



(11) **EP 2 873 529 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
19.10.2016 Bulletin 2016/42

(51) Int Cl.:
B41J 2/175^(2006.01) B41J 2/195^(2006.01)

(21) Application number: **13005433.1**

(22) Date of filing: **19.11.2013**

(54) **Inkjet printing system**

Tintenstrahl-drucksystem

Système d'impression à jet d'encre

(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

(43) Date of publication of application:
20.05.2015 Bulletin 2015/21

(73) Proprietors:
• **Archroma IP GmbH**
4153 Reinach (CH)
• **Ink-Situ AG**
4132 Muttenz (CH)

(72) Inventors:
• **Prasad, Anjani**
Kasarvadavali, Thane West, 400615 (IN)

• **Lara, Juan Maria**
EI Prat de Llobregat; 08820 Barcelona (ES)
• **Jervidalo, Rune**
4310 Rheinfelden (DE)

(74) Representative: **Ricker, Mathias**
Wallinger Ricker Schlotter Tostmann
Patent- und Rechtsanwälte
Zweibrückenstrasse 5-7
80331 München (DE)

(56) References cited:
EP-A1- 1 935 652 EP-A2- 0 613 927
WO-A1-97/09176 WO-A1-2012/105938
WO-A2-00/44569 US-A- 4 614 953
US-A- 4 862 192 US-B1- 6 352 324

EP 2 873 529 B1

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

[0001] The invention relates to an inkjet printing system, in particular to an inkjet printing machine and to a formulation unit for an inkjet printing machine and to a method for preparing ink for the inkjet printing system.

[0002] It is state of the art that ink for inkjet printing machines is prepared from specialised ink manufacturers in ink production plants with an output capacity between 50 to 300 liter per batch. With these production facilities only one color is produced at a time. Because of the large batches often corrections have to be made to the ink to achieve the correct rheology. After the preparation of every batch the facility has to be cleaned for the next color. The ink, which consists to 50-60% of water is filled in usually 5 or 10-liter shipping canisters and is sent all over the world. Since most manufacturers promise a 2-year shelf time the ink needs to be stabilized with a high level of solvent and for some type of ink anti-fungi chemicals to make it stable.

[0003] Another disadvantage of current ink supply is that the ink in the shipping canisters contains a large amount of air bubbles which involves misprints. There have been attempts to sell degassed ink in vacuum bags, but this requires a high logistical effort.

[0004] Therefore one problem to be solved by the present invention is to reduce logistical efforts for supplying ink to printing systems. Additionally, the quality of the ink as to air bubbles and required solvent and anti-fungi chemicals should be increased.

[0005] WO 00/44569 discloses a formulation unit for an inkjet printing machine.

First Aspect of the Invention

[0006] According to a *first aspect* of the invention, the problem is solved by a formulation unit for an inkjet printing machine as defined in claim 1.

[0007] As the storage tank of the formulation unit is connectable to the supply device of the printing unit, the ink does not have to be filled in canisters and to be shipped to the printing machine. In this way it is possible to prepare the ink when it is needed in the printing process and in particular also in a lower quantity. Thus fewer chemicals for preserving the ink are necessary and the logistic costs for providing the ink can be reduced.

[0008] A further preferred embodiment of the formulation unit comprises at least two preparation devices and at least two storage tanks connected to said preparation devices, for the preparation and the storage of the same or respectively different inks. Such an embodiment allows for example to prepare two or more ink colors at the same time. It is also possible to produce besides different colors also a different kinds of ink or another chemical (here also referred to as "ink"), for instance for a treatment of the substrate. As it is provided in an advantageous embodiment that every preparation device serves for the preparation of one ink it is not necessary to clean the

preparation device after every ink preparation procedure, inducing less water consumption for cleaning. It is considered as suitable to clean the preparing device approximately every 2 to 4 weeks of machine time, which means very easy maintenance.

[0009] The connection from a storage tank to the printing device of a further preferred embodiment of the formulation unit is adapted to supply ink continuously from the storage tank to the printing device during the printing process. This means that in operation of the printing device the storage tank of the formulation unit is constantly connected to the printing device. In a further preferred embodiment, the preparation device is adapted to prepare ink which is supplied to the storage tank while ink is supplied from the storage tank to the printing device in particular according to the demand of the printing device. In this way, the supply from and to the storage tank can take place concurrently and independently. This also involves the possibility to establish a partially or wholly automated process where ink is prepared in the preparation device according to the filling level of the storage tank and/ or according to the demand of the printing device.

[0010] In more elementary embodiments of the formulation unit, the ingredients of the ink have to be filled manually into the preparation unit, for example a dye in form of powder or in form of a color-concentrate, which are difficult to handle and to dose, from a prepared package, or a certain volume of the necessary additive chemicals or of deionized water. The amount of additive chemicals and deionized water is for example defined by the package size of a dye-powder. In a more enhanced embodiment for example a dye-powder is still filled in manually, wherein the deionized water and the additive chemicals are added by means of known automated metering equipment. The same applies if a color-concentrate is used for preparing the ink, which already contains the necessary additive chemicals and only deionized water needs to be added. Subsequently dye-powder, dye-fluid or color-concentrate are referred to as "dye" irrespective of whether or not all necessary chemicals are already contained in the dye. Where appropriate, a distinction will be made.

[0011] In a preferred example the formulation unit comprises a dosing device for automatically dosing at least one ingredient of the ink, in particular the dye. Apart from loss of dye in small packages, this avoids dusting of powder dyes and with liquid dyes this avoids sprinkling and spill and additionally and more important the incorporation of air while filling the dye into the preparation device. In addition to an automated metering equipment for deionized water and for possible further ingredients, a dosing device for automatically dosing the dye enables a wholly automated process for preparing ink in the formulation unit, in particular also on demand. A dosing device for automatically dosing the dye enables also the preparation of different volumes of ink, for example for preparing a smaller amount of a sparsely used ink in a

printing procedure.

[0012] In a further preferred embodiment the formulation unit comprises a degassing device which is arranged between the preparation device and the storage tank and wherein the storage tank is a buffer vacuum container which is connected directly to the ink inlet of the printing device. As air incorporated in the ink leads to malfunction of the printing device and to misprints, degassing of the ink improves the quality of the ink and the printing result visibly. For not to allow air or gas to incorporate again into the ink after the degassing in the degassing device, the ink is directly supplied to a storage tank which is a buffer vacuum container and therefore does not contain gas or air that could incorporate into the ink. The outlet of the buffer vacuum container is connected directly to the ink inlet of the printing device. This tubing is also free from gas or air that the ink can be jetted with high quality onto a substrat.

Second Aspect of the Invention

[0013] According to a **second aspect** of the invention, the problem is solved by an inkjet printing machine with a formulation unit and a printing unit. The printing unit comprises a printing device for jetting ink onto a substrat, an ink supply device for supplying ink to the printing device and a substrat supply device for supplying the substrat to the printing device.

[0014] The formulation unit of the inkjet printing machine is designed as described before. In a preferred embodiment of the machine the size of the formulation unit is small as also the amount of ink which is prepared in one preparing process. By contrast, ink distribution canisters and also storage tanks of known inkjet printing machines contain usually several liters of ink for longer printing periods which means long residence and storage times particularly for ink with small output quantities. The formulation unit of the inkjet printing machine according to the invention allows frequently preparing and storing smaller volumes of ink according to the demand of the printing process and printing device respectively. In this way a simple, reliable and thus economical installation with very easy maintenance is provided.

[0015] The substrate on which the printing device of the printing machine jets ink is preferably a textile. However, it is also possible to use the invention for inkjet printing machines for other substrats like paper or films, foils or any other substrate suitable for inkjet printing.

Third Aspect of the Invention

[0016] According to a **third aspect** of the invention, the problem is solved by a method for preparing an ink using a formulation unit in particular as described above. The method depends on the kind of the dye used.

[0017] In a first embodiment the method comprises the steps:

a) fill the preparation tank (32) with a first amount of deionized water;

bc) add a predetermined amount of dye, preferably in form of a color-concentrate;

d) mix the ingredients filled into the preparation tank (32);

e) add a second amount of deionized water;

f) mix the ingredients filled into the preparation tank (32).

[0018] The method is especially suitable for being performed by using the above described formulation unit, and in particular with an inkjet printing machine as described above. However it is also possible to use any other suitable formulation unit. For performing the method, a dye designed as color-concentrate is used, which contains further chemicals, in particular solvents necessary to prepare ink.

[0019] In a first step (a) the tank is filled with a first amount of deionized water. A preferred amount for the first filling is about one third of the final volume of water. Deionized water is required for maintaining the purity of the product at a maximum level.

[0020] In a second step (bc) a certain amount of a dye, preferably in form of a color-concentrate according to the volume of the prepared ink is put into the tank. In one embodiment, the color-concentrate is heated up to 30°C, preferably up to 50°C, preferably up to 55°C, preferably up to 70°C prior to being mixed with deionized water. The advantage of using the dye in form of a color-concentrate is that dust formation can be reduced, preferably prevented.

[0021] In a third step (d) the ingredients within the tank are mixed in a way that the dye, preferably in form of a color-concentrate dissolves completely and possibly no air is introduced into the fluid.

[0022] In a fourth step (e) a second amount of deionized water (a preferred amount is two third of the final volume) is added to the tank and in a fifth step (f) the ingredients within the tank are again mixed to dissolve the ingredients completely and in a way to avoid the introduction of air into the fluid. In a preferred embodiment the ingredients and the formulation unit are adapted such that the whole process takes less than 10 minutes which means high flexibility and low logistic costs as the lead time for the preparation of ink is very short.

[0023] In an example the method comprises the steps:

a) fill the preparation tank (32) with a first amount of deionized water;

b) add a predetermined amount of additive chemicals;

- c) add a predetermined amount of dye;
- d) mix the ingredients filled into the preparation tank (32);
- e) add a second amount of deionized water;
- f) mix the ingredients filled into the preparation tank (32).

[0024] The second embodiment differs from the first embodiment of the method in an additional step b) where-in additive chemicals are added to the water in the tank. Those chemicals serve in particular for enhancing the dissolution of the color concentrate (for example Hostapal or DEG).

[0025] In contrast to the first embodiment, in step c) a dye is added, which does not have to contain any other chemicals than color ingredients, as additive chemicals are filled separately into the preparation tank.

[0026] The term "ink" as used herein according to the invention means a composition comprising at least a dye. Further components which may be present within the ink is water, preferably deionized water; and/or additive chemicals. Compounds which can be used as suitable additive chemicals for an ink can be selected from the group: ink stabilizing compounds; anti-fungi chemicals; diluents, or a mixture of one or more of these compounds.

[0027] The term "dye" as used herein according to the invention, means a substance which is capable of being used as a component of an ink. The dye can be used in any form suitable to be mixed with further components in order to form an ink for inkjet printing machines. In one embodiment, the dye is used in a solid form, preferably in powder form. In another embodiment, the dye is used in a liquid form or viscous form, preferably in form of a color-concentrate.

[0028] In one embodiment, the dye used is in powder form only consisting of pure dye powder, e.g. reactive dyes, like Reactive Red, Reactive Yellow, Reactive Blue, Reactive Turquoise, Reactive Red, Reactive Black, or Reactive Orange. If the dye is used in powder form only consisting of pure dye powder, deionized water and further additive chemicals can be added in order to obtain an ink. Preferably, at least a diluent is added to the pure dye powder.

[0029] Generally every diluent suitable to be used in an ink and known by the skilled person can be used. Such a diluent preferably comprises at least one compound selected from the group of glycol, wetting agents, or solubilizers.

[0030] In a preferred embodiment, the diluent is provided in step b) of the above described second embodiment of the method according to the invention.

[0031] In one embodiment, the dye used has a tar-like viscosity and is preferably used in the form of a color-concentrate. In this embodiment, the dye comprises the dye powder suspended in at least one additive chemical,

preferably in a diluent as defined above. The advantage is, that now only water, in particular deionized water can be added in order to obtain an ink.

5 Figures

[0032] Further advantages, features and possible applications of the present invention ensue from the following description in conjunction with the figures.

10

Fig. 1 shows a schematic view of an exemplary inkjet printing machine according to the invention.

15

Fig. 2 shows a schematic diagram of an exemplary preparing device and storage tank of a formulation unit according to the invention.

20

Fig. 3 shows a schematic diagram of an exemplary formulation unit according to the invention.

25

[0033] Fig. 1 shows a schematic view of an exemplary inkjet printing machine 1 according to the invention. The inkjet printing machine 1 comprises a printing unit 10 and a formulation unit 20. The printing unit 10 comprises a printing device 11 moving along an axis and jetting ink onto a textile 15 which is supplied by means of a substrate supply device 12 to the printing device. The printing unit 10 further comprises an ink supply device 13 for supplying ink to the printing device 11.

30

[0034] The exemplary formulation unit 20 comprises eight preparation devices 30 for preparing ink. The number of preparation devices depends in particular on the number of inks which are used for print procedures and can vary according to the application of the inkjet printing machine. Also inkjet printing machines with a formulation unit having 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12 or even more preparation devices 30 are possible. Each preparation device 30 is connected to a storage tank 50 which is, in the exemplary inkjet printing machine 1 constantly connected to the ink supply device 13 for supplying ink from the storage tank 50 to the printing device 11. In another not shown embodiment the storage tank 50 is not constantly connected to the inkjet printing machine 1. Such embodiments may comprise a second storage tank into which ink from the formulation unit 20 is supplied and which is constantly connected to the ink supply device 13.

35

[0035] A preparation device 30 comprises a preparation tank 32 for receiving the ingredients of the ink and at least one preparation pump 35 for mixing the ingredients within the preparation tank 32 and for pumping the ink into the storage tank 50.

40

[0036] The formulation unit has a control device 60 which may be integrated into the control device of the inkjet printing machine 1. When performing a manual preparation procedure, the operator enters for example the amount (for example 900 or 1000g) and color of the dye which is in the dye-package that he is going to use

45

50

for the preparation of ink at the touch screen display of the control device 60. The control device 60, for example a PLC-control operates the different components at least of the formulation unit 20. Subsequently the relevant equipment of the preparation device 30 automatically measures the correct amount of deionized water and of the necessary additives and supplies these ingredients into the preparation tank 32. Then the preparation device 30 is operated to mix the ingredients for example by circulating the mixture by means of the preparation pump 35 until the dye is completely solved, which may take 5 minutes. Then the preparation device 30 of the formulation unit 20 automatically passes the ink through an ink filter 37 (shown in Figs. 2 and 3) and into the storage tank 50. Preferably the ink filter 37 is fine mesh filter with a mesh in the range up to few micrometers. In a preferred embodiment the preparation pump 35 is a self-priming membrane pump which is air-operated and has a positive displacement. With this kind of pump the cleanness of the preparation device 30 is facilitated.

[0037] Fig. 2 shows a schematic diagram of an exemplary preparing device 30 and storage tank 50 of a formulation unit 20 according to the invention. The work flow of this exemplary preparing device 30 is as follows: A dosing pump 34 passes a predetermined amount of water from a deionized water inlet 31 into a preparation tank 32. The amount of water dosed by the dosing pump 34 is controlled by the control device 60 (shown in Fig. 1). A dye dosing device 38 serves for dosing the dye which is also supplied from the dye dosing device 38 into the preparation tank 32. The dye dosing device 38 is responsible for adjusting the concentration of the dye through exact volumetric addition and for supplying the dye as soon as a request comes from the control device 60.

[0038] For applications where the dye used requires further additives for the preparation of ink, the formulation unit 20 comprises an additive dosing device 39 (shown with dotted lines), which supplies a predetermined amount of additives, e.g. a diluent into the preparation tank 32.

[0039] The preparation tank 32 of the exemplary embodiment is heatable as is especially beneficial for the solution of some kinds of dyes, in particular for dyes, preferably in form of a color-concentrate having a high viscosity. In an exemplary embodiment a color-concentrate with a very high viscosity is used. It becomes fluid when water is added and heated to 55 centigrade. When all ingredients are received in the preparation tank 32, the valve 36 is closed and the preparation pump 35 is activated. The preparation pump 35 circulates the mixture from the preparation tank 32 through the circulation tube 33 and back to the preparation tank 32 until the liquid is completely solved. In a preferred embodiment with about 2 liters capacity of the preparation tank and an ink volume of about 1.5 liters, the solution circulation takes about five minutes.

[0040] After the circulation process is completed, the valve 36 is operated to close the connection to the circu-

lation tube 33 and thereby to open the connection to an ink filter 37. Now, the preparation pump 35 passes the solution through the ink filter 37 and thereby out of the preparation unit 20.

[0041] The exemplary embodiment of the formulation unit shown in Fig. 2 further comprises a degassing device 48 which is arranged in the formulation unit 20 in the connection between the preparation unit 20 and the storage tank 50. Although the preparation of the ink by means of circulating the ingredients reduces the introduction of air into the ink, small air bubbles within the ink can still reduce the quality of the ink. The degassing device 48 which is arranged after the ink filter 37 extracts gasses from the ink before the ink is supplied into the storage tank 50 of the formulation unit 20. From the outlet 51 of the storage tank 50 the ink is supplyable to a printing device 10 of an inkjet printing machine 1 (shown in Fig. 1).

[0042] Fig. 3 shows a schematic diagram of a preferred exemplary formulation unit 20 according to the invention. The schematically shown formulation unit 20 comprises eight preparing devices 30. Such a preferred formulation unit 20 with eight preparing devices 30 will for example have a size of approximately 1 meter length, 0.5 meter breadth and 1.2 meter height. A PLC control will manage the dosing pump 34 at the inlet of deionised water, the preparation pump 35 and the valve 36 for switching the process from circulating the ingredients of the ink for solving them to the supply of the ink solution to the ink filter 37.

[0043] For the preparation of ink with the exemplary embodiment of the formulation unit 20 of Fig. 3 a prepacked dye in form of a color-concentrate is used, which is filled manually into the preparation tank 32. All additives required to prepare an ink are already contained within the color-concentrate. Only a predetermined amount of deionised water has to be added, which is dosed by means of the dosing pump 34. Apart from the differences with filling the ingredients of the ink into the preparation tank 32, the procedure of preparing the ink with the formulation unit 20 is performed according to the workflow as described with reference to Fig. 2.

Reference numerals:

[0044]

1	inkjet printing machine
10	printing unit
11	printing device
12	substrat supply device
13	ink supply device
20	formulation unit
30	preparation device
31	water inlet
32	preparation tank
33	circulation tube
34	dosing pump
35	preparation pump
36	valve

- 37 ink filter
- 38 dye dosing device
- 39 additive dosing device
- 48 degassing device
- 50 storage tank
- 51 outlet of the storage tank
- 60 control device

Claims

1. A formulation unit for an inkjet printing machine, wherein

- the inkjet printing machine (1) comprises a printing unit (10) with a printing device (11) and with an ink supply device (13) for supplying ink to the printing device (11); and
- the formulation unit (20) comprises at least one preparation device (30) for the preparation of the ink and at least one storage tank (50) for storing prepared ink,
- the preparation device comprising a preparation tank (32) for receiving the ingredients of the ink, the ingredients including at least water and a dye,
- a dye dosing device (38) for automatically dosing the dye and supplying the dye into the preparation tank,
- a water inlet (31),
- a metering equipment for automatically passing a predetermined amount of water from the water inlet (31) into the preparation tank (32), and
- a preparation pump (35) for mixing the ingredients within the preparation tank (32) and for pumping the ink into the at least one storage tank (50),

wherein the at least one storage tank (50) is connectable to the supply device (13) of the printing unit (11) for supplying ink from the storage tank (50) to the printing device (11) and

wherein the at least one preparation device (30) is adapted to prepare ink and to supply ink to the storage tank (50) while ink is supplied from the storage tank (50) to the printing device (11).

2. The formulation unit of claim 1, wherein the connection from the at least one storage tank (50) to the printing device (11) is adapted to supply ink continuously from the storage tank (50) to the printing device (11) during the printing process.
3. The formulation unit of any one of the preceding claims, comprising at least two preparation devices (30) and at least two storage tanks (50) connected to said preparation devices (30), for the preparation

and the storage of the same or respectively different inks.

4. The formulation unit of claim 1, wherein the preparation device (30) comprises a circulation tube (33) for circulating the ingredients filled in the preparation tank (32) through the circulation tube (33) and back to the preparation tank (32).
5. The formulation unit of any one of the preceding claims, wherein the preparation device (30) comprises an ink filter (37) for filtering the prepared ink.
6. The formulation unit of any one of the preceding claims, comprising a degassing device (48) which is arranged between the preparation device (30) and the storage tank (50) and wherein the storage tank (50) is a buffer vacuum container which is connected directly to the ink inlet of the printing device (11).
7. An inkjet printing machine (1) comprising:
- a formulation unit (20) of any one of the preceding claims and
 - a printing unit (10) comprising
 - a printing device (11) for jetting ink onto a substrat
 - an ink supply device (13) for supplying ink to the printing device (11), and
 - a substrat supply device (12) for supplying the substrat (15) to the printing device (11).
8. The inkjet printing machine of claim 7, wherein the substrat (15) is a textile.
9. Method for preparing an ink using a formulation unit (20) as defined in any one of claims 1 to 6, the method comprising the steps:
- a) fill the preparation tank (32) with a first amount of deionized water;
 - bc) add a predetermined amount of dye, preferably in form of a color-concentrate;
 - d) mix the ingredients filled into the preparation tank (32);
 - e) add a second amount of deionized water;
 - f) mix the ingredients filled into the preparation tank (32).

Patentansprüche

1. Zubereitungseinheit für eine Tintenstrahldruckmaschine, wobei
- die Tintenstrahldruckmaschine (1) eine Druckeinheit (10) mit einer Druckeinrichtung (11) und

- mit einer Tintenversorgungseinrichtung (13) zum Zuführen von Tinte zu der Druckeinrichtung (11) aufweist; und
- die Zubereitungseinheit (20) wenigstens eine Zubereitungseinrichtung (30) zur Zubereitung der Tinte und wenigstens einen Speicherbehälter (50) zur Speicherung der zubereiteten Tinte aufweist,
 - die Zubereitungseinrichtung einen Zubereitungsbehälter (32) zur Aufnahme der Inhaltsstoffe der Tinte, wobei die Inhaltsstoffe wenigstens Wasser und einen Farbstoff umfassen,
 - eine Farbstoffdosiereinrichtung (38) zum automatischen Dosieren des Farbstoffs und zum Zuführen des Farbstoffs in den Zubereitungsbehälter,
 - einen Wassereinlass (31),
 - eine Dosiervorrichtung zum automatischen Einleiten einer vorbestimmten Menge an Wasser aus dem Wassereinlass (31) in den Zubereitungsbehälter (32), und
 - eine Zubereitungspumpe (35) zum Mischen der Inhaltsstoffe in dem Zubereitungsbehälter (32) und zum Pumpen der Tinte in den wenigstens einen Speicherbehälter (50) aufweist,
 - wobei der wenigstens einen Speicherbehälter (50) mit der Versorgungseinrichtung (13) der Druckeinheit (11) zum Zuführen von Tinte aus dem Speicherbehälter (50) zu der Druckeinrichtung (11) verbindbar ist und
 - wobei die wenigstens eine Zubereitungseinrichtung (30) eingerichtet ist, Tinte zuzubereiten und dem Speicherbehälter (50) zuzuführen während Tinte aus dem Speicherbehälter (50) zu der Druckeinrichtung (11) zugeführt wird.
2. Zubereitungseinheit gemäß Anspruch 1, wobei die Verbindung von dem wenigstens einen Speicherbehälter (50) zu der Druckeinrichtung (11) eingerichtet ist, Tinte kontinuierlich von dem Speicherbehälter (50) zu der Druckeinrichtung (11) während des Druckvorgangs zuzuführen.
3. Zubereitungseinheit gemäß einem der vorhergehenden Ansprüche, welche wenigstens zwei Zubereitungseinrichtungen (30) und wenigstens zwei Speicherbehälter (50), die mit jenen Zubereitungseinrichtungen (30) verbunden sind, zur Zubereitung und zur Speicherung derselben oder von jeweils verschiedenen Tinten aufweist.
4. Zubereitungseinheit gemäß Anspruch 1, wobei die Zubereitungseinrichtung (30) ein Umwälzrohr (33) zum Umwälzen der in den Zubereitungsbehälter (32) gefüllten Inhaltsstoffe durch das Umwälzrohr (33) hindurch und zu dem Zubereitungsbehälter zurück aufweist.
5. Zubereitungseinheit gemäß einem der vorhergehenden Ansprüche, wobei die Zubereitungseinrichtung (30) einen Tintenfilter (37) zum Filtern der zubereiteten Tinte aufweist.
6. Zubereitungseinheit gemäß einem der vorhergehenden Ansprüche, aufweisend eine Entgasungseinrichtung (48), die zwischen der Zubereitungseinrichtung (30) und dem Speicherbehälter (50) angeordnet ist, und wobei der Speicherbehälter (50) ein Puffervakuumbehälter ist, der direkt mit dem Tinteneinlass der Druckeinrichtung (11) verbunden ist.
7. Tintenstrahl Druckmaschine (1) aufweisend:
- eine Zubereitungseinheit (20) gemäß einem der vorhergehenden Ansprüche und
 - eine Druckeinrichtung (10) aufweisend
 - o eine Druckeinrichtung (11) zum Aufstrahlen von Tinte auf ein Substrat
 - o eine Tintenversorgungseinrichtung (13) zum Zuführen von Tinte zu der Druckeinrichtung (11) und
 - o eine Substratversorgungsvorrichtung (12) zum Zuführen von Substrat (15) zu der Druckeinrichtung (11).
8. Tintenstrahl Druckmaschine gemäß Anspruch 7, wobei das Substrat (15) ein Textil ist.
9. Verfahren zum Zubereiten einer Tinte mittels einer gemäß einem der Ansprüche 1 bis 6 definierten Zubereitungseinheit (20), wobei das Verfahren die folgenden Schritte aufweist:
- a) Befüllen des Zubereitungsbehälters (32) mit einer ersten Menge an demineralisiertem Wasser;
 - bc) Zugeben einer vorbestimmten Menge des Farbstoffs, vorzugsweise in Form eines Farbkonzentrats;
 - d) Mischen der in den Zubereitungsbehälter (32) gefüllten Inhaltsstoffe;
 - e) Zugeben einer zweiten Menge an demineralisiertem Wasser;
 - f) Mischen der in den Zubereitungsbehälter (32) gefüllten Inhaltsstoffe.

Revendications

1. Unité de formulation pour une machine d'impression à jet d'encre, dans laquelle
- la machine d'impression à jet d'encre (1) comprend une unité d'impression (10) avec un dispositif d'impression (11) et avec un dispositif

d'alimentation en encre (13) pour alimenter en encre le dispositif d'impression (11) ; et

- l'unité de formulation (20) comprend au moins un dispositif de préparation (30) pour la préparation de l'encre et au moins un réservoir de stockage (50) pour stocker l'encre préparée,
- le dispositif de préparation comprenant un réservoir de préparation (32) pour recevoir les ingrédients de l'encre, les ingrédients comprenant au moins de l'eau et une couleur,
- un dispositif de dosage de couleur (38) pour doser automatiquement la couleur et alimenter en couleur le réservoir de préparation,
- une arrivée d'eau (31),
- un système de dosage pour acheminer automatiquement une quantité prédéfinie d'eau de l'arrivée d'eau (31) vers le réservoir de préparation (32), et
- une pompe de préparation (35) pour mélanger les ingrédients dans le réservoir de préparation (32) et pour pomper l'encre dans le au moins un réservoir de stockage (50), dans laquelle le au moins un réservoir de stockage (50) peut être relié au dispositif d'alimentation (13) de l'unité d'impression (11) pour alimenter en encre du réservoir de stockage (50) vers le dispositif d'impression (11), et

dans laquelle le au moins un dispositif de préparation (30) est adapté pour préparer l'encre et alimenter en encre le réservoir de stockage (50) pendant que de l'encre est alimentée du réservoir de stockage (50) vers le dispositif d'impression (11).

2. Unité de formulation selon la revendication 1, dans laquelle la connexion depuis le au moins un réservoir de stockage (50) vers le dispositif d'impression (11) est adaptée pour alimenter en encre de manière continue du réservoir de stockage (50) vers le dispositif d'impression (11) lors du processus d'impression.
3. Unité de formulation selon l'une quelconque des revendications précédentes, comprenant au moins deux dispositifs de préparation (30) et au moins deux réservoirs de stockage (50) reliés auxdits dispositifs de préparation (30), pour la préparation et le stockage des encres identiques ou respectivement différentes.
4. Unité de formulation selon la revendication 1, dans laquelle le dispositif de préparation (30) comprend un tube de circulation (33) pour faire circuler les ingrédients versés dans le réservoir de préparation (32) via le tube de circulation (33) et revenir vers le réservoir de préparation (32).
5. Unité de formulation selon l'une quelconque des revendications précédentes, dans laquelle le dispositif

de préparation (30) comprend un filtre à encre (37) pour filtrer l'encre préparée.

6. Unité de formulation selon l'une quelconque des revendications précédentes, comprenant un dispositif de dégazage (48) agencé entre le dispositif de préparation (30) et le réservoir de stockage (50), et dans laquelle le réservoir de stockage (50) est un récipient tampon sous vide directement relié à l'orifice d'amenée d'encre du dispositif d'impression (11).
7. Machine d'impression à jet d'encre (1) comprenant :
 - une unité de formulation (20) selon l'une quelconque des revendications précédentes et
 - une unité d'impression (10) comprenant
 - un dispositif d'impression (11) pour projeter de l'encre sur un substrat
 - un dispositif d'alimentation en encre (13) pour alimenter en encre le dispositif d'impression (11), et
 - un dispositif d'alimentation en substrat (12) pour alimenter en substrat (15) le dispositif d'impression (11).
8. Machine d'impression à jet d'encre selon la revendication 7, dans laquelle le substrat (15) est un textile.
9. Procédé de préparation d'une encre à l'aide d'une unité de formulation (20) définie selon l'une quelconque des revendications 1 à 6, le procédé comprenant les étapes suivantes :
 - a) remplir le réservoir de préparation (32) avec une première quantité d'eau déionisée ;
 - bc) ajouter une quantité prédéfinie de couleur, de préférence sous forme de concentré de couleur ;
 - d) mélanger les ingrédients versés dans le réservoir de préparation (32) ;
 - e) ajouter une deuxième quantité d'eau déionisée ;
 - f) mélanger les ingrédients versés dans le réservoir de préparation (32).

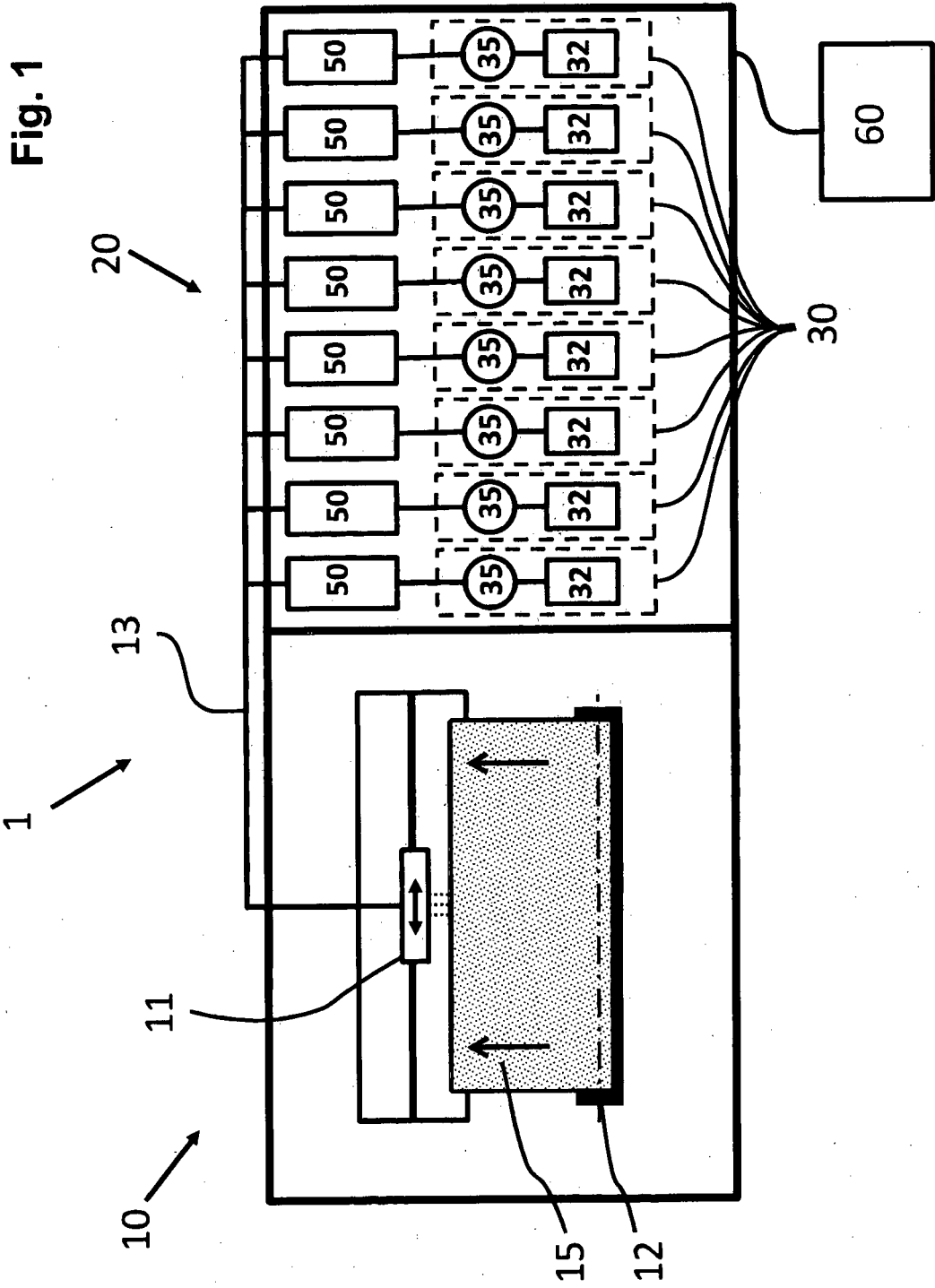
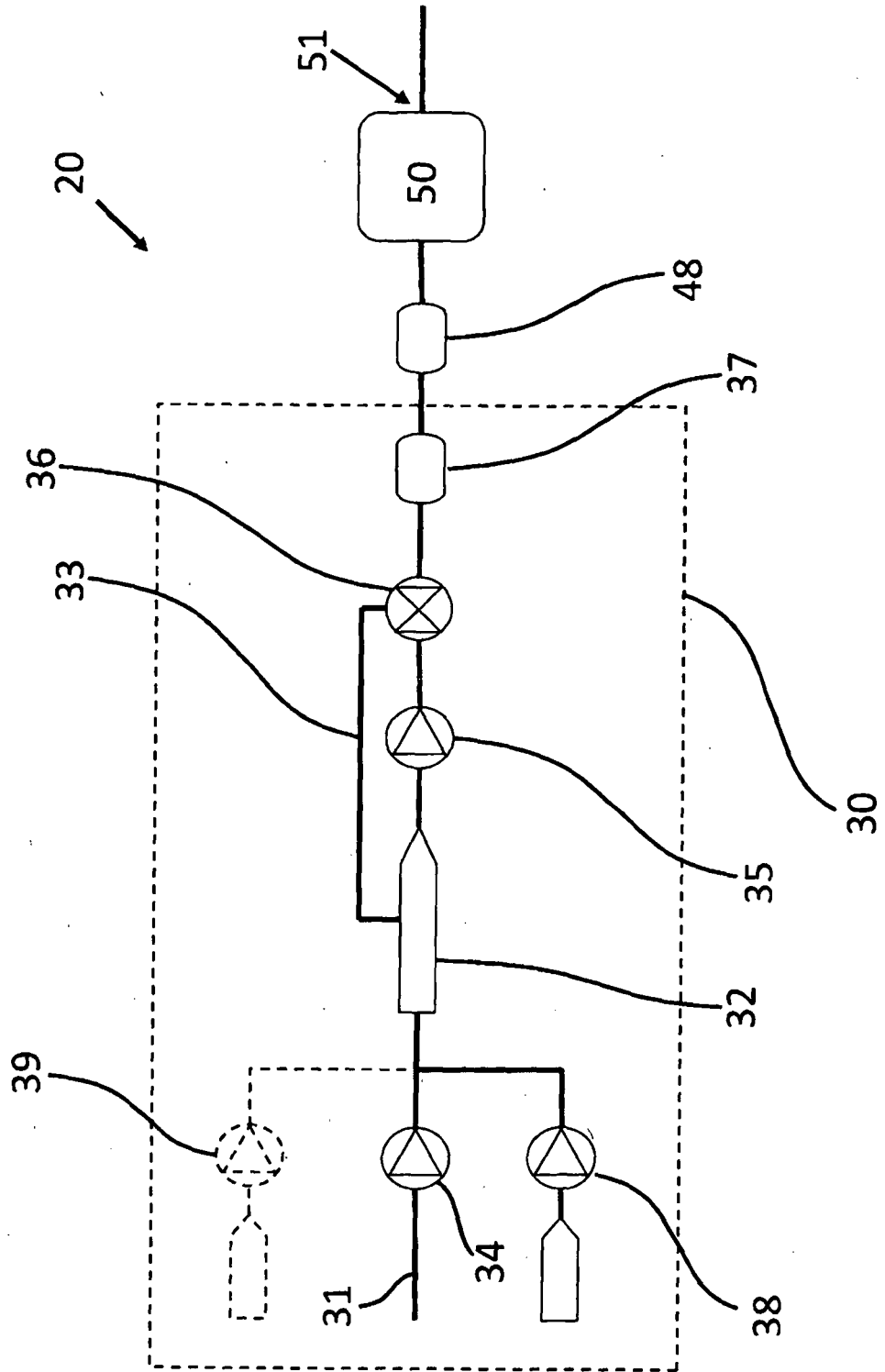
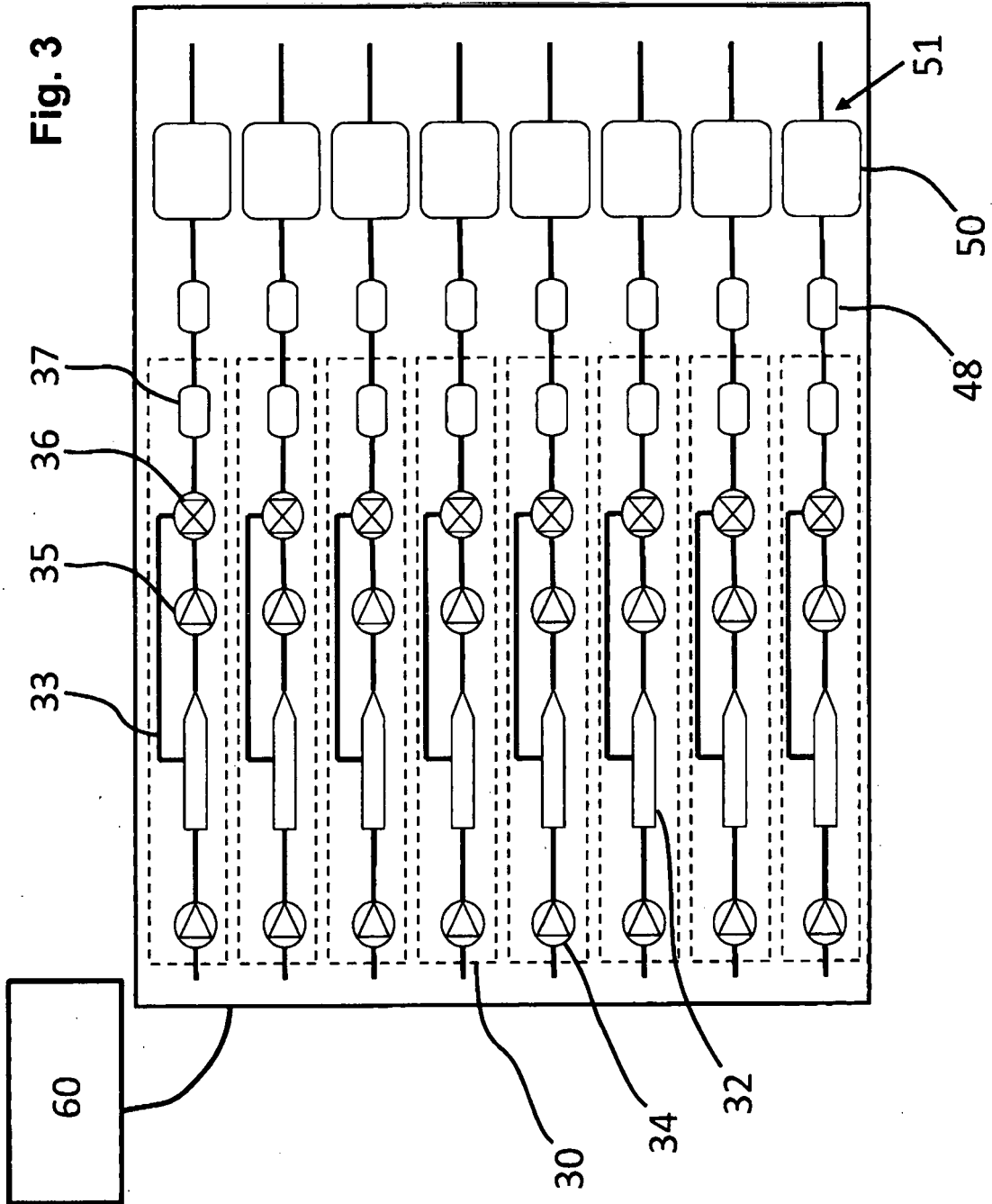


Fig. 2





REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 0044569 A [0005]