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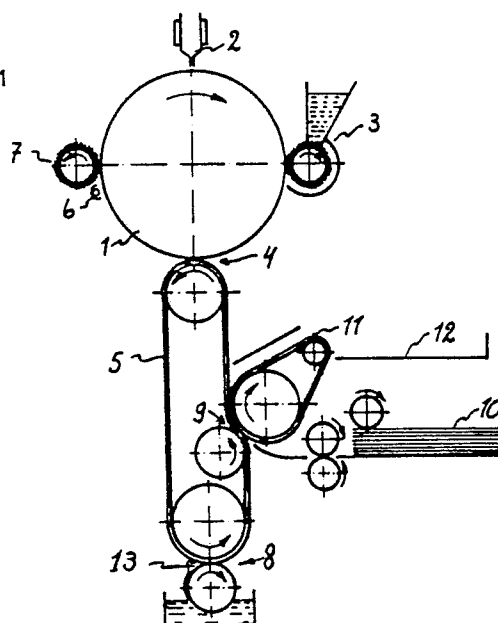
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DE FR GB NL(71) Applicant: **Océ-Nederland B.V.**
St. Urbanusweg 43
NL-5914 CC Venlo(NL)(72) Inventor: **Kuin, Nicolaas Paulus Joseph**
Leliestraat 11
NL-5971 AM Grubbenvorst(NL)
Inventor: **Pleyers, Jozef Jan Antonius**
Oldenneelhof 5
NL-5991 BS Baarlo(NL)

(54) Image forming process.

(57) Image forming process in which a latent image is formed on an image registration medium (1), by wetting selectively with water, the image is developed with a water-absorbent toner powder and the powder image under the influence of pressure is transferred onto a resiliently deformable, hydrophobic intermediate support (5). The intermediate support (5) with the powder image adhering thereto is covered with water and immediately thereafter the water is squeezed off and finally the sticky powder image is transferred under the influence of pressure onto a receiving paper and fixed thereon.

FIG. 1



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Image forming process

This invention relates to an image forming process in which an image is formed on a resiliently deformable intermediate support having a hydrophobic surface, by means of a water-absorbent powder, the intermediate support with the powder image present thereon is covered with water and the water is squeezed off immediately thereafter and finally the sticky image is transferred by pressure onto and fixed on a paper receiving support.

A process of this kind is known from European Patent Application 0 074 677. In this known process, the image is formed on the intermediate support in an electrophotographic process in which a charge image is formed on a drum having a photoconductive surface layer, the said charge image is developed with water-absorbent toner powder and then the powder image is transferred onto the intermediate support by pressure. The electrophotographic image forming process requires a plurality of processing stations to form the powder image and to regenerate the photoconductive layer after the image transfer.

The invention provides a new image forming process particularly suitable for forming images which can be transferred onto a paper receiving support and fixed thereon in accordance with the process as described in the above-mentioned European Patent Application 0 074 677.

The process as meant in the preamble is characterised according to the invention in that the image is formed on the intermediate support by wetting an image registration medium with water in accordance with an image pattern, bringing the thus selectively wetted image registration medium into contact with water-absorbent powder and transferring the powder image formed onto the intermediate support by pressure. Thus the invention provides a simple image forming process requiring considerably fewer processing stations than the known electrophotographic image forming processes.

According to a preferred embodiment of the invention, the image is formed by means of an ink-jet device, the latter being filled, not with ink, but with water. Since water is used as the image forming liquid, the problems normally occurring with ink-jet devices due to clogging of the fine spray nozzles by dried ink, are obviated.

According to another embodiment of the invention, the image forming process makes use of a printing plate the surface of which has hydrophilic image portions against an oleophilic background. During the printing process the printing plate is brought into contact with a water-yielding means, such as a roller wetted with water, only the image

portions of the printing plate accepting water, and then with water-absorbent powder supplied, for example, to the printing plate by means of a magnetic roller. The powder image thus formed on the printing plate is then transferred by pressure to a resiliently deformable intermediate support having a hydrophobic surface.

The image registration medium on which an image is formed by image-wise wetting with water, for example in an ink-jet device, followed by a development with water-absorbent powder, may consist of a support the surface of which is provided with a water-accepting layer or the surface of which is rendered water-accepting by suitable surface treatment. Suitable materials for use as an image registration medium in the process according to the invention are known from planographic printing techniques, more particularly offset printing. They may, for example, consist of aluminium, the surface of which is rendered water-accepting by anodization or by treatment with an aqueous solution of a silicate or an acid such as mellitic acid, phosphomolybdic acid or polyvinylphosphonic acid. Materials of this kind are described inter alia in German Auslegeschrift 1 134 093, Netherlands Patent 101 230 and US Patents 2 598 043, 2 714 066, 2 764 085, 3 030 210, 3 136 636 and 3 247 791.

The image registration medium may also consist of a plastics support or a preferably water-proofed paper support to which a water-accepting layer is applied, with or without the use of an anchoring layer, the water-accepting layer containing a filler such as clay, titanium dioxide, zinc oxide or barium sulphate, and a more or less hydrophilic binder which is insoluble in water or has been made insoluble in water. Such materials are also known from planographic printing technique and are described inter alia in US Patents 2 542 784, 2 724 665 and 3 161 521, UK Patents 692 387, 728 205 and 739 874, Canadian Patent 673 857 and Netherlands Patent Application 64 03 127. Suitable image registration media are also cellulose ester film superficially saponified to a depth of 2 -3 micrometer and polyester or other plastics film carrying a cellulose ester layer which has been superficially saponified. Materials of this kind are known as supports for light-sensitive diazotype material.

In the image forming process according to the invention the image registration medium is first wetted with water in accordance with an image pattern. The amount of water applied to the image portions in these conditions is small and is generally 0.5 -5 g/m². In the case of weak water-

absorbent surfaces, e.g. aluminium whose surface has been anodized or material having a cellulose ester layer saponified to a depth of only 2 to 3 micrometer, a water yield of 0.5 -2 g/m² is usually sufficient, while in the case of materials having a stronger water-absorbent top layer, e.g. with the composition of a planographic layer as is conventional on paper planographic printing plates, the water yield must generally be somewhat higher and be between 2 and 5 g/m².

Image-wise wetting of the image registration medium can be carried out by a water-filled ink-jet device. Suitable ink-jet devices for this purpose are so-called impulse jet devices in which the liquid (in this case water) is forced out of the spray nozzles by pressure pulses generated by a piezoelectric element. Impulse jet devices of this kind are described inter alia in US Patent 3 832 579 and German Patent Application 2 643 566.

According to another embodiment of the invention, an image registration medium is used in the form of a printing plate on which a water-accepting image is present against a water-repellent background. The printing plate can be obtained by exposing a light-sensitive, negative working planographic printing plate beneath a positive original and then developing it in the way specified for the printing plate. The light-sensitive planographic printing plate consists, for example, of an aluminium support whose surface is pre-treated with a silicate solution and then sensitized with a diazocompound, the light-decomposition product of which is water-insoluble and water-repellent. The diazo compound is, for example, a condensation product of p-diazodiphenylamine with an aldehyde, such as formaldehyde. Light-sensitive, negative working planographic printing plates are generally known in offset printing and are described inter alia in UK Patent 1 129 407 and US Patent 2 714 066.

The image registration medium wetted with water in accordance with an image pattern is developed by bringing the image registration medium into contact with water-absorbent powder fed to the image registration medium by a suitable transport means, e.g. a magnetic roller. A suitable water-absorbent powder consists of a binder which in water of 30°C is swellable but insoluble, such as a hydrolyzed polyvinyl acetate having a degree of hydrolysis between 55 and 65% or higher than 98%, in which non-swellable filler material, e.g. a mixture of magnetically attractable pigment and carbon black, is finely distributed. Developing powder of this composition is described in detail in European Application 0 078 077.

The powder image thus formed on the image registration medium is then transferred onto and fixed on a receiving paper in the manner described in the abovementioned European Patent Application 0 074 677.

Devices for performing the process according to the invention are illustrated diagrammatically in the accompanying Figures.

Fig. 1 illustrates a device in which the image is formed by an impulse jet device.

Fig. 2 illustrates a device in which a printing plate is used.

The device according to Fig. 1 comprises an aluminium drum 1 whose surface is rendered water-accepting and which is driven in the direction indicated by an arrow. Reference 2 denotes an impulse jet device by means of which water droplets are applied to the surface of the drum 1 in accordance with an image pattern. The latent wet image formed on the drum 1 is developed by the magnetic brush developer device 3 filled with water-absorbent powder. In a pressure zone 4 drum 1 comes into pressure contact with belt 5 consisting of a flexible support having thereon a resiliently deformable and hydrophobic top layer, the belt being driven at the same speed as the circumferential speed of drum 1, in the direction indicated by arrows. The powder image is transferred from drum 1 onto belt 5 in the pressure zone 4. The drum 1 then runs past a heating element 6, where the drum is dried, but is not heated to such an extent that powder particles remaining thereon will soften, and past a cleaning device 7. From pressure zone 4 belt 5 runs to a second pressure zone 8. Immediately before this pressure zone, at the entry of the water meniscus 13 present there, belt 5 with the powder image adherent thereto is immersed in water. The excess water is squeezed off in pressure zone 8. In the third pressure zone 9 the now sticky powder image is transferred onto a sheet of receiving paper fed from a stock stack 10. The copy is fed by belt 11 to a collection station 12.

The device according to Fig. 2 comprises a plate cylinder 20 known from offset printing machines, on which a printing plate having water-accepting image portions and water-repellent background areas is secured by clamping means not shown. The plate cylinder is driven in the direction indicated by an arrow. Water is fed to the printing plate by a damping roller 21 partially submerged in a water reservoir 22. The wetted image portions of the printing plate are provided with a layer of water-absorbent powder by the magnetic brush developer device 23. The powder image is then transferred onto a belt 25 in the pressure zone 24 and then transferred to and fixed on a sheet of receiving paper.

ing paper in the manner described in connection with Fig. 1. The image portions of the printing plate are then re-wetted with water and provided with a layer of water-absorbent powder.

Claims

1. An image forming process in which an image is formed on a resiliently deformable intermediate support (5) having a hydrophobic surface, by means of a water-absorbent powder, the intermediate support (5) with the powder image present thereon is covered with water and the water is squeezed off immediately thereafter and finally the sticky image is transferred by pressure onto and

fixed on a paper receiving support, characterised in that the image is formed on the intermediate support (5) by wetting an image registration medium - (1) with water in accordance with an image pattern, bringing the thus wetted image registration medium (1) into contact with water-absorbent powder and transferring the powder image formed onto the intermediate support (5) by pressure.

2. A process according to claim 1, characterised in that the image pattern is formed by spraying the image registration medium (1) with water image-wise.

3. A process according to claim 1, characterised in that image registration medium (1) is provided with water-accepting image portions and water-repellent background areas.

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FIG. 1

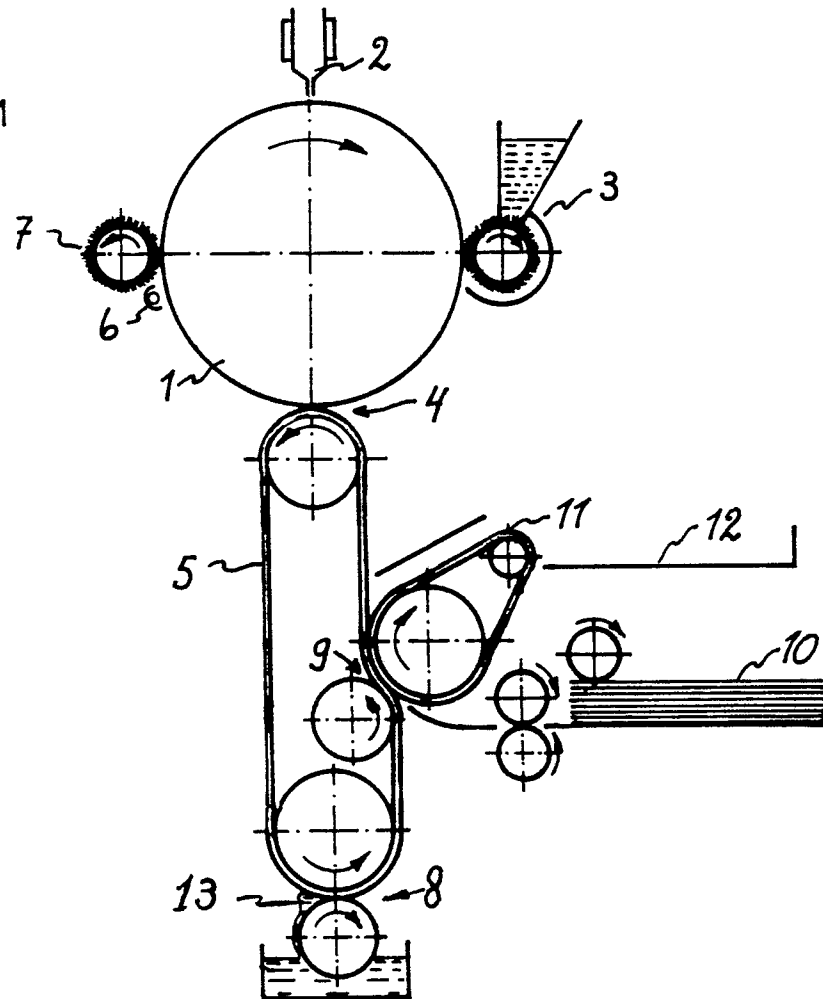
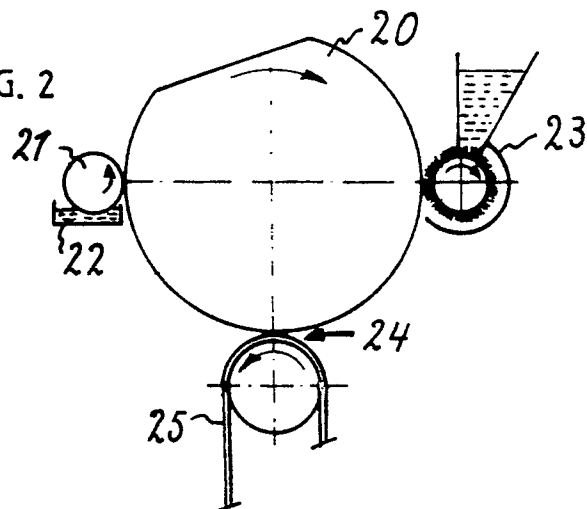


FIG. 2





DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	US-A-3 446 184 (L.W. JOHNSON) * Column 2, lines 10-29 *	1	G 03 G 17/00 B 41 M 1/06
A	--- IBM TECHNICAL DISCLOSURE BULLETIN, vol. 21, no. 2, July 1978, pages 698,699, New York, US; G.T. SLAUGHTER: "Ink jet printer/copier" * Whole document *	1,2	
A	--- GB-A-1 501 214 (XEROX CORP.) * Claims 1,2 *	1,2	
A	--- XEROX DISCLOSURE JOURNAL, vol. 5, no. 5, September/October 1980, page 477, Stamford, US; R.L. SCHANK: "Two-fluid direct mode printing master" * Whole document *	1,3	
D,A	--- EP-A-0 074 677 (OCE NEDERLAND B.V.) * Page 5, lines 8-36; figure 1 *	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			G 03 G 17 G 03 G 13 B 41 M 1
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 03-09-1986	Examiner CIGOJ P.M.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	