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(54) **Method and device for double-sided printing**

Verfahren und Vorrichtung zum doppelseitigen Drucken

Procédé et dispositif pour l'impression recto verso

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(73) Proprietor: **SAGEMCOM DOCUMENTS SAS**
92500 Rueil Malmaison (FR)

(72) Inventor: **Lang, Robert**
7082 Donnerskirchen (AT)

(74) Representative: **Gibler & Poth Patentanwälte OG**
Dorotheergasse 7
1010 Wien (AT)

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Printed by Jouve, 75001 PARIS (FR)

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 conveyed 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 EP 0 840 181 A discloses a method for duplex printing according to the preamble of claim 1.

[0004] The US 6 128 327 B1 discloses printing of several copies of the same printing job and duplex printing.

[0005] The US 2007/147921 A discloses a device for double-sided printing of recording media according to the preamble of claim 8.

[0006] The objects 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 and in which an existing device for one-sided printing can be used as a result of merely minor adaptation.

[0007] This is achieved according to the invention by the features of claim 1.

[0008] 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 is printed, whereby the printing speed is high even with double-sided printing. Quick double-sided printing by means of one printing unit for one-sided printing, the two sides being printed on one side at different times, is consequently possible using simple means and without technical modifications to the, in particular in development, expensive, printing unit. This consequently makes the inexpensive configuration and production of the printer possible, it being necessary to make only minor or no technical modifications to a printer for one-sided printing, particularly in the case of motors for conveying the recording media and in the case of the printing unit.

[0009] The device can thereby be used for one-sided and double-sided printing of recording media, in particular paper, it being possible to change between one-sided and double-sided printing without mechanical intervention. With a print job which substantially constitutes a command to print a specific number of pages continuously, the recording media can be printed on both sides and with an immediately subsequent print job further recording media can be printed on one side, it being possible to change from one-sided to double-sided printing and vice versa without a pause, in particular without stopping the device. Operation for a user is thus simple and intuitive, whereby the device is particularly suitable for home or office use.

[0010] The invention also relates to a device for double-sided printing of recording media according to the precharacterising clause of claim 9.

[0011] The object of the invention is moreover 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 and in which an existing device for one-sided printing can be used as a result of only minor adaptation.

[0012] This is achieved according to the invention by the features of claim 9.

[0013] As a result a device for one-sided printing, in particular an already existing device, can be redesigned by way of simple adaptation measures, in particular by constructionally simple redesign measures, into the device for double-sided printing, wherein a printing path, an output path, a storage container and the - in particular at least one - receiving roller can be constructed so as to be identical to the device for one-sided printing, whereby the production and development costs of the device are low.

[0014] This results in the advantage that different formats, in particular different sizes and areas, of recording media can be printed on one side and one both sides by means of the same printing device and without external intervention. This ensures the high flexibility of the printing device with respect to different formats, areas and sizes of recording media, whereby ease of use can be ensured and the printing device is particularly suitable for home and office use.

[0015] This allows subsequent conversion of the device for one-sided printing and the formation of conversion kits, whereby an existing device for one-sided printing can be converted by the user. As a result of double-sided printing paper consumption can be reduced in the home and office, whereby even with existing devices recording media consumption and costs can be lowered and the environment conserved.

[0016] The sub-claims, which like claim 1 also form part of the description, relate to further advantageous embodiments of the invention.

[0017] 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 double-sided printing of recording media of a particularly preferred embodiment,

Fig. 2 schematically shows in profile the device of Fig. 1 and three recording media during a first step,

Fig. 3 schematically shows in profile the device of Fig. 1 and three recording media during a second step which follows the first step,

Fig. 4 schematically shows in profile the device of Fig. 1 and three recording media during a third step which follows the second step,

Fig. 5 schematically shows in profile the device of Fig. 1 and three recording media during a fourth step which follows the third step,

Fig. 6 schematically shows in profile the device of Fig. 1 and three recording media during a fifth step which follows the fourth step,

Fig. 7 schematically shows in profile the device of Fig. 1 and three recording media during a sixth step which follows the fifth step and

Fig. 8 schematically shows in profile the device of Fig. 1 and three recording media during a seventh step which follows the sixth step.

[0018] Fig. 1 to 8 show a method for double-sided printing of recording media 2, preferably sheets, comprising a printing unit 13 for one-sided printing, a recording medium 2, after printing of a first side, again being via a duplex path 5 fed to the printing unit 13 for printing of the second side, and the recording media 2, before printing of a first side, being received by means of a receiving roller 12 from a storage container 11, in which method it is proposed so the speed of printing decreases only slightly compared with one-sided printing and so an existing device for one-sided printing can be used as result of merely minor adaptation that between printing the first side of one of the recording media 2 and the second side of the same recording medium 2 at least one side of a further recording medium 2 is printed.

[0019] It is thereby possible that at the same time as one recording medium 2 is being turned over, one side of a further recording medium 2 is printed, whereby the printing speed is high even with double-sided printing. Quick double-sided printing is consequently possible using simple means and without technical modifications to the, in particular in development, expensive, printing unit 13 for one-sided printing. This consequently makes inexpensive configuration and production of the device, in particular the printer, possible.

[0020] The device 1 can thus be used for one-side and double-sided printing of recording media 2, in particular paper, it being possible to change between one-sided and double sided printing without mechanical intervention.

[0021] With a print job which substantially constitutes a command to print a specific number of pages continuously, the recording media 2 can be printed on both sides and with an immediately subsequent print job further recording media 2 can be printed on one side, it being possible to change from one-sided to double-sided printing and vice versa without pausing the device 1, in particular the printer. Operation for a user is thus simple and intuitive, whereby the device 1 is particularly suitable for home and office use.

[0022] Recording media 2 that are used can advantageously be paper and/or plastic sheets and can advantageously have standard sizes, for example the size of "A5" to "A3", in particular "A4", "US legal" and/or "US letter".

[0023] It can advantageously be provided that after printing the first side of a first recording medium 2 and printing the second side of the same recording medium 2 exactly one side of the preceding or subsequent recording medium 2 is printed. This ensures the uniform print sequence, the recording medium 2 being output each time the second side of the recording medium 2 has been printed.

[0024] In an advantageous development of the invention it may be provided that a respective group of two recording media 2 - a first recording medium 22 and a second recording medium 23 - is printed on both sides, first of all the first side of the first recording medium 22 of the group being printed, after a first printing pause the first side of the second recording medium 23 of the group being printed, subsequently after a second printing pause the second side of the first recording medium 22 being printed and finally the second side of the second recording medium 23 being printed. The printing pause ensures that the first recording medium 22 returned into the duplex path 5 is sufficiently spaced apart from the second recording medium 23 and the first recording medium 22 is given sufficient time by the subsequent second recording medium 23 to return into the duplex path 5, the output path 4 of the first recording medium 22 being cleared before the second recording medium 23 is conveyed into the region of the output path 4. It is particularly advantageous in this connection that the pause is provided before printing of the recording medium 2, so the recording medium 2 is conveyed through the printing path 3 at constant speed and is conveyed uniformly through the printing unit 13 and the fixing unit 14. This ensures constant print results over the entire area and extent of the recording medium 2 and allows use of sensitive, in particular temperature-sensitive, recording media 2 without the risk of damage in the region of the printing unit 13 or in the region of the fixing unit 14.

[0025] It may advantageously be provided in this connection that during the first pause, in particular the first printing pause and/or printing of the first side of the sec-

ond recording medium 23, the first recording medium 22 is conveyed via the duplex path 5 and that during the second pause, in particular printing pause, and/or printing of the second side of the first recording medium 22 the second recording medium 23 is conveyed via the duplex path. Print steps of different recording media are thus executed simultaneously, whereby the capacity, in particular of the printing unit 13, is increased and the high and substantially constant print speed is thus ensured.

[0026] The leading edge - viewed in the direction of movement 9 of the recording medium 2 - of the recording medium 2 in the duplex path 5 is arranged in the storage container 11 between the receiving roller 12 and the recording media 2. A recording medium brought into the duplex path 5 can thus be received by the - at least one - receiving roller 12 and be conveyed into the printing path 3 and in the process the same receiving roller 12 is used for receiving and conveying the recording media 2 into the printing path 3 for recording media 2 in the duplex path 5 and for recording media 2 in the storage container 11. The device can thus be constructed compactly, inexpensively and using few - in particular few moving - components.

[0027] In an embodiment not covered by the claims the duplex path 5 could be constructed so as to be spaced apart from at least one storage container 11. This would allow a particularly short duplex path 5 and the length of time for guiding the recording medium 2 in the duplex path 5 could therefore be short.

[0028] In the device for double-sided printing according to the invention the recording medium 2 in the duplex path 5 is conveyed at least in certain sections by means of one drive roller 33 constructed with a freewheel and connected upstream of the receiving roller 12. The freewheel ensures that after the recording medium 2 has been captured by the receiving roller 12 and/or with the start of conveying of the recording medium 2 by the receiving roller 12, conveying of the recording medium 2 by the drive roller 33 is neither blocked nor hindered. This ensures gentle conveying of the recording media 2 between the duplex path 5 and the printing path 3, it being possible to reduce the error rate and to print even sensitive recording media 2 on both sides.

[0029] In a device for carrying out the method according to the invention it may be provided that the drive roller 33 is constructed without a freewheel, wherein for simultaneous conveying of the recording medium 2 by the receiving roller 12 and the drive roller 33 it can advantageously be provided that a conveying speed of receiving roller 12 and drive roller 33 are matched with each other, in particular are identical. In particular the conveying speed of the drive roller 33 can be variable. The drive roller 33 thus ensures that after the recording medium 2 has been captured by the receiving roller 12 and/or with the start of conveying of the recording medium 2 by the receiving roller 12, conveying of the recording medium 2 by the drive roller 33 is unhindered and this allows stress-free and/or deformation-free conveying and guiding of the recording medium 2.

[0030] The leading edge - viewed in the direction of movement 9 of the recording medium 2 - of the recording medium 2 in the duplex path 5 is arranged in the storage container 11. The receiving mechanism, which includes the receiving roller 12, in the region of the storage container 11 can thus be identical to a receiving mechanism in a device without a duplex path 5. This allows continued use of the existing receiving mechanism of the device without a duplex path 5, whereby the device 1 comprising the duplex path 5 can be retrofitted inexpensively and using simple measures.

[0031] It can advantageously be provided that the drive roller 33 is arranged above the at least one storage container 11. This ensures the compact arrangement of the drive roller 33 and reliable conveying of the recording medium 2 in the duplex path 5.

[0032] In addition to the method figures 1 to 5 also show the device 1 for double-sided printing of recording media 2, preferably sheets, comprising the printing unit 13 for one-sided printing, at least the duplex path 5 being provided for bringing the recording medium 2 from at least the reversing device 51 to the printing unit 13 for printing the second side, and the receiving roller 12 for receiving the recording medium 2 from a storage container being provided, in which method it is proposed that the receiving roller 12 is arranged along the duplex path 5, and that the drive roller 33 connected upstream of the receiving roller 12 in the duplex path 5 comprises a freewheel.

[0033] Consequently a device, in particular an existing device, for one-sided printing can be converted by way of simple adaptation measures, in particular by simple constructional conversion measures, into the device 1 for double-sided printing, wherein a printing path 3, an output path 4, a storage container 11 and the - in particular at least one - receiving roller 12 can be constructed so as to be identical to the device for one-sided printing, whereby the production and development costs are low.

[0034] This allows subsequent retrofitting of the device for one-sided printing and the formation of conversion kits, whereby the existing device for one-sided printing can be subsequently retrofitted. As a result paper consumption can be reduced in the home and office by means of the existing devices, it being possible to lower recording media consumption and costs and to conserve the environment.

[0035] In this connection it may in a particularly advantageous development of the invention be provided that the spacing between the drive roller 33 and the receiving roller 12 is less than the length - viewed in the direction of movement of the recording medium - of the receiving region 18 of the storage container 11, the size of the receiving region 18 of the storage container 11 corresponding in particular to the area or size of the recording means 2 that is to be received. Compact arrangement of the drive roller 33 and reliable conveying of the recording medium 2 in the duplex path 5 is thereby ensured, it being possible to ensure a particularly gentle transition of the

recording media 2 from the duplex path 5 to the printing path 3 by means of the freewheel of the recording media 2 and to reduce the error rate and to print even sensitive recording media 2 on both sides.

[0036] Fig. 1 schematically shows in profile a device 1 for double-side printing of recording media 2 of a particularly preferred embodiment. The device 1 of recording media 2, the printing path 3, the output path 4, the duplex path 5, the output device 41, the reversing device 51, the output device 41 and the reversing device 51 being identical in the preferred embodiment, the direction of movement 9, the storage container 11, the receiving roller 12, the printing unit 13, the fixing unit 14, printing path rollers 15, control sensors 16, control rollers 31, output rollers 32, return pulleys 42, the output rollers 32 and the return pulleys 42 being identical in the preferred embodiment, and drive rollers 33 are shown. The printing path 3, the output path 4 and the duplex path 5 guide the recording medium 2 through the device 1, these paths forming the path of movement for the recording medium 2.

[0037] Alternatively a reversing path specially provided for this purpose and comprising return pulleys 42 may be formed. The time for turning over the recording media 2 can be particularly short as a result.

[0038] Using Fig. 1 the complete procedure of double-sided printing of one of the recording media 2 will be described, wherein further recording media 2 that are moved at the same time will not be considered. This procedure corresponds to a double-sided print job, the print job substantially constituting a command to continuously print a predetermined number of pages of a recording medium 2.

[0039] The recording medium 2, which at the start of the print job is situated in particular in the storage container 11, is first of all captured by the receiving mechanism, in particular the receiving roller 12, and conveyed into the printing path 3. The recording medium 2 is printed on the first side in the printing path 3.

[0040] A plurality of storage containers 11 that are different from each other, in particular for recording media 2 of different sizes, areas and/or thicknesses and different orientation of the recording media 2, and/or at least one feeding chute for manually feeding the recording media 2, can advantageously also be provided, it being possible to form a plurality of feed rollers 12, in particular ones which are arranged spatially separate from each other, in the device 1.

[0041] The recording medium 2 is thereafter conveyed in its direction of movement 9 in the direction of a point of intersection 6 and furthermore into the output path 4. In this advantageous development of the invention the point of intersection 6 is the region at which printing path 3, output path 4 and duplex path 5 meet and/or cross in certain sections. In the output path 4 in the direction of an output opening (not shown) the recording medium 2 is conveyed by means of the output rollers 32 of the output device 41. As soon as a trailing edge of the recording medium 2 has passed the point of intersection 6 the direction of movement 9 of the recording medium 2 is reversed, whereby the recording medium 2 is guided in the direction of the duplex path 5. The recording medium 2 is conveyed in the output path 4 in the direction of the duplex path 5 by means of duplex rollers 42 of a reversing device 51. Output rollers 32 and duplex rollers 42 can be constructed particularly advantageously as universal rollers 52. The direction of movement 9 of the recording medium 2 also is being reversed when the direction of rotation of the universal rollers 52 is reversed. This allows reliable and exact conveying, in particular guidance, of the recording medium 2 and only a small number of moving parts in or on the device 1, whereby production and maintenance are inexpensive.

[0042] The point of intersection 6 is advantageously formed in such a way that a recording means 2 conveyed in the direction of the printing unit 13, in particular in the direction of the duplex path 5, is reliably guided in the duplex path 5, it being possible to advantageously construct the component forming the point of intersection 6 in one piece, whereby the device, in particular the printer, is compact and inexpensive and an existing model of a device for one-sided printing can be expanded by the duplex path 5 using simple and inexpensive measures.

[0043] In the duplex path 5 the recording medium 2 is conveyed by means of the drive rollers 33 further in the direction of the receiving rollers 12, it being possible to convey the recording medium 2 in the storage container 11 at least in certain sections. In an embodiment not covered by the claims, the duplex path 5 could be constructed in the device 1 outside the region of the at least one storage container 11.

[0044] Renewed take-up of the recording medium 2 is subsequently carried out by means of a predetermined control signal by the receiving rollers 12 or an alternative receiving mechanism. The recording medium 2 is again conveyed into the printing path 3, the second side of the recording medium 2 being printed. Immediately thereafter the recording medium 2 is again conveyed into the output path 4, the recording medium 2 being conveyed in the printing path 3 by means of the printing path rollers 15 and the control rollers 31 and the recording medium 2 again being guided through the point of intersection 6.

[0045] The recording medium 2 is conveyed in the output path 4 by means of the output rollers 32. Since the recording medium 2 has already been printed on both sides at this point in time it is ejected through the output opening (not shown) and conveyed into an output tray (not shown), wherein the recording medium 2 in the output tray is ready for removal.

[0046] Figures 2 to 8 schematically show in profile the device 1 according to Fig. 1 and a plurality of recording media 2, which are different from each other and are moved at the same time, during different steps, the progression of the method being shown continuously. The plurality of recording media 2 is shown in dot-dash lines. Different recording media 2 with the same area/size and thickness and different area/size and/or thickness can

be printed simultaneously, in particular in one print job. Figures 2 to 8 illustrate different steps of the method thereto, the choice of steps, in particular the number of chosen steps, being used merely for the purpose of illustration; a different division of method steps, i.e. division into individual steps, may also be chosen.

[0047] Fig. 2 schematically shows in profile the device 1 of Fig. 1 and three recording media 2 which are different form each other: a zeroth recording medium 21, a first recording medium 22 and a second recording medium 23, during a first step. The zeroth recording medium 21 is situated in this case, i.e. during this step, in the printing path 3 and is printed on the second side in the process. The first recording medium 22 and the second recording medium 23 are situated in the storage container 11 and are not involved in the procedure during the first step.

[0048] Fig. 3 schematically shows in profile the device 1 of Fig. 1 and the zeroth recording medium 21, the first recording medium 22 and the second recording medium 23 during a second step which immediately follows the first step. In this case, i.e. during the second step, the zeroth recording medium 21 is situated in the output path 4 and as it has already been printed on both sides, is output through the output opening. The first recording medium 22 is printed on the first side, i.e. is printed on one side during this step. The second recording medium 23 is situated in the storage container and is not involved in the procedure during the second step. The zeroth recording medium 21 and the first recording medium 22 are successively arranged in the path of movement so as to be spaced apart with a only a slight spacing, in particular less than the length of the zeroth recording medium 21.

[0049] Fig. 4 schematically shows in profile the device of Fig. 1 and the zeroth recording medium 21, the first recording medium 22 and the second recording medium 23 during a third step which follows the second step. The zeroth recording medium 21 is already situated fully in an output tray (not shown). The first recording medium 22 is situated in the output path 4 just before, after or at the time the direction of rotation of the output rollers 32 is reversed. After reversing the direction of rotation of the output rollers 32 and the corresponding reversal of the direction of movement 9 of the first recording medium 22 the first recording medium 22 is moved in the direction of the duplex path 5. In this case, i.e. during the third step, the second recording medium 23 is in contact with the receiving roller 12, a predeterminable control signal controlling the intake and guidance of the second recording medium 23 in the printing path 3 and a pause, in particular a printing pause, being formed between printing of the first recording medium 22 and the second recording medium 23. The first recording medium 22 and the second recording medium 23 are successively arranged in the path of movement so as to be spaced apart by more than the length of the first recording medium 22.

[0050] Fig. 5 schematically shows in profile the device of Fig. 1 and the zeroth recording medium 21, the first recording medium 22 and the second recording medium 23 during a fourth step which follows the third step. The zeroth recording medium 21 is situated fully in the output tray. The first recording medium 22 is situated in the duplex path 5 during this step. The second recording medium 23 is situated in the printing path 3 and is printed on the first side.

[0051] Fig. 6 schematically shows in profile the device of Fig. 1 and the zeroth recording medium 21, the first recording medium 22 and the second recording medium 23 during a fifth step which follows the fourth step. The zeroth recording medium 21 is situated fully in the output tray. The first recording medium 22 is still in the duplex path 5, the conveying speed of the second recording medium 23 being reduced and/or conveying being paused for a predetermined unit of time and a pause, in particular a printing pause, is thus formed. The second recording medium 23 is situated in the output path 4 just before, after or at the time the direction of rotation of the output rollers 32 is reversed from the direction of rotation for moving the second recording medium 23 in the direction of the ejection opening to the direction of rotation for moving the second recording medium 23 in the direction of the duplex path 5. By reversing the direction of rotation of the output rollers 32 the corresponding direction of movement 9 of the second recording medium 23 is reversed. In the process the second recording medium 23 and the first recording medium 22 can approach each other in the path of movement. In particular at the end of this step the first recording medium 22 and the second recording medium 23 are successively arranged in the path of movement, in particular both are in the duplex path 5 at least in certain sections, so as to be successively spaced apart at a slight spacing, in particular less than the length of the second recording medium.

[0052] Fig. 7 schematically shows in profile the device of Fig. 1 and the zeroth recording medium 21, the first recording medium 22 and the second recording medium 23 during a sixth step which follows the fifth step. The zeroth recording medium 21 is brought fully into the output tray. The first recording medium 22 is situated in the printing path 3 and is printed for a second time and on the second side. After printing the second side of the first recording medium 22 the first recording medium 22 is conveyed in the direction of the point of intersection 6. The second recording medium 23 is situated in the duplex path 5 and is already in contact with the receiving roller, the first recording medium 22 and the second recording medium 23 being successively arranged in the path of movement so as to be spaced apart at a slight spacing, in particular less than the length of the first recording medium 22.

[0053] Fig. 8 schematically shows in profile the device 1 of Fig. 1 and the zeroth recording medium 21, the first recording medium 22 and the second recording medium 23 during a seventh step which follows the sixth step. The zeroth recording medium 21 is brought fully into the output tray. The first recording medium 22 is situated in

the output path 4 and - since it is printed on both sides - is output through the output opening into the output tray. The second recording medium 23 is situated in the printing path 3 and is printed on the second side during the seventh step. The first recording medium 22 and the second recording medium 23 are successively arranged in the path of movement so as to be spaced apart at a slight spacing, in particular less than the length of the first recording medium 22.

[0054] In a further step (not shown) subsequent to printing of the second side of the second recording medium 23, whereby the second recording medium 23 is printed completely and on two sides, the second recording medium 23 is conveyed in the direction of the point of intersection 6, further in the direction of the output path 4 and through the output opening into the output tray, the direction of rotation of the output rollers 32 and the direction of movement 9 of the second recording medium 23 in the output path 4 not being reversed accordingly.

[0055] The above-described method is not restricted to just three recording media 2, rather it may be understood as a continuous method, wherein between printing of the first side of one of the recording media 2 and the second side of the same recording medium 2 at least one side of a further recording medium 2 is printed on a recurring basis.

[0056] The drive roller 33 is constructed with a freewheel. As soon as the recording medium 2 is moved more quickly in the path of movement than it would be moved by the drive roller 33, in particular as a result some other force effect, the drive roller 33 freewheels. As a result the recording medium 2 can simultaneously be conveyed by the drive roller 33 and the receiving roller 12 or a further receiving roller constructed in addition to the receiving roller 12. The freewheel thus ensures that even with a different drive speed of receiving roller 12 and drive roller 33, the recording medium 2 is conveyed over the entire surface of the recording medium 2 at a constant speed and thus no stresses or deformations occur in the recording medium 2 along the surface, in particular along the length in the direction of movement 9.

[0057] Conveying of the recording medium 2 in the duplex path 5 is thus particularly gentle, it being possible to reliably convey even sensitive recording media 2.

[0058] Different sizes, thicknesses and/or material types of recording media 2 can be particularly advantageously conveyed in the duplex path 5 which in particular comprises the drive roller 33 with the freewheel. Recording media 2 which differ from each other in particular in terms of area can be printed during one of the print jobs or in successive print jobs. High flexibility of the device 1 when choosing the recording media 2 is thus ensured, it being possible to print especially different recording media 2 with area ratios to each other of 1 to 4, in particular of 1 to 3, and/or length ratios of 1 to 2, in particular 1 to 1.5 in one print job and/or in successive print jobs.

[0059] The recording media 2 of different size, in particular area, can in the process be arranged in different storage containers 11, wherein in particular one of the sizes is arranged in one of the storage containers 11 respectively.

[0060] The spacing in the path of movement of two recording media 2 - a first recording medium 22 and a second recording medium 23 - which, in particular, can be constructed with different lengths in the direction of movement 9, can advantageously be guided by the length of the first of the two recording media, i.e. the first recording medium 22. It may particularly advantageously be provided in this connection that immediately after first printing of the first recording medium 22, i.e. on the first side of the first recording medium 22, the spacing between the first recording medium 22 and the second recording medium 23 in the path of movement is greater than the length of the first recording medium 22 in the direction of movement 9, and that immediately after second printing of the first recording medium 22, i.e. on the second side of the first recording medium 22, the spacing between the first recording medium 22 and the second recording medium 23 in the path of movement is less than the length of the first recording medium 22 in the direction of movement 9. The printing unit 13 is thus used particularly efficiently time-wise, the first recording medium 22 being given sufficient time to be conveyed fully into the output path 4 and from there back into the duplex path 5 without there being a risk of the first recording medium 22 and the second recording medium 23 coming into contact with other at the point of intersection or being conveyed into each other during double-sided printing. A low error rate and high reliability and print speed are thus ensured.

[0061] If the speed of movement of the recording medium 2 in the individual sections of the path of movement, i.e. in the printing path 3, the output path 4 and the duplex path 5, is different, in particular are in predetermined ratios to each other, these ratios can advantageously be considered when determining the spacing of the recording media 2 from each other in the path of movement. In particular the method of double-sided printing can be accelerated by the partially quicker conveying of the recording medium 2, i.e. the movement which is faster in parts than in adjoining regions of the path, in particular of the printing path, , and printing-free time units, i.e. the time units without printing activity of the printing unit 13, are reduced. High utilisation and high time efficiency of the device 1 can thus be ensured.

[0062] The storage container 11 can advantageously be constructed so as to be changeable in size to receive recording media 2 of different sizes. A plurality of storage containers 11 that are changeable in size and/or storage containers 11 of different size can likewise be constructed in or on the device 1. The recording media 2 can equally be supplied by means of one or more manual feed tray (s).

[0063] 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 resorted, so the recording media 2 of a print job, printed on both sides, are output into the output tray with constantly increasing, sorting page numbers.

[0064] With double-sided printing of at least one of the recording media 2 it can particularly advantageously be provided that the higher of the two page numbers to be printed on a recording medium 2 is printed on the first side of the recording medium 2, i.e. before turning the recording medium 2 over, wherein it is in particular provided that the sequence of page numbers to be printed is basically increasing, i.e. each recording medium 2 following one of the recording media 2 is printed with higher page numbers than the recording medium 2. It may thus be ensured that with double-sided printing of recording media 2 the document, after being output into the output tray, is output with constantly increasing page numbers and in the correct sort order.

[0065] 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 2 is printed on the first side of the recording medium 2, i.e. before the recording medium 2 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 2 following one of the recording media 2 being printed with lower page numbers than the recording medium 2. It may thus be ensured for the reversed print sequence as well that with double-sided printing of recording media 2, the document, after being output into the output tray, is output with constantly increasing page numbers and in the correct sort order.

[0066] 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 2 printed first is guided in the duplex path 5 and again in the printing path 3 and in the process is turned over, the recording medium 2 being guided through the printing path 3 print-free, onwards into the output path 4 and 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 2 the document is output in the correct sort order.

[0067] A print image is produced on the page when printing a page of a recording medium 2. To compensate for the rotation of the recording medium 2 when the page is turned over, the print image of the second side of the recording medium 2 is advantageously rotated by 180° in comparison with the print image of the first side of the same recording medium 2. It can thus be ensured that after the recording medium 2 printed on both sides has been output, top and bottom on the first page and on the second page are arranged in the same region of the recording medium 2 and thus the recording medium 2 has only to be turned as usual for regarding, especially for reading, the first page and the second page.

Claims

1. Method for double-sided printing of recording media (2), preferably sheets, comprising a printing unit (13) for one-sided printing, a recording medium (2), after printing of a first side, again being fed via a duplex path (5) to the printing unit (13) for printing of a second side,
, whereby between printing the first side of one of the recording media (2) and the second side of the same recording medium (2) at least one side of a further recording medium (2) is printed, **characterised in that** the recording media (2), before printing of the first side, are received by means of a receiving roller (12) from a storage container (11) and **in that** the leading edge - viewed in the direction of movement (9) of the recording medium (2) - of the recording medium (2) in the duplex path (5) gets arranged in the storage container (11).

2. Method according to claim 1, **characterised in that** after printing the first side of a first recording medium (2, 22) and printing the second side of the same recording medium (2, 22) exactly one side of the preceding or following recording medium (2) is printed.

3. Method according to claim 1 or 2, **characterised in that** a respective group of two recording media (2) is printed on both sides, first of all the first side of the first recording medium (2, 22) of the group being printed, after a first printing pause the first side of the second recording medium (2, 23) of the group being printed, subsequently after a second printing pause the second side of the first recording medium (2, 22) being printed and finally the second side of the second recording medium (2, 23) being printed.

4. Method according to claim 3, **characterised in that** during the first printing pause and/or printing of the first side of the second recording medium (2, 23) the first recording medium (2, 22) is conveyed via the duplex path (5), and **in that** during the second printing pause and/or printing of the second side of the first recording medium (2, 22) the second recording medium (2, 23) is conveyed via the duplex path (5).

5. Method according to any one of claims 1 to 4, **characterised in that** the recording medium (2) in the duplex path (5) is conveyed at least in certain sections by means of a drive roller (33) constructed with a freewheel and connected upstream of the receiving

roller (12).

6. Method according to claim 5, **characterised in that** the drive roller (33) is arranged above the storage container (11),

7. Device for double-sided printing of recording media (2), preferably sheets, comprising a printing unit (13) for one-sided printing, at least one duplex path (5) being provided for bringing the recording medium (2) from at least one reversing device (51) to the printing unit (13) for printing the second side, a receiving roller (12) for receiving the recording medium (2) from a storage container (11) for storing recording media (2) before being printed on a first side, wherein the receiving roller (12) is arranged along the duplex path (5), and a drive roller (33) connected upstream of the receiving roller (12) in the duplex path (5) **characterised in that** the drive roller (33) allows the conveyance of a recording medium (2) in the duplex path (5) in the direction to the receiving roller (12) in such a manner that the leading edge - viewed in the direction of movement (9) of the recording medium (2) - of the recording medium (2) in the duplex path (5) gets arranged in the storage container (11) and **in that** the drive roller (33) is constructed with a freewheel that ensures that after the recording medium (2) has been captured by the receiving roller (12) and/or with the start of conveying of the recording medium (2) by the receiving roller (12), conveyance of the recording medium (2) is neither blocked nor hindered by the drive roller (33).

8. Device according to claim 7, **characterised in that** the spacing between the drive roller (33) and the receiving roller (12) is less than the length - viewed in the direction of movement (9) of the recording medium (2) - of the receiving region of the storage container (11).

Patentansprüche

1. Verfahren zum doppelseitigen Bedrucken von Aufzeichnungsmedien (2), vorzugsweise Bögen, umfassend eine Druckeinheit (13) zum einseitigen Drucken, ein Aufzeichnungsmedium (2), das nach Bedrucken einer ersten Seite über eine Duplexbahn (5) erneut der Druckeinheit (13) zugeführt wird, um eine zweite Seite zu bedrucken, wobei zwischen dem Bedrucken der ersten Seite eines der Aufzeichnungsmedien (2) und der zweiten Seite desselben Aufzeichnungsmediums (2) mindestens eine Seite eines weiteren Aufzeichnungsmediums (2) bedruckt wird,
dadurch gekennzeichnet, dass die Aufzeichnungsmedien (2) vor dem Bedrucken der ersten Seite über eine Aufnahmewalze (12) aus einem Lagerbehälter (11) aufgenommen werden und dass die - in der Bewegungsrichtung (9) des Aufzeichnungsmediums (2) gesehen - vordere Kante des Aufzeichnungsmediums (2) in der Duplexbahn (5) im Lagerbehälter (11) angeordnet wird.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** nach dem Bedrucken der ersten Seite eines ersten Aufzeichnungsmediums (2, 22) und dem Bedrucken der zweiten Seite desselben Aufzeichnungsmediums (2, 22) genau eine Seite des vorhergehenden oder nachfolgenden Aufzeichnungsmediums (2) bedruckt wird.

3. Verfahren nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** jeweils eine Gruppe von zwei Aufzeichnungsmedien (2) auf beiden Seiten bedruckt wird, wobei zunächst die erste Seite des ersten Aufzeichnungsmediums (2, 22) der Gruppe, nach einer ersten Druckpause dann die erste Seite des zweiten Aufzeichnungsmediums (2, 23) der Gruppe, anschließend nach einer zweiten Druckpause die zweite Seite des ersten Aufzeichnungsmediums (2, 22) und schließlich die zweite Seite des zweiten Aufzeichnungsmediums (2, 23) bedruckt wird.

4. Verfahren nach Anspruch 3, **dadurch gekennzeichnet, dass** während der ersten Druckpause und/oder während des Bedruckens der ersten Seite des zweiten Aufzeichnungsmediums (2, 23) das erste Aufzeichnungsmedium (2, 22) über die Duplexbahn (5) gefördert wird und dass während der zweiten Druckpause und/oder während des Bedruckens der zweiten Seite des ersten Aufzeichnungsmediums (2, 22) das zweite Aufzeichnungsmedium (2, 23) über die Duplexbahn (5) gefördert wird.

5. Verfahren nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** das Aufzeichnungsmedium (2) in der Duplexbahn (5) zumindest abschnittsweise über eine Antriebswalze (33) gefördert wird, die mit einem Freilaufrad konstruiert und stromaufwärts der Aufnahmewalze (12) angeschlossen ist.

6. Verfahren nach Anspruch 5, **dadurch gekennzeichnet, dass** die Antriebswalze (33) oberhalb des Lagerbehälters (11) angeordnet ist.

7. Vorrichtung zum doppelseitigen Bedrucken von Aufzeichnungsmedien (2), vorzugsweise Bögen, umfassend eine Druckeinheit (13) zum einseitigen Drucken, wobei mindestens eine Duplexbahn (5) vorgesehen ist, um das Aufzeichnungsmedium (2) von mindestens einer Wendevorrichtung (51) der Druckeinheit (13) zum Bedrucken der zweiten Seite zuzuführen, eine Aufnahmewalze (12) zum Aufneh-

men des Aufzeichnungsmediums (2) aus einem Lagerbehälter (11) zum Lagern von Aufzeichnungsmedien (2) vor dem Bedrucken einer ersten Seite, wobei die Aufnahmewalze (12) entlang der Duplexbahn (5) angeordnet ist, und eine Antriebswalze (33), die stromaufwärts der Aufnahmewalze (12) in der Duplexbahn (5) angeschlossen ist, **dadurch gekennzeichnet, dass** die Antriebswalze (33) das Fördern eines Aufzeichnungsmediums (2) in der Duplexbahn (5) in Richtung zur Aufnahmewalze (12) hin in einer solchen Weise ermöglicht, dass die - in der Bewegungsrichtung (9) des Aufzeichnungsmediums (2) gesehen - vordere Kante des Aufzeichnungsmediums (2) in der Duplexbahn (5) im Lagerbehälter (11) angeordnet wird, und dass die Antriebswalze (33) mit einem Freilaufrad konstruiert ist, das sicherstellt, dass nach dem Ergreifen des Aufzeichnungsmediums (2) durch die Aufnahmewalze (12) und/oder mit dem Beginn des Förderns des Aufzeichnungsmediums (2) durch die Aufnahmewalze (12) das Fördern des Aufzeichnungsmediums (2) durch die Antriebswalze (33) weder blockiert noch behindert wird.

8. Vorrichtung nach Anspruch 7, **dadurch gekennzeichnet, dass** der Abstand zwischen der Antriebswalze (33) und der Aufnahmewalze (12) kleiner als die Länge - in der Bewegungsrichtung (9) des Aufzeichnungsmediums (2) gesehen - des Aufnahmebereichs des Lagerbehälters (11) ist.

Revendications

1. Une méthode d'impression recto verso de supports d'enregistrement (2), de préférence des pages, comprenant une unité d'impression (13) pour une impression sur une face, un support d'enregistrement (2), après impression d'une première face, étant à nouveau alimenté via un chemin recto verso (5) vers unité d'impression (13) pour l'impression d'une deuxième face, où entre l'impression de la première face de l'un des supports d'enregistrement (2) et la deuxième face du même support d'enregistrement (2) au moins une face d'un autre support d'enregistrement (2) est imprimée, **caractérisée en ce que** les supports d'enregistrement (2), avant l'impression de la première face, sont reçus au moyen d'un rouleau de réception (12) à partir d'un container de stockage (11) et **en ce que** le bord principal - visualisé dans le sens du mouvement (9) du support d'enregistrement (2) - du support d'enregistrement (2) dans le chemin recto verso (5) est disposé dans le container de stockage (11).

2. Une méthode selon la revendication 1, **caractérisée en ce que** après l'impression de la première face d'un premier support d'enregistrement (2, 22) et l'impression de la deuxième face du même support d'enregistrement (2, 22) exactement une face du support d'enregistrement précédent ou suivant (2) est imprimée.

3. Une méthode selon la revendication 1 ou 2, **caractérisée en ce qu'**un groupe respectif de deux supports d'enregistrement (2) est imprimé sur les deux faces, d'abord la première face du premier support d'enregistrement (2, 22) du groupe étant imprimée, après une première pause d'impression la première face du deuxième support d'enregistrement (2, 23) du groupe étant imprimée, ensuite, après une deuxième pause d'impression, la deuxième face du premier support d'enregistrement (2, 22) étant imprimée et enfin, la deuxième face du deuxième support d'enregistrement (2, 23) étant imprimée.

4. Une méthode selon la revendication 3, **caractérisée en ce que**, pendant la première pause d'impression et/ou l'impression de la première face du deuxième support d'enregistrement (2, 23) le premier support d'enregistrement (2, 22) est transporté via le chemin recto verso (5), et **en ce que** pendant la deuxième pause d'impression et/ou l'impression de la deuxième face du premier support d'enregistrement (2, 22) le deuxième support d'enregistrement (2, 23) est transporté via le chemin recto verso (5).

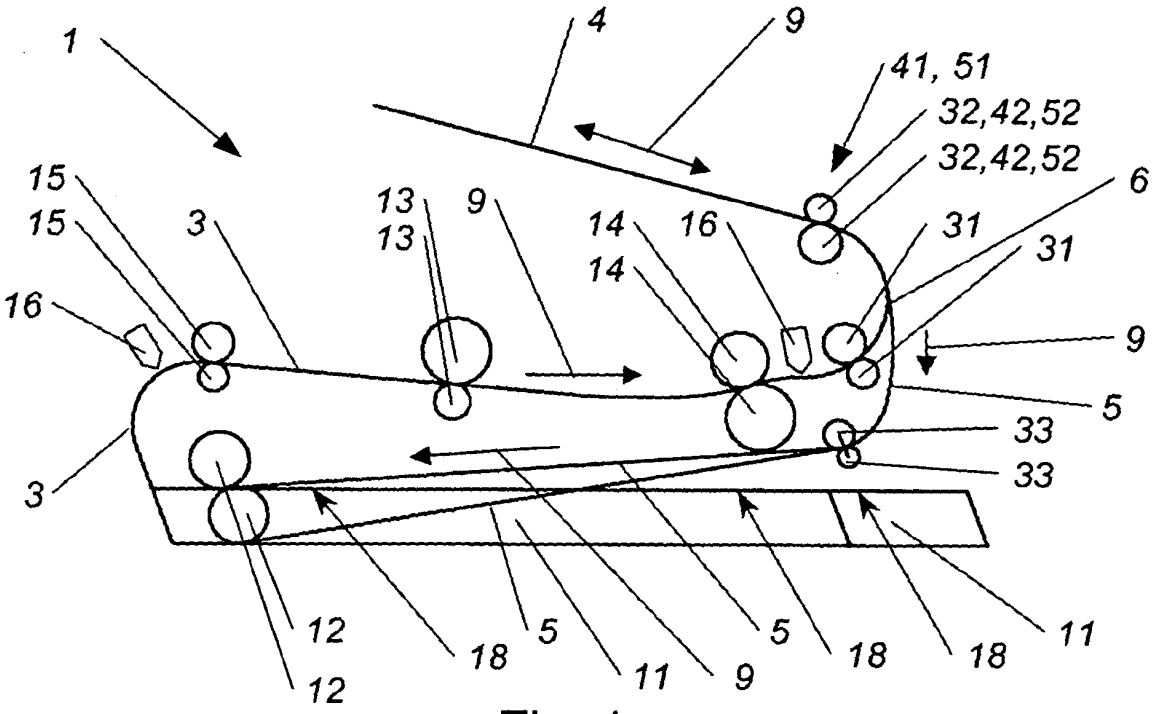
5. Une méthode selon l'une des revendications 1 à 4, **caractérisée en ce que** le moyen d'enregistrement (2) dans le chemin recto verso (5) est transporté au moins dans certaines sections au moyen d'un rouleau d'entraînement (33) construit avec une roue libre et connecté en amont du rouleau de réception (12).

6. Une méthode selon la revendication 5, **caractérisée en ce que** le rouleau d'entraînement (33) est disposé au-dessus du container de stockage (11).

7. Dispositif pour une impression recto verso de supports d'enregistrement (2), de préférence des pages, comprenant une unité d'impression (13) pour une impression sur une face, au moins un chemin recto verso (5) étant fourni pour apporter le support d'enregistrement (2) à partir d'au moins un dispositif inverseur (51) vers l'unité d'impression (13) pour l'impression de la deuxième face, un rouleau de réception (12) pour recevoir le support d'enregistrement (2) à partir d'un container de stockage (11) pour stocker des supports d'enregistrement (2) avant d'être imprimés sur une première face, où le rouleau de réception (12) est disposé le long du chemin recto verso (5), et un rouleau d'entraînement (33) connecté en amont du rouleau de réception (12) dans le chemin recto verso (5), **caractérisé en ce que** le rouleau d'entraînement (33) permet le transport d'un support d'enregistrement (2) dans le chemin recto

verso (5) dans le sens du rouleau de réception (12), de sorte que le bord principal - visualisé dans le sens du mouvement (9) du support d'enregistrement (2) - du support d'enregistrement (2) dans le chemin recto verso (5) soit disposé dans le container de stockage (11), et **en ce que** le rouleau d'entraînement (33) est construit avec une roue libre qui garantit qu'une fois que le support d'enregistrement (2) a été saisi par le rouleau de réception (12) et/ou avec le début du transport du moyen d'enregistrement (2) par le rouleau de réception (12), le transport du support d'enregistrement (2) n'est ni bloqué, ni gêné par le rouleau d'entraînement (33).

8. Dispositif selon la revendication 7, **caractérisé en ce que** l'espace entre le rouleau d'entraînement (33) et le rouleau de réception (12) est inférieur à la longueur-visualisée dans le sens du mouvement (9) du support d'enregistrement (2) - de la région de réception du container de stockage (11).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6
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13
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14
14
16
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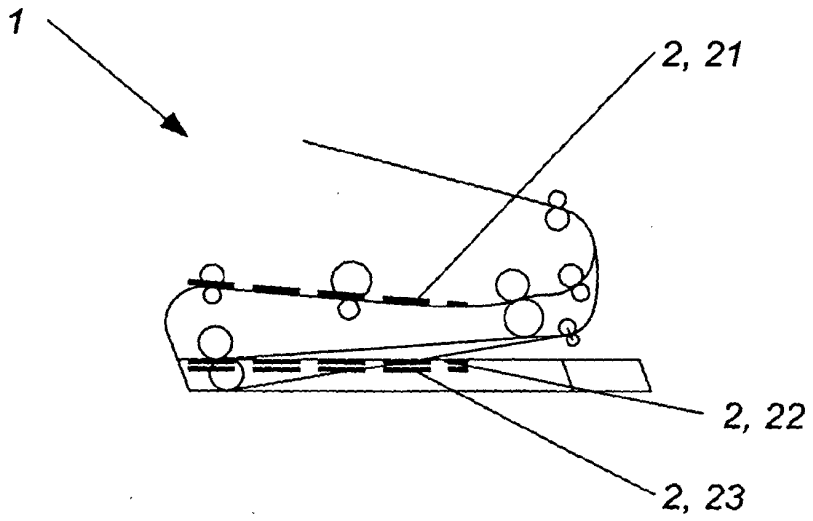
12
12
18
5
11
9
5
18
18
11

Fig. 1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2, 22
2, 23

Fig. 2

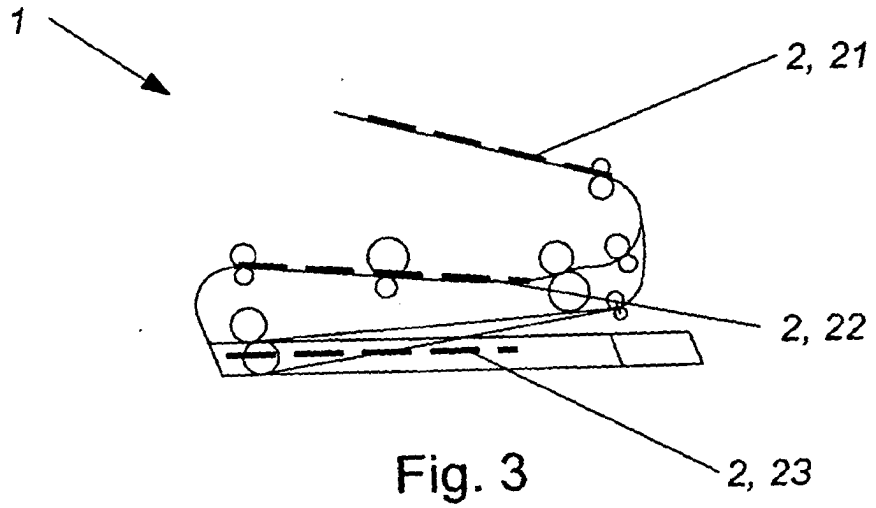

Fig. 3

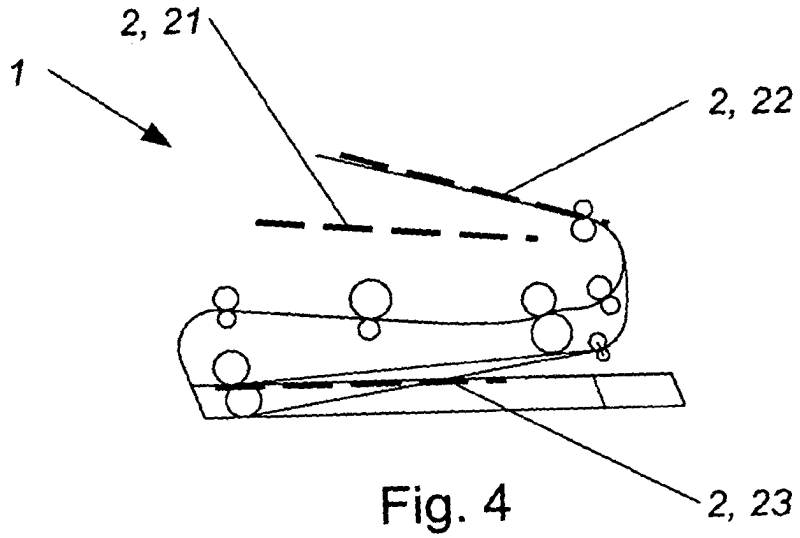

Fig. 4

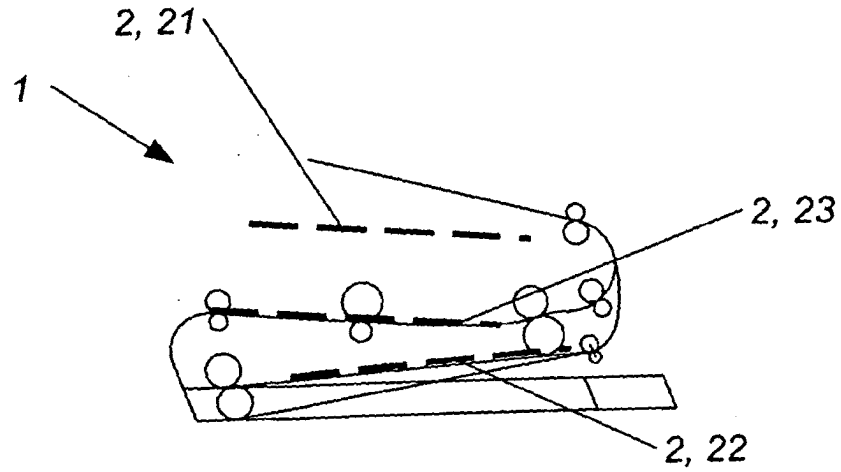

Fig. 5

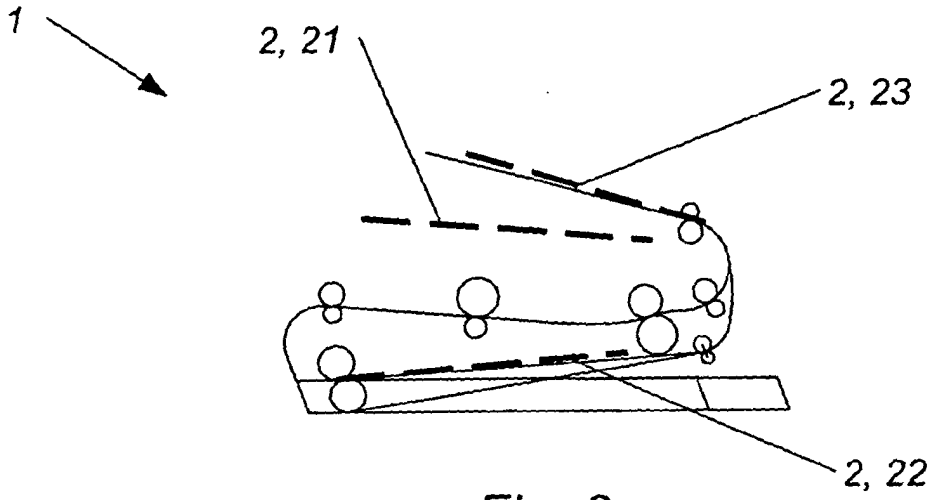

Fig. 6

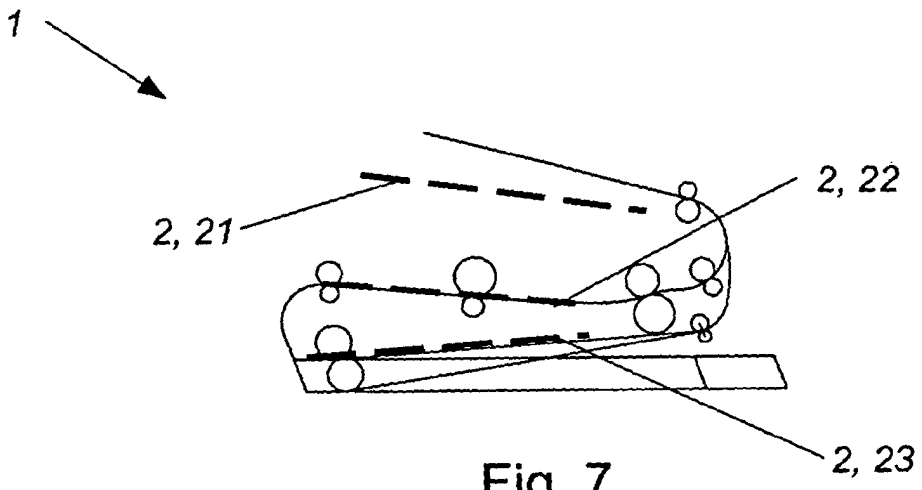

Fig. 7

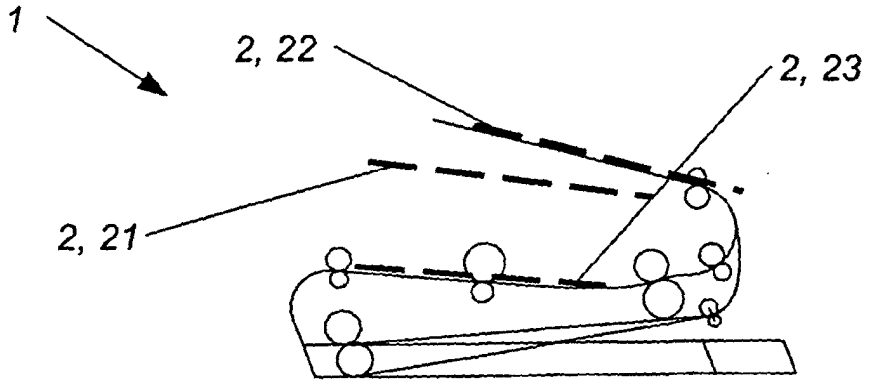

Fig. 8

REFERENCES CITED IN THE DESCRIPTION

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