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(54) Method and apparatus for drying printed materials

Verfahren und Vorrichtung zum Trocknen von Druckerzeugnissen

Procédé et dispositif pour sécher des produits imprimés

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Description

[0001] The invention relates to a method for drying printed materials substantially immediately after the manufacture thereof.

[0002] During a printing process solvent-rich ink is applied to an unprinted carrier, for instance of paper or cardboard. In a first phase of the printing process the molecules of the solvent can move virtually unobstructed and can be extracted in simple manner from an applied ink film, for instance by blowing a continuous flow of air over the ink film. The drying speed in this first phase is constant. In a second phase the ink surface of the ink film dries slowly, while the interior of the ink film still remains wet for some time. The drier the ink layer becomes, the more the escape of molecules from the solvent is obstructed. The drying speed in the second phase is determined by the diffusion in the ink film. In a third phase the printed material still contains only a small residual quantity of solvent, which residual quantity is designated with the term "retention". Both the surface and the interior of an applied ink film are dry in this third phase, so that molecules of a solvent are as it were captive in the ink film. The solvent is only released slowly.

[0003] The retention of solvent in finished printed materials increasingly represents a problem in cases where this solvent has toxic properties, such as for instance the solvent toluene commonly applied in intaglio techniques. Current norms for toluene retention in finished printed materials are realized according to per se known methods in the above described first and second phase of the printing process. In order to decrease the toluene retention still further, finished printed material has to be stored for a longer period according to the prior art, for instance a period of at least three weeks, so that the toluene can be released slowly from the printed material.

[0004] There are drawbacks to prolonged storage of finished printed material. Storage takes up much costly space and in some cases is not possible, for instance in the case of magazines where the period between printing and appearance is inherently very short.

[0005] The object of the invention is to provide a method for drying printed materials, according to which the retention of solvent in finished printed materials can be reduced considerably at acceptably low cost and within a very short period relative to the retention attainable by means of prior art methods.

[0006] A further object is to provide an apparatus for performing the proposed method.

[0007] These objectives are achieved, and other advantages gained, with a method which according to the invention comprises of exposing a quantity of printed material for a determined period to a predetermined low pressure relative to the atmospheric pressure.

[0008] The method is for instance performed by subjecting finished printed material still in the printing press to a very low pressure immediately after the last printing

run. The printing press is for instance provided for this purpose with a vacuum chamber closable by rollers, wherein finished printed material is fed into the vacuum chamber on a conveyor belt between a first pair of co-acting infeed rollers and is discharged from the vacuum chamber between a second pair of co-acting outfeed rollers.

[0009] In an advantageous embodiment the method according to the invention comprises the successive steps of:

- (i) feeding a quantity of printed material under conditions of room temperature and atmospheric pressure into a space closable and evacuable in vacuum-tight manner,
- (ii) closing the space,
- (iii) at least partially evacuating the space for a determined period and maintaining a predetermined low pressure in the space relative to the atmospheric pressure, and
- (iv) removing the quantity of printed material from said space after the determined period.

[0010] The method is particularly suitable for drying printed materials wherein at least one ink contains a solvent other than water, in particular an organic solvent, wherein according to the invention the predetermined low pressure is lower than the maximum vapour pressure of this solvent at room temperature. By evacuating the space to a pressure lower than the maximum vapour pressure a concentration gradient of the solvent in the applied ink film and the vicinity thereof can be maintained, which concentration gradient is necessary to sustain a diffusion in the gas phase (i.e. in the printed material, for instance paper, and in the vicinity thereof) of molecules of the solvent.

[0011] According to an advantageous embodiment of the method according to the invention the gases released during the evacuation according to step (iii) are guided to regeneration means for the solvent.

[0012] The determined period in step (iii) amounts for instance to a maximum of ten hours.

[0013] The determined period in step (iii) amounts for instance to at least one hour.

[0014] In a method according to the invention the predetermined pressure is preferably higher than 5 mbar (500 Pa). This preferred method is based on the consideration that the pump speed required at a pressure lower than 5 mbar is undesirably high from a cost viewpoint, and on the insight that at a pressure lower than 5 mbar the evaporation of water from printed materials is so high that, with a view to further processing of the printed materials, for instance in a binder, the moisture content becomes unacceptably low.

[0015] The quantity of printed materials to be fed in step (i) is provided by way of example in the form of collected and bound finished printed materials, so-called *bundles*, but can also be provided for instance in the

form of rolled-up folded sheets, so-called *printed rolls*, or in the form of flat folded sheets, so-called *piles*.

[0016] It has been found that close-packing of printed sheets of paper in a stack of finished printed material or in a pile under conditions of low pressure forms no obstacle to a rapid release of solvent.

[0017] The invention further relates to an apparatus for drying printed materials, comprising an autoclave and pumping means for evacuating the autoclave to a predetermined pressure, which autoclave is adapted to temporarily store therein a quantity of printed materials substantially immediately after manufacture of these printed materials.

[0018] An apparatus according to the invention preferably comprises regeneration means for regenerating solvent from gases released during evacuation of the autoclave. Regeneration of solvent generally affords a cost advantage, while in the case of harmful gases it is an obvious advantage that these gases not be released into the environment.

[0019] In an embodiment the regeneration means comprise an adsorber for adsorbing solvent thereon, and in normal operation of the apparatus the pumping means guide the released gases over the adsorber.

[0020] In a subsequent embodiment the regeneration means comprise a condenser, and in normal operation of the apparatus the pumping means guide the released gases over the condenser in order to separate the released gases into a low-solvent gas phase and a solvent-rich liquid phase.

[0021] In yet another embodiment the pumping means comprise a liquid ring-pump provided with a water buffer vessel, in a part of which buffer vessel a solvent-rich phase is created in normal operation of the apparatus, and the regeneration means are coupled to the solvent-rich phase of the buffer vessel.

[0022] In an advantageous embodiment the pumping means in an apparatus according to the invention comprise a cascade connection of at least one vacuum pump and at least one roots pump placed between this vacuum pump and the autoclave. The roots pump is applied in this embodiment to displace gases from the autoclave to the vacuum pump at a substantial compression ratio (for instance of a factor 10). The interposing of a roots pump results in a reduction of the required capacity of a vacuum pump to an extent such that a decrease in the total investment and operating costs of the apparatus is thereby achieved.

[0023] In a particularly advantageous embodiment the autoclave comprises at least three closable and separately evacuable compartments which are each provided with a closable entrance and a closable exit, wherein the exit of a first compartment forms the entrance of a second compartment and the exit of this second compartment forms the entrance of a third compartment.

[0024] In such an autoclave with three compartments it is possible to dry batches of finished printed materials in semi-continuous manner. The pressure in the second

compartment is herein held continuously at the predetermined low value. A batch of printed materials, for instance loaded on pallets, is placed in the first compartment which is then closed and evacuated until the pressure in the first compartment becomes equal to the pressure in the second compartment. After opening of the exit of the first compartment the batch of printed materials is pushed along to the second compartment using a per se known transport system, and the exit of the first compartment is closed. The batch of printed materials is then held under the low pressure in the second compartment for a determined period, during which the first compartment can be loaded with a subsequent batch of finished printed materials and once again evacuated, and the third compartment can be discharged and evacuated once again. Once the determined period has elapsed, the exit of the second compartment is opened and the batch of printed materials is pushed along to the third compartment using a per se known transport system, whereafter the following batch of printed materials is subjected to the transporting and drying steps described here.

[0025] The invention will be elucidated hereinbelow on the basis of embodiments and with reference to the drawings.

[0026] In the drawings:

Fig. 1 shows a graphic representation of the drying speed of paper printed with a toluene-containing intaglio ink as a function of time,

Fig. 2 shows a graphic representation of the toluene reduction in batches of paper, each printed with a toluene-containing intaglio ink, as a function of the (low) external pressure applied for a determined period,

Fig. 3 is a graphic representation of the toluene reduction in batches of paper, each printed with a toluene-containing intaglio ink, at a (low) external pressure as a function of time,

Fig. 4 shows a first embodiment of an apparatus for drying printed materials according to the invention, Fig. 5 shows a second embodiment of an apparatus for drying printed materials according to the invention,

Fig. 6 shows a third embodiment of an apparatus for drying printed materials according to the invention, and

Fig. 7 is a schematic view of a "pile" of finished printed material in a form in which it is suitable for loading onto a pallet and feeding into an autoclave of a drying apparatus according to the invention.

[0027] Corresponding components are designated in the drawings with the same reference numerals.

[0028] Fig. 1 is a graphic representation along linear scales in random units of the drying speed, s , of paper printed with a toluene-containing intaglio ink as a function of time, t , wherein the drying speed is defined as

discharged mass per unit of time. During the printing process a toluene-containing ink is applied to a paper surface. The finished printed material may initially contain for instance about 6000 mg toluene per kg paper. In a first phase (I) the toluene molecules present are displaceable in virtually unobstructed manner and can be extracted in large quantities from the applied ink film, for instance by guiding heated air over the ink film at high speed. The greater part of the toluene is herein removed from the paper at a constant drying speed. In a second phase (II) the ink surface dries while the interior of the ink film still remains dry for a time. The printed materials can then contain for instance a quantity of toluene of between about 1500 mg/kg and about 6000 mg/kg. As the ink layer dries further, the escape of toluene is obstructed more strongly by the ink film. The decreasing drying speed is determined by the diffusion of the toluene in the ink film. In a third phase (III), when the printed materials leave the printer, the ink surface and the interior of the ink film are dried, as a result of which the toluene molecules are as it were captive in the ink film. In this phase the paper contains for instance less than about 1500 mg/kg toluene, which is only released slowly. It is during the second phase that the method according to the invention finds optimal application.

[0029] Fig. 2 is a graphic representation of the toluene reduction, red. (%), of paper printed with a toluene-containing intaglio ink and dried in accordance with the invented method, as a function of the (low) external pressure, p (mbar), applied for a determined period, for three different process parameters obtained by measuring the toluene reduction of a large number of batches at a determined pressure p and a residence time t . Curve A (unbroken line) shows the toluene reduction of paper printed with a standard toluene-containing intaglio ink and dried in an autoclave for 1.5 hours under conditions of low pressure p . Curve A shows that when the pressure is reduced from about 20 mbar to about 12 mbar the toluene reduction increases until a maximum value of about 50% is obtained, whereafter a further decrease in the pressure no longer results in a further toluene reduction. Curve B (dashed line) shows the toluene reduction of the same printed material as in curve A when it has been dried in the autoclave for 3 hours under conditions of low pressure p . Curve B shows that when the pressure is reduced from about 20 mbar to about 12 mbar the toluene reduction increases until a maximum value of about 63% is obtained, whereafter, as in curve A, a further decrease in the pressure no longer results in a further toluene reduction. The finding that below a sufficiently low pressure, in this case a "critical pressure" of 12 mbar, a further pressure decrease does not result in a further toluene reduction, is in line with the assumption that the decreasing drying speed is determined by the diffusion of the toluene in the ink film, on which the external pressure has no effect. The existence of a "critical pressure" for drying printed materials under low pressure is of great practical importance because a de-

crease in the pressure below this critical value is not only pointless, as shown above, but also results in an increase in the required pump capacity, and therewith in a (needless) increase in the cost of the pump installation. A further decrease in the pressure moreover leads to a stronger evaporation of water from paper, which is likewise disadvantageous for the required pump capacity and furthermore results in adverse consequences for the paper properties. Curve C (broken line) shows the toluene reduction of paper printed with a toluene-containing, so-called LR intaglio ink which is dried in an autoclave for 1.5 hours under conditions of low pressure p . An LR ink is an ink with an open structure from which the toluene can escape more easily than from the closed structure of the conventional intaglio inks. Because toluene evaporates more quickly from an LR ink than from a conventional ink, the diffusion of toluene in paper printed with an LR ink must be more rapid than in paper printed with a conventional ink, so that a lower pressure must also be applied to sustain this diffusion. Curve C shows that when the pressure is reduced from about 20 mbar to a "critical pressure" of about 10 mbar the toluene reduction increases until a maximum value of about 65% is obtained, whereafter a further decrease in the pressure no longer results in a further toluene reduction. The "critical pressure" for the LR ink used here is therefore, as expected, lower than that for a conventional intaglio ink, while the realized ink reduction is significantly higher.

[0030] Fig. 3 is a graphic representation of the toluene reduction in batches of paper, each printed with a toluene-containing intaglio ink, at a (low) external pressure as a function of time. Curve AB (unbroken line) shows the toluene reduction of the same printed material as in curves A and B of fig. 2 when this printed material has been dried in the autoclave under a pressure of 5 mbar. Curve AB shows that in a first phase (i) of about 1 hour, in which low pressure is applied around the printed material and this low pressure penetrates slowly into the printed material, the toluene reduction increases comparatively quickly until a value of about 40% is obtained. In a second phase (ii), in which a constant toluene concentration is adjusted on the surface of the ink film on the printed material, a further toluene reduction is then achieved to a value of about 80%. The toluene evaporation in this phase (ii) is determined by the diffusion in the ink film, and hereby by the concentration gradient of the toluene in the ink film. In a third phase (iii), after a total time period of about 10 hours, the toluene evaporation proceeds ever more slowly as a result of a decreasing toluene concentration on the surface of the ink film. Curve C (broken line) shows the toluene reduction of the same printed material as in curve C of fig. 2 (with an LR ink) when this printed material has been dried in the autoclave under a pressure of 5 mbar. Curve C shows, just as curve AB, a progression in which three phases (i, ii, iii) can be distinguished. This shows that the second phase (ii) and third phase (iii) occur sooner

in paper printed with LR ink (curve C) than in corresponding paper printed with conventional intaglio ink (curve AB).

[0031] Fig. 4 shows a highly simplified diagram of an apparatus 1 for drying toluene-containing printed material according to the invention, with an autoclave 2 which is connected to the inlet of a roots pump 3, the outlet of which is connected to the respective inlets of three backing pumps 4 placed in parallel, the respective outlets of which are connected to a toluene recovery installation (TRI) 5, an air outlet of which is connected to the space 6 in which is arranged the press for the printed materials for drying. In this embodiment autoclave 2 is a cylinder with a length of about 15 m and a diameter of about 3.5 m, in which about 20 pallets of finished printed materials can be stored. The operation of the apparatus is as follows. Using backing pumps 4 air is extracted from the filled autoclave 2 until a pressure of about 10 mbar is obtained. At this low pressure toluene evaporates and escapes as gas from the printed material, and the roots pump provides a volume displacement at a compression factor having a value of about 10. Air from the autoclave is guided by pumps 3, 4 directly to an adsorber (not shown) of the TRI 5, where condensation water is drawn off and guided to a water/toluene separator, where toluene is recovered which can be re-used in the printing process. Air from the TRI 5, which in principle is free of toluene, is fed back in the apparatus of this embodiment to space 6 in which the relevant printing press is arranged.

[0032] Fig. 5 shows a highly simplified diagram of an alternative embodiment of a drying apparatus 7 which differs from the apparatus 1 of fig. 4 in that between roots pump 3 and backing pumps 4 a condenser 8 is placed for guiding thereover air coming from autoclave 2 and causing condensation from this air of a water/toluene mixture which is guided to a water/toluene separator 9 where toluene is recovered which can be re-used in the printing process.

[0033] Fig. 6 shows a highly simplified diagram of a subsequent embodiment of a drying apparatus 7 which differs from the apparatus 1 of fig. 4 in that behind the first roots pump 3 is placed a second stage with a roots pump 11, wherein the first roots pump 3 functions in a pressure range of 10 to 30 mbar and the second roots pump 11 functions in a pressure range of 30 (the vapour pressure of water) to 100 mbar. A liquid ring-vacuum pump 12 is connected behind the second roots pump 11. When this pump 12 operates at a pressure of 30 mbar, there occurs in the liquid ring condensation of toluene which is discharged with the water to a cooling water buffer vessel 13, where a separation between pure water and a toluene-rich phase takes place. In this embodiment pure water from buffer vessel 13 is drained for re-use to a boiler-house 14, while the toluene-rich phase is guided to a water/toluene separator 9.

[0034] Fig. 7 shows a perspective view of a "pile" 15 of finished printed material in a form in which it is suitable

for loading onto a pallet and feeding into an autoclave of a drying apparatus according to the invention. A pile 15 comprises a number of printed and vertically placed folded sheets 16 which are clamped between two vertical wooden partition plates 17 using a tightly fastened strapping strip 18. It has been found that under conditions of low pressure the closed structure of a pile forms no obstacle to a rapid release of toluene.

Claims

1. Method for drying printed materials substantially immediately after the manufacture thereof, comprising of exposing a quantity of printed material for a determined period to a predetermined low pressure relative to the atmospheric pressure.
2. Method as claimed in claim 1, comprising the successive steps of:
 - (i) feeding a quantity of printed material under conditions of room temperature and atmospheric pressure into a space closable and evacuable in vacuum-tight manner,
 - (ii) closing the space,
 - (iii) at least partially evacuating the space for a determined period and maintaining a predetermined low pressure in the space relative to the atmospheric pressure, and
 - (iv) removing the quantity of printed material from said space after the determined period.
3. Method as claimed in claim 1 or 2 for drying printed materials wherein at least one ink contains a solvent other than water, in particular an organic solvent, **characterized in that** the predetermined low pressure is lower than the maximum vapour pressure of said solvent at room temperature.
4. Method as claimed in claim 3, **characterized in that** the gases released during the evacuation according to step (iii) are guided to regeneration means for the solvent.
5. Method as claimed in claim 3 or 4, **characterized in that** the determined period in step (iii) amounts to a maximum of ten hours.
6. Method as claimed in any of the claims 3-5, **characterized in that** the determined period in step (iii) amounts to at least one hour.
7. Method as claimed in any of the foregoing claims, **characterized in that** the predetermined pressure is higher than 5 mbar (500 Pa).
8. Method as claimed in any of the claims 2-7, **char-**

acterized in that the quantity of printed materials to be fed in step (i) is provided in the form of printed rolls.

9. Method as claimed in any of the claims 2-7, **characterized in that** the quantity of printed materials (16) to be fed in step (i) is provided in the form of piles (15).

10. Apparatus (1, 7, 10) for drying printed materials according to a method as claimed in claim 2 or 3, comprising an autoclave (2) and pumping means (3, 4, 11, 12) for evacuating the autoclave (2) to a predetermined pressure, **characterized in that** the autoclave (2) is adapted to temporarily store therein a quantity of printed materials substantially immediately after manufacture of said printed materials.

11. Apparatus (1, 7, 10) as claimed in claim 10 for drying printed materials according to a method as claimed in claim 3, **characterized in that** this comprises regeneration means (5, 8, 9, 13) for regenerating solvent from gases released during evacuation of the autoclave (2).

12. Apparatus (1) as claimed in claim 11, **characterized in that** the regeneration means (5) comprise an adsorber for adsorbing solvent thereon, and in normal operation of the apparatus (1) the pumping means (3, 4) guide the released gases over the adsorber.

13. Apparatus (7) as claimed in claim 11, **characterized in that** the regeneration means comprise a condenser (8), and in normal operation of the apparatus (7) the pumping means (3, 4) guide the released gases over the condenser (8) in order to separate the released gases into a low-solvent gas phase and a solvent-rich liquid phase.

14. Apparatus (10) as claimed in claim 11, **characterized in that** the pumping means (12) comprise a liquid ring-pump (12) provided with a water buffer vessel (13), in a part of which buffer vessel (13) a solvent-rich phase is created in normal operation of the apparatus (10), and the regeneration means (9) are coupled to the solvent-rich phase of the buffer vessel (13).

15. Apparatus (1, 7, 10) as claimed in any of the claims 10-14, **characterized in that** the pumping means comprise a cascade connection of at least one vacuum pump (4, 12) and at least one roots pump (4, 11) placed between this vacuum pump (4, 12) and the autoclave (2).

16. Apparatus as claimed in any of the claims 10-15, **characterized in that** the autoclave comprises at

least three closable and separately evacuable compartments which are each provided with a closable entrance and a closable exit, wherein the exit of a first compartment forms the entrance of a second compartment and the exit of this second compartment forms the entrance of a third compartment.

Patentansprüche

1. Verfahren zur Trocknung von Druckwerk, im Wesentlichen sofort nach dessen Herstellung, und dieses Verfahren umfasst das einem vorher festgelegten Unterdruck in Bezug auf den atmosphärischen Druck Aussetzen einer Druckwerkmenge während eines bestimmten Zeitabschnitts.

2. Verfahren nach Anspruch 1, und dieses Verfahren umfasst folgende Schritte:

- (i) die Zuführung einer Druckwerkmenge unter Bedingungen von Zimmertemperatur und atmosphärischem Druck in einen vakuumdicht verschließbaren und evakuierbaren Raum,
- (ii) das Verschließen des Raumes,
- (iii) das während eines bestimmten Zeitraums wenigstens teilweise Evakuieren des Raumes und das Halten eines vorher festgelegten Unterdrucks in Bezug auf den atmosphärischen Druck in dem Raum, und
- (iv) die Entfernung der Druckwerkmenge aus besagtem Raum nach dem bestimmten Zeitabschnitt.

3. Verfahren nach Anspruch 1 oder 2 zur Trocknung von Druckwerk, in welchem zumindest eine Tinte ein anderes Lösungsmittel als Wasser, insbesondere ein organisches Lösungsmittel enthält, **dadurch gekennzeichnet, dass** der vorher festgelegte Unterdruck niedriger als der maximale Dampfdruck besagten Lösungsmittels bei Zimmertemperatur ist.

4. Verfahren nach Anspruch 3, **dadurch gekennzeichnet, dass** die während der Evakuierung gemäß Schritt (iii) freigesetzten Gase Regenerierungsmitteln für das Lösungsmittel zugeführt werden.

5. Verfahren nach Anspruch 3 oder 4, **dadurch gekennzeichnet, dass** der bestimmte Zeitabschnitt in Schritt (iii) höchstens 10 Stunden beträgt.

6. Verfahren nach einem der Ansprüche 3-5, **dadurch gekennzeichnet, dass** der bestimmte Zeitabschnitt in Schritt (iii) zumindest eine Stunde beträgt.

7. Verfahren nach einem der obigen Ansprüche, **da-**

durch gekennzeichnet, dass der vorher festgelegte Druck höher als 5 mbar (500 PA) ist.

8. Verfahren nach einem der Ansprüche 2-7, **dadurch gekennzeichnet, dass** die in Schritt (i) zuzuführende Druckwerkmenge in Form von Druckrollen zur Verfügung gestellt wird. 5
9. Verfahren nach einem der Ansprüche 2-7, **dadurch gekennzeichnet, dass** die in Schritt (i) zuzuführende Druckwerkmenge in Form von Stapeln (15) zur Verfügung gestellt wird. 10
10. Vorrichtung (1, 7, 10) zur Trocknung von Druckwerk gemäß eines Verfahren nach Anspruch 2 oder 3, die einen Autoklav (2) und Pumpmittel (3, 4, 11, 12) zur Evakuierung des Autoklavs (2) bis zu einem vorher festgelegten Druck umfasst, **dadurch gekennzeichnet, dass** der Autoklav (2) eingerichtet ist, um in ihm eine Druckwerkmenge im Wesentlichen sofort nach der Herstellung besagten Druckwerks vorübergehend zu lagern. 15
11. Vorrichtung (1, 7, 10) nach Anspruch 10 zur Trocknung von Druckwerk gemäß eines Verfahrens nach Anspruch 3, **dadurch gekennzeichnet, dass** diese Vorrichtung (1, 7, 10) Regenerierungsmittel (5, 8, 9, 13) zur Regenerierung von Lösungsmittel aus während der Evakuierung des Autoklavs (2) freigesetzten Gasen umfasst. 20
12. Vorrichtung (1) nach Anspruch 11, **dadurch gekennzeichnet, dass** die Regenerierungsmittel (5) einen Adsorber zur Adsorption von Lösungsmittel umfassen, und die Pumpmittel (3, 4) bei normalem Betrieb der Vorrichtung (1) die freigesetzten Gase über den Adsorber leiten. 25
13. Vorrichtung (7) nach Anspruch 11, **dadurch gekennzeichnet, dass** die Regenerierungsmittel einen Kondensator (8) umfassen, und die Pumpmittel (3, 4) bei normalem Betrieb der Vorrichtung (7) die freigesetzten Gase über den Kondensator (8) leiten, um die freigesetzten Gase in eine lösungsmittelarme Gasphase und eine lösungsmittelreiche Flüssigphase zu trennen. 30
14. Vorrichtung (10) nach Anspruch 11, **dadurch gekennzeichnet, dass** die Pumpmittel (12) eine mit einem Wasserausgleichsbehälter (13) versehene Flüssigkeitsringpumpe (12) umfassen, und in einem Teil dieses Ausgleichsbehälters (13) bei normalem Betrieb der Vorrichtung (10) eine lösungsmittelreiche Phase entsteht, und die Regenerierungsmittel (9) mit der lösungsmittelreichen Phase des Ausgleichsbehälters (13) gekoppelt sind. 35
15. Vorrichtung (1, 7, 10) nach einem der Ansprüche 40

10-14, **dadurch gekennzeichnet, dass** die Pumpmittel eine Kaskadenschaltung von zumindest einer Vakuumpumpe (4, 12) und zumindest einer zwischen dieser Vakuumpumpe (4, 12) und dem Autoklav (2) angebrachten Roots Pumpe (4, 11) umfassen.

16. Vorrichtung nach einem der Ansprüche 10-15, **dadurch gekennzeichnet, dass** der Autoklav zumindest drei verschließbare und separat evakuierbare Kammern umfasst, die jeweils mit einem verschließbaren Eingang und einem verschließbaren Ausgang versehen sind, wobei der Ausgang einer ersten Kammer den Eingang einer zweiten Kammer bildet und der Ausgang dieser zweiten Kammer den Eingang einer dritten Kammer bildet. 15

Revendications

1. Procédé pour sécher des matières imprimées substantiellement immédiatement après la fabrication de celles-ci, comprenant l'exposition d'une certaine quantité de matière imprimée pendant une période déterminée à une basse pression prédéterminée par rapport à la pression atmosphérique.
2. Procédé suivant la revendication 1, comprenant les étapes successives consistant à:
 - (i) amener une certaine quantité de matière imprimée dans des conditions de température ambiante et de pression atmosphérique dans un espace que l'on peut fermer et évacuer d'une manière étanche au vide,
 - (ii) fermer l'espace,
 - (iii) évacuer au moins partiellement l'espace pendant une période de temps prédéterminée et maintenir une basse pression prédéterminée dans l'espace par rapport à la pression atmosphérique, et
 - (iv) retirer la quantité de matière imprimée hors dudit espace après la période déterminée.
3. Procédé suivant la revendication 1 ou 2 pour sécher des matières imprimées, dans lequel au moins une encre contient un solvant autre que l'eau, en particulier un solvant organique, **caractérisé en ce que** la basse pression prédéterminée est inférieure à la tension de vapeur maximum dudit solvant à la température ambiante.
4. Procédé suivant la revendication 3, **caractérisé en ce que** les gaz libérés durant l'évacuation conformément à l'étape (iii) sont guidés vers des moyens de régénération pour le solvant.
5. Procédé suivant la revendication 3 ou 4, **caracté-**

sé en ce que la période déterminée dans l'étape (iii) est égale à un maximum de dix heures.

6. Procédé suivant l'une quelconque des revendications 3 à 5, **caractérisé en ce que** la période déterminée dans l'étape (iii) est égale à au moins une heure. 5
7. Procédé suivant l'une quelconque des revendications précédentes, **caractérisé en ce que** la pression prédéterminée est supérieure à 5 mbars (500 Pa). 10
8. Procédé suivant l'une quelconque des revendications 2 à 7, **caractérisé en ce que** la quantité de matières imprimées à amener dans l'étape (i) est fournie sous la forme de rouleaux imprimés. 15
9. Procédé suivant l'une quelconque des revendications 2 à 7, **caractérisé en ce que** la quantité de matières imprimées (16) à amener dans l'étape (i) est fournie sous la forme de piles. 20
10. Dispositif (1, 7, 10) pour sécher des matières imprimées selon un procédé suivant la revendication 2 ou 3, comprenant un autoclave (2) et des moyens de pompage (3, 4, 11, 12) pour évacuer l'autoclave (2) à une pression prédéterminée, **caractérisé en ce que** l'autoclave (2) est apte à stocker temporairement en lui une certaine quantité de matières imprimées substantiellement immédiatement après la fabrication desdites matières imprimées. 25 30
11. Dispositif (1, 7, 10) suivant la revendication 10 pour sécher des matières imprimées selon un procédé suivant la revendication 3, **caractérisé en ce que** ledit dispositif comprend des moyens de régénération (5, 8, 9, 13) pour régénérer un solvant à partir des gaz libérés durant l'évacuation de l'autoclave (2). 35 40
12. Dispositif (1) suivant la revendication 11, **caractérisé en ce que** les moyens de régénération (5) comprennent un adsorbeur pour adsorber un solvant sur celui-ci et, lors du fonctionnement normal du dispositif (1), les moyens de pompage (3, 4) guident les gaz libérés sur l'adsorbeur. 45
13. Dispositif (7) suivant la revendication 11, **caractérisé en ce que** les moyens de régénération comprennent un condenseur (8) et, lors du fonctionnement normal du dispositif (7), les moyens de pompage (3, 4) guident les gaz libérés sur le condenseur (8) en vue de séparer les gaz libérés en une phase gazeuse à faible teneur en solvant et en une phase liquide riche en solvant. 50 55
14. Dispositif (10) suivant la revendication 11, **caracté-**

risé en ce que les moyens de pompage (12) comprennent une pompe en anneau de liquide (12) pourvue d'une cuve tampon d'eau (13), une phase riche en solvant étant créée dans une partie de ladite cuve tampon (13) lors du fonctionnement normal du dispositif (10), et les moyens de régénération (9) sont couplés à la phase riche en solvant de la cuve tampon (13).

15. Dispositif (1, 7, 10) suivant l'une quelconque des revendications 10 à 14, **caractérisé en ce que** les moyens de pompage comprennent une connexion en cascade d'au moins une pompe à vide (4, 12) et d'au moins une pompe Roots (4, 11) placée entre cette pompe à vide (4, 12) et l'autoclave (2).
16. Dispositif suivant l'une quelconque des revendications 10 à 15, **caractérisé en ce que** l'autoclave comprend au moins trois compartiments fermables et évacuables séparément qui sont chacun pourvus d'une entrée fermable et d'une sortie fermable, dans lequel la sortie d'un premier compartiment forme l'entrée d'un deuxième compartiment et la sortie de ce deuxième compartiment forme l'entrée d'un troisième compartiment.

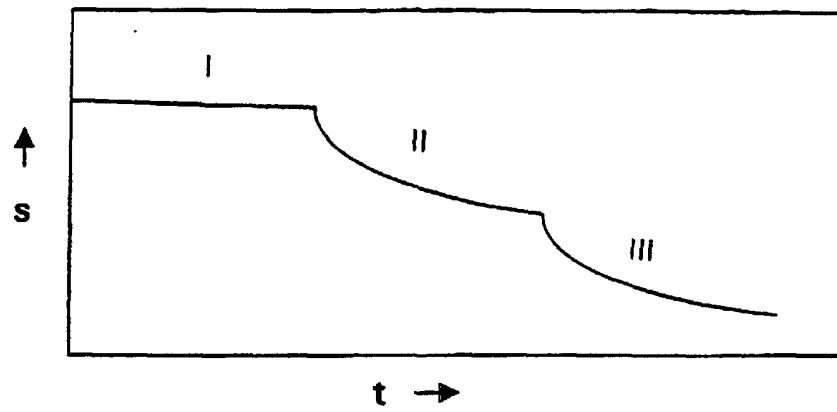


Fig. 1

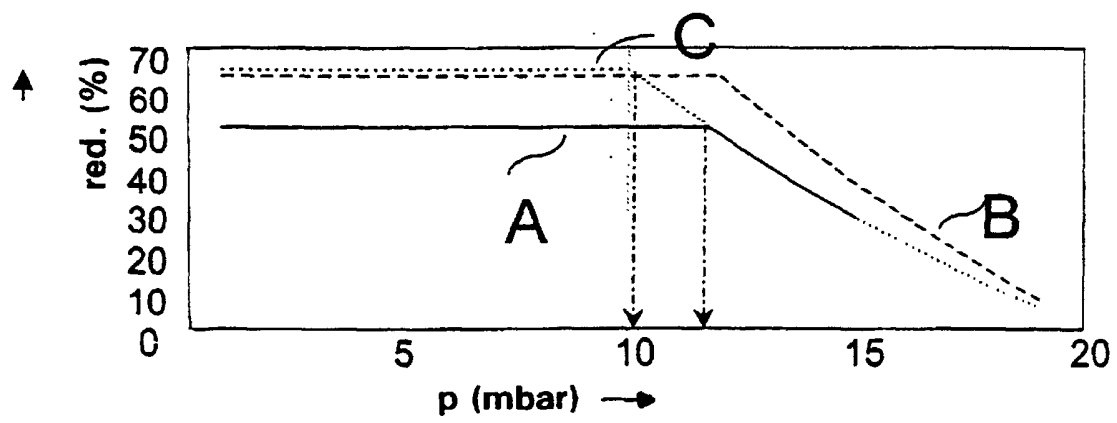


Fig. 2

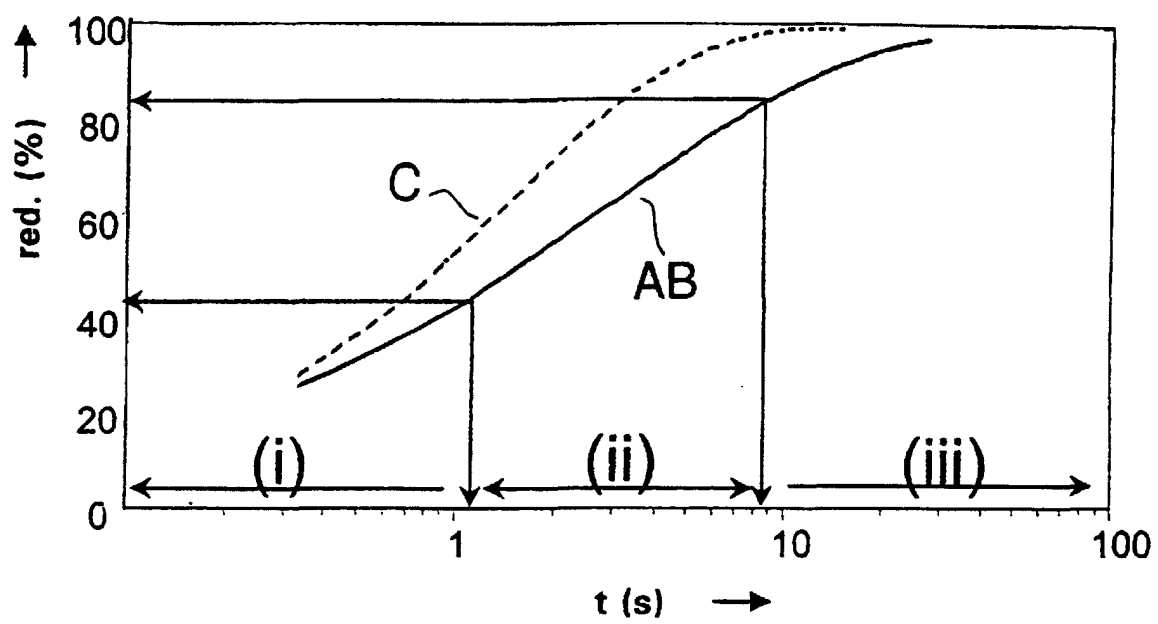


Fig. 3

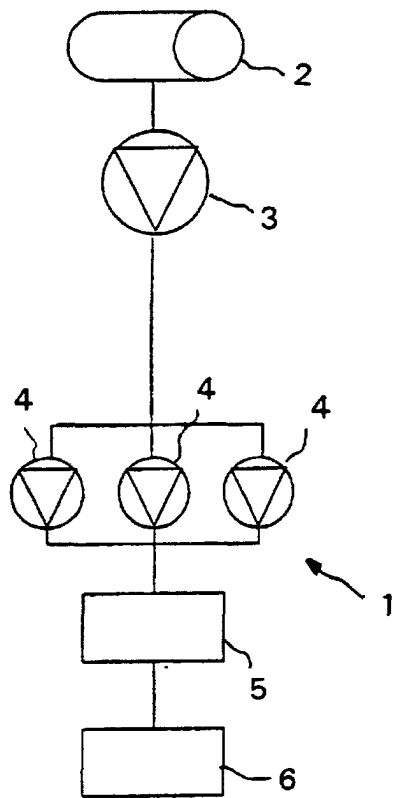


Fig. 4

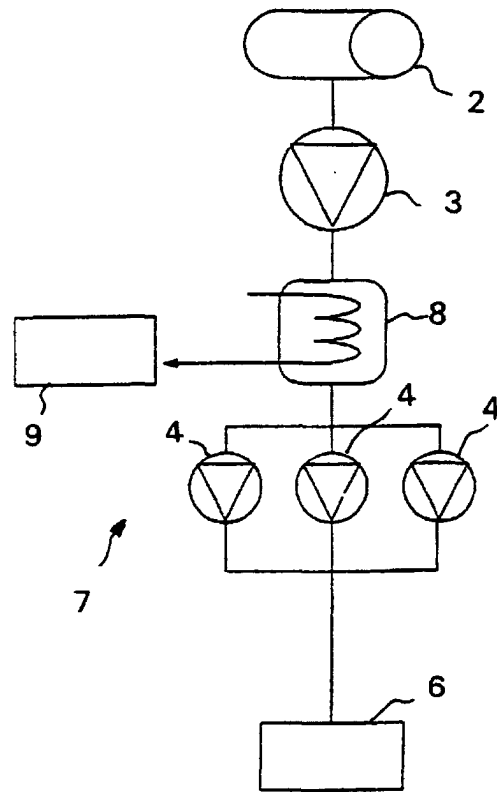


Fig. 5

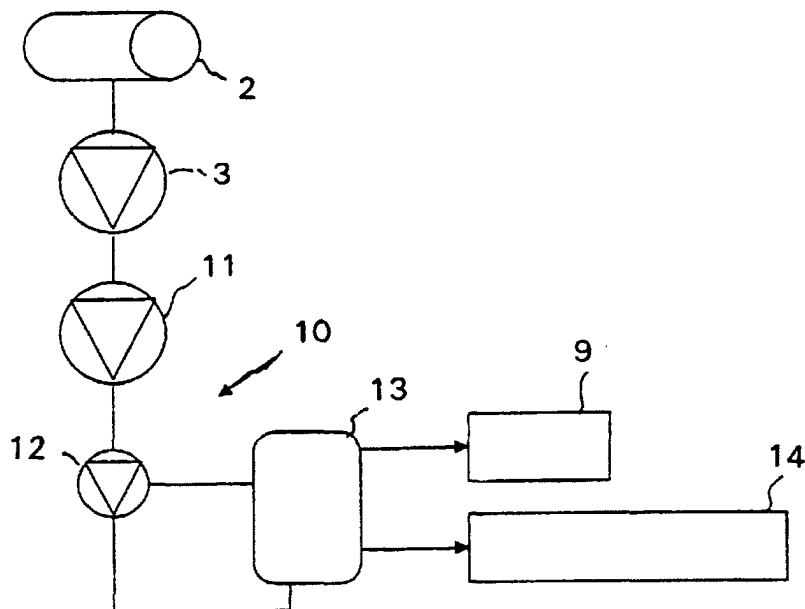


Fig. 6

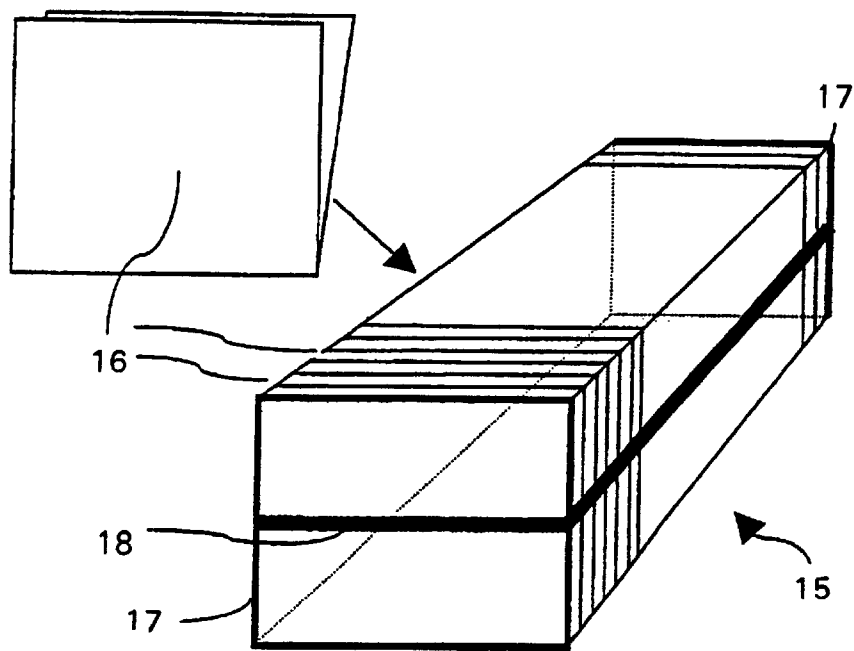


Fig. 7