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(71) Applicant: **OCE HOLDING B.V.** [NL/NL]; P.O. Box 101, St. Urbanusweg 43, 5914 CA Venlo (NL).

(72) Inventor: **JACOBS, Roy H.R.;** St. Urbanusweg 43, 5914 CA Venlo (NL).

(74) Agent: **OCE IP DEPARTMENT;** P.O. Box 101, St. Urbanusweg 43, 5914 CA Venlo (NL).

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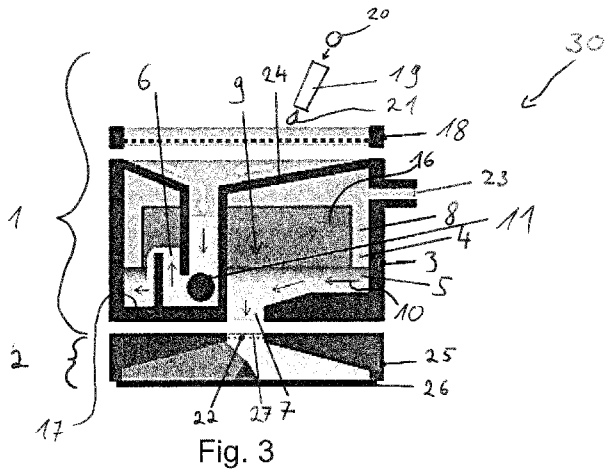


Fig. 3

(57) Abstract: The present invention provides an ink supply system (1) for supplying ink to a drop-forming unit (2) of a print-head (100) in a printing system, comprising: a housing (3) enclosing a reservoir (4) which holds a volume of ink (5) to be supplied to a drop-forming unit (2) in a print-head (30); an inlet (6) for admitting ink into the reservoir (4); and an outlet (7) for discharging the ink from the reservoir (4) to supply the drop-forming unit (2); wherein the system (1) is configured to regulate a level of the ink (5) in the reservoir (4) such that a free space (8) remains above the ink (5) held in the reservoir (4), and wherein the reservoir (4) comprises flow channel (9) configured to guide the ink (5) along a predetermined horizontal path (10) through or around the reservoir (4) from the inlet (6) to the outlet (7).. Furthermore, the invention provides a print-head (30) in a printing system, comprising such an ink supply system (1) and a drop-forming unit (2) which is supplied with ink from the outlet (7) of the ink supply system (l).The invention further provides a printing system that includes such an ink supply system (1) and/or such a print-head (30).

INK SUPPLY SYSTEM, PRINT-HEAD AND PRINTING SYSTEM

FIELD OF THE INVENTION

The present invention relates to an ink supply system for supplying ink to a drop-forming unit of a print-head in a printing system and to a print-head including such an ink supply system. The invention also relates to a printing system that includes such an ink supply system and/or print-head.

BACKGROUND OF THE INVENTION

Although applicable to any kind of printing system, the present invention and the problem upon which it is based will be explained in greater detail with reference to printing systems which use ink of the melt ink type; that is, ink which is liquid at an elevated temperature and which is generated by melting solid elements, such as toner pearls. In printing systems known to the applicant, in which a print-head uses ink of the melt ink type, freshly melted ink is fed into an ink reservoir, from which a drop-forming unit of the print-head is supplied with the ink. Part of such a print-head known to the applicant is shown in Fig. 1.

Referring to Fig. 1, the print-head 100 comprises a drop-forming unit 102 and a heated ink reservoir 104. In the reservoir 104 of the print-head 100, freshly melted ink 105A enters the reservoir 104 via an inlet 106 which is positioned generally centrally of the reservoir 104. The "older" ink 105B already present in the heated reservoir 104 is generally warmer and less dense than the freshly melted ink 105A which is somewhat cooler and therefore denser. As a consequence, the freshly melted ink 105A entering the reservoir 104 through the central inlet 106 tends to sink and flow directly downwards towards the drop-forming unit 102. This results in poor mixing of the freshly melted ink 105A and the "older" ink 105B.

On one hand, this leads to the formation of areas in the reservoir 104, which are poorly supplied with fresh ink 105A and in which the older ink 105B will tend to remain or accumulate and become prone to degradation over time. In particular, this may create so-called "dead zones" within the reservoir 104 in which very little renewal the ink takes place and the ink becomes degraded ink through formation of particles or crystallization. This is problematic as particles formed in the ink may then settle and block parts of the drop-

forming unit 102 and/or cause problems in the jetting of the ink or affect the printing result. On the other hand, even where no degradation of the ink occurs, over time the older ink 105B typically has a different gloss in the printing result compared to freshly melted ink 105A. Accordingly, if some amounts of the older ink 105B are being used by the drop-forming unit 102 at the same time, e.g. in different areas of the print medium, the printing result will be affected by the different glosses, thereby producing what is known as "dosage banding".

Another problem with the freshly melted ink 105A sinking or flowing downwards directly into the drop-forming unit 102 is the higher likelihood of air bubbles or gas bubbles still being entrained in the freshly melted ink 105A. That is, air bubbles or gas bubbles may be generated in the ink from changes in temperature or pressure and/or from the fluid dynamics of the ink flow. Such bubbles may block channels or nozzles of the drop-forming unit 102 and thereby cause creation of dead zones in the drop-forming unit 102.

It is therefore an object of the present invention to provide an ink supply system that obviates or at least mitigates the above stated disadvantages such that temperature uniformity of ink flowing towards the drop-forming unit (ultimately the nozzles) is improved.

SUMMARY OF THE INVENTION

In a first aspect of the present invention, the object is at least partly achieved by providing an ink supply system for supplying ink to a drop-forming unit of a print-head in a printing system, comprising:

a housing enclosing a reservoir arranged for holding a volume of ink to be supplied to a drop-forming unit in the print-head;

an inlet for admitting ink into the reservoir; and

an outlet for discharging the ink from the reservoir arranged for supplying the ink to the drop-forming unit;

wherein the reservoir comprises a single continuous flow channel formed by the side walls and an elongate projection which is upstanding from a base of the reservoir, the flow channel being configured to guide the ink along a predetermined horizontal path through and/or around the reservoir from the inlet to the outlet; and

wherein the ink supply system is configured to, in operation, accommodate the volume of ink in the reservoir such that a free space remains above the ink held in the

reservoir along the entire length of the flow channel.

In this way, the invention provides an ink supply system which is configured for supplying the drop-forming unit of a print-head in a printing system with ink that is generally homogenous or uniform. In particular, the reservoir according to the present invention is configured to avoid or exclude the creation of "dead zones" in which older ink accumulates and very little renewal the ink takes place. This is achieved by providing the flow channel configured to guide the ink along a predetermined horizontal path through and/or around the reservoir. Due to the predetermined horizontal path, the freshly introduced ink cannot reach the drop-forming unit earlier than other ink already present in the reservoir but necessarily flows along the predetermined path, along which mixing with the older ink may take place. In other words, the flow channel is configured to ensure that all of the ink flows more or less in order of its entry into the reservoir towards the drop-forming unit. Furthermore, because a free space remains above the ink held in the reservoir along the entire length of the flow channel, any air bubbles entrained in the ink may rise and escape into the free space as the ink flows along the predetermined path. A further advantage is that the ink supply system of the present invention may allow higher flow rates of ink than is typical with convention systems because good ink mixing is provided and because the horizontal flow path provides the ink sufficient time for air bubbles to escape. For this reason, the ink supply system of the invention is suited for use with modern drop-forming units, in particular drop-forming units employing micro-electromechanical systems (MEMS), which can be supplied at high flow rates.

In an embodiment, the predetermined horizontal path defined by the flow channel is a circuitous or indirect path through and/or around the reservoir from the inlet to the outlet. In this way, the flow channel is configured to ensure that all of the ink travels along an indirect path through the reservoir towards the drop-forming unit. This means that ink just admitted through the inlet has time to mix with older ink present in the reservoir as both the fresher and older ink flow along the channel, and the circuitous path also provides time for any air bubbles entrained in the ink to escape. Advantageously, the ink can then be supplied to the drop-forming unit in a generally homogenous state. Thus, the flow channel is preferably configured to mix ink freshly admitted into the reservoir through the inlet at a first temperature with older ink in the reservoir at a second temperature. In this way, an equalization of temperatures and a uniform mixture of the ink can be achieved.
In a preferred embodiment, therefore, the flow channel is configured to allow air bubbles

in the ink to escape into the free space as the ink flows along the flow channel, especially along substantially an entire length of the flow channel. This enables any air bubbles to escape readily and ensures that a bubble-free ink can be supplied to the drop-forming unit. Accordingly, the flow channel preferably is open to the free space all along the predetermined horizontal path to allow air bubbles in the ink to escape directly into the free space. This then advantageously provides a compact design of the reservoir.

In an embodiment, the inlet comprises valve means configured to prevent back-flow of the ink held in the reservoir. In particular, the ink may be purged from the reservoir through the print-head by application of pressure within the reservoir housing. The valve means may be formed as float check valve, which opens and closes the inlet in response to pressure applied to the reservoir. A liquid ink head or column height at the inlet above the valve means may therefore open the valve to admit the ink to the reservoir, whereas an elevated pressure within the reservoir housing during a purge action may close the check valve to prevent back-flow.

In an embodiment, the reservoir comprised in the ink supply system includes a sensor means for sensing and/or controlling the level of the ink held in the reservoir.
In this embodiment, maintaining the free space above the ink held in the reservoir along the entire length of the flow channel can be better controlled.

In an embodiment, the flow channel is formed or defined by at least one side wall of the reservoir enclosed by the housing and by at least one elongate projection or wall upstanding from a base of the reservoir. In this regard, the flow channel can be realized just by dividing the reservoir by means of the elongate projection or wall in a simple to manufacture and effective manner. The at least one side wall thereby, at least partially, contributes to the formation of the channel. In a further embodiment, however, the flow channel may also be formed or defined by one or more elongate projections or walls upstanding from a base of the reservoir. In particular, the elongate projection or wall is preferably formed integral with the reservoir. In this way, the projection or wall and the reservoir can be formed in one part. For example, this part could be made of a material comprising a polymer and/or manufactured by means of injection moulding, which is a fast and simple way to manufacture the reservoir.

In an embodiment, the reservoir is formed as a generally rectangular chamber and the

flow channel extends at least along one or more side walls of the reservoir chamber enclosed by the housing. In this way, the flow channel may be configured to follow the side walls of the rectangular chamber. Thus, the flow channel can be realized with a geometry which is easy to form or manufacture. The flow channel may thus be configured to guide the ink along all of the side walls, in particular all four lateral walls, of the reservoir chamber.

In an embodiment, the inlet is positioned generally centrally within the reservoir. The predetermined horizontal path formed by the flow channel thereby winds generally spirally through or around the reservoir from the inlet. Alternatively or in addition, the outlet may be positioned generally centrally within the reservoir. The predetermined horizontal path formed by the flow channel may thereby wind generally spirally through and/or around the reservoir to the outlet. In this way, the complete surface of the reservoir can be used to form the horizontal path. In another embodiment, the predetermined horizontal path formed by the flow channel may follow a generally serpentine path through the reservoir. In this case, the inlet and/or outlet may be positioned at generally opposite ends or sides of the reservoir.

In an embodiment, the flow channel is formed as a single continuous channel. In this way, a maximum length of the flow channel can be achieved. Alternatively, however, the reservoir may comprise a plurality of flow channels (i.e. two or more), each of which is configured to guide the ink along a predetermined horizontal path through or around the reservoir from the inlet to the outlet.

In an embodiment, the ink supply system comprises a first filtering device upstream of the inlet, which filters the ink before it enters the reservoir chamber. In this way, the inadvertent introduction of particles or contaminants into the reservoir can be substantially avoided.

In an embodiment, the ink supply system comprises a melting device for melting solid ink elements, such as toner pearls. The melting device is preferably arranged upstream of a first filtering device for providing liquid ink to the filtering device before the ink enters the reservoir. In this way, the ink supply system may be advantageously fed with liquid ink of the melted ink type, and the freshly melted ink is firstly filtered to ensure that any non-melted ink particles are not admitted to the reservoir via the inlet.

In a second aspect, the present invention relates to a print-head for a printing system, wherein the print-head comprises: an ink supply system according to any one of the previously described embodiments; and a drop-forming unit which is supplied with ink via the outlet of the ink supply system.
The print-head may comprise the ink supply system according to the first aspect of the present invention as an integral part.

As discussed above, the invention is configured for supplying the drop-forming unit of the print-head with a homogenous or uniform ink from the reservoir, which is essentially free of air bubbles. This is achieved by providing the reservoir with a flow channel which is configured to guide the ink along a predetermined horizontal path through and around the reservoir. At the same time the ink level in the reservoir is regulated to maintain a space above the ink. The predetermined horizontal path then prevents freshly melted ink from reaching the drop-forming unit in advance of ink admitted to the reservoir substantially earlier. Rather, the ink necessarily flows along the predetermined path, along which it may mix with older ink and along which air bubbles may escape into the free space, before the ink is supplied to the drop forming unit.

In an embodiment, the print-head includes a second filtering device for filtering the ink from the ink supply system prior to delivery to the drop-forming unit. In this way, the second filter device provides an additional degree of assurance or safety to remove any remaining particles or contaminants from the ink before the ink finally reaches the drop-forming unit. In this regard, the second filter device will typically be arranged between the outlet of the reservoir and an inlet to the drop forming unit.

In a third aspect, the present invention relates to a printing system comprising an ink supply system according to any one of the above embodiments of the first aspect and/or a print-head according to any one of the above embodiments of the second aspect.
Therefore, the printing system according to the third aspect of the present invention either comprises a print-head comprising an ink supply system according to the present invention or an ink supply system according to the present invention and a print-head, wherein the print-head and the ink supply system may be separate elements of the printing system.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the invention and the advantages thereof, exemplary embodiments of the invention are explained in more detail in the following description with reference to the accompanying drawing figures, in which like reference characters designate like parts and in which:

Fig. 1 is a schematic cross-sectional side view of part of a print-head known to the applicant;

Fig. 2 is a top view of a reservoir of an ink supply system according to a preferred embodiment;

Fig. 3 is a schematic cross-sectional side view of a print-head having an ink supply system according to a preferred embodiment, and including a reservoir as shown in Fig. 2;

Fig. 4 is a top view of a reservoir of an ink supply system according to another preferred embodiment; and

Fig. 5 is a flow diagram that schematically illustrates a method of supplying ink to a drop-forming unit via an ink supply system according to a preferred embodiment.

The accompanying drawings are included to provide a further understanding of the present invention and are incorporated in and constitute a part of this specification. The drawings illustrate particular embodiments of the invention and together with the description serve to explain the principles of the invention. Other embodiments of the invention and many of the attendant advantages of the invention will be readily appreciated as they become better understood with reference to the following detailed description.

It will be appreciated that common and/or well understood elements that may be useful or necessary in a commercially feasible embodiment are not necessarily depicted in order to facilitate a more abstracted view of the embodiments. The elements of the drawings are not necessarily illustrated to scale relative to each other. It will further be appreciated that certain actions and/or steps in an embodiment of a method may be described or depicted in a particular order of occurrences while those skilled in the art will understand that such specificity with respect to sequence is not actually required. It will also be understood that the terms and expressions used in the present specification have the ordinary meaning as

is accorded to such terms and expressions with respect to their corresponding respective areas of inquiry and study, except where specific meanings have otherwise been set forth herein.

DETAILED DESCRIPTION OF EMBODIMENTS

With reference firstly to Fig. 1 of the drawings, a schematic cross-sectional side view of a print-head 100 known by the applicant is illustrated. As already described above in the introduction, the print-head 100 comprises an ink reservoir 104 and a drop-forming unit 102. Freshly melted ink 105A enters the reservoir 104 through an inlet 106 positioned generally centrally of the reservoir 104. The freshly melted ink 105A is cooler and therefore denser than the older ink 105B already present in the reservoir 104, such that the freshly melted ink 105A entering the reservoir 104 centrally tends to sink and flow directly down towards the drop-forming unit 102, leading to the creation of "dead zones" in which the freshly melted ink 105A and the older ink 105B are only poorly mixed.

With reference now to Figs. 2 of the drawings, a top view of a reservoir 4 of an ink supply system 1 according to a preferred embodiment of the invention is shown. The reservoir 4 is enclosed by a housing 3 and formed as a generally rectangular chamber with four side walls 12, 13, 14, 15. The reservoir 4 comprises an inlet 6, an outlet 7 and defines a flow channel 9 enclosed by the housing 3 and extending along the side walls 12, 13, 14, 15 circuitously around the reservoir 4 from the inlet 6 to the outlet 7. More specifically, the flow channel 9 is defined by the side walls 12-15 and an elongate projection 16 which is upstanding from a base 17 of the reservoir 4. The flow channel 9 is thereby configured to guide ink admitted through the inlet 6 into the reservoir 4 along a predetermined horizontal path 10 around the reservoir 4 to the outlet 7.

With reference now also to Fig. 3 of the drawings, a schematic sectional view of a print-head 30 having an ink supply system 1 which incorporates the reservoir 4 of Fig. 2 is illustrated. The print-head 30 comprises an ink supply system 1 and a drop-forming unit 2. The ink supply system 1 is configured to control admission of the ink 5 in the reservoir 4 and prevent back-flow of the ink during a purge of the reservoir 4. To this end, the inlet 6 comprises valve means 11 in the form of a ball-float check valve in the inlet 6. The ball-float of the valve 11 can move vertically downwards to an open position (as shown) under the influence of a liquid ink head or column height above the valve means 11 to admit the

ink 5 to the reservoir. By increasing pressure inside the housing 3 via a duct 23 to purge the ink form the reservoir, the ball-float of the valve means 11 can move vertically upwards to a closed position to prevent back-flow through the inlet 6. Furthermore, a level sensor (not shown) may control the level of the ink in the reservoir 4 such that a free space 8 remains above the ink 5 held in the reservoir 4. As the predetermined horizontal path 10 defined by the flow channel 9 is a circuitous path around the reservoir 4, the flow channel 9 is designed to ensure that all of the ink admitted through the inlet 6 flows more or less in order of entry into the reservoir 4 towards the drop-forming unit 2, but also allows more freshly admitted ink to mix with older ink present in the reservoir 4 as the ink flows along the flow channel 9. Furthermore, the flow channel 9 is open to the free space 8 inside the reservoir 4, to allow air bubbles in the ink 5 to escape into the free space 8 as the ink flows along the flow channel 9.

The ink is introduced into the reservoir from a melting device 19, which comprises a heated and tapering tube for melting solid ink elements 20, such as toner pearls inserted therein, to produce liquid ink 21, symbolized by a droplet in Fig. 3. The liquid ink 21 is then provided to a first filtering device 18 arranged downstream the melting device 18 and upstream of the inlet 6 to the reservoir 4, which filters the ink before it is collected by a funnel means 24 under the first filter device 18 and supplied to the inlet 4. The freshly melted ink admitted into the reservoir 4 through the inlet 6 at a first temperature may then mix with older ink in the reservoir 4 at a second temperature by means of the flow channel 9 inside the reservoir 4. In this way, ink 5 discharged from the outlet 7 of the reservoir 4 to an inlet 27 of the drop-forming unit 2 for supplying the drop-forming unit 2 is substantially homogenously mixed and at a uniform temperature.

The drop-forming unit 2 in this embodiment includes an intermediate assembly 25 and an arrangement of microelectromechanical systems ("MEMS") 26 for issuing the ink droplets. The intermediate assembly 25, at the inlet 27 of the drop forming unit 2, is equipped with a second filtering device 22 serves as a safety mechanism to remove any remaining particles from the ink before the ink reaches the MEMS. The intermediate assembly 25 may then split or divide the ink flow internally for delivering the ink to a suitable location of the MEMS, which is configured to form the drops to be printed on a print medium in a manner known by those skilled in the art and therefore not explained here in detail.

With reference to Fig. 4 of the drawings, a top or plan view of a reservoir 4 of an ink

supply system 1 according to another embodiment is illustrated. According to this embodiment, the inlet 6 is located adjacent to a side wall 12 of the housing 3 which encloses the reservoir 4 and the outlet 7 is located generally centrally within the reservoir 4. The predetermined horizontal path 10 formed by the flow channel 9 in this embodiment is longer and winds generally spirally around or through the reservoir 4 from the inlet 6 to the outlet 7. The flow channel 9 is thus formed as a single continuous channel by a number of internal walls or projections 16 which are upstanding from the base 17 of the reservoir 4.

Finally, referring to Fig. 5 of the drawings, a flow diagram is shown that illustrates schematically the steps in a method of supplying ink to a drop-forming unit 2 by means of an ink supply system 1 according to a preferred embodiment. In a first step (i) of the method, solid ink elements 20, especially ink pearls or toner pearls, are melted to liquid ink by means of a melting device 19 and provided to the first filtering device 18. In a second step (ii), the ink is then filtered by a first filtering device 18 and admitted into a reservoir 4 through an inlet 6. In a third step (iii), the ink is guided by means of flow channel 9 along a predetermined horizontal path 10 through or around the reservoir 4 from the inlet 6 to an outlet 7 of the reservoir 4. Finally, in a fourth step (iv), the ink is admitted from the outlet 7 into a drop-forming unit 2.

Although specific embodiments of the invention are illustrated and described herein, it will be appreciated by those of ordinary skill in the art that a variety of alternate and/or equivalent implementations exist. It should be appreciated that the exemplary embodiment or exemplary embodiments are examples only and are not intended to limit the scope, applicability, or configuration in any way. Rather, the foregoing summary and detailed description will provide those skilled in the art with a convenient road map for implementing at least one exemplary embodiment, it being understood that various changes may be made in the function and arrangement of elements described in an exemplary embodiment without departing from the scope as set forth in the appended claims and their legal equivalents. Generally, this application is intended to cover any adaptations or variations of the specific embodiments discussed herein.

For the avoidance of doubt, the use of the ink supply system according to the present invention is not limited to hot-melt inks but also applies to e.g. UV-curable inks, aqueous (latex) inks and solvent inks.

It will also be appreciated that in this document the terms "comprise", "comprising", "include", "including", "contain", "containing", "have", "having", and any variations thereof, are intended to be understood in an inclusive (i.e. non-exclusive) sense, such that the process, method, device, apparatus or system described herein is not limited to those features or parts or elements or steps recited but may include other elements, features, parts or steps not expressly listed or inherent to such process, method, article, or apparatus. Furthermore, the terms "a" and "an" used herein are intended to be understood as meaning one or more unless explicitly stated otherwise. Moreover, the terms "first", "second", "third", etc. are used merely as labels, and are not intended to impose numerical requirements on or to establish a certain ranking of importance of their objects.

LIST OF REFERENCE SIGNS

1	ink supply system
2	drop-forming unit
3	housing
4	reservoir
5	ink
6	inlet
7	outlet
8	free space
9	flow channel
10	horizontal path
11	valve means
12	side wall
13	side wall
14	side wall
15	side wall
16	projection or wall
17	base
18	first filtering device
19	melting device
20	ink elements
21	liquid ink
22	second filtering device
23	duct
24	funnel means
25	intermediate assembly
26	microelectromechanical systems
27	inlet
30	print-head
100	print-head
102	drop-forming unit
104	reservoir
106	inlet
105A	freshly melted ink
105B	older ink

CLAIMS

1. An ink supply system (1) for supplying ink to a drop-forming unit (2) of a print-head (30) in a printing system, comprising:

a housing (3) enclosing a reservoir (4) arranged for holding a volume of ink (5) to be supplied to a drop-forming unit (2) in the print-head (30);

an inlet (6) for admitting ink into the reservoir (4); and

an outlet (7) for discharging the ink from the reservoir (4) arranged for supplying the ink to the drop-forming unit (2);

wherein the reservoir (4) comprises a single continuous flow channel (9) formed by the side walls (12, 13, 14, 15) and an elongate projection (16) which is upstanding from a base (17) of the reservoir (4), the flow channel (9) being configured to guide the ink (5) along a predetermined horizontal path (10) through and/or around the reservoir (4) from the inlet (6) to the outlet (7); and

wherein the ink supply system (1) is configured to, in operation, accommodate the volume of ink (5) in the reservoir (4) such that a free space (8) remains above the ink (5) held in the reservoir (4) along the entire length of the flow channel (9).

2. The ink supply system (1) according to claim 1, wherein the predetermined horizontal path (10) defined by the flow channel (9) is a circuitous or indirect path through and/or around the reservoir (4) from the inlet (6) to the outlet (7), such that the flow channel (9) is configured to mix fresh ink admitted through the inlet (6) with older ink present in the reservoir (4) as the fresh and older ink flow along the flow channel (9).

3. The ink supply system (1) according to claim 1 or claim 2, wherein the inlet comprises valve means (11) configured to prevent back-flow of the ink (5) held in the reservoir (4).

4. The ink supply system (1) according to any one of claims 1-3, wherein the reservoir (4) includes a sensor means for sensing and/or controlling the level of the ink (5) held in the reservoir (4).

5. The ink supply system (1) according to any one of claims 1 to 4, wherein the flow

channel (9) is configured to allow air bubbles in the ink to escape into the free space (8) as the ink flows along the channel.

6. The ink supply system (1) according to any one of claims 1 to 5, wherein the reservoir (4) is formed as a generally rectangular chamber and wherein the flow channel (9) extends at least along one or more side walls (12; 13; 14; 15) of the reservoir chamber enclosed by the housing (3).

7. The ink supply system (1) according to claim 6, wherein the flow channel (9) is configured to guide the ink (5) to flow along all of the side walls (12; 13; 14; 15), in particular all four lateral walls, of the reservoir chamber.

8. The ink supply system (1) according to any one of the preceding claims, wherein the inlet (6) and/or the outlet (7) is positioned generally centrally within the reservoir (4) and wherein the predetermined horizontal path (10) formed by the flow channel (9) winds generally spirally through and/or around the reservoir (4) from the inlet (6) to the outlet (7).

9. The ink supply system (1) according to any one of the preceding claims, comprising a first filtering device (18) upstream of the inlet (6), which filters the ink before it enters the reservoir (4).

10. The ink supply system (1) according to claim 9, further comprising a melting device (19) for melting solid ink elements (20), such as toner pearls, upstream of the filtering device (18) for providing liquid ink (21) to the filtering device (18).

11. A print-head (30) in a printing system, comprising:

an ink supply system (1) according to any one of claims 1 to 12; and

a drop-forming unit (2) which is supplied with ink from the outlet (7) of the ink supply system (1).

12. A print-head (30) according to claim 11, further comprising a second filtering device (22) for filtering the ink from the ink supply system (1) for delivery to the drop-forming unit (2).

13. A printing system comprising an ink supply system (1) according to any one of claims 1 to 10 and/or a print-head (30) according to claim 11 or 12.

FIG 1

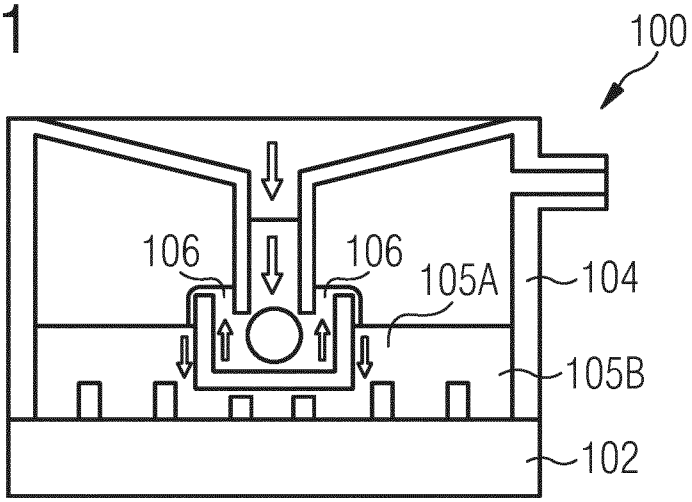


FIG 2

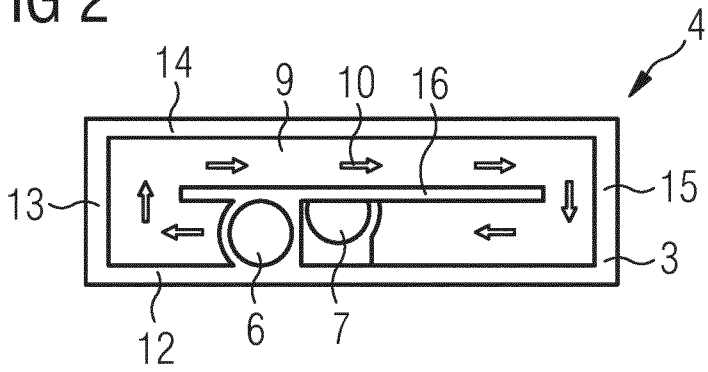


FIG 3

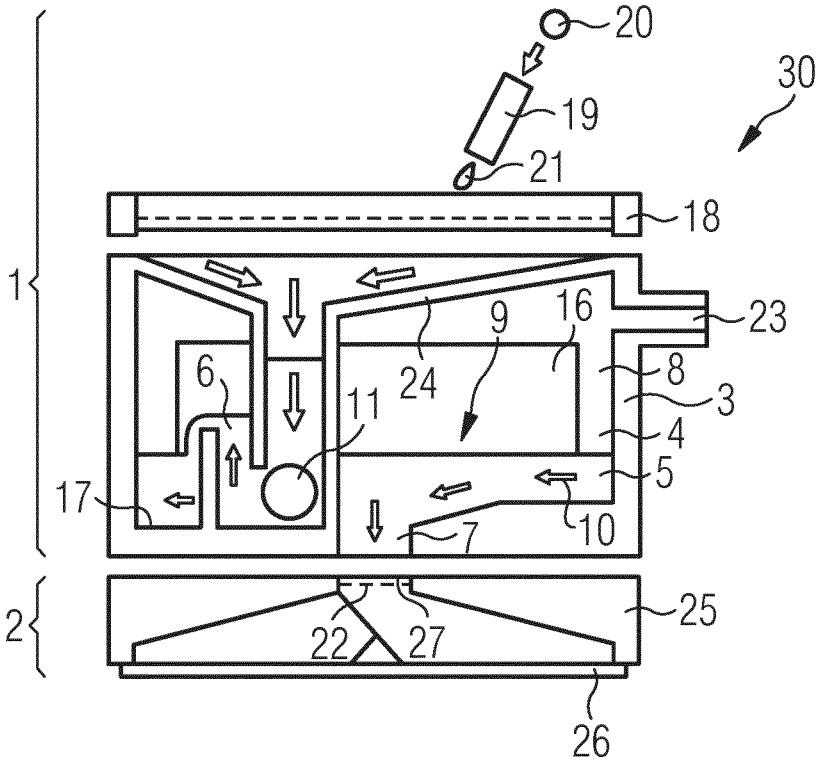


FIG 4

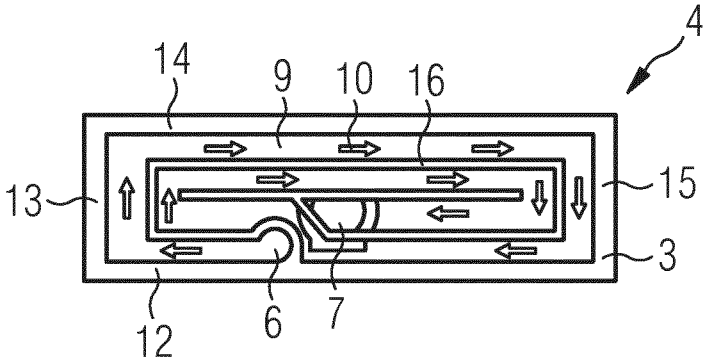
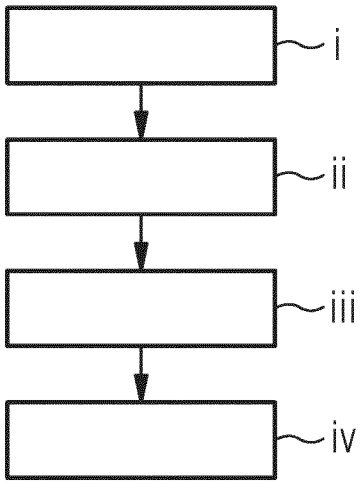


FIG 5



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/05Q479

A. CLASSIFICATION OF SUBJECT MATTER
INV. B41J2/175
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B41J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal , WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X Further documents are listed in the continuation of Box C.

X See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
23 March 2017	31/03/2017

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Adam, Emmanuel

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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