 17.

[0048] The web can be made of a material provided with a non-permanent adhesive, but in this case a better solution is to use a web that doesn't wear with time, for example a web that is attached to the fabric 5 by means of a hook and loop fastener, i.e. a kind of Velcro® in which the fabric 5 itself constitutes one of the coupling elements.

[0049] Another possible means to attach the backing to the fabric is using the electrostatic effect, i.e. electrostatically charging the web 16 and/or the fabric 5 in order to cause them to temporarily adhere to each other when brought into contact.

[0050] A portion of the web arranged in closed loop travels through the printing zone of the printer, and the fabric is printed while being attached to the backing web.

[0051] In this case, as shown in figure 4, a single motor can be used for winding up the fabric after it is separated from the backing, and for the movement of the backing web, by providing a transmission belt 21 between the fabric take-up roller 20 and one of the rollers 17.

[0052] The motor may either be associated to the take-up reel 20, as in the previous embodiment, or to a roller 17; further, since the backing web is driven by friction by the drive roller 3 of the printer, it is also possible to use this drive from the printer instead of providing an extra motor.

[0053] Another possibility is transmitting the motion of the backing web 16 to the fabric take-up reel 20 by means of a roller in contact with the web itself, instead of taking it from the spindle of a roller 17.

[0054] In this embodiment there is no consumption of stiffening backing.

[0055] It has to be noted that both the described apparatus 4 and 14 for backing the fabric to be printed may be provided as accessories that can be coupled to a conventional inkjet printer when a user wishes to print on fabric, and have means for their attachment to the media inlet and to the media outlet of the printer, or they can be incorporated within an inkjet printer such that no additional accessory is needed for printing on fabric.

[0056] Thus, the invention also relates to an inkjet printer that incorporates the described backing means.

[0057] It will be apparent that although the fabric to be printed has been shown in the drawings as a continuous band fed from a reel, the invention allows to print satis-

factorily any piece of fabric, regardless of its length and width, because the backing web will ensure its correct positioning in the printing zone.

[0058] On the other hand, even if the present specification refers to printing on "fabric", this term has to be interpreted widely, and it has to be understood that the invention applies to any material having a similar behaviour, e.g. with poor stiffness that may cause trouble in the printing operation.

Claims

1. A method for printing on media, in which the media is fed once through an inkjet printer (1), comprising the steps of:
 - a) feeding a web of removable stiffening backing (6;16) to the printer;
 - b) applying the media (5) on said removable stiffening backing (6;16) web immediately prior to printing; and
 - c) printing on said media, on the side opposite to the backing.
2. A method as claimed in claim 1, further comprising the step of removing said stiffening backing web (6; 16) from the media (5) immediately after printing.
3. A method as claimed in claims 1 or 2, wherein said stiffening backing web (6) is supplied continuously from a feed reel (8).
4. A method as claimed in claim 3, which comprises the step of loading said backing feed reel (8) to the inkjet printer.
5. A method as claimed in claims 3 or 4, wherein said stiffening backing web (6) is made of paper and is attached to the media (5) with a non-permanent adhesive.
6. A method as claimed in claim 2, wherein said stiffening backing comprises a continuous web (16) arranged to form a closed loop which has a portion travelling in a printing zone of said inkjet printer (1).
7. A method as claimed in claim 6, wherein said continuous web (16) is attached to the media (5) by means of hook and loop fasteners.
8. A method as claimed in claim 6, wherein said continuous web (16) is attached to the media (5) by electrostatic effect.
9. A method as claimed in claim 6, wherein said continuous web (16) is provided with a non-permanent adhesive.

10. A media backing apparatus (4,14) for inkjet printers, comprising means (4a;14a) for applying a removable stiffening backing (6;16) to a media (5) and means for attachment to the media inlet of an inkjet printer (1). 5
11. A media backing apparatus (4;14) as claimed in claim 10, further comprising means (4b;14b) for removing said stiffening backing (6;16) from the media (5) and means for attachment to the media outlet of said inkjet printer (1). 10
12. A media backing apparatus (14) as claimed in claim 11, wherein said removable stiffening backing comprises a continuous web (16) arranged to form a closed loop which has a portion travelling in a printing zone of said inkjet printer (1). 15
13. A media backing apparatus as claimed in any of claims 10 to 12, wherein said apparatus is built as a kit which can be attached to an inkjet printer. 20
14. A media backing apparatus as claimed in claim 13, wherein the power drive for the advance of said stiffening backing is taken from the printer. 25
15. A media backing apparatus as claimed in claim 13, wherein said stiffening backing is driven through the printer by a media drive roller of said inkjet printer. 30
16. An inkjet printer (1) comprising means (4a;14a) for applying a removable stiffening backing (6;16) to a media (5), and printing means (2) for printing on said media (5) provided with said stiffening backing (6;16). 35
17. An inkjet printer (1) as claimed in claim 16, further comprising means (4b;14b) for removing said stiffening backing (6;16) from the media (5) after printing. 40
18. An inkjet printer (1) as claimed in claim 16, wherein said stiffening backing comprises a continuous web (16) arranged to form a closed loop which has a portion travelling in a printing zone of said inkjet printer. 45

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FIG.1

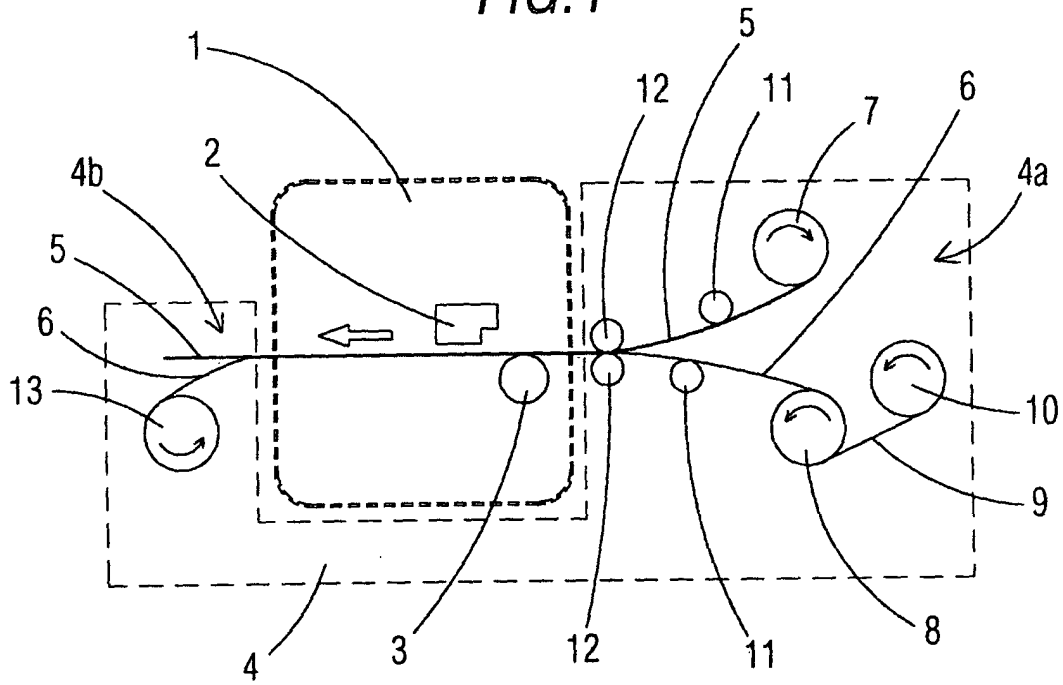


FIG.2

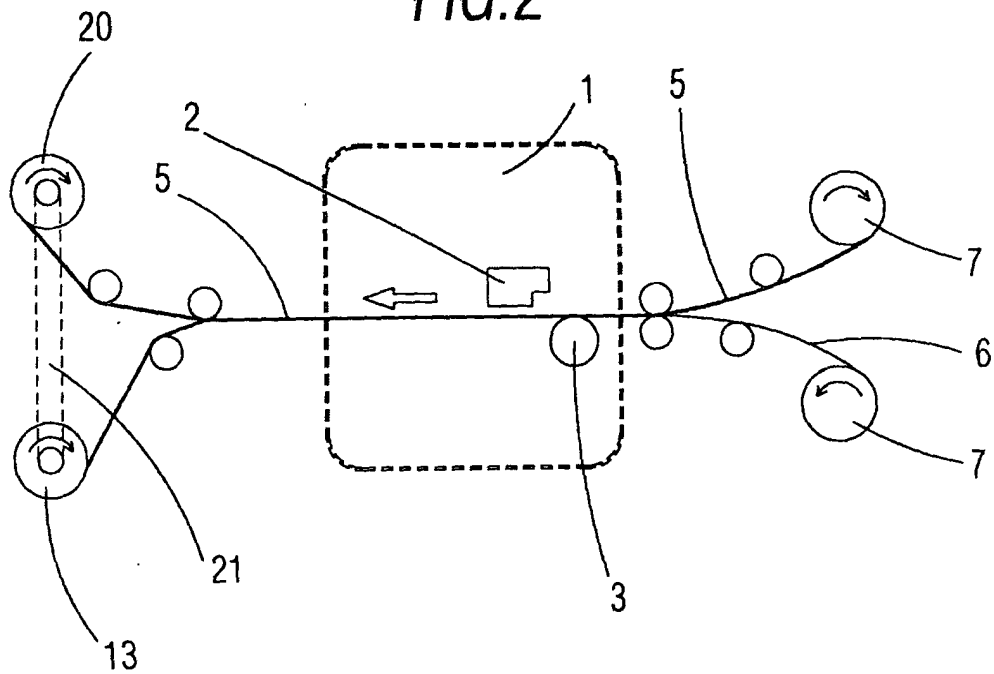


FIG. 3

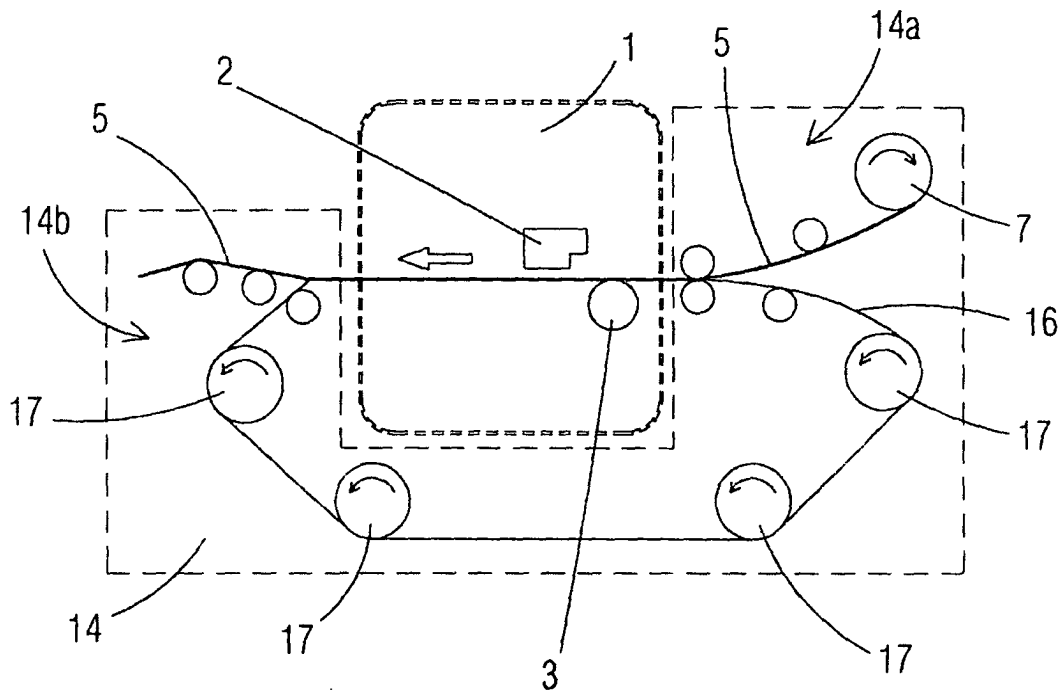
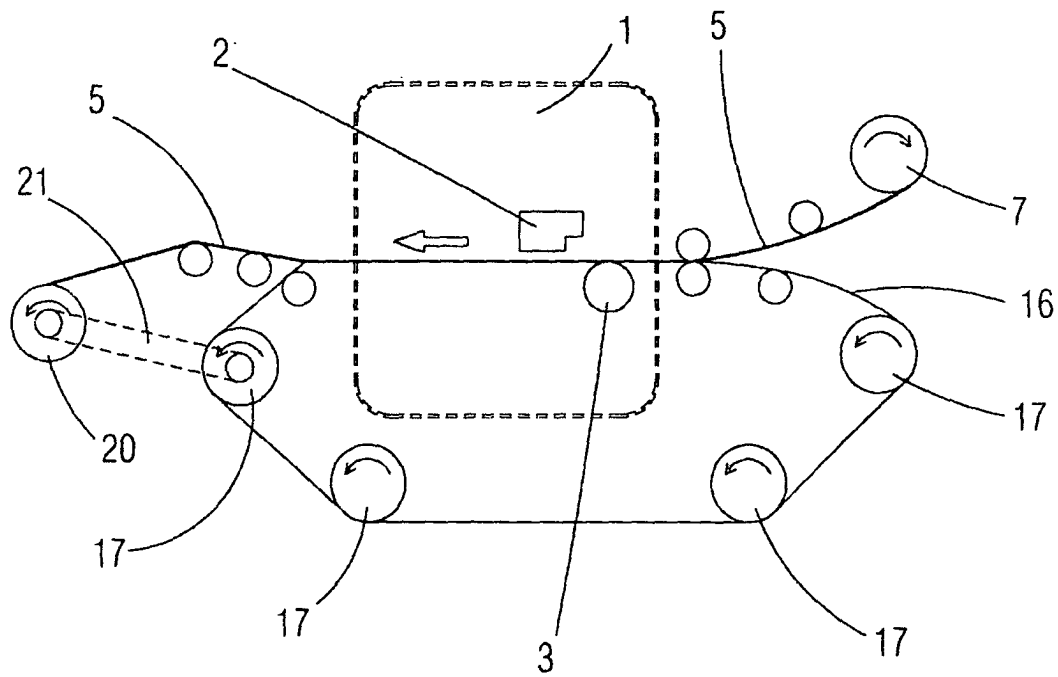


FIG. 4





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 12 1124

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 12 October 2001	Examiner Bridge, S
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03.82 (F04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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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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