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(54) METHOD FOR DETERMINING PRINTED IMAGES

(57) This comprises performing a movement of the transverse and/or longitudinal register of printing rollers (R_1, R_2, R_3, R_4, R_5), or withdrawing same from printing status, printing marks, detecting them, comparing the detected positions with at least one positional reference, and performing at least one subsequent operation. A first aspect comprises using marks that, if printed, would appear superposed, using an area of the material (2) as positional reference, and performing, as subsequent operation, an operation of associating marks with respect to printing rollers and/or register adjustment and/or pressure adjustment. A second aspect comprises performing preliminary printing and detection of the marks before said register movements, using the pre-detected positions as positional references, and performing, as subsequent operation, an operation of determining marks with respect to printing groups.

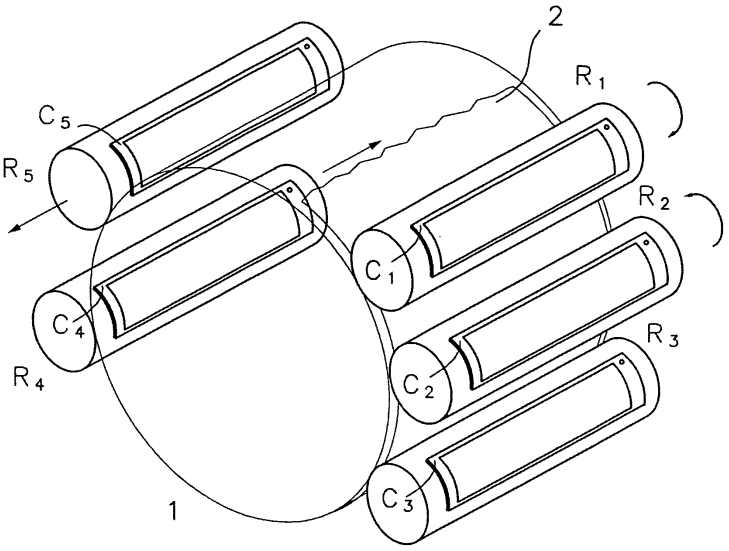

Fig. 1a

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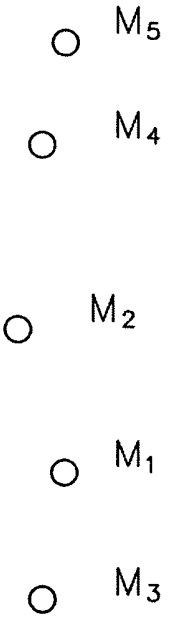

Fig. 1b

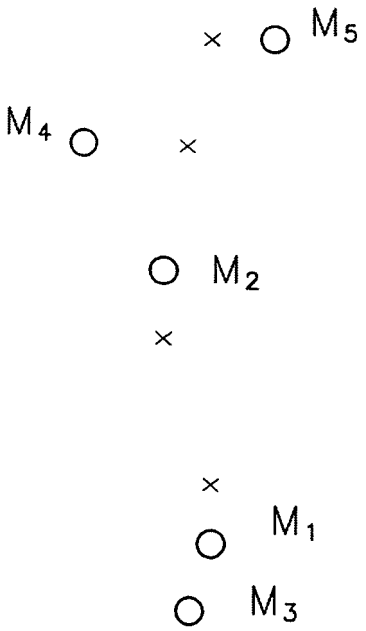

Fig. 1c

Description

Field of the Art

[0001] The present invention generally relates to a method of determining printed images, particularly applicable to a printer with printing groups each carrying a printing roller with a respective characteristic image to be printed on a material, but the determination or discernment of which is not initially possible, either because its belonging to a certain roller is in principle unknown or because some of the characteristic images would appear partly or completely superposed in the event of performing a first printing.

Prior State of the Art

[0002] Different types of printers, such as flexographic printers comprising a series of printing groups, with printing rollers, with characteristic images or marks to be printed incorporated in the rollers either directly, for example by intaglio printing, or by means of corresponding printing plates or engraved jacket in the case of flexography.

[0003] Said printing machines can incorporate automatic systems for adjusting the register of the printing or of the transfer of the ink through inspection of the characteristic images or marks printed on a material.

[0004] In such machines it is common to exchange the rollers or the printing plates for others when a new pattern is to be printed, therefore before adjusting them in relation to either the register or the pressure, and due to the fact that each new roller, jacket or printing plate mounted carries a new mark, it is necessary to assign each mark to a printing group.

[0005] In the event that the order of the marks with respect to the printing groups is pre-established by the work order, any change in this pre-established order must be reassigned manually.

[0006] If there is not pre-established order, an operator must check it visually, directly inspecting the rollers, printing plates or the already printed material, which delays performing the register and pressure adjustment operations necessary to begin printing the new pattern since in order to start it is necessary to wait until the operator finishes the visual inspection and enters the corresponding data in the automatic system responsible for performing said operations, or otherwise performing them manually.

[0007] The method proposed by the present invention is applicable for the mentioned case that the order of the marks is not always fixed with respect to the order of the printing groups.

[0008] In addition, there is a type of characteristic images or marks (generally as auxiliary images or marks for mounting or pre-mounting tasks) in the printing plates or printing jackets which, when they are printed on a laminar material, appear partially superposed, making it impossible to perform subsequent operations using said marks, such as the automatic register adjustment or pressure adjustment, as well as the mentioned determination of to which printing roller each mark belongs.

[0009] Proposals aimed at using said marks, which in the case of being printed appear superposed, for performing one or more of the operations mentioned in the previous paragraph are not known.

[0010] In either of the two mentioned cases, both the case referring to the fact that the order of the marks is not always fixed with respect to the order of the printing groups, and the case referring to the superposing of the marks used in the case of being printed, it is not possible to perform an initial determination or discernment of the marks, either because in principle it is unknown to which it belongs or because some of the characteristic images appear partly or completely superposed.

Explanation of the Invention

[0011] It seems necessary to offer an alternative to the state of the art which covers the gaps found therein by means of providing a method the application of which allows performing a determination of printed images, or marks, for the for the two mentioned cases, i.e., both when the order of the marks is not always fixed with respect to the order of the printing groups, and when some or all of the marks appear superposed, making the determination or discernment thereof impossible.

[0012] Such objective is achieved with the present invention by means of providing a method the application of which allows clearly determining the different printed marks to perform subsequent operations, as well as determining which mark corresponds to each printing group, without needing to visually inspect the roller, jacket, printing plate or printed material, thus reducing the wait time prior to starting the register and pressure adjustment operations necessary to begin printing compared to conventional visual inspection methods described in the previous section.

[0013] To that end, the present invention relates to a method of determining printed images, of the type comprising the use of a printer with at least one first and one second printing groups including respective first and second printing rollers, generally with one and the same printing development, each of said printing rollers with at least one respective characteristic image to be printed on a material.

[0014] According to a first aspect, the proposed method comprises using as characteristic images several images, at least some of which, if printed, would appear partially or completely superposed in relation to one another on an area of said material.

[0015] Said superposition, albeit partial, initially makes the determination or discernment of each characteristic image impossible.

[0016] To solve this and to thus determine each characteristic image, the proposed method according to the first aspect of the invention comprises performing the fol-

lowing steps:

a) moving in a controlled manner the transverse and/or longitudinal register of one or more of said printing rollers, or withdrawing same from printing status,
b) actuating said printing groups to perform printing of one or more of said characteristic images on said material to be printed,
c) detecting, by means of an automatic detection system, said characteristic images if they have been printed on the material to be printed, to identify them and know their relative position within said printing development, or detect the absence of said characteristic images if they have not been printed on said material in said step b),
d) comparing the relative positions detected in step c) with the relative position of said area of the material, to determine a possible positional discrepancy for at least one of the characteristic images and/or determine a possible absence of printing of one of said characteristic images, and
e) performing at least one operation of associating characteristic images with respect to printing rollers and/or of register adjustment and/or pressure adjustment of said printing rollers.

[0017] For one embodiment said step e) comprises performing said operation of associating characteristic images with respect to printing rollers by means of the following sub-steps:

e1) determining that one of said printing rollers is associated to a characteristic image which has undergone at least one positional discrepancy if the transverse and/or longitudinal register of said printing roller has been moved in said step a),
and/or

e2) determining that one of said printing rollers is associated to one of said characteristic images, which has not undergone a positional discrepancy, if the register of said printing roller has not been moved in said step a),
and/or

e3) determining that one of said printing rollers is associated to one of said characteristic images, which has not been printed, if said printing roller has been withdrawn from printing status in said step a).

[0018] For one preferred embodiment of the first aspect of the invention, said characteristic images are mounting marks used for positioning and mounting, or pre-mounting, printing plates on printing rollers, which are common in printing plates found on the market, whereby register marks are not necessary expressly to perform said pressure and register adjustments, since by means of the method proposed by the first aspect of the invention said mounting marks are used to perform their original function, i.e., the correct mounting of the printing plates on the printing rollers, in addition to performing the functions conventionally performed with other additional marks, i.e., the marks referring to the mentioned pressure adjustments and transverse and longitudinal register adjustment.

[0019] According to a second aspect, the proposed method is applied to the determination of printed images with respect to printing groups, and is of the type comprising:

i) actuating said printing groups to perform a first printing of said characteristic images on said material to be printed.
The method proposed by the second aspect of the invention comprises determining which roller is associated to each of said characteristic images by means of the automatic and sequential performance, after said step i), of the following steps:
ii) detecting, by means of an automatic detection system, said characteristic images once they have been printed on the material to be printed, to identify them and know their relative position within said printing development,
iii) moving in a controlled manner the transverse and/or longitudinal register of one or more of said printing rollers, or withdrawing same from printing status,
iv) actuating said printing groups to perform a second printing of one or more of said characteristic images on said material to be printed,
v) detecting on the material to be printed, by means of said automatic detection system, said characteristic images if they have been printed again on the material to be printed, to identify them and know their relative position within said printing development, or detect the absence of said characteristic images if they have not been printed again on said material in said step iv),
vi) comparing the result of the detections of step v) with that of the detections of step ii) to determine a possible positional discrepancy for one or more of the characteristic images and/or determine a possible disappearance of one of said characteristic images,
vii) determining that one of said printing rollers is associated to a characteristic image which has undergone a positional discrepancy at least if the transverse and/or longitudinal register of said printing roller has been moved in said step iii),
and/or
viii) determining that one of said printing rollers is associated to one of said characteristic images, which has not undergone a positional discrepancy, if the register of said printing roller has not been moved in said step iii),

and/or

ix) determining that one of said printing rollers is associated to one of said characteristic images, which has disappeared from the printing, if said printing roller has been withdrawn from printing status in said step iii).

[0020] Based on the foregoing description of the method proposed by both the first and the second aspect of the present invention, it is deduced that for one embodiment applied to a machine with two printing rollers with respective characteristic images, such as auxiliary register marks, it is possible to determine which mark is associated to each roller:

- by moving the transverse and/or longitudinal register of one of the rollers and therefore determining that the mark which has undergone a positional discrepancy with respect to said area of the material, for the first aspect, or which has also been moved upon resuming printing, according to the second aspect, is the one corresponding to the roller which has been moved (step e1) according to the first aspect or step vii) according to the second aspect), and that the one which has not been moved belongs to the roller which has not been moved (step e2) or viii)), or
- withdrawing from printing status one of the rollers and therefore determining that the mark which has not been printed in step b) or which has not been printed again in step iv) corresponds to the roller which has been withdrawn from printing status (step e3) or ix)), and that the one which has not undergone a positional discrepancy belongs to the roller which has not been moved (step e2) or viii)), or
- moving the transverse and/or longitudinal register of one of the rollers and withdrawing from printing status another one of the rollers, and therefore determining that the mark which has undergone a positional discrepancy with respect to said area of the material, for the first aspect, or which has also been moved upon printing again, according to the second aspect, is the one which corresponds to the roller which has been moved (step e1) or vii)), and that the one which has not been printed in step b) or iv) corresponds to the roller which has been withdrawn from printing status (step e3) or ix)).

[0021] In relation to said detected positions in said step c) or in said steps ii) and v), they are preferably respective longitudinal and transverse positions of each characteristic image within said printing development.

[0022] For other embodiments applied to machines of more than two printing groups, it is possible to perform all steps e1) a e3) and vii) a ix), and even if necessary with some variations in relation to the movements of the transverse and/or longitudinal register of each roller, or a combination of movements, also taking into account the direction of said movements, as well as even the magnitude of the movement, depending on the number of groups incorporated by the machine.

[0023] Such embodiments applied to machines of more than two groups will be duly described in a later section.

Brief Description of the Drawings

[0024] The previous and other advantages and features will be more fully understood from the following detailed description of several embodiments with reference to the attached drawings, which must be considered in an illustrative and non-limiting manner and in which:

Figure 1a is a schematic perspective depiction of part of a flexographic machine with five printing rollers, in which some of the most relevant elements to be taken in account by the method proposed by the present invention for one embodiment can be seen,

Figure 1b is a schematic plan view of a series of marks printed in step i) of the method proposed by the second aspect of the invention, using the machine of Figure 1a,

Figure 1c is a schematic plan view of a series of marks printed in step iv) of the method proposed by the second aspect of the invention, using the machine of Figure 1a, for the same embodiment of Figure 1b,

Figure 2a is a schematic perspective depiction of part of a flexographic machine with seven printing rollers, in which some of the most relevant elements to be taken into account by the method proposed by the present invention for another embodiment can be seen,

Figure 2b is a schematic plan view of a series of marks printed in step i) of the method proposed by the second aspect of the invention using the machine of Figure 2a,

Figure 2c is a schematic plan view of a series of marks printed in step iv) of the method proposed by the second aspect of the invention using the machine of Figure 2a for the same embodiment of Figure 2b,

Figure 3a is a schematic perspective depiction of part of a flexographic machine with five printing rollers, in which some of the most relevant elements to be taken into account by the method proposed by the second aspect of the present invention for one embodiment can be seen,

Figure 3b is a schematic plan view of a series of marks as they would appear printed before step a) of the method proposed by the first aspect of the invention using the machine of Figure 3a for one embodiment for which all the marks would appear superposed,

Figure 3c is a schematic plan view of a series of marks printed in step b) of the method proposed by the first aspect of the invention using the machine of Figure 3a for the same embodiment of Figure 3b, and

Figure 3d is another schematic plan view of a series of printed superposed marks after having performed a register adjustment of the printing rollers of the machine of Figure 3a according to the method proposed by the first aspect of the invention for the same embodiment of Figures 3b and 3c.

Detailed Description of several Embodiments

[0025] The present invention relates to a method of determining printed images, of the type comprising the use of a printer of any type but with at least two printing groups with respective printing rollers (or another class of support which is not necessarily a roller) with respective characteristic images to be printed.

[0026] The explanation of the proposed method applied to a printing machine with two printing rollers has already been provided in the section of the explanation of the invention, the proposed method being described in this section for several embodiments based on the use of a printing machine (specifically a flexographic machine but it could be another machine which a person skilled in the art would consider suitable) with a plurality of printing rollers: five for the embodiment shown in Figures 1a to 1c and 3a to 3d, and seven for the embodiment of Figures 2a to 2c.

[0027] Although the method is applicable for any type of characteristic image, of any size and location, for the embodiments shown in the Figures 1a to 1c and 2a to 2c referring to the second aspect of the invention, said characteristic images are auxiliary marks for register M_1, M_2, M_3...M_n located in respective sides of printing plates C_1, C_2, C_3...C_n, for being printed in a side margin of a laminar material 2 to be printed.

[0028] The preceding paragraph refers to the marks and to the printing plates, and reference will also later be made to the rollers, indicating the maximum number as n, due to the fact that said number n may vary depending on the embodiment, specifically for the embodiment shown in Figures 1a to 1c and 3a to 3d n=5, and for the embodiment shown in Figures 2a to 2c n=7.

[0029] As can be seen in Figures 1a, 2a and 3a, for several embodiments, the method is applied to a flexographic printer of the type comprising a rotating support drum 1 (shown transparently for the sake of visual clarity) on which a laminar material to be printed 2 (shown only in part for the sake of clarity) is supported, with a plurality of printing groups (not all shown) arranged around said support drum 1 and spaced along its perimeter, including respective printing rollers R_1, R_2, R_3... R_n, each of them with at least one respective mark to be printed M_1, M_2, M_3...M_n.

[0030] For said embodiments shown, the method comprises performing all the steps for all the printing groups and all the marks M_1, M_2, M_3...M_n.

[0031] Figures 1 bans 2b show the marks printed by the first printing of step i) of the method proposed by the second aspect of the invention (said figures do not show the laminar material 2 on the they have been printed).

[0032] It can be seen both in Figure 1b and in the 1c, and, though not as well, in Figure 1a, how the marks M_1, M_2, M_3, M_4, M_5 therein shown are respective circles which, although it cannot be seen since the drawings are in black and white, have each been printed with a different color, the mentioned color of each mark M_1, M_2, M_3, M_4, M_5 for one embodiment being the characteristic which allows distinguishing them from one another.

[0033] For another embodiment, the mentioned distinguishing characteristic of the marks is the relative position within the printing, there being for said embodiment a series of windows (one per mark) delimiting respective areas where it is possible to detect a mark, each mark being moved, according to the proposed method, only through the inside of its respective window, without the possibility of entering in the window of another mark. In other words, even though the marks, for example the marks shown in Figures 1b and 1c M_1, M_2, M_3, M_4, M_5, are of the same color, the fact that each of them can be moved only through the inside of its respective window (not shown) allows distinguishing them by their relative position, despite the fact that all of them are identical and the same color.

[0034] In said Figure 1b, the marks M_1, M_2, M_3, M_4, M_5 have been printed longitudinally separated along the mentioned margin of the laminar material 2, and they also appear out of both transverse and longitudinal register.

[0035] In relation to marks M_1, M_2, M_3, M_4, M_5, M_6, M_7 shown in Figures 2a to 2c, these marks are respective segments of lines, each of them with a different inclination, and which unlike the marks of Figures 1a to 1c, have been printed substantially on one and the same marginal area of the laminar material 2, without being longitudinally separated along the laminar material 2 by more than the small (longitudinal and transverse) separations typical of register errors (which can be seen in Figure 2b), or the separations forced in step iii) of the proposed method which can be seen in Figure 2c (as also occurs with the embodiment of Figure 1c).

[0036] For another embodiment not shown, the marks M_1, M_2, M_3...M_n are different geometric figures.

[0037] It can be seen in Figures 1a, 2a and 3a how for the embodiments therein shown the marks M_1, M_2, M_3...M_n are defined or incorporated in respective printing plates C_1, C_2, C_3...C_n, said printing rollers R_1, R_2, R_3... R_n being associated to said characteristic images M_1, M_2, M_3...M_n since each of them carries one of said printing plates C_1, C_2, C_3...C_n.

[0038] The method proposed by the second aspect of the invention comprises performing previously described step ii) for detecting the marks as they are depicted in Figures 1b and 2b.

[0039] Said detections of said step ii), and of step v) described in further detail below, are performed by means of an automatic detection system which, for the embodiment shown in Figures 2b and 2c, comprises, for

the purpose of performing the detections visually, an automatic image capture and treatment system (not shown) formed, for example, by at least one camera located above the rotating support drum 1, upstream with respect to the direction of movement of the laminar material 2, associated to a corresponding electronic circuitry, directly on the printed laminar material 2 or in a corresponding monitor or display (not shown), said automatic image capture and treatment system being associated to a corresponding electronic system suitable for performing at least said steps vi) to ix), as well as collaborating, if necessary, when performing steps ii) and v), as well as giving the orders by means of the corresponding sending of suitable control signals to means of actuating the groups and the printing rollers, which allow performing steps i), iii) and iv).

[0040] For one embodiment for which it is not necessary to detect the shape or the color of the marks, and for which it is therefore not necessary to use a camera, such as that mentioned above for which the marks were distinguished from one another by their relative position within the printing, the mentioned automatic detection system comprises one or more photoelectric sensors, also associated to an electronic system like that described in the preceding paragraph.

[0041] In relation to step iii) of the method proposed by the second aspect of the invention, said step comprises moving the transverse and/or longitudinal register of at least all except one of said printing rollers R_1, R_2, R_3... R_n, each in a different direction or in the same direction as another but with a different magnitude different, or withdrawing same from printing status.

[0042] Specifically for the embodiment of Figure 1a, step iii) is performed for moving the printing rollers R_1, R_2, R_3, R_4, R_5 shown therein according to the indicative arrows also shown therein, i.e.:

- moving the longitudinal, or angular, register of a first printing roller R_1 in one direction, and of a second printing roller R_2 in the opposite direction, and
- moving the transverse, or axial, register of a fourth R_4 and a fifth R_5 printing rollers, each in one direction.

[0043] With respect to the third printing roller R_3, the latter is not actuated in said step iii), therefore it does not move in any direction.

[0044] The result of said movements, or the absence thereof as is the case of the third printing roller R_3, can be seen in Figure 1c, and is detectable in step v) of the proposed method.

[0045] Said Figure 1c shows the previous positions of the marks (i.e., those shown in Figure 1a) by means of a number of corresponding "x", which allows performing a comparison with their respective current positions, which allows appreciating how all the marks, except that indicated as M_3, have undergone respective positional discrepancies, determined in step vi) of the method, and different from one another, specifically mark M_5 has been moved to the right mark M_4 to the left, mark M_2 upwards and mark M_1 downwards. In other words, said step vi) has been performed to determine a series of positional discrepancies different for all except one of the marks, i.e., for M_1, M_2, M_4 and M_5.

[0046] Continuing with the embodiment of Figures 1a to 1c, the method proposed by the second aspect of the invention comprises performing said step vii) to determine that each of the printing rollers R_1, R_2, R_4 and R_5 actuated in step iii) is associated to one of said marks M_1, M_2, M_4 and M_5 which have undergone respective positional discrepancies, if the transverse and/or longitudinal register of said printing roller R_1, R_2, R_4 and R_5 has been moved in said step iii), with a direction corresponding to that experienced by the printed mark M_2, M_3, M_4 and M_5, i.e., mark M_2 corresponds to roller R_2, M_3 to R_3, M_4 to R_4 and M_5 to R_5.

[0047] The method comprises determining in step viii) that the third roller R_3, the register of which has not been moved, is associated to mark M_3 which has not undergone any positional discrepancy.

[0048] The movements to which the registers of the printing rollers have been subjected in step iii) are enough for the embodiment shown in Figures 1a to 1c, but this is not the case for one embodiment which involves using a machine with a larger number of printing rollers, as is the case shown in Figure 2a.

[0049] For the embodiment of Figure 2a, step iii) is performed for moving the printing rollers R_1, R_2, R_3, R_4, R_5, R_6, R_7, shown therein according to the indicative arrows also shown therein, i.e.:

- withdrawing from printing status a first printing roller R_1,
- moving the longitudinal register of a second printing roller R_2 in one direction, and that of a third printing roller R_3 in the opposite direction, and
- moving the transverse register of a sixth printing roller R_6 in one direction, and that of a fifth R_5 and a seventh R_7 printing rollers in one and the same direction, opposite to that of roller R_6, but with a different magnitude, specifically with a magnitude greater than roller R_5 as is sought to be indicated with the longer length of the arrow therein shown.

[0050] Obviously the fact that a certain roller of is moved in one way or another, for example the sixth roller R_6 axially in one direction, must only be interpreted as an example for explaining the rollers shown in Figures 1a and 2a, since the number of the roller which undergoes a certain movement is irrelevant, it can be the first or the second, etc., what is important is that said movements are different from one another (either relating to the type of movement, to the direction, to, if necessary, the magnitude of the movement or to a combination thereof).

[0051] Continuing with the embodiment shown in Figures 2a to 2c, the fourth printing roller R_4 is not actuated in said step iii), therefore it is not moved in any direction.

[0052] The result of said movements, or the absence thereof as in the case of the fourth printing roller R_4, can be seen in Figure 2c, and is detectable in step v) of the proposed method.

[0053] Said Figure 2c also shows how all the marks, except those indicated as M_4 and as M_1, have undergone respective positional discrepancies, determined in step vi) of the method, and different from one another, specifically mark M_5 has been moved to the right, mark M_6 to the left, mark M_3 upwards, mark M_2 downwards and mark M_7 also to the right but with a smaller magnitude than M_5. In other words, said step vi) has been performed to determine a series of positional discrepancies different for all except two of the marks, i.e., for M_2, M_3, M_5, M_6 and M_7.

[0054] Figure 2c also shows that mark M_1 has not been printed, which has been determined in step vi) as a disappearance of said mark M_1.

[0055] Continuing with the embodiment of Figures 2a to 2c, the method proposed by the second aspect of the invention comprises performing said step vii) to determine that each of the printing rollers R_2, R_3, R_5, R_6 and R_7 actuated in step iii) is associated to one of said marks M_2, M_3, M_5, M_6 and M_7 which have undergone respective positional discrepancies, if the transverse and/or longitudinal register of said printing roller R_2, R_3, R_5, R_6 and R_7 has been moved in said step iii), with a direction and a magnitude corresponding to that experienced by the printed mark M_2, M_3, M_5, M_6 and M_7, i.e., mark M_2 corresponds to roller R_2, M_3 to R_3, M_5 to R_5, M_6 to R_6, and M_7 to R_7.

[0056] For one embodiment said magnitudes have pre-determined values.

[0057] Continuing with the embodiment of Figures 2a to 2c, the method proposed by the second aspect of the invention comprises determining in step viii) that the fourth roller R_4, which has not been moved, is associated to the mark M_4 which has not undergone any positional discrepancy, as well as performing said step ix) to determine that the first printing roller R_1 withdrawn from the printing upon being actuated in said step iii) is associated to the first mark M_1, which has disappeared from the printing.

[0058] For one embodiment the proposed method is performed before a process of register adjustment of said printing rollers R_1, R_2, R_3... R_n.

[0059] For another embodiment the method proposed by the second aspect of the invention is performed before a process of pressure adjustment of at least part of the rollers of said printing groups.

[0060] In relation to the method proposed by the first aspect of the invention, it can be observed in Figures 3b to 3d (as well as, although with more difficulty in Figure 3a in its respective printing plates C_1, C_2, C_3, C_4, C_5), how the marks M_1, M_2, M_3, M_4, M_5 shown therein are respective circles (Figures 3b to 3d do not show the laminar material 2 on which the marks have been printed), in this case partially superposed and printed within a determined area Z (shown with a dashed line). Unlike Figures 3b and 3d, Figure 3b shows a hypothetical preliminary printing, for the purpose of clarifying the explanation of the method proposed by the first aspect of the invention, since it is not essential to perform printing of the marks M_1, M_2, M_3, M_4, M_5 before step a).

[0061] Said circles are an exaggerated representation of the real marks, for the sake of clarity, since they are actually microdots generally having a diameter of substantially 0.1 mm to 1 mm or slightly greater.

[0062] For a preferred embodiment said marks M_1, M_2, M_3, M_4, M_5 are auxiliary mounting marks used for positioning and coupling said printing plates C_1, C_2, C_3, C_4 C_5 on said printing rollers R_1, R_2, R_3, R_4,R_5.

[0063] Figure 3b shows the marks M_1, M_2, M_3, M_4, M_5 as they would appear printed if a printing before step a) of the method proposed by the first aspect of the invention, for the embodiment in which they are the mentioned microdots, were performed. It can be seen in said Figure 3b that the microdots M_1, M_2, M_3, M_4, M_5 appear partially superposed, a register adjustment of the printing rollers R_1, R_2, R_3, R_4, R_5 not having been yet performed. Said superposition, although partial, initially prevents the determination or discernment of each mark, it not being possible to clearly distinguish each mark separately, which makes it difficult, and even in some cases impossible, to determine which roller each mark belongs to, as well as their pressure adjustment, since the marks are not seen in their entirety, and their register adjustment, since it is not possible to identify which roller each mark belongs to.

[0064] In addition, Figure 3c shows the same marks or microdots M_1, M_2, M_3, M_4, M_5 once they have been printed in step b), step a) for moving the printing rollers R_2, R_3, R_4, R_5 shown in Figure 3a having been moved, for the embodiment shown, according to the indicative arrows also shown therein, i.e.:

- axially moving the transverse register to a second printing roller R_2 in one direction, and to a fifth printing roller R_5 in the opposite direction, and
- angularly moving the longitudinal register of a third R_3 and a fourth R_4 printing rollers, each in one direction.

[0065] In relation to the first printing roller R_1, it is not actuated in said step a), therefore it is not moved in any direction.

[0066] The result of said movements, or the absence thereof as is the case of the first printing roller R_1, can be seen in Figure 3c, and can be detected in step c) of the method proposed by the first aspect of the invention.

[0067] Said Figure 3c depicts the preliminary positions that the marks would have adopted if they had been printed before step a) (i.e., those shown in Figure 3a) by means of corresponding "x", which allows performing a comparison with their respective current positions, which allows appreciating how all the marks, except that indi-

cated as M_1, have undergone respective positional discrepancies.

[0068] Actually, according to the method proposed by the first aspect of the invention, it is not necessary to perform printing before step a), i.e., the printing shown by Figure 3b is not performed, therefore the mentioned positional discrepancies are not determined by comparing each printed mark with its preliminary position but rather by means of the previously described step d) consisting of comparing the relative positions detected in step c) with the relative position of said area Z of the material 2, to determine the positional discrepancies for all the marks M_2, M_3, M_4, M_5 except for a first mark indicated as M_1.

[0069] It can be seen in said Figure 3c, where the marks M_1, M_2, M_3, M_4 and M_5 appear printed not superposed in relation to another, how the positional discrepancies determined in step d) with respect to the area Z, are different from one another, specifically the mark M_5 has moved to the right of said area Z, the mark M_4 downwards, the mark M_2 towards the left and the mark M_3 upwards. In other words, said step d) has been performed to determine a series of different positional discrepancies for all except one of the marks, i.e., for M_2, M_3, M_4 and M_5.

[0070] Once the marks M_1, M_2, M_3, M_4 and M_5 have been separated as seen in Figure 3c, they can be easily distinguished, which makes it possible to perform the operations of determining or associating marks M_1, M_2, M_3, M_4 and M_5 with respect to printing rollers R_1, R_2, R_3, R_4, R_5 (according to steps e1) to e3) described in a previous section) as well as register adjustment and pressure adjustment of the printing rollers R_1, R_2, R_3, R_4, R_5.

[0071] The embodiments described for the second aspect of the invention for which there was a larger number of printing rollers than those shown by Figure 3a and, as a result, identical movements with one and the same direction for two different printing rollers, but with different pre-determined magnitudes, are also applicable in a similar manner for the first aspect of the invention, with the difference that steps i) and ii) of the method proposed by the second aspect are not necessary according to the first aspect, whereby the comparisons to determine the positional discrepancies are performed with respect to the area Z shown in Figures 3b to 3c.

[0072] The method proposed by the first aspect of the invention comprises performing said pressure adjustment by means of using an automatic image capture (camera or the like) and treatment system associated to an electronic system for, according to one embodiment, detecting the absence or presence of each of said marks M_1, M_2, M_3, M_4, M_5 on said laminar material 2 and acting accordingly by increasing or decreasing the pressure exerted by each printing roller R_1, R_2, R_3, R_4, R_5 on the laminar material 2, as well as the pressure of their associated ink rollers (not shown).

[0073] For a more elaborate embodiment the method proposed by the first aspect of the invention comprises, to perform said pressure adjustment, comparing, by means of said electronic system, the marks M_1, M_2, M_3, M_4, M_5 captured with respective pre-determined reference marks registered in said electronic system and indicative of a good printing quality (due to their color, shape, etc.), and if said comparison offers as a result a discrepancy or deviation indicative of the fact that the quality of any of the marks M_1, M_2, M_3, M_4, M_5 captured is not good, compensating said discrepancy by means of adjusting the pressure of the corresponding printing roller R_1, R_2, R_3, R_4, R_5 which has printed said image and of a corresponding ink roller (not shown) to which it is associated.

[0074] In relation to the mentioned register adjustment, for a preferred embodiment the method proposed by the first aspect comprises taking as a common reference a first mark M_1 (the printing roller R_1 of which has not been moved in step a)) and adjusting the position of the printing rollers R_2, R_3, R_4, R_5 carrying the remaining marks M_2, M_3, M_4, M_5 until the position of said marks M_2, M_3, M_4, M_5, once they have been printed on the material 2, is identical to that of said first mark M_1, i.e., until all the marks M_1, M_2, M_3, M_4, M_5 overlap as shown in Figure 3d. To that end, the method proposed by the first aspect of the invention comprises:

- comparing the relative positions detected in said step c) for each of the printed marks M_2, M_3, M_4, M_5, except for said first M_1, with respective relative register positions equal to the position of the first mark M_1 detected in step c), or common reference register position, plus the known movement (actuation of the axial or angular roller) of the transverse and/or longitudinal register undergone by each of the marks M_2, M_3, M_4, M_5 in said step a),
- adjusting the transverse and longitudinal register of the printing rollers R_2, R_3, R_4, R_5 the marks M_2, M_3, M_4, M_5 of which have been printed, in said step b), with a relative position different from the relative register position with which it has been compared, until each of them has reached its respective relative register position, and
- moving each of the printing rollers R_2, R_3, R_4, R_5 according to the same movement undergone in said step a), identical in magnitude and along the same movement axis, but in an opposite direction, so that all the marks M_1, M_2, M_3, M_4, M_5 are printed completely superposed in relation to one another on the laminar material 2 in said common reference register position or position of the first mark M_1 within said area Z, as shown in Figure 3d.

[0075] For another non-preferred embodiment the common reference position is not the position of the first mark M_1 detected in step c), but another different one, such as a pre-determined position different from the relative positions of the marks M_1, M_2, M_3, M_4, M_5 detected in step c), it being possible for said embodiment, not shown, that the first mark M_1 has also been moved in

step a), since it is not used as reference for the register adjustment of the printing rollers R_2, R_3, R_4, R_5 of the remaining marks M_2, M_3, M_4, M_5.

[0076] Continuing with the embodiment shown, it can be observed in Figure 3d how once all the marks M_1, M_2, M_3, M_4, M_5, particularly mounting microdots, are located in the common reference register position, they are completely superposed, it not being possible to distinguish in said Figure 3d more than a single circle, representative of all the completely superposed microdots M_1, M_2, M_3, M_4, M_5.

[0077] A person skilled in the art could introduce changes and modifications in the described embodiments without departing from the scope of the present improvements as it is defined in the attached claims.

Claims

1. A method for determining printed images, of the type comprising the use of a printer with at least one first and one second printing groups including respective first (R_1) and second (R_2) printing rollers having one and the same printing development, each of said printing rollers (R_1, R_2) with at least one respective characteristic image to be printed (M_1, M_2) on a laminar material (2), said method being **characterized in that** it comprises using as characteristic images (M_1, M_2) images at least some of which, if printed, would appear at least partially superposed in relation to another inside an area (Z) of said laminar material (2), and **in that** it comprises performing the following steps:

a) moving in a controlled manner the transverse and/or longitudinal register of at least one of said printing rollers (R_2), or withdrawing same from printing status,

b) actuating at least said printing groups to perform printing of at least one of said characteristic images (M_1, M_2) on said material to be printed (2),

c) detecting, by means of an automatic detection system, said characteristic images (M_1, M_2) if they have been printed on the material to be printed (2), to at least identify them and know their relative position within said printing development, or detect the absence of said characteristic images (M_1, M_2) if they have not been printed on said laminar material (2) in said step b),

d) comparing the relative positions detected in step c) with the relative position of said area (Z) of the laminar material (2), to determine a possible positional discrepancy for at least one of the characteristic images (M_1, M_2) and/or determine a possible absence of printing of one of said characteristic images (M_1, M_2), and

e) performing at least one operation of associating characteristic images (M_1, M_2) with respect to printing rollers (R_1, R_2) and/or register adjustment and/or pressure adjustment of said printing rollers (R_1, R_2).

2. The method according to claim 1, **characterized in that** said step e) comprises performing said operation of associating characteristic images (M_1, M_2) with respect to printing rollers (R_1, R_2) by means of the following sub-steps:

e1) determining that one of said printing rollers (R_1, R_2) is associated to a characteristic image (M_1, M_2) which has undergone a positional discrepancy, which is at least one in number, at least if the transverse and/or longitudinal register of said printing roller (R_1, R_2) has been moved in said step a),
and/or
e2) determining that one of said printing rollers (R_1, R_2) is associated to one of said characteristic images (M_1, M_2), which has not undergone a positional discrepancy, if the register of said printing roller (R_1, R_2) has not been moved in said step a),
and/or
e3) determining that one of said printing rollers (R_1, R_2) is associated to one of said characteristic images (M_1, M_2), which has not been printed, if said printing roller (R_1, R_2) has been withdrawn from printing status in said step a).

3. A method for determining printed images with respect to printing groups, of the type comprising the use of a printer with at least one first and one second printing groups including respective first (R_1) and second (R_2) printing rollers having one and the same printing development, each of said printing rollers (R_1, R_2) with at least one respective characteristic image to be printed (M_1, M_2) on a laminar material (2), said method being of the type comprising:

i) actuating at least said printing groups to perform a first printing of said characteristic images (M_1, M_2) on said material to be printed (2),
and said method being **characterized in that** it comprises determining which roller is associated to each of said characteristic images (M_1, M_2) by means of the automatic and sequential performance, after said step i), of the following steps:
ii) detecting, by means of an automatic detection system, said characteristic images (M_1, M_2) once they have been printed on the material to be printed (2), to at least identify them and know their relative position within said printing development,

iii) moving in a controlled manner the transverse and/or longitudinal register of at least one of said printing rollers (R_2), or withdrawing same from printing status,

iv) actuating at least said printing groups to perform a second printing of at least one of said characteristic images (M_1, M_2) on said material to be printed (2),

v) detecting on the material to be printed (2), by means of said automatic detection system, said characteristic images (M_1, M_2) if they have been printed again on the material to be printed (2), to at least identify them and know their relative position within said printing development, or detect the absence of said characteristic images (M_1, M_2) if they have not been printed again on said laminar material (2) in said step iv),

vi) comparing the result of the detections of step v) with that of the detections of step ii) to determine a possible positional discrepancy for at least one of the characteristic images (M_1, M_2) and/or determine a possible disappearance of one of said characteristic images (M_1, M_2),

vii) determining that one of said printing rollers (R_1, R_2) is associated to a characteristic image (M_1, M_2) which has undergone a positional discrepancy, which is at least one in number, at least if the transverse and/or longitudinal register of said printing roller (R_1, R_2) has been moved in said step iii),

and/or

viii) determining that one of said printing rollers (R_1, R_2) is associated to one of said characteristic images (M_1, M_2), which has not undergone a positional discrepancy, if the register of said printing roller (R_1, R_2) has not been moved in said step iii),

and/or

ix) determining that one of said printing rollers (R_1, R_2) is associated to one of said characteristic images (M_1, M_2), which has disappeared from the printing, if said printing roller (R_1, R_2) has been withdrawn from the printing status in said step iii).

4. The method according to claim 2 or 3, **characterized in that** said sub-step e1) or step vii) comprises determining that one of said printing rollers (R_1, R_2) is associated to said characteristic image (M_1, M_2) which has undergone a positional discrepancy, which is at least one in number, if the register of said printing roller (R_1, R_2) has been moved in said step a) or in said step iii), at least with a direction corresponding to that experienced by the printed characteristic image (M_1, M_2) which has undergone said positional discrepancy.

5. The method according to any of the previous claims, **characterized in that** said characteristic images are auxiliary marks for register (M_1, M_2).

6. The method according to claim 5, **characterized in that** it is applied to a flexographic printer of those comprising a rotating support drum (1), on which a laminar material to be printed (2) is supported, with a plurality of printing groups arranged around said support drum (1) and spaced along its perimeter, including respective printing rollers (R_1, R_2, R_3... R_n), each of them with at least one respective mark to be printed (M_1, M_2, M_3...M_n), and **in that** it comprises performing all steps for all the printing groups and all the marks (M_1, M_2, M_3...M_n), comprising:

said step a) or said step iii), moving the transverse and/or longitudinal register of at least all except one of said printing rollers (R_1, R_2, R_3... R_n), each in a different direction or in the same direction as another one but with a different magnitude or combination of the movements, or withdrawing same from printing status,

performing said step d) or said step vi) to determine a series of different positional discrepancies for at least all except one of the marks (M_1, M_2, M_3...M_n) or to determine a series of different positional discrepancies for at least all except two of the marks (M_1, M_2, M_3...M_n) and determine the absence of printing or disappearance of one of said marks (M_1, M_2, M_3...M_n),

said sub-step e1) or said step vii), determining that each of said printing rollers (R_1, R_2, R_3... R_n) actuated in said step a) or in said step iii) is associated to one of said marks (M_1, M_2, M_3...M_n) which have undergone respective positional discrepancies, if the register of said printing roller (R_1, R_2, R_3... R_n) has been moved in said step a) or in said step iii), at least with a direction corresponding to that experienced by the printed mark (M_1, M_2, M_3...M_n), and

said sub-step e3) or step ix), determining that one of said printing rollers (R_1, R_2, R_3... R_n) is associated to one of said marks (M_1, M_2, M_3...M_n), which has not been printed or has disappeared from the printing, if said printing roller (R_1, R_2, R_3... R_n) has been withdrawn from printing status in said step a) or in said step iii).

7. The method according to claim 6, **characterized in that** said step e1) or said step vii) comprises determining that each of said printing rollers (R_1, R_2, R_3...R_n) actuated in said step a) or in said step iii) is associated to one of said marks (M_1, M_2, M_3...M_n) which have undergone respective positional discrepancies, if the register of said printing roller (R_1, R_2, R_3... R_n) has been moved, in said step a) or in said step iii), with a direction and a magnitude corresponding to those experienced by the printed mark

(M_1, M_2, M_3...M_n).

8. The method according to claim 6 or 7, **characterized in that** said magnitudes have pre-determined values.

9. The method according to any of the previous claims, **characterized in that** said characteristic images (M_1, M_2, M_3...M_n) are defined or incorporated in respective printing plates (C_1, C_2, C_3...C_n), or in engraved jackets, said printing rollers (R_1, R_2, R_3... R_n) being associated to said characteristic images (M_1, M_2, M_3...M_n) since each of them carries one of said printing plates (C_1, C_2, C_3...C_n), or one of said engraved jackets.

10. The method according to any of the previous claims, **characterized in that** said characteristic images (M_1, M_2, M_3...M_n) are different from one another.

11. The method according to claim 10, **characterized in that** said marks (M_1, M_2, M_3...M_n) are segments of lines, each of them with a different inclination.

12. The method according to claim 10, **characterized in that** said marks (M_1, M_2, M_3...M_n) are different geometric figures.

13. The method according to any of the previous claims, **characterized in that** it comprises printing each of said marks (M_1, M_2, M_3...M_n) with a different color.

14. The method according to any of the previous claims, **characterized in that** each of said marks (M_1, M_2, M_3...M_n) has a different relative position to the printing.

15. The method according to any of the previous claims, **characterized in that** it is performed before a process for the register adjustment of said printing rollers (R_1, R_2, R_3...R_n).

16. The method according to any of the previous claims, **characterized in that** it is performed before a process for the pressure adjustment of at least part of the rollers of said printing groups.

17. The method according to claim 1, 2, 3 or 6, **characterized in that** it comprises performing said detections of said steps c), ii) and v) visually by means of an automatic image capture and treatment system comprised in said automatic detection system.

18. The method according to claim 3 or 6, **characterized in that** it comprises performing said detections of said steps b) and e) by means of at least one photoelectric sensor comprised in said automatic detection system.

19. The method according to claim 1, 2, 3, 16 or 17, **characterized in that** it comprises performing at least said steps d) to e) and said steps vi) to ix) by means of an electronic system associated to said automatic detection system.

20. The method according to claim 1, 2 or 3, **characterized in that** said positions detected in said step c) or steps ii) and v) are respective longitudinal and transverse positions of each characteristic image (M_1, M_2) within said printing development.

21. The method according to any of the previous claims, **characterized in that** said characteristic images (M_1, M_2, M_3...M_n) are auxiliary mounting marks used for positioning and coupling said printing plates (C_1, C_2, C_3...C_n) on said printing rollers (R_1, R_2, R_3... R_n).

22. The method according to any of the previous claims, **characterized in that** said characteristic images (M_1, M_2, M_3...M_n) are microdots.

23. The method according to claim 22, **characterized in that** each of said microdots has a diameter of substantially 0.1 mm to 1 mm.

24. The method according to any of the previous claims when they depend on claim 1 or on claim 2, **characterized in that** it comprises detecting in said step c) said characteristic images (M_1, M_2, M_3...M_n) printed on the laminar material (2) in said step b), not superposed in relation to another.

25. The method according to claim 24, **characterized in that** comprises, once said characteristic images (M_1, M_2, M_3...M_n) are printed on the laminar material (2) in a non-superposed manner, performing in said step e) said operation of register adjustment and/or pressure adjustment for each of the characteristic images (M_1, M_2, M_3...M_n).

26. The method according to claim 1, 2, 16 or 25, **characterized in that** it comprises performing said pressure adjustment by means of using an automatic image capture and treatment system associated to an electronic system for at least detecting the absence or presence of each of said characteristic images (M_1, M_2, M_3...M_n) on said laminar material (2).

27. The method according to claim 26, **characterized in that** to perform said pressure adjustment it comprises comparing, by means of said electronic system, the characteristic images (M_1, M_2, M_3...M_n) captured with respective pre-determined reference characteristic images registered in said electronic system and indicative of a good printing quality, and if said comparison offers as a result a discrepancy or deviation indicative of the fact that the quality of

any of the characteristic images (M_1, M_2, M_3...M_n) captured is not sufficient, compensating said discrepancy by means of adjusting the pressure of the corresponding printing roller (R_1, R_2, R_3... R_n) which has printed said image and of a corresponding ink roller to which it is associated.

28. The method according to claim 1, 2 or 25, **characterized in that** to perform said register adjustment it comprises:

- comparing the relative positions detected in said step c) for each of the printed characteristic images (M_2, M_3...M_n), except for a first characteristic image (M_1), with respective relative register positions equal to the position of the first characteristic image (M_1) detected in step c), or common reference register position, plus the movement of the transverse and/or longitudinal register undergone by each of the characteristic images (M_2, M_3...M_n) in said step a),
- adjusting the transverse and longitudinal register of the printing rollers (R_2, R_3... R_n) the characteristic images (M_2, M_3...M_n) of which have been printed, in said step b), with a relative position different from the relative register position with which it has been compared, until each of them has reached its respective relative register position, and
- moving each of the printing rollers (R_2, R_3... R_n) according to the same movement undergone in said step a), identical in magnitude and along the same movement axis, but in an opposite direction, so that all the characteristic images (M_1, M_2, M_3...M_n) are printed completely superposed in relation to one another on the laminar material (2) in said common reference register position or position of the first characteristic image (M_1) within said area (Z).

29. The method according to claim 1, 2 or 25, **characterized in that** to perform said register adjustment it comprises:

- comparing the relative positions detected in said step c), for each of the printed characteristic images (M_1, M_2, M_3...M_n), with respective relative register positions equal to a reference register position common to all the characteristic images (M_1, M_2, M_3...M_n) plus the movement of the transverse and/or longitudinal register undergone by each of the characteristic images (M_1, M_2, M_3...M_n) in said step a),
- adjusting the transverse and longitudinal register of the printing rollers (R_1, R_2, R_3... R_n) the characteristic images (M_1, M_2, M_3...M_n) of which have been printed with a relative position different from the relative register position with which it has been compared, until each of them has reached its respective relative register position, and
- moving each of the printing rollers (R_1, R_2, R_3... R_n) according to the same movement undergone in said step a), identical in magnitude and along the same movement axis, but in an opposite direction, so that all the characteristic images (M_1, M_2, M_3...M_n) are printed completely superposed in relation to one another on the laminar material (2) in said common reference register position.

30. The method according to claim 29, **characterized in that** said common reference register position is a pre-determined position.

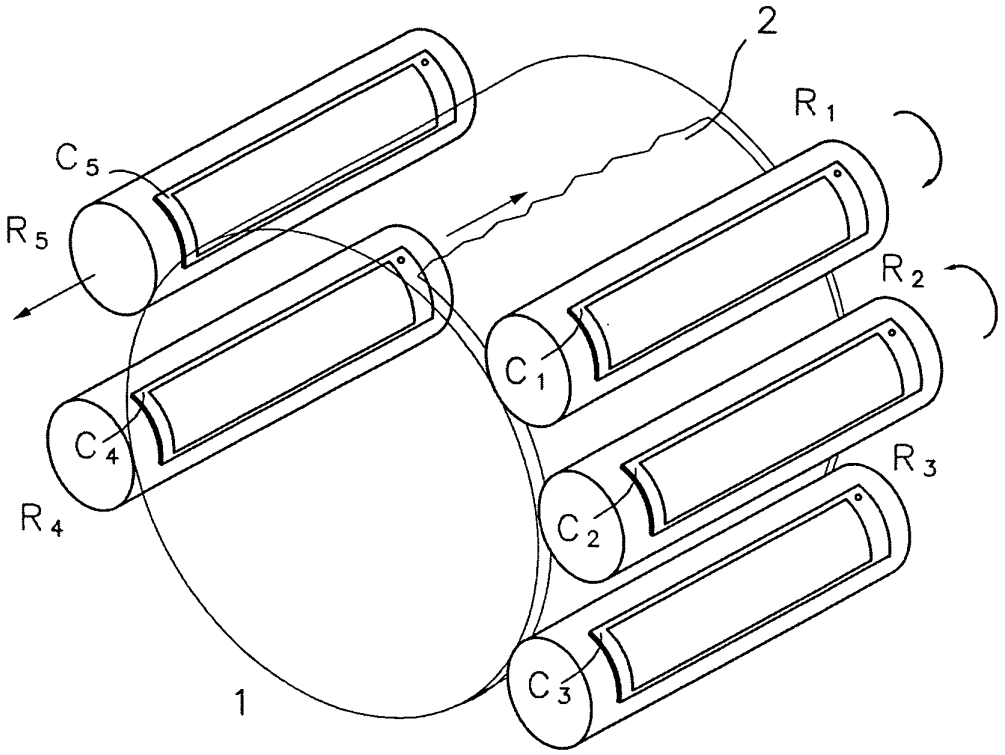

Fig. 1a

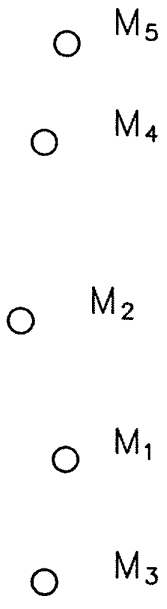

Fig. 1b

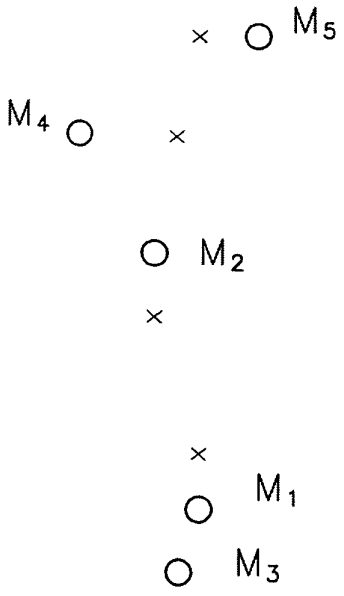

Fig. 1c

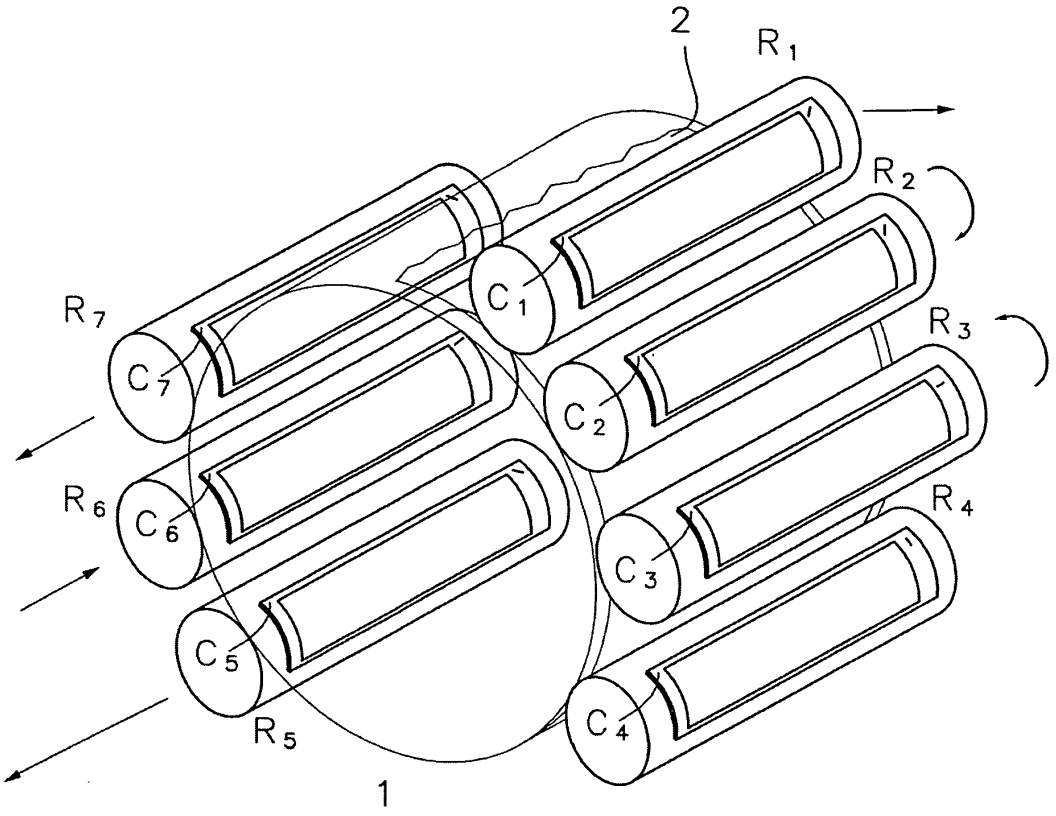

Fig.2a

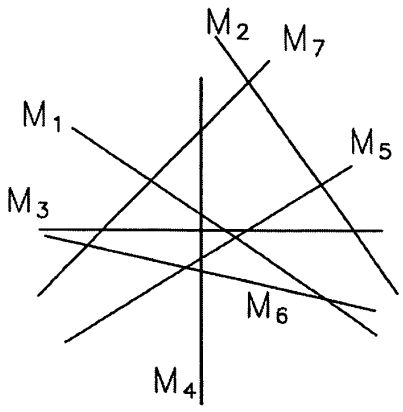

Fig.2b

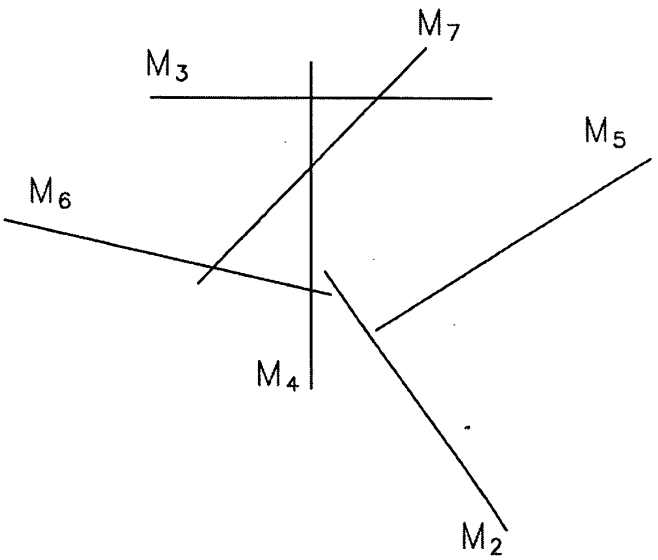

Fig.2c

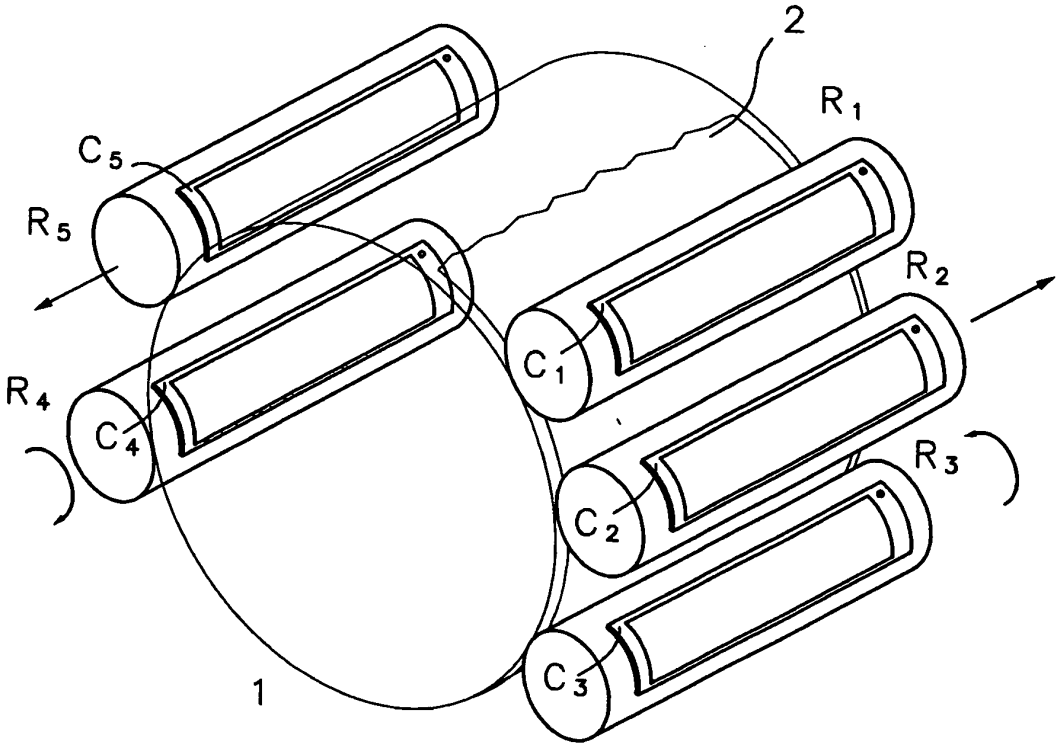

Figura 1a

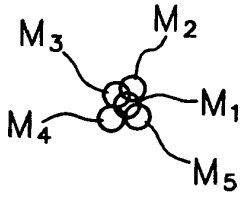

Figura 1b

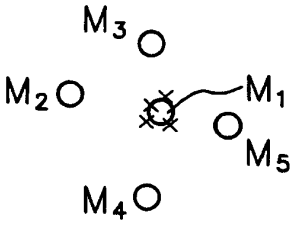

Figura 1c

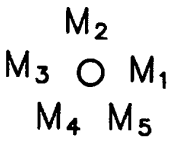

Figura 1d