(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 349 069 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
18.07.2018 Bulletin 2018/29

(51) Int Cl.:
G03G 15/16 *(2006.01)* ***G03G 15/00*** *(2006.01)*

(21) Application number: **18020006.5**

(22) Date of filing: **09.01.2018**

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

(30) Priority: **13.01.2017 IT 201700002608 U**

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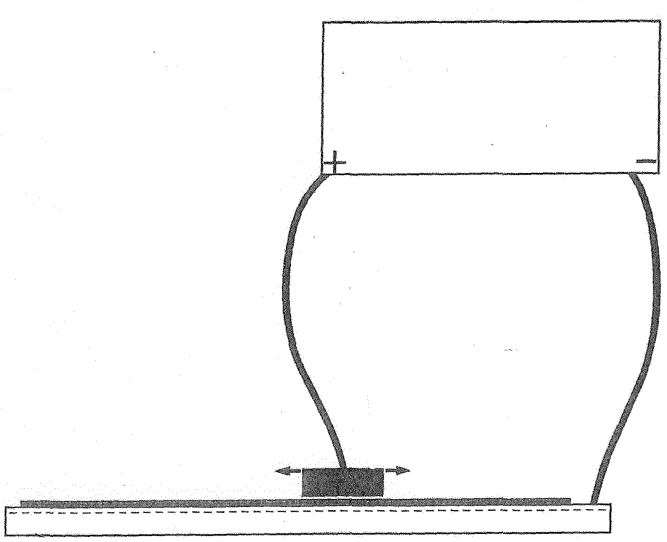
(54) EQUIPMENT AND PRINTING METHOD ON ANY KIND OF SUPPORT

(57) The present invention is the use of equipment consisting of a modified laser printer, a generator of electrostatic charges or an ultrasonic wave generator and a heating apparatus for printing on any support. The toner, until it is fixed to the surface of the object with the heating apparatus, maintains its initial characteristics, i.e. powder particles. The image, which comes out from the laser printer is placed on the surface on which to transfer the print; the head of the electrostatic charge generator is made to slide on the back face of the sheet generating an electrostatic force such as to push the toner particles onto the underlying surface, reproducing the same image but in a mirror-like manner; the sheet is then removed and the image is permanently attached on the surface of material via the heating apparatus which carries the toner to the melting temperature.

TABLE 4

figure 6



EP 3 349 069 A1

Description

[0001] Object of the present invention is the use of equipment consisting of a modified laser printer, a generator of electrostatic charges and a heating apparatus for printing on any support.

[0002] At present, the printing is carried out on different supports adopting appropriate techniques depending on the same. For example, for certain media the printing is carried out in the laboratory, on films or paper, after which they have been put with adesive on the support; in other cases the printing is produced in the laboratory and directly on the support, limited in shape and size; still, it is possible to print on vertical supports but they must be homogeneous, not curved, of limited height and free from obstacles. In each of the cases indicated, the printing procedures use films or printed papers with water-based or solvent based inks and in any case it is not possible to use only one apparatus to produce said prints.

[0003] Ultimately, at the current state of the art, it is not possible to adopt a single printing method valid for the production of images on any type of support or surface.

[0004] The aim of the present invention is the production of environmentally friendly prints on any surface, without limitations of shape and size of the surface itself, as well as in the laboratory also directly on the place where the surface to be printed is located, and envisages the use of any type of toner, whatever the composition of the material to be printed.

[0005] Another object of the present invention, in accordance with the foregoing, is the possibility of producing prints by adopting a single method valid for all materials, simultaneously overcoming all the current limitations regarding the composition, shape, size and homogeneity of the surface of the object to be printed.

[0006] Another object of the present invention, in accordance with the foregoing, is to use a laser printer by introducing in it innovative passages which allow printing outside the printer and independently thereof.

[0007] It is known that the process applied by laser printers is divided, schematically, into the following steps:

1. Static loading of the drum through the PCR. The continuous flow of electrical current from the PCR generates a state of charge on the photosensitive surface of the drum
2. Exposure: the laser beam reads the image to be reproduced and scans the surface of the drum by removing the charge in areas where the toner should not be placed in the next stage of development. At this point there is on the surface of the drum a "hidden" image which is nothing but the reproduction in negative of the image to be printed
3. Development: the development phase takes place through the acquisition, by the magnetic drum, of the toner dust on the hidden image. Toner powder, coming its own tank it is attracted to the drum itself and attaches itself to the areas that are sensitive to the charge, ie to the hidden image.
4. Transfer: the next step is to move the toner on the sheet of paper. During its sliding, the sheet is electrostatically charged by the displacement roller, so that the toner on the drum, with a charge of sign opposite to that of the sheet, moves onto the sheet of paper creating the image to be printed.
5. Fusion: the toner particles that are already present on the sheet of paper are not yet perfectly attached to it, they need the melting phase. The sheet of paper passes through a zone of the printer called "baking oven", consisting of the fuser roller and the presser. The pressure roller compresses the sheet on the fuser roller, which with the heat emitted welds the toner to the paper.

[0008] The procedure object of the present application modifies the above description, articulating itself in the following phases:

a. The image to be reproduced (table n.1, figure n.1) is sent to the laser printer in specular mode with respect to the initial orientation (table n.1, figure n.2)
b. The laser printer performs its procedure as described in paragraphs 1 to 4 above. The melting step is then excluded (point 5.), thus obtaining on the sheet a print which still has the toner in its original state of powder (table 1, figure 2).
The sheet coming from the printer is placed on the surface to be printed, in contact with it and with the printed side (provided with toner) facing it (table n.3, figure n.4-5)
c. Through a generator of electrostatic charges (harmless and completely safe for things or people) apply charges or to the sheet or to the surface to be printed or both (table n.4, figure n.5) which, acting on the toner, create a force such as to reject the toner particles from the sheet, and in this way transfer the print onto the chosen material.
d. Once the toner has been transferred, the previously positioned sheet is removed (table n.5, figure n.6) and the printing is definitively fixed on the material through a heat source at a suitable temperature (table n.6, figure n.8 (Fusion temperature of toner)

[0009] The innovative procedure described thus allows to print with toner on any material and surface. Moreover it allows the production of prints of any size, being able to realize an image of any size.

[0010] This procedure therefore achieves the exceeding of the current limits of laser printing with regard to the composition, the shape and the size of the support. Moreover, it has the following advantages also compared to the other existing printing techniques:

- possibility of printing as well as in the laboratory also directly on the place where the surface to be printed is located

- high print quality
- possibility of printing on horizontal, vertical, curved and asymmetrical surfaces.
- low toner costs compared to inks, films, paints and special papers used in other printing techniques
- ease of application of the prints on surfaces
- low cost, low energy consumption, minimum space and easy transportability of the machinery necessary for printing.
- possibility to correct any errors or imperfections by removing the toner from the printing surface before casting.
- Ecological as it provides for a minimum production of waste materials.
- ecocompatibility linked to the non-use of chemical products.
- Ecological as it provides for the reuse of the sheets used by the laser printer since at the end of the process on them there is no more toner powder
- The whole process is much faster than any other printing technique.
- respect of the initial characteristics of the substrate to be printed, since the same are not altered by printing (for example, with this procedure printing on a wooden surface does not cover the natural grain of the wood support)
- practical and economic method as it allows printing with just one machine anywhere.

[0011] The electrostatic charge generator, used for the transfer of toner, can be replaced by an ultrasonic wave generator of adequate frequency and intensity to fix the toner on the surface of any support

Claims

1. Equipment and printing method on any kind of support **characterized in that** it comprises a laser printer that is private of the toner smelting furnace, an electrostatic charge generator or an ultrasonic wave generator and a heating device up to the toner melting temperature, and in which:

   the image to be printed on the surface of the object, made specular with respect to the initial orientation, is sent to the aforesaid laser printer;
   the image, which come out from the laser printer and that presents, on the face of the sheet, the un-melted toner held together only by the electrostatic forces, is placed on the surface on which to transfer the print;
   the head of the electrostatic charge generator is made to slide on the back face of the sheet generating an electrostatic force such as to push the toner particles onto the underlying surface, reproducing the same image but in a mirror-like manner;
   the sheet is then removed and the image is permanently attached on the surface of material via the heating apparatus which carries the toner to the melting temperature.

2. Equipment and printing method on any support according to claim 1) **characterized in that** the electrostatic charge used, to obtain the transfer of toner on the surface of the object to be printed, can be of a positive or negative sign relative to the electrostatic charge of the toner which it takes in the printer.

3. Equipment and printing method on any support according to claim 1) **characterized in that** toner of any color can be used and any micron size of the particles can be used.

4. Equipment and printing method on any support as claimed in claim 1) **characterized in that** the toner, until it is fixed to the surface of the object with the heating apparatus, maintains its initial characteristics, ie powder particles.

5. Equipment and printing method on any support according to claim 1) **characterized in that** the electrostatic wave generator used for the transfer of the toner, can be replaced by an ultrasonic wave generator of adequate frequency and intensity to fix the toner on the surface of any support..

6. Equipment and printing method on any support according to claim 1) **characterized in that** on the surface, on which the image can be transferred, further electrostatic charges of suitable sign, positive or negative, can be applied to further facilitate the transfer.

TABLE 1

figure 1

figure 2

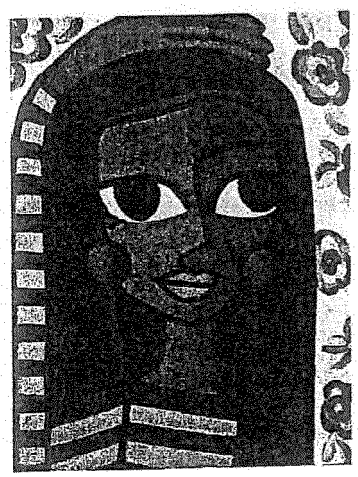


TABLE 2

figure 3

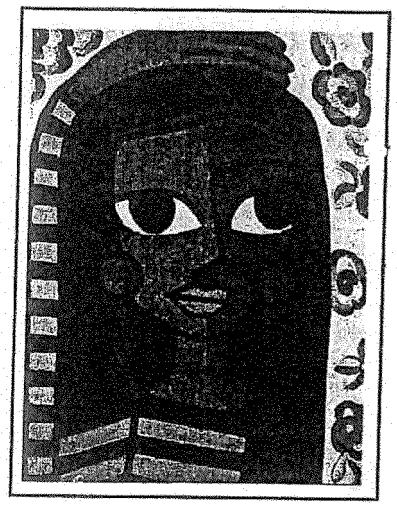


TABLE 3

figure 4

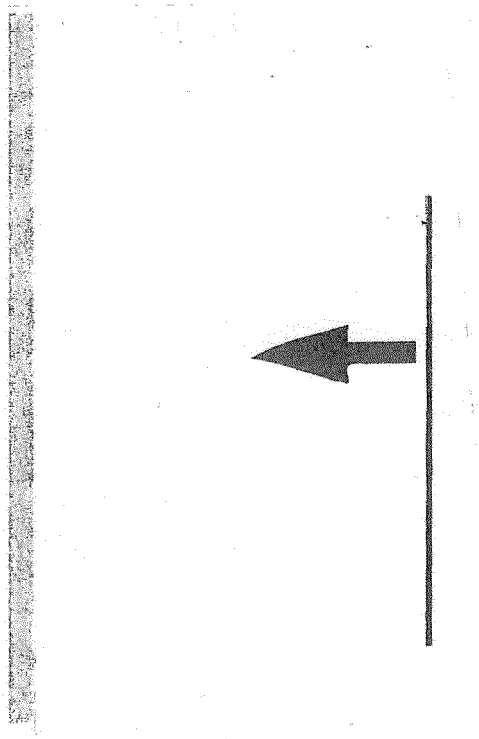


figure 5

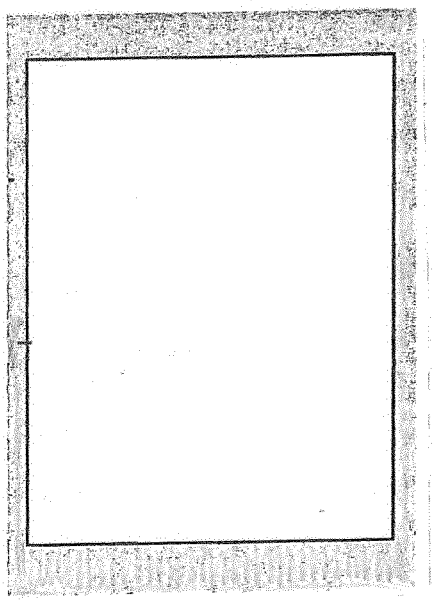


TABLE 4

figure 6

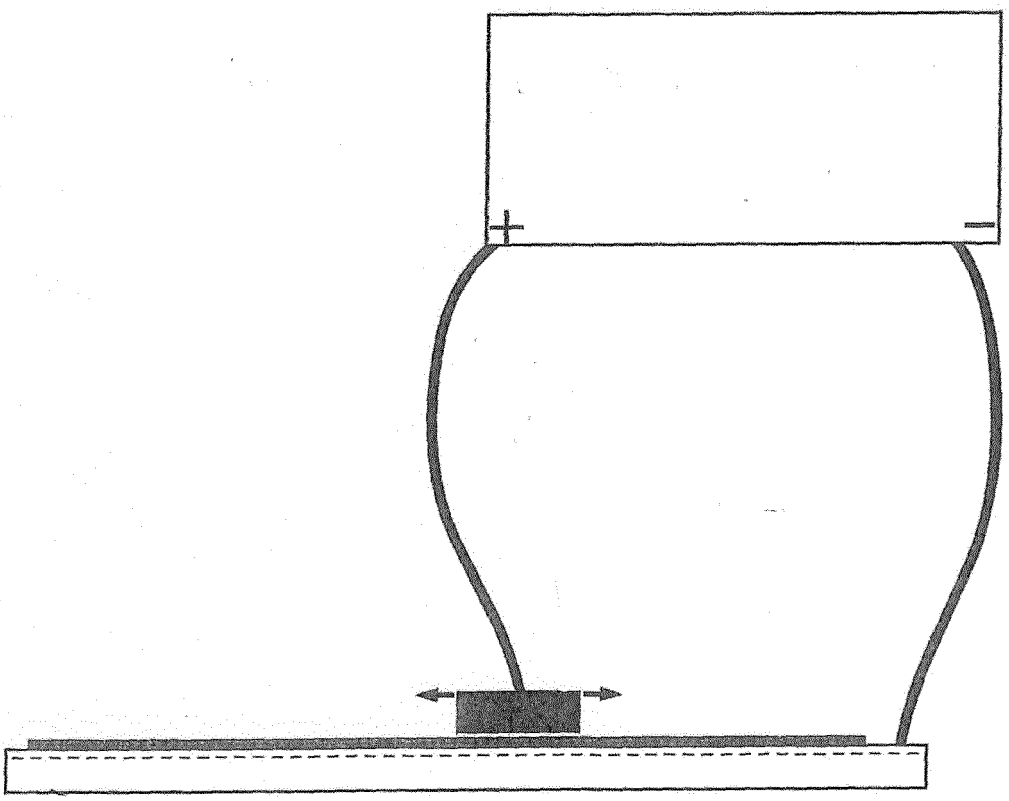


TABLE 5

figure 7

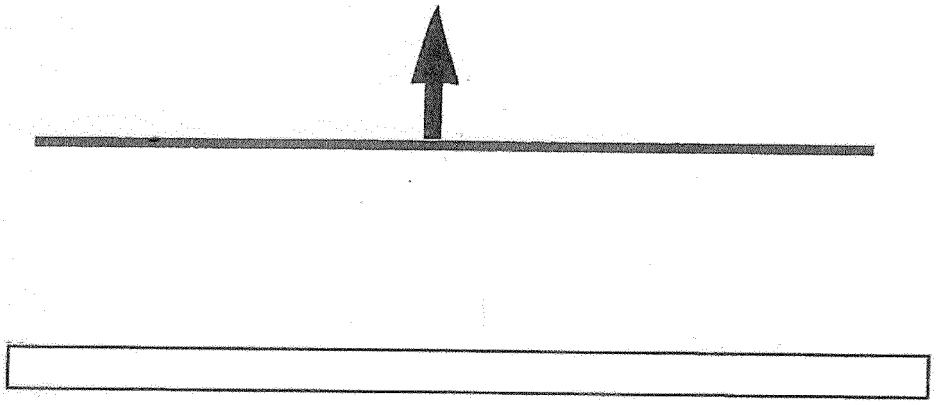
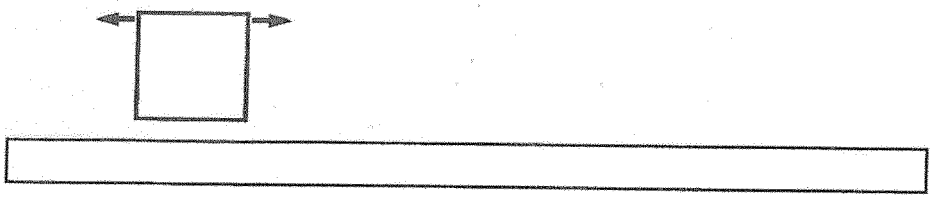


TABLE 6

figure 8



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EUROPEAN SEARCH REPORT

Application Number
EP 18 02 0006

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	US 4 066 802 A (CLEMENS CARL F) 3 January 1978 (1978-01-03) * column 4, lines 18-42 *	1-4,6 5	INV. G03G15/16 G03G15/00
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A	FR 2 762 410 A1 (DESCOIN DENIS [FR]) 23 October 1998 (1998-10-23) * abstract; figures *	1-6	
A	US 5 477 315 A (MASHTARE DALE R [US]) 19 December 1995 (1995-12-19) * the whole document *	1,5	
A	JP 2006 208496 A (KONICA MINOLTA BUSINESS TECH) 10 August 2006 (2006-08-10) * abstract; figures *	1,5	
			TECHNICAL FIELDS SEARCHED (IPC) G03G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	17 May 2018	Urbaniec, Tomasz

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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