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(54) Method and device for double-sided printing

(57) In a method for double-sided printing of recording media (81-84), preferably sheets, using a device comprising a printing unit (13) for one-sided printing, a recording medium, after printing of a first side, is again fed via a duplex path (6) to the printing unit for printing of the second side. So that the speed of printing decreases only slightly compared with one-sided printing it is proposed that, after a start phase, between printing of the first side of one of the recording media and the second side of the same recording medium (83), first of all the second side of the recording medium (82) preceding the recording medium (83) is printed and after the second side of the recording medium (82) preceding the recording medium (83) is printed, the first side of the recording medium (84) following the recording medium is printed.

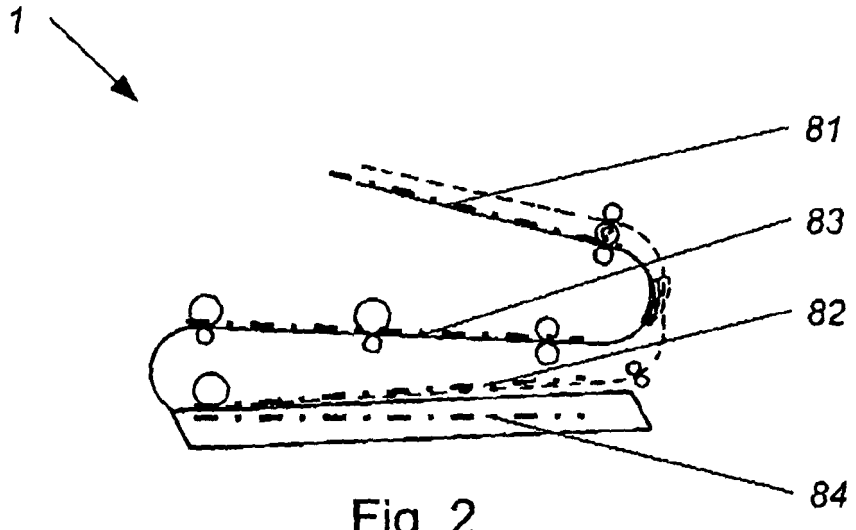

Fig. 2

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Description

[0001] The invention relates to a method for double-sided printing of recording media according to the precharacterising clause of claim 1.

[0002] Methods for double-sided printing of recording media comprising print units for one-sided printing are known, wherein after printing a first side of a sheet, the sheet is turned over and fed to the printing unit for a second time. The sheet is turned over in an output region or a reversing path provided for this purpose. In the process the sheet, once guided to the printing unit, is printed, turned over once, fed to the printing unit and printed again. The drawback of this method is that the time for printing a sheet on both sides is lengthened compared with one-sided printing of two sheets, both the process of turning over and the renewed feeding of the sheet to the printing unit lengthening the time, and the number of printed pages per unit of time, i.e. the printing speed, which according to the invention is measured as the number of printed sheets per unit of time, considerably decreasing compared with just one-sided printing of recording media.

[0003] The object of the invention is therefore to disclose a method for double-sided printing of recording media of the type mentioned in the introduction, with which said drawbacks can be avoided and with which the printing speed decreases only slightly compared with one-sided printing or is the same.

[0004] This is achieved according to the invention by the features of claim 1.

[0005] This results in the advantage that at the same time as one recording medium is being turned over, one side of a further recording medium can be printed, whereby the printing speed with double-sided printing of recording media after the start phase of the printer is substantially the same as the printing speed with one-sided printing of recording media. Quick printing of both sides is consequently possible using simple means and without technical modifications to the, in particular in development, expensive, printing unit.

[0006] Printing of recording media at substantially the same printing speed is thus ensured with the device, in particular the printer, comprising the printing unit for one-sided printing, in the case of one-sided as well as double-sided printing, it being possible for a user to choose between one-sided and double-sided printing of recording media simply and without mechanical intervention and in particular by way of an electronic control unit. Operation is thus simple and intuitive for a user, whereby the device is particularly suitable for home or office use.

[0007] A first side and a second side are thus likewise alternately printed in each case, the recording medium being output after printing of the second side, thus ensuring a substantially constant number of output recording media per unit of time. This ensures a substantially uniform conveying speed of the recording medium in the different methods steps. The recording medium can be conveyed by means of a motor which drives all conveying rollers. This allows inexpensive configuration and production of the printer, only minor or no technical modifications to a printer for one-sided printing being required particularly in the case of motors for conveying the recording media and in the case of the printing unit.

[0008] The invention also relates to a device for double-sided printing of recording media according to the precharacterising clause of claim 8.

[0009] The object of the invention is furthermore to disclose a device for double-sided printing of recording media of the type mentioned in the introduction with which said drawbacks can be avoided and with which the printing speed decreases only slightly compared with one-sided printing or is the same.

[0010] This is achieved according to the invention by the features of claim 8.

[0011] The recording medium can thus be conveyed into the duplex path for the purpose of being returned after printing of the first side and can be guided into the output path for the purpose of being output after printing of the second side. The recording medium situated in the duplex path and the further recording medium situated in the output path can thus be moved simultaneously and in different directions, in particular can be moved past each other, crossing or collision of the two recording media being prevented.

[0012] Continuous conveying of the recording medium is thus possible in the duplex path, the reversing device and the output path. The recording media can thus be conveyed in the printer substantially constantly and continuously overall, conveying being possible by means of a common drive unit and it being possible to simplify control of conveying of recording media. This allows inexpensive configuration and production of the printer, only minor or no technical modifications to a printer for one-sided printing being required particularly in the case of motors for conveying the recording media and in the case of the printing unit.

[0013] The sub-claims, which, like claims 1 and 8, also form part of the description, relate to further advantageous embodiments of the invention.

[0014] The invention will be described in more detail with reference to the accompanying drawings in which only preferred embodiments are illustrated by way of example and in which:

Fig. 1 schematically shows in profile a device for printing of recording media of a particularly preferred embodiment,

Fig. 2 schematically shows in profile the device of Fig. 1 and four recording media, which are different from each other, during a first step after the start phase,

Fig. 3 schematically shows in profile the device of Fig. 1 and four recording media, which are different

from each other, during a second step, immediately following the first step, after the start phase,

Fig. 4 schematically shows in profile the device of Fig. 1 and five recording media, which are different from each other, during a third step, immediately following the second step, after the start phase and

Fig. 5 schematically shows in profile the device of Fig. 1 and five recording media, which are different from each other, during a fourth step, immediately following the third step, after the start phase.

[0015] Fig. 1 to 5 show a method for double-sided printing of recording media 8, preferably sheets, comprising a printing unit 13 for one-sided printing, a recording medium, after printing of a first side, again being fed via a duplex path 6 to the printing unit 13 for printing of the second side, in which method it is proposed so the speed of printing decreases only slightly compared with one-sided printing that after a start phase between printing of the first side of one of the recording media 8, 83 and the second side of the same recording medium 8, 83, first of all the second side of the recording medium 8, 82 preceding the recording medium 8, 83 is printed and after the second side of the recording medium 8, 82 preceding the recording medium 8, 83 is printed, the first side of the recording medium 8, 84 following the recording medium 8, 83 is printed.

[0016] This means that at the same time as one recording medium 8 is being turned over, one side of a further recording medium 8 is printed, whereby the printing speed with double-sided printing of recording media 8, after the start phase of the printer, is substantially the same as the printing speed with one-sided printing of recording media 8. Quick printing of both sides is consequently possible using simple means and without technical modifications to the, in particular in development, expensive, printing unit.

[0017] According to the disclosed invention double-sided printing is taken to mean that a recording medium is printed once on one side on the first side and thereafter a second time on one side on the second side opposite the first, at least one print-free unit of time of this recording medium being provided in particular between an end time of the printing process of the first side and a start time of the printing process of the second side.

[0018] According to the disclosed invention printing speed is taken to mean the number of individual printed pages per unit of time, wherein with double-sided printing, per recording medium 8, in particular paper, two pages per recording medium are printed. At the same printing speed but with one-sided printing, twice as many recording media 8 than in the case of double-sided printing are guided and output to/at the ejection opening 31.

[0019] With the device, in particular the printer, comprising the printing unit 13 for one-sided printing, substantially the same printing speed is thus ensured in the case of one-sided and double-sided printing of recording media B. Also it is possible for a user to choose between one-sided and double-sided printing of recording media 8 simply and without mechanical intervention. Operation is thus simple and intuitive for a user, whereby the printer is particularly suitable for home and office use.

[0020] A first side and a second side are thus likewise alternately printed in each case, the recording medium 8 being output after printing of its second side, thus ensuring a substantially constant number of output recording media 8 per unit of time. This allows a substantially constant conveying speed of the recording medium in the device 1, whereby acceleration-induced stresses in the device 1 and in the recording media 8 can be avoided. The number of motors used for conveying can in the process be kept low, the motor(s) driving the guide rollers, preferably by means of a gear. This makes inexpensive configuration and production of the printer and/or device 1 possible, only minor or no technical modifications to a device for one-sided printing being required particularly in the case of motors for conveying the recording media 8 and in the case of the printing unit 13.

[0021] In an advantageous development of the invention it may be provided that after the printing unit 13 the recording medium 8 is fed by means of a switching mechanism 2 either along an output path 4 to an ejection opening 41 for outputting the recording medium 8 or a reversing device 51 arranged along a reversing path 5 for reversing the direction of movement 9 of the recording medium 8. The switching mechanism 2 can comprise an adjusting mechanism, a switching lever or an adjusting lever, for adjusting and switching the path of transport of the recording medium 8 after the printing unit 13. Two recording media 8 conveyed immediately one after the other can thus alternately be conveyed and guided to the two paths that are different from each other - the output path 4 or the reversing path 5. Two recording media 8 situated immediately one after the other can thus particularly be guided to different paths - reversing path 5 and output path 4 - without intersecting, crossing or touching each other. The recording medium 8 brought into the reversing device 5 thus does not hinder the recording medium 8, which is brought into the output path 4, immediately following it.

[0022] In a development of the invention it is advantageously possible during conveying of one of the recording media 8 in the duplex path 6 to guide a further one of the recording media from the printing unit 13 to the ejection opening 41. This allows the particularly short spacing between recording media 8 that are conveyed immediately one after another without recording media 8 guided immediately one after another being hindered.

[0023] It may advantageously be provided that during conveying, i.e. guiding at a predetermined speed, of one of the recording media 8 in the duplex path 6 another of the recording media 8 is furthermore guided from a storage container 11 for providing the recording media 8 to the printing unit 13. In particular the printing speed in the

case of double-sided printing can thus be substantially identical to the printing speed in the case of one-sided printing of the recording medium 8.

[0024] In an advantageous development of the invention it may be provided that the reversing device 51 comprises duplex rollers 52 and the ejection opening 41 output rollers 42, and the output rollers 42 and the duplex rollers 52 comprise a common roller 43, and that the recording medium 8 is guided in the output path 4 and the reversing path 5 by means of the common roller 43. This allows a particularly simple configuration and particularly simple construction of the device 1, in particular the printer. The device can thus be particularly inexpensive to produce, it being possible to convert an existing device 1 for one-sided printing, in particular an existing printer model, by means of simple measures.

[0025] In a particularly advantageous development it may be provided that only one of the output rollers 42 and duplex rollers 52, in particular the common roller 43, is driven. The recording media 8 can thus be guided in the output path 4 and the reversing path 5 by means of the driven, in particular common, roller 43. The device 1 can thus be produced particularly inexpensively, it being possible to convert an existing driving mechanism for one-sided printing, in particular comprising a motor for conveying the recording media 8, by means of simple measures to double-sided printing.

[0026] In a particularly advantageous development of the invention it may be provided that the recording medium 8 in the duplex path 6 is guided at least in certain sections into the storage container 11 for providing the recording media 8. An intake device 12 for recording media 8 in the storage container 11 and for recording media 8 issuing from the duplex path 6 can thus be used. This aids inexpensive production of the device 1 in particular, it being possible to substantially construct the intake device 12 and the printing unit 13 and a fixing unit 14 of the device 1 so as to be identical to the device for one-sided printing, i.e. a single-side printing device, of a recording medium 8.

[0027] Fig. 1 to 5 also show a device 1 for double-sided printing of recording media 8, preferably sheets, comprising a printing unit 13 for one-sided printing, at least one output path 4 for bringing the recording medium 8 from the printing unit 13 to an ejection opening 41 being arranged so as to adjoin the printing unit 13, and at least one duplex path 6 being provided for bringing the recording medium 8 from at least one reversing device 51 to the printing unit 13 for printing the second side, in which it is proposed, so the speed of printing, i.e. a printing speed, decreases only slightly compared with one-sided printing, that the at least one duplex path 6 and the at least one output path 4 are constructed so as to be separate.

[0028] The recording medium 8 can thus be conveyed into the duplex path 6 for the purpose of being returned after printing of the first side and can be guided into the output path 4 for the purpose of being output after printing of the second side. The recording medium 8 situated in the duplex path 6 and the further recording medium 8 situated in the output path 4 can thus be moved simultaneously and in different directions, in particular can be moved past each other, crossing or collision of the two recording media 8 being prevented.

[0029] Continuous conveying of the recording medium 8 is thus possible in the duplex path 6, the reversing device 5 and the output path 4. The recording media 8 can thus be conveyed in the device 1 substantially constantly and continuously overall, conveying being possible by means of a driving mechanism, comprising in particular an electric motor, and it being possible to simplify control of conveying of recording media 8. This allows inexpensive configuration and production of the device 1, only minor or no technical modifications to the device, particularly a printer, for one-sided printing being required particularly in the case of motors for conveying the recording media 8 and in the case of the printing unit 13.

[0030] It can advantageously be provided that at least one reversing path 5 branches off from the at least one output path 4 to the at least one reversing device 51, and that a switching mechanism 2 is provided for optional activation of the at least one output path 4 and the at least one reversing path 5. This ensures control of the recording media 8 in the direction of the output path 4 or in the direction of the reversing path 5, reliable control also being ensured with recording media 8 that immediately and quickly follow each other.

[0031] It may advantageously be provided in a development of the invention that the at least one reversing path 5 forms part of at least one duplex path 6 and the at least one duplex path 6 is cleared by the switching mechanism when the at least one output path 4 is activated. Two recording media 8 are thus highly reliably prevented from colliding in the region of the switching mechanism 2, and in particular a recording media 8 jam, in particular a paper jam, can be prevented.

[0032] In a particularly advantageous embodiment it may be provided that the reversing device 51 comprises duplex rollers 52 and the ejection opening 41 output rollers 42 and that the output rollers 42 and the duplex rollers 52 comprise a common roller 43. The device 1 can thus be particularly inexpensive to produce, it being possible to convert an existing device for one-sided printing, in particular an existing printer model, by means of simple measures.

[0033] In this connection it can be provided that only one of the output rollers 42 and duplex rollers 52, in particular the common roller 43, is driven. An existing driving mechanism, in particular the existing driving mechanism of a device for one-sided printing, can thus be converted by means of simple measures for double-sided printing.

[0034] In an advantageous development of the invention it may be provided that a storage container 11 for providing the recording media 8 forms part of the duplex path 6. The existing driving mechanism for one-sided printing can thus be converted by means of simple and

inexpensive measures for double-sided printing.

[0035] Fig. 1 schematically shows in profile a device 1 for double-sided printing of recording media of a particularly preferred embodiment. Illustrated are: the storage container 11, a plurality of conveying rollers 7, the printing unit 13, a fixing unit 14, the control means 2, a printing path 3, the output path 4, the reversing path 5, the duplex path 6, control sensors 15, the duplex rollers 52, the output rollers 42 and the direction of movement 9 of the recording media 8 during operation of the device 1.

[0036] Using Fig. 1 the complete procedure of double-sided printing of one of the recording media 8 will be described, wherein for the purpose of simpler illustration further recording media 8 that are moved at the same time will not initially be considered. This procedure corresponds to a double-sided print job which substantially constitutes a command and which in particular is formed as an external electronic pulse, for example a pulse of a computer, to continuously print a predetermined number of pages of a recording medium 8.

[0037] In this preferred embodiment one of the plurality of recording media 8 situated in the storage container 11 is taken into the printing path 3 by an intake device 12 at the start of printing. At the start of printing the recording medium 8 can alternatively be fed for example by means of a feeding chute or from one of a plurality of storage containers. A plurality of storage containers 11 that are different from each other, in particular for recording media 8 of different sizes, areas, thicknesses and/or orientations, and at least one feeding chute for manually feeding the recording media 8, can advantageously also be provided, it being possible to form a plurality of intake devices 12 in the device 1.

[0038] In the printing path 3, in which the recording medium 8 is conveyed and guided in only one direction of movement during operation, the recording medium 8 is guided to the printing unit 13 and subsequently to the fixing unit 14, the printing procedure in this region of the device 1 being substantially identical to the printing procedure of a device 1 for one-sided printing.

[0039] The recording medium 8 is thereafter guided to the control means 2. The control means 2 guide the recording medium 8 as a function of whether the recording medium 8 should be output or fed to the printing unit 13 again, either to the output path 4 or the reversing path 5. After printing of the first side of the recording medium 8 the recording medium 8 is in particular guided to the reversing path 5 and after printing of the second side of the recording medium 8 to the output path 4.

[0040] Subsequently again the direction of movement 9 of the recording medium 8 brought in the reversing path is reversed and the recording medium 8 is guided in the direction of the duplex path 6. In the process the switching mechanism 2 clears the way to the duplex path 6 and the recording medium 8 is guided into the duplex path 6 and onwards into the printing path 3.

[0041] The duplex path 6, in which the recording medium is guided and conveyed by means of conveying rollers 7, can advantageously be constructed at least in certain sections in the region of the at least one storage container 11. Conveying of the recording medium 8 in the duplex path 6 can advantageously be guided at least in certain sections by means of the intake device 12 arranged in the region of the storage container 11, in particular in the printing path 3.

[0042] Alternatively the duplex path 6 can be spaced apart from at least one supply container 11. This allows a particularly short duplex path 6 and the duration of guidance of the recording medium 8 in the duplex path 6 can thus be short.

[0043] In the printing path 3 the recording medium 8 is guided for a second time to the printing unit 13 and to the fixing unit 14, the printing sequence in this region of the printing path 3 being substantially identical to the printing sequence of a device for one-sided printed and the second side of the recording medium 8 being printed.

[0044] The recording medium 8 is conveyed a second time to the switching mechanism 2, the switching mechanism 2 guiding the recording medium 8 in the direction of the output path 4. In the output path 4 the recording medium 8 is conveyed onwards to the ejection opening 41 and output. In the process the recording medium 8 is guided entirely out of a path of movement of the recording medium 8, which substantially comprises the printing path 3, the reversing path 5, the duplex path 6 and the output path 4.

[0045] At least one control sensor 15 for controlling and positioning the recording medium 8 is advantageously provided in the device 1 and/or several recording media 8 one to each other. As shown in Fig. 1 a control sensor 15 can advantageously be constructed upstream of the printing unit 13 for example. Correct positioning of the recording medium 8 during printing of the first side and printing of the second side can thus be ensured. It may thus be ensured that printed lines on the first side and the second side are superimposed, a high quality imprint being ensured with a recording medium 8 printed on both sides and when looking through the recording medium 8.

[0046] Furthermore, as is also shown in Fig. 1, a control sensor 15 can advantageously be constructed upstream of the switching mechanism 2 for example. Correct control of the switching mechanism 2 and the error probability can thus be reduced.

[0047] Alternatively, instead of two control sensors 15 fewer or more control sensors may be formed and/or the control sensors 15 can be arranged in the device at a different position that is suitable for control, it being possible by means of advantageous arrangement of control sensors 15 to ensure good positioning of the recording medium during printing of the first side and printing of the second side as well as correct control of the switching mechanism 2 and to reduce the error probability.

[0048] Figures 2 to 5 schematically show in profile the device of Fig. 1 and a plurality of recording media 8, which are different from each other and are moved at the same time, in different snapshots after the start phase, which

snapshots are described below, the progress of the method for printing the first side of one of the recording media 8, 83 through to printing of the second side of the same recording medium 8, 83 - including the further recording media 8 moved at the same time - being continuously shown. The plurality of recording media 8 are shown in dot-dash lines, a first recording medium 81, a second recording medium 82, a third recording medium 83 and a fourth recording medium 84 being shown. The difference in recording media 81 to 84 is used merely for the purpose of simpler illustration and is not evaluative.

[0049] Different recording media 8 with the same area and thickness and with different areas and thicknesses can be printed at the same time, in particular in one print job.

[0050] Figures 2 to 5 show different steps thereto and immediately successive steps of the preferred embodiment of the method respectively. In other embodiments a different division of method steps, i.e. division into individual steps, can also be chosen.

[0051] Fig. 2 schematically shows in profile the device of Fig. 1 and four recording media, which are different from each other, during a first step after the start phase. The first recording medium 81 is situated in this case, i.e. during the first step, in the output path 4. It has already been printed on both sides and is ejected through the ejection opening 41. The third recording medium 83 is in the process, i.e. in the meantime, printed on its first side and can then be guided in the direction of the switching mechanism 2 and in turn then by means of the switching mechanism 2 in the direction of the reversing path 5. The second recording medium 82 is situated in this case in the duplex path 6 and is in contact with the intake device 12 and thus prepared for printing of the second side. The fourth recording medium 84 is situated in the storage container in this case and is not yet involved in the procedure, in particular the printing procedure.

[0052] Fig. 3 shows a second immediately successive step - and the step shown in Fig. 2 - of the device 1 and method. The first recording medium 81 has already been output and is situated in an output tray (not shown). The second recording medium 82 is in the process, i.e. during the second step, printed on the second side and is situated in the printing path 3. The third recording medium 83 is situated in the reversing path 5, approximately in an end position, in which the direction of movement 9 of the third recording medium 83 is reversed. The fourth recording medium 84 is in the process prepared for capture by means of the intake device and for this purpose is in contact with the intake device which can be activated according to a predeterminable control signal.

[0053] Fig. 4 in turn shows a further, third step, this step immediately following the second step - shown in Fig. 3. The first recording medium 81 is still situated in the output tray. The second recording medium 82, which has now been printed on both sides, is ejected in the process, i.e. during the third step. The third recording medium 83 is situated in the region of the storage container 11 in the duplex path 6 and is in contact with the intake device 12, a predeterminable control signal controlling the intake of the third recording medium 83. The fourth recording medium 84 is printed on its first side in the process and is situated in the printing path 3. The third step shown in Fig. 4 is substantially identical to the first step shown in Fig. 2, only the second recording medium 82 being replaced by the first recording medium 81 in the output path 4, the third recording medium 83 being replaced by the second recording medium 82 in the duplex path 6 and the fourth recording medium 84 being replaced by the third recording medium 83 in the printing path 3.

[0054] Fig. 5 shows a fourth step, the fourth step immediately following the third step - shown in Fig. 4. The first recording medium 81 and the second recording medium 82 are brought into the output tray (not shown). The third recording medium 83 is printed on its second side and is situated in the printing path 3 during the fourth step. The fourth recording medium 84 is situated in the reversing path 5 shortly before, after or during reversal of the direction of movement 9 of the reversing device 51 and accordingly the reversal of the direction of movement 9 of the fourth recording medium 84.

[0055] After printing the second side of the third recording medium 83 (not shown) the medium is conveyed by means of the switching mechanism 2, especially the adjusting lever, into the output path 4 and from there onwards to the ejection opening 41 and ejected at this location. The complete printing process of the third recording medium 83 is thus concluded, wherein between printing of the first side of one of the recording media 8, 83 and the second side of the same recording medium 8, 83, the second side of the recording medium 8, 82 preceding the recording medium 83 is printed and after the second side of the recording medium 8, 82 preceding the recording medium 8, 83 is printed, the first side of the recording medium 8, 84 following the recording medium 8, 83 is printed.

[0056] The method shown in Fig. 2 to Fig. 5 is continuous, in the case of double-sided printing of recording media 8 a recording medium 9 being output substantially every time a page has been printed for a second time, and taking place after the start phase of the device 1.

[0057] The start phase, during which the first side of the recording medium 8 printed on both sides is printed and turned over, forms the start of each independent print job. After the first side of the recording medium 8 has been printed and before a further recording medium 8 following the recording medium 8 is taken in, a predetermined unit of time is inserted which substantially corresponds to at least the duration of a printing step, i.e. the step in which the recording medium 8 is in continuous contact with the printing unit 13 and a side of the recording medium 8 is thus fully printed. At least one unit of time is thus substantially longer than the duration of the printing step no recording medium in contact with the printing unit 13, whereby a printing pause is formed. A unit of time

substantially longer than the duration of a printing step is a printing pause according to the invention.

[0058] The printing pause can in particular constitute substantially the only printing pause during a print job, the two - thus not immediately - successive recording media 8 - the recording medium 8 and the further recording medium 8 - having sufficient spacing from each other that the recording medium 8 printed first has left the reversing path completely and is completely disposed in the duplex path before the second printed, further recording medium 8 is guided into the region of the switching mechanism 2. This thus ensures that in the start phase the two recording media 8, which are consecutively conveyed in the reversing path, do not run into each other and/or touch each other.

[0059] In a particularly advantageous configuration the output rollers 42 and the duplex rollers 52 are arranged so as to cooperate, it being possible in particular for the output rollers 42 and the duplex rollers 52 - as shown in Fig. 1 - to comprise a common roller 43. The three illustrated conveying rollers 7, the output rollers 42, the duplex rollers 52 and the common roller 43 are in mutual contact, in particular only one conveying roller 7, in particular the common roller 43, being constructed to be driven, and the other two conveying rollers 7 being constructed as co-running conveying rollers 7.

[0060] The output roller 42 and the duplex roller 52 are advantageously arranged so as to oppose the common roller 43, the mutually opposing output roller 42 and the duplex roller 52 in particular having the same direction of rotation. The recording medium 8 can advantageously be guided in the output path 4 between the output roller 42 and the output roller 42 constructed as a common roller 43, and the recording medium 8 can be guided in the reversing path 5 between the duplex roller 52 constructed as a common roller 43 and the duplex roller 52. In the process one of the recording media B can particularly advantageously be guided in the output path 4 in the direction of the ejection opening 41 while at the same time a further one of the recording media 8 can be guided in the reversing path 5 in the direction of the duplex path 6. The output path 4 and the reversing path 5 can in this case be adjacent to each other at least in certain sections and/or be substantially parallel, it being possible for the two recording media 8 to be moved past each other. This allows good utilisation of the device 1 and in particular of the printing unit 13, it being possible for double-sided printing of recording media 8 to take place substantially at the same printing speed as one-sided printing of recording media 8.

[0061] With an uneven number of pages, wherein the last recording medium 8 is to be printed only on one side, the last recording medium 8 can advantageously be guided into the output path 4 as soon as the first side has been printed. The return to the duplex path 6 and the second passage through the printing unit 13 is thus avoided, time is saved and the device 1 cleared more quickly for the next print job, whereby the efficiency of the device can be increased further.

[0062] Immediately successive print jobs can advantageously be combined, so the number of start phases of the device 1 can be reduced and the average printing speed can be further increased. For visual separation of the recording media 8 [of] a plurality of print jobs in the output tray it can be provided that a recording medium 8, which in particular has a different area and/or colour, is inserted between the recording media 8 of two print jobs, that the output tray is displaced in parallel and/or is rotated after the recording media 8 of a first print job have been output and before the recording media 8 of a second print job are output, that the recording media 8 of the different print jobs are output in a staggered manner and/or that the recording media 8 of different print jobs are output into different output trays.

[0063] The method is thus particularly suitable for double-sided printing of one to a large number of recording media 8 per print job and a large number of print jobs, it being possible to also print recording media 8 on one side in the device 1 without loss of efficiency or printing speed.

[0064] With a print job comprising a plurality of pages of a document for printing, the print job - at least print job-internally and/or device-internally - beginning with page number one and with a constantly increasing page number extending to a predetermined page number, the printing sequence of the page numbers can advantageously be re-sorted, so the recording media 8 of a print job, printed on both sides, are output into the output tray with constantly increasing, sorting page numbers.

[0065] With double-sided printing of at least one of the recording media 8 it can particularly advantageously be provided that the higher of the two page numbers to be printed on a recording medium 8 is printed on the first side of the recording medium 8, i.e. before turning the recording medium 8 over, wherein it is in particular provided that the sequence of page numbers to be printed is basically increasing, i.e. each recording medium 8 following one of the recording media 8 is printed with higher page numbers than the recording medium 8. It may thus be ensured that with double-sided printing of recording media 8 the document, after being output into the output tray, is output with constantly increasing page numbers and in the correct sort order.

[0066] For the case where a reversed print sequence is chosen, with the print job - at least print job-internally and/or device-internally - beginning with a predetermined highest page number and with a constantly decreasing page number extending to page number one, it may advantageously be provided that the lower of the two page numbers to be printed on a recording medium 8 is printed on the first side of the recording medium 8, i.e. before the recording medium 8 is turned over, wherein it is in particular provided that the sequence of page numbers to be printed is basically decreasing, i.e. each recording medium 8 following one of the recording media 8 being printed with lower page numbers than the recording me-

dium B. It may thus be ensured for the reversed print sequence as well that with double-sided printing of recording media 8, the document, after being output into the output tray, is output with constantly increasing page numbers and in the correct sort order.

[0067] When printing in the reversed print sequence and if the print job comprises an uneven number of page numbers it can advantageously be provided that, after printing the first side, the recording medium 8 printed first is guided into the reversing path 5, into the duplex path 6 and again into the printing path 3 and in the process is turned over, the second side of the recording medium 8 not being printed in the printing path 3, and is guided onwards into the output tray where it is output. It can thus be ensured that even when printing in the reversed print sequence and for an uneven number of page numbers that with double-sided printing of recording media 8 the document is output in the correct sort order.

[0068] A print image is produced on the page when printing a page of a recording medium 8. To compensate for the rotation of the recording medium 8 when the page is turned over, the print image of the second side of the recording medium 8 is advantageously rotated by 180° in comparison with the print image of the first side of the same recording medium 8. It can thus be ensured that after the recording medium 8 printed on both sides has been output, [?] are arranged top and bottom on the first page and on the second page in the same region of the recording medium 8.

[0069] Further embodiments according to the invention merely comprise some of the described features, it being possible to provide each combination of features, in particular also of different, described embodiments.

Claims

1. Method for double-sided printing of recording media (8), preferably sheets, comprising a printing unit (13) for one-sided printing, a recording medium, after printing of a first side, again being fed via a duplex path (6) to the printing unit (13) for printing of the second side, **characterised in that** after a start phase between printing of the first side of one of the recording media (8, 83) and the second side of the same recording medium (8, 83), first of all the second side of the recording medium (8, 82) preceding the recording medium (8, 83) is printed and after the second side of the recording medium (8, 82) preceding the recording medium (8, 83) is printed, the first side of the recording medium (8, 84) following the recording medium (8, 83) is printed.

2. Method according to claim 1, **characterised in that** after the printing unit (13) the recording medium (8) is fed by means of a switching mechanism (2) either along an output path (4) to an ejection opening for output of the recording medium (8) or a reversing device (51), arranged along a reversing path (5), for reversing the direction of movement (9) of the recording medium (8).

3. Method according to claim 1 or 2, **characterised in that** during conveying of one of the recording media (8) in the duplex path (6) a further one of the recording media (8) is guided from the printing unit (13) to the ejection opening (41).

4. Method according to claim 1, 2 or 3, **characterised in that** during conveying of one of the recording -media (8) in the duplex path (6) another of the recording media (8) is furthermore guided from a storage container (11) for providing the recording media (8) to the printing unit (13).

5. Method according to claim 2, 3 or 4, **characterised in that** the reversing device (51) comprises duplex rollers (52) and the ejection opening (41) output rollers (42) and the output rollers (42) and the duplex rollers (52) comprise a common roller (43), and **in that** the recording medium (8) is guided in the output path (4) and in the reversing path (5) by means of the common roller (43).

6. Method according to claim 5, **characterised in that** only one of the output rollers (42) and the duplex rollers (52), in particular the common roller (43), is driven.

7. Method according to any one of claims 4 to 6, **characterised in that** the recording medium (8) in the duplex path (6) is guided at least in certain sections into the storage container (11) for providing the recording media (8).

8. Device (1) for double-sided printing of recording media (8), preferably sheets, comprising a printing unit (13) for one-sided printing, at least one output path (4) for bringing the recording medium (8) from the printing unit (13) to an ejection; opening (41) being arranged so as to adjoin the printing unit (13), and at least one duplex path (6) being provided from bringing the recording medium (8) from at least one reversing device (51) to the printing unit (13) for printing the second side, **characterised in that** the at least one duplex path (6) and the at least one output path (4) are constructed separately from each other.

9. Device according to claim 8, **characterised in that** at least one reversing path (5) branches off from the at least one output path (4) to the at least one reversing device (51), and **in that** a switching mechanism (2) is provided for optional activation of the at least one output path (4) and the at least one reversing path (5).

10. Device according to claim 9, **characterised in that** the at least one reversing path (5) forms part of the at least one duplex path (6) and the at least one duplex path (6) is cleared by the switching mechanism (2) when the at least one output path (4) is activated.

11. Device according to claim 8, 9 or 10, **characterised in that** the reversing device (51) comprises duplex rollers (52) and the ejection opening (41) comprises output rollers (42), and **in that** the output rollers (42) and the duplex rollers (52) comprise a common roller (43).

12. Device according to claim 7, **characterised in that** only one of the output rollers (42) and duplex rollers (52), in particular the common roller (43), is driven.

13. Device according to any one of claims 8 to 12, **characterised in that** a storage container (11) for providing the recording media (8) forms part of the duplex path (6).

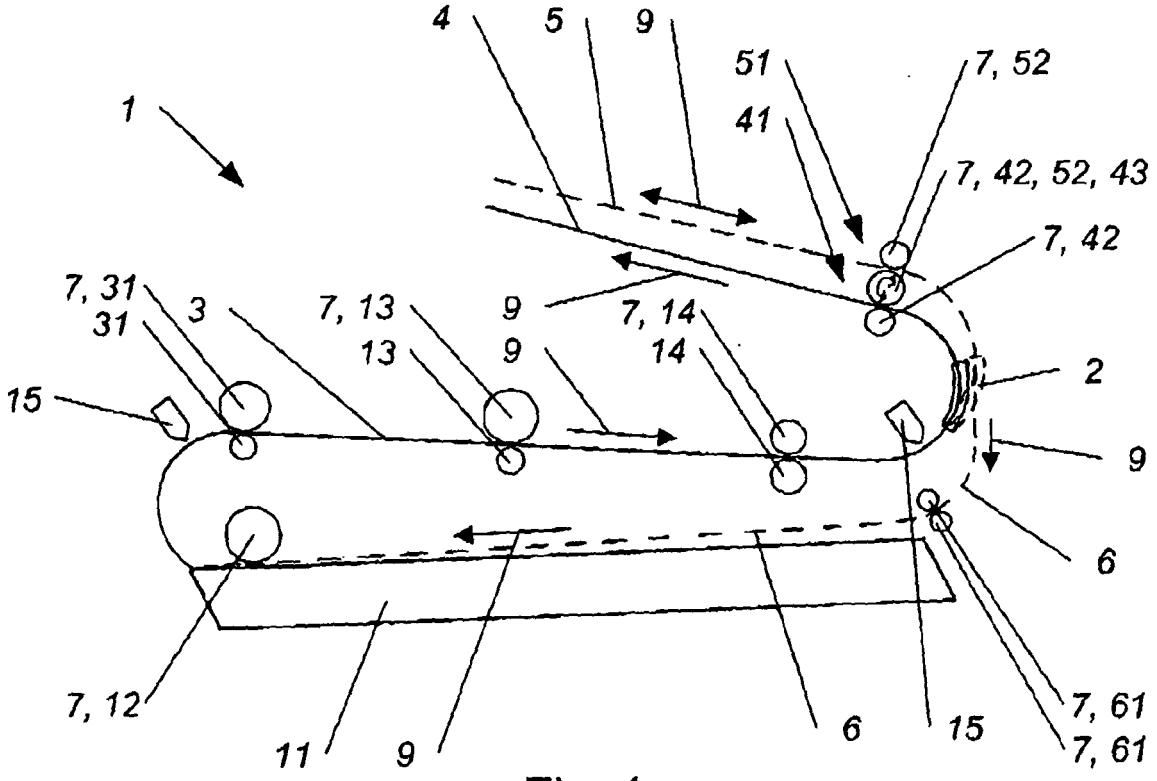
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Fig. 1

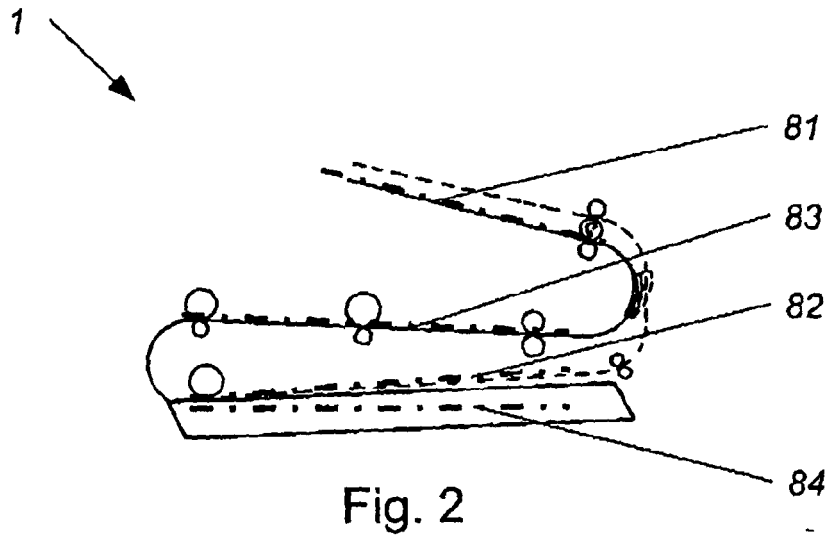
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Fig. 2

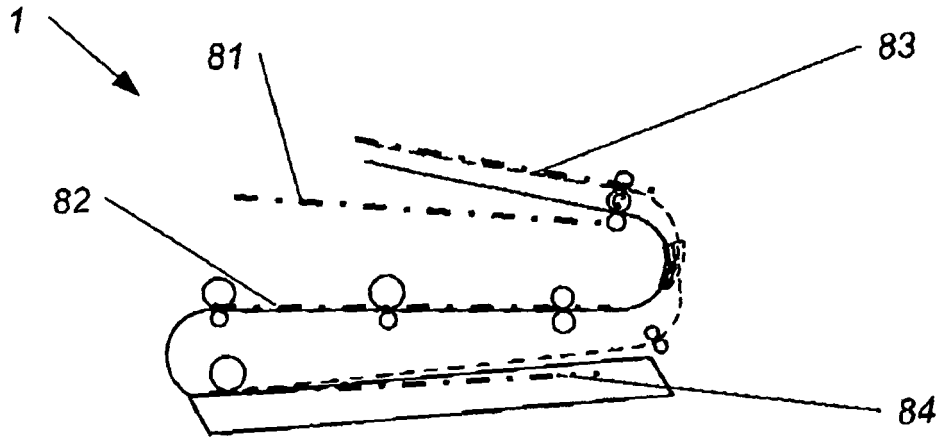

Fig. 3

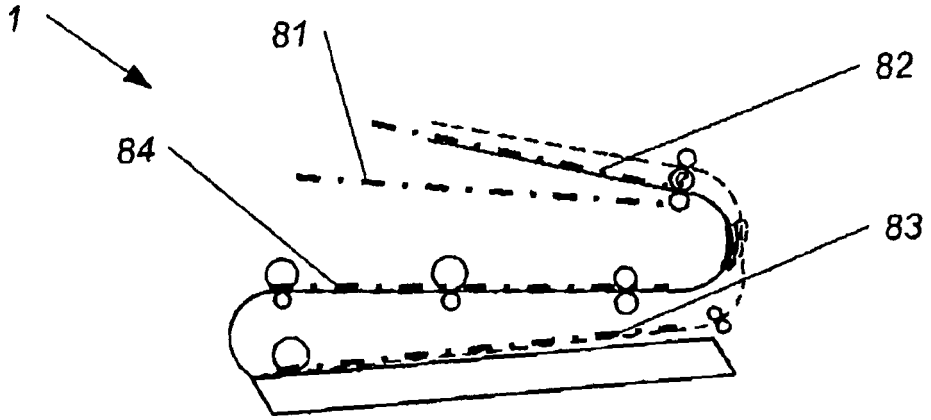

Fig. 4

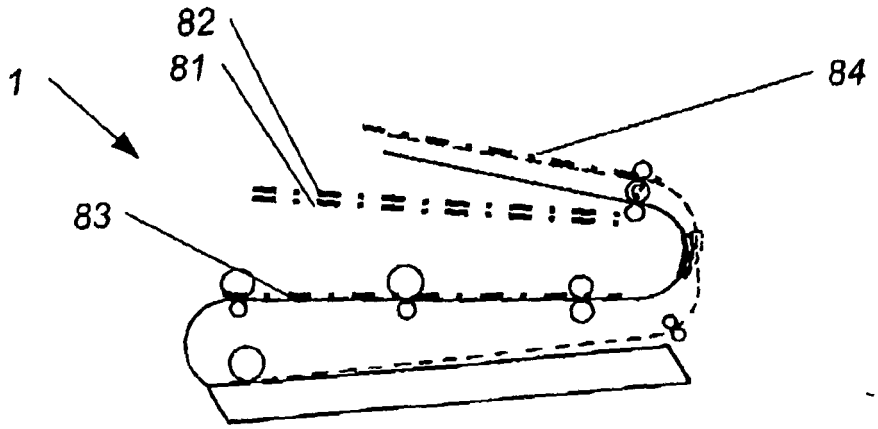

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 07 29 0933

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	US 6 340 157 B1 (WATANABE KAZUO [JP] ET AL) 22 January 2002 (2002-01-22) * column 10, line 35 - column 12, line 17 * * column 24, line 5 - column 25, line 65 * * figures 1,23-29 *	1-4,8-10 5,6	INV. B41J3/60 B41J13/00 G03G15/23
X A	US 2005/214050 A1 (CARTER DANIEL L [US] ET AL CARTER DANIEL L [US] ET AL) 29 September 2005 (2005-09-29) * paragraphs [0032] - [0037] * * figures 5A-E *	1,3,4 8	
X Y A	US 2007/147921 A1 (CHAE SEOK-HEON [KR]) 28 June 2007 (2007-06-28) * paragraphs [0056] - [0062] * * figures 2-9 *	1,3,4 7 8	
X	US 2003/063935 A1 (SEO IN-SIK [KR]) 3 April 2003 (2003-04-03) * paragraphs [0022], [0027], [0030] - [0032], [0044] * * figure 2A *	1-4, 7-10,13	TECHNICAL FIELDS SEARCHED (IPC) B41J G03G
X Y A	DE 33 41 413 A1 (KONISHIROKU PHOTO IND [JP]) 17 May 1984 (1984-05-17) * page 7, line 20 - page 8, line 17 * * page 11, line 18 - page 13, line 16 * * figures 3,5,6 *	8-12 5,6,13 1,2	
X A	EP 0 840 181 A (OCE TECH BV [NL] OCE TECH BV) 6 May 1998 (1998-05-06) * column 4, line 39 - column 5, line 11 * * figure 1 *	1-4,8-10 11-13	
Y A	US 2007/122225 A1 (IZUCHI MASATOSHI [JP] ET AL) 31 May 2007 (2007-05-31) * paragraphs [0091], [0092], [0100] * * figures 11-14 *	7,13 1,8	

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

Place of search	Date of completion of the search	Examiner
Munich	21 January 2008	Björklund, Sofie

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

European Patent Office

Application Number
EP 07 29 0933

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☒ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

European Patent Office

LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 07 29 0933

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-7

A method of double-sided printing of recording media using a device comprising a printing unit for one-sided printing and a duplex path, defining the printing sequence of subsequent pieces of recording media.

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2. claims: 8-13

A device for double-sided printing of recording media comprising a printing unit for one-sided printing, a duplex path, a reversing device, an ejection opening, and an output path constructed separately from the duplex path.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 29 0933

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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21-01-2008

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6340157 B1	22-01-2002	JP 3352979 B2	03-12-2002
		JP 2001026378 A	30-01-2001
US 2005214050 A1	29-09-2005	US 2007014610 A1	18-01-2007
US 2007147921 A1	28-06-2007	CN 1991627 A	04-07-2007
US 2003063935 A1	03-04-2003	CN 1410849 A	16-04-2003
		JP 3946098 B2	18-07-2007
		JP 2003118914 A	23-04-2003
		JP 2007099524 A	19-04-2007
		KR 20030027617 A	07-04-2003
DE 3341413 A1	17-05-1984	JP 59092861 A	29-05-1984
EP 0840181 A	06-05-1998	EP 0841601 A1	13-05-1998
		JP 3251218 B2	28-01-2002
		JP 10133435 A	22-05-1998
		US 6069704 A	30-05-2000
US 2007122225 A1	31-05-2007	JP 2007145574 A	14-06-2007

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