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

(11) **EP 3 501 835 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
26.06.2019 Bulletin 2019/26

(51) Int Cl.:
B41J 2/175 *(2006.01)* ***B41J 2/18*** *(2006.01)*

(21) Application number: **18211084.1**

(22) Date of filing: **07.12.2018**

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

(30) Priority: **20.12.2017 EP 17208832**

(71) Applicant: **OCE Holding B.V.**
5914 CA Venlo (NL)

(72) Inventors:
- **MAKAREVSKI, Serguei**
  5914 CA Venlo (NL)
- **STUART, Gregory Ch.**
  5914 CA Venlo (NL)
- **CONSIDINE, Paul S.**
  5914 CA Venlo (NL)

(74) Representative: **OCE IP Department**
St. Urbanusweg 43
5914 CA Venlo (NL)

(54) INK RESERVOIR FOR SUPPLYING INK TO A PRINT HEAD OF AN INKJET PRINTER

(57) An ink reservoir for supplying ink to a print head of an inkjet printer, comprises an ink chamber delimited by at least a front wall surface, a back wall surface, two side wall surfaces, and a bottom wall surface, the ink chamber having an outlet located in a portion of a wall surface delimiting a lower portion of the ink chamber, the ink chamber having a return inlet located in a portion of a wall surface delimiting an upper portion of the ink chamber. The bottom wall surface comprises a curved surface extending between the front wall surface and the back wall surface in a first direction and extending from the one side wall surface to the other side wall surface in a second direction, the curved surface having a concave contour in a plane normal to the first direction and parallel to the second direction.

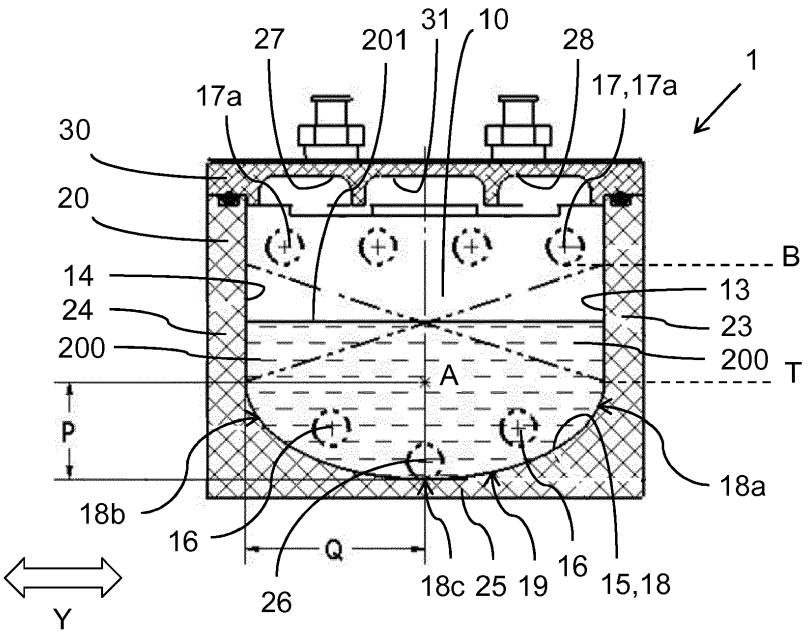

Fig. 3b

EP 3 501 835 A1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to an ink reservoir for supplying ink to a print head of an inkjet printer, comprises an ink chamber delimited by at least a front wall surface, a back wall surface, two side wall surfaces, and a bottom wall surface, the ink chamber having an outlet located in a portion of a wall surface delimiting a lower portion of the ink chamber, and the ink chamber having a return inlet located in a portion of a wall surface delimiting an upper portion of the ink chamber. The present invention further relates to an inkjet printer comprising such an ink reservoir.

BACKGROUND ART

[0002] A known ink reservoir for supplying ink to a print head of an inkjet printer comprises an ink chamber for containing a volume of ink, delimited by a front wall surface, a back wall surface, two side wall surfaces, and a bottom wall surface.

[0003] The ink reservoir has an outlet for discharging ink towards a print head, located in a portion of a wall surface delimiting a lower portion of the ink chamber. The location of the outlet assures that when the ink chamber is only filled up to a certain level, the outlet communicates with an ink volume present at the bottom of the ink chamber.

[0004] The ink reservoir has a return inlet for receiving air bubbles back from a print head, located in a portion of a wall surface delimiting an upper portion of the ink chamber. Receiving air bubbles back from a print head assures reliable functioning of the print head during printing. The location of the return inlet assures that when the ink chamber is only filled up to a certain level, the return inlet communicates with an empty volume present at the top of the ink chamber.

[0005] The known ink reservoir comprises a set of baffles to limit the sloshing of an ink volume inside the ink chamber during motion of the reservoir. Limited sloshing keeps the return inlet free from ink, so that air bubbles returning from a print head can be freely received inside the ink chamber.

[0006] A drawback of the known reservoir is its susceptibility to sedimentation when used in combination with a pigmented ink. Sludge formed by settling pigment particles may reach a print head, which can make ejection nozzles of the print head unreliable. Sediment of pigment particles inside a print head needs to be cleared out before printing, which wastes ink.

[0007] The present invention aims to provide an improved ink reservoir for supplying ink to a print head of an inkjet printer. In particular, the present invention aims to provide an ink reservoir that is less susceptible to sedimentation of pigment particles when used in combination with a pigmented ink.

SUMMARY OF THE INVENTION

[0008] At least one of the above objectives is attained by an ink reservoir wherein the bottom wall surface comprises a curved surface extending between the front wall surface and the back wall surface in a first direction and extending from the one side wall surface to the other side wall surface in a second direction, the curved surface having a concave contour in a plane normal to the first direction and parallel to the second direction.

[0009] By the bottom wall surface comprising a curved surface as described, an ink reservoir according to the invention allows an ink volume present at the bottom of the ink chamber to perform a controlled sloshing motion between the two side wall surfaces when the ink reservoir is moved back and forth in the second direction, wherein the top surface of the ink volume approximately rocks about an axis extending in the first direction. By the controlled sloshing motion, pigmented ink is kept better in suspension.

[0010] The outlet may be a primary outlet positioned at a certain level, wherein the ink chamber further has a secondary outlet positioned at a level below that of the primary outlet. Ink withdrawn via the primary outlet will then have a relatively low degree of sedimentation, which makes it suitable to be supplied to a print head. Ink withdrawn from the secondary outlet will have a relatively high degree of sedimentation, and may then be supplied to a circulation system for circulating ink to increase the degree of suspension.

[0011] The secondary outlet may have a central position with respect to the concave contour. Then, ink withdrawn via the secondary outlet is more likely to contain pigment sediment, that accumulates by falling towards a center line of the curved surface.

[0012] The primary outlet may have an off-center position with respect to the concave contour. Then, ink withdrawn via the primary outlet is more likely to contain ink in suspension.

[0013] Preferably, the curved surface has a slope in a plane normal to the second direction. Then, ink and pigment particle sediment will be promoted to accumulate at one side of the ink chamber in order to be discharged via a respective one of the outlets.

[0014] The curved surface may comprise a generalized cylindrical surface, or a ruled surface, shaped according to the concave contour.

[0015] Opposite sloping portions of the curved surface may each smoothly transition into a respective one of the two side wall surfaces, in order to limit flow disturbances at the respective transitions.

[0016] The concave contour may have a width-to-height ratio of more than one to optimize the ink volume.

[0017] Optimally, the width-to-height ratio is between 1:1.75 and 1:2.5.

[0018] Preferably, the concave contour comprises a semi-elliptical curve.

[0019] In order to prevent the top surface of an ink vol-

ume inside the ink chamber from reaching the return inlet during motion of the reservoir, the return inlet may be located in either the front wall surface or the back wall surface, at a certain distance away from either of the two side wall surfaces.

[0020] A relatively stable sloshing motion of an ink volume inside the ink chamber is attained if the ink chamber is filled up to around halfway between a top level of the curved surface and a bottom level of the return inlet, and the reservoir is moved at such a speed, that the top surface of the ink volume rocks back and forth over said distance along each of the two side wall surfaces. Also, the ink level at the center of the reservoir may then be measured and used as a reference of the total ink volume present inside the ink chamber, and used as an input for a system controlling the filling level.

[0021] A filling level of the ink chamber, a speed of motion of the ink reservoir and a position of the return inlet are preferably mutually tuned such that in operation of an inkjet printer comprising the reservoir, the top surface of an ink volume inside the ink chamber remains at a certain distance away from the return inlet during motion of the ink volume inside the ink chamber due to motion of the reservoir.

[0022] Preferably, the top surface of an ink volume remains away from the return inlet at a distance of 2 mm or more.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] The invention will be described in more detail with reference to the drawings, wherein:

- Fig. 1 shows, as an example of an inkjet printer having a movable carriage, a flatbed inkjet printer in a schematic perspective view;
- Fig. 2a shows a frontal view of an ink reservoir according to the invention, indicating a section A-A;
- Fig. 2b shows the section A-A of the ink reservoir of Fig. 2a;
- Fig. 3a shows a side view of an ink reservoir according to the invention, indicating a section B-B;
- Fig. 3b shows the section B-B of the ink reservoir of Fig. 3a.

DETAILED DESCRIPTION OF THE DRAWINGS

[0024] With reference to Fig. 1, an inkjet printer 100 comprises a receiving area 101 for receiving a recording medium, a carriage 102 carrying a print head, and a primary guiding structure 103a, 103b for guiding the carriage 102 to move in a width-wise direction Y relative to the receiving area 101.

[0025] During printing, the carriage 102 moves at a certain speed from one side of the receiving area 101 to the opposite side in the width-wise direction Y, while ejecting droplets of ink. A swath of ink droplets is thereby deposited on a recording medium accommodated in the receiving area 101, to form a line of dots on said medium, extending in the width-wise direction Y.

[0026] The shown inkjet printer 100 is a wide-format flatbed printer, comprising a medium support table 104 defining the receiving area 101, and a secondary guiding structure 105 that allows the primary guiding structure 103a, 103b to move in a length-wise direction X relative to the receiving area 101, normal to the width-wise direction Y.

[0027] In the printer shown, when a first line of dots has been printed, the primary guiding structure 103a, 103b is moved relative to the receiving area 101 in the length-wise direction X before a second line of dots is printed. During the printing of the second line of dots, the carriage 102 moves in an opposite direction with respect to the receiving area 101 as compared to the direction of motion during the printing of the first line of dots.

[0028] In another type of inkjet printer, when a first line of dots has been printed, a recording medium is driven to move relative to the carriage before a second line of dots is printed. In a printer of such a type, like in the depicted printer, a carriage carrying a print head still moves in opposite directions between opposite sides of a receiving area during the printing of subsequent lines of dots.

[0029] In inkjet printers of both the above types, an ink reservoir for supplying ink to the print head is known to be mountable on the carriage, so that during printing, the ink reservoir continually moves back and forth in a width-wise direction Y of a receiving area, together with the carriage and a print head mounted thereon.

[0030] At least one of possibly multiple ink reservoirs mounted on a carriage of an inkjet printer may comprise a pigmented ink, comprising a suspension of pigment particles in a carrier liquid. An example of a pigmented ink is a white ink as currently used in many printing applications, comprising pigment particles of titanium dioxide.

[0031] Figure 1 schematically shows an ink reservoir mounted on the carriage 102 to be connected to a circulation system 300 for circulating ink from the reservoir to increase the degree of suspension of the ink. The circulation system 300 is connected to the reservoir via a first connection 301 for supplying ink from the reservoir to the circulation system 300, and via a second connection 302 for feeding ink back from the circulation system 300 to the reservoir.

[0032] With reference to Figures 2b and 3b, an ink reservoir 1 according to the invention comprises a container body 20 having an ink chamber 10 for containing a volume of liquid ink.

[0033] The ink chamber 10 is enclosed by a front wall 21, a back wall 22, two side walls 23, 24, and a bottom wall 25 of the container body 20, so that the ink chamber 10 is delimited by a respective front wall surface 11, a back wall surface 12, two side wall surfaces 13, 14, and a bottom wall surface 15.

[0034] The bottom wall surface 15 comprises a curved

surface 18 extending between the front wall surface 11 and the back wall surface 12 in a first direction X and extending from the one side wall surface 13 to the other side wall surface 14 in a second direction Y.

[0035] Figure 2a indicates a section A-A normal to the second direction Y. As can be seen from said section, depicted in Figure 2b, the curved surface 18, or at least a center line 18c thereof, has a slope K in a plane normal to the second direction Y.

[0036] Figure 3a indicates a section B-B normal to the first direction X. As can be seen from said section, depicted in Figure 3b, the curved surface 18 has a concave contour 19 in a plane normal to the first direction X and parallel to the second direction Y.

[0037] In the shown example, the curved surface 18 comprises a generalized cylindrical surface defined around a straight axis A, shaped according to a concave contour 19. The axis A extends in parallel to the center line 18c of the bottom wall surface 18. The concave contour 19, defined in a vertical plane, comprises in this example a semi-elliptical curve having a width-to-height ratio (Q/P) of more than one. Opposite portions 18a, 18b of the curved surface 18 sloping towards the center line 18c of the curved surface 18 each smoothly transition into a respective one of the two side wall surfaces 13, 14.

[0038] The ink chamber 10 has two primary outlets 16 for discharging ink towards a print head, both located in a lower portion 11a of the front wall surface 11. With special reference to Figure 3b, the two primary outlets 16 are positioned at mutually the same level above the bottom wall surface 15, each in an off-center position with respect to the concave contour 19 when seen in the first direction X.

[0039] The ink chamber 10 further has a secondary outlet 26 for discharging ink towards a circulation system 300, also located in the lower portion 11a of the front wall surface 11. With special reference to Figure 3b, the secondary outlet 26 is positioned above the bottom wall surface 15 at a level below that of the two primary outlets 16, in a center position with respect to the concave contour 19 when seen in the first direction X.

[0040] The ink chamber 10 further has a plurality of primary return inlets 17 for receiving air bubbles back from a print head, located in an upper portion 11b of the front wall surface 11. The primary return inlets 17 are aligned in the second direction Y, wherein the two outer return inlets 17a are each located at a certain distance away from a respective closest side wall surface 13, 14.

[0041] The ink reservoir 1 further has a secondary return inlet or fill port 27 for receiving ink back from a circulation system 300. The secondary return inlet 27 in this case also serves for receiving fresh ink, which is fed to a circulation system 300 to be transferred to the ink chamber 10. In the shown example, the secondary return inlet 27 is provided in a lid 30 cooperating with the container body 20 for closing off the ink chamber 10 in an air-tight way, which lid 30 is further provided with a vacuum port 28 for imposing a vacuum inside the ink chamber 10. The secondary return inlet 27 and the vacuum port 28 are both located in a bottom surface 31 of the lid 30, which delimits the ink chamber 10 at the top side.

[0042] The ink chamber 10 is shown filled with ink 200 up to around halfway between a top edge T of the curved surface 18 at the location of the front wall 21 and a bottom edge B of each of the return inlets 17, wherein the top surface 201 of the ink volume 200 is in a horizontal resting position while the ink reservoir 1 is stationary.

[0043] The ink reservoir 1 is intended to be mounted on the carriage of an inkjet printer in an upright position as shown in the drawings, such that the first direction X and the second direction Y respectively correspond with the length-wise direction X and the width-wise direction Y of a receiving area 101 of the inkjet printer as described earlier.

[0044] In operation, the primary outlets 16 and the secondary outlet 26 both communicate with the filled lower portion 10a of the ink chamber 10, while the primary return inlets 17, the secondary return inlet 27 and the vacuum port 28 each communicate with the empty upper portion 10b of the ink chamber 10.

[0045] During printing, the ink reservoir 1 moves back and forth in the second direction Y together with the carriage on which the ink reservoir 1 is mounted. During this motion, or at least during an acceleration for reaching a certain speed to perform this motion in one of the backward and forward directions, the ink 200 inside the ink chamber 10 sloshes such that the top surface 201 of the ink volume 200 adopts one of two slanted positions, indicated in Figure 3b by dashed lines, in which the top surface 201 partly faces in said backward or forward direction. As a result, during the back and forth motion of the ink reservoir 1, the top surface 201 approximately rocks about an axis extending in the first direction X. At a specific speed or acceleration of the ink reservoir 1 in the backward and forward directions, the top surface 201 rocks back and forth along each of the two side wall surfaces 13, 14 between the bottom level B of the primary return inlets 17 and the top level T of the curved surface 18. A level sensor 29 externally positioned on a thinned part of the back wall 22 may then be used to measure the ink level near the rocking axis of the top surface 201.

[0046] As a result of the sloshing as described, ink withdrawn via the primary outlets 16 and supplied to a print head of the inkjet printer has a relatively high degree of suspension.

[0047] Any sludge or sediment settling on the bottom wall surface 15 will be inclined to slide down along each of the opposite sloping portions 18a, 18b of the curved surface 18 towards the center of the curved surface 18 in the second direction Y, and to slide down along the whole of the curved surface 18 as sloping in a plane normal to said direction Y towards the secondary outlet 26 in the first direction X.

[0048] As a result of the sliding of sludge and sediment as described, ink withdrawn via the secondary outlet 26 and supplied to a circulation system 300 for increasing

the degree of suspension has a relatively high degree of sedimentation.

[0049] It is noted that other shapes of the bottom wall surface may be feasible, in which the same or similar effects as those described above are obtained. For instance, the concave contour need not necessarily be smooth or curved along the whole of its length, even though smoothness is expected to prevent the formation of sediment. Some parts of the concave contour may be flat, as long as the contour is curved as a whole, wherein portions of the contour oppositely positioned with respect to a center of the contour both slope down towards said center. Preferably, the concave contour is symmetrical. A slope of the bottom wall surface as a whole, down towards a side of the ink chamber where one or more outlets are located, need not necessarily be constant over the entire decline. Also, the concave contour need not necessarily have a constant shape over the entire decline. Lastly, the curved surface need not necessarily extend along the whole distance from the front wall surface to the back wall surface.

[0050] It is to be understood that the disclosed embodiments are merely exemplary of the invention, which can be embodied in various forms. Specific structural and functional details are not to be interpreted as limiting, but merely as a basis for the claims and as a teaching for one skilled in the art to variously employ the present invention in virtually any appropriately detailed structure. In particular, features presented and described in separate dependent claims may be applied in combination, and any advantageous combination of such claims is herewith disclosed.

[0051] Further, it is contemplated that structural elements may be generated by application of three-dimensional (3D) printing techniques. Therefore, any reference to a structural element is intended to encompass any computer executable instructions that instruct a computer to generate such a structural element by three-dimensional printing techniques or similar computer controlled manufacturing techniques. Furthermore, such a reference to a structural element encompasses a computer readable medium carrying such computer executable instructions.

[0052] Further, the terms and phrases used herein are not intended to be limiting; but rather, to provide an understandable description of the invention. The terms "a" or "an", as used herein, are defined as one or more than one. The term plurality, as used herein, is defined as two or more than two. The term another, as used herein, is defined as at least a second or more. The terms including and/or having, as used herein, are defined as comprising (i.e., open language). The term coupled, as used herein, is defined as connected, although not necessarily directly.

[0053] The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

Claims

1. Ink reservoir for supplying ink to a print head of an inkjet printer, comprising an ink chamber (10) delimited by at least a front wall surface (11), a back wall surface (12), two side wall surfaces (13, 14), and a bottom wall surface (15), the ink chamber (10) having an outlet (16) located in a portion (11a) of a wall surface (11) delimiting a lower portion (10a) of the ink chamber (10), the ink chamber (10) having a return inlet (17) located in a portion (11b) of a wall surface (11) delimiting an upper portion (10b) of the ink chamber (10),
wherein the bottom wall surface (15) comprises a curved surface (18) extending between the front wall surface (11) and the back wall surface (12) in a first direction (X) and extending from the one side wall surface (13) to the other side wall surface (14) in a second direction (Y), the curved surface (18) having a concave contour (19) in a plane normal to the first direction (X) and parallel to the second direction (Y).

2. Ink reservoir according to claim 1, wherein the outlet is a primary outlet (16) positioned at a certain level, wherein the ink chamber (10) further has a secondary outlet (26) positioned at a level below that of the primary outlet (16).

3. Ink reservoir according to claim 2, wherein the secondary outlet (26) has a central position with respect to the concave contour (19).

4. Ink reservoir according to claim 2, wherein the primary outlet (16) has an off-center position with respect to the concave contour (19).

5. Ink reservoir according to one of the preceding claims, wherein the curved surface (18) has a slope (K) in a plane normal to the second direction (Y).

6. Ink reservoir according to one of the preceding claims, wherein the curved surface (18) comprises a generalized cylindrical surface shaped according to the concave contour (19).

7. Ink reservoir according to one of the preceding claims, wherein opposite sloping portions (18a, 18b) of the curved surface (18) each smoothly transition into a respective one of the two side wall surfaces (13, 14).

8. Ink reservoir according to one of the preceding claims, wherein the concave contour (19) has a

width-to-height ratio of more than one.

9. Ink reservoir according to one of the preceding claims, wherein the concave contour (19) has a width-to-height ratio between 1:1.75 and 1:2.5.

10. Ink reservoir according to one of the preceding claims, wherein the concave contour (19) comprises a semi-elliptical curve.

11. Ink reservoir according to one of the preceding claims, wherein the return inlet (17) is located in either the front wall surface (11) or the back wall surface (12), at a certain distance away from either of the two side wall surfaces (13, 14).

12. Ink reservoir according to one of the preceding claims, filled with a volume of ink (200) up to around halfway between a top level (T) of the curved surface (18) and a bottom level (B) of the return inlet (17).

13. Inkjet printer comprising a receiving area (101) for receiving a recording medium, a carriage (102) carrying a print head, a primary guiding structure (103a, 103b) for guiding the carriage (102) to move in a width-wise direction (Y) relative to the receiving area (101), and an ink reservoir (1) for supplying ink to the print head of the inkjet printer, wherein the ink reservoir (1) is an ink reservoir (1) according to one of the preceding claims, mounted on the carriage (102) such that the second direction (Y) corresponds with the width-wise direction (Y) of the receiving area (101).

14. System comprising an inkjet printer (100) according to claim 13, and further comprising a circulation system (300) for circulating ink to keep the ink in suspension, wherein the ink reservoir (1) of the inkjet printer (100) comprises a secondary outlet (26) for supplying ink to the circulation system (300), and a secondary return inlet (27) for receiving ink back from the circulation system (300).

15. Method of keeping pigmented ink in suspension within an ink reservoir (1) mounted on a carriage (102) of an inkjet printer (100), comprising the step of allowing an ink volume (200) present at the bottom of an ink chamber (10) of the ink reservoir (1) to perform a controlled sloshing motion between two side wall surfaces (13, 14) of the ink chamber (10) when the ink reservoir (1) moves back and forth in a width-wise direction (Y) together with the carriage (102).

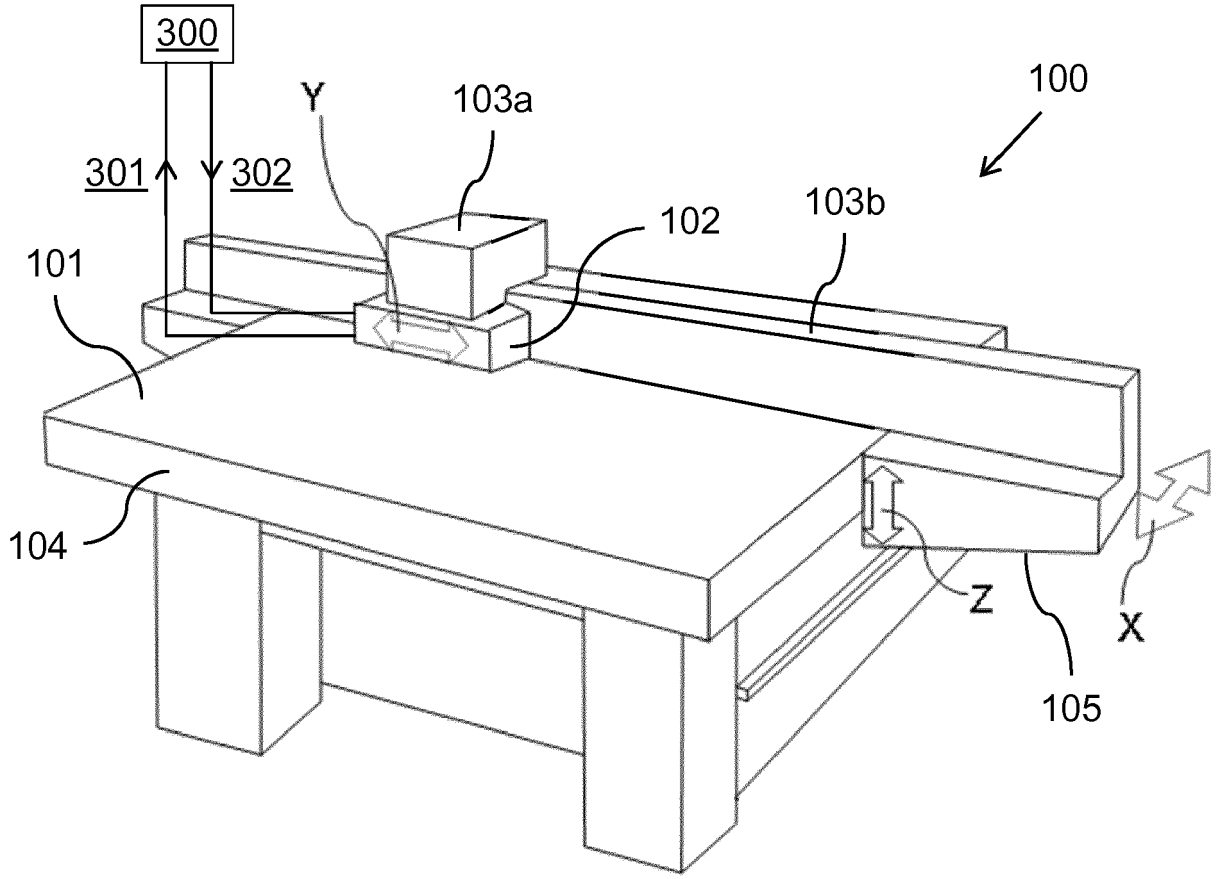

Fig. 1

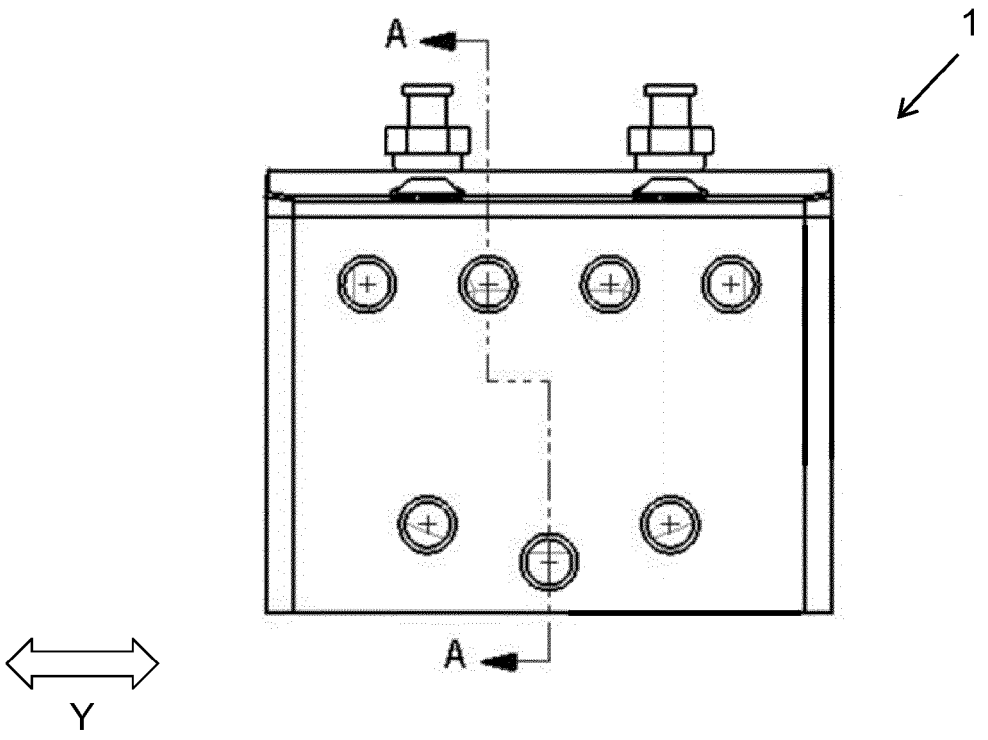
A
1
A
Y

Fig. 2a

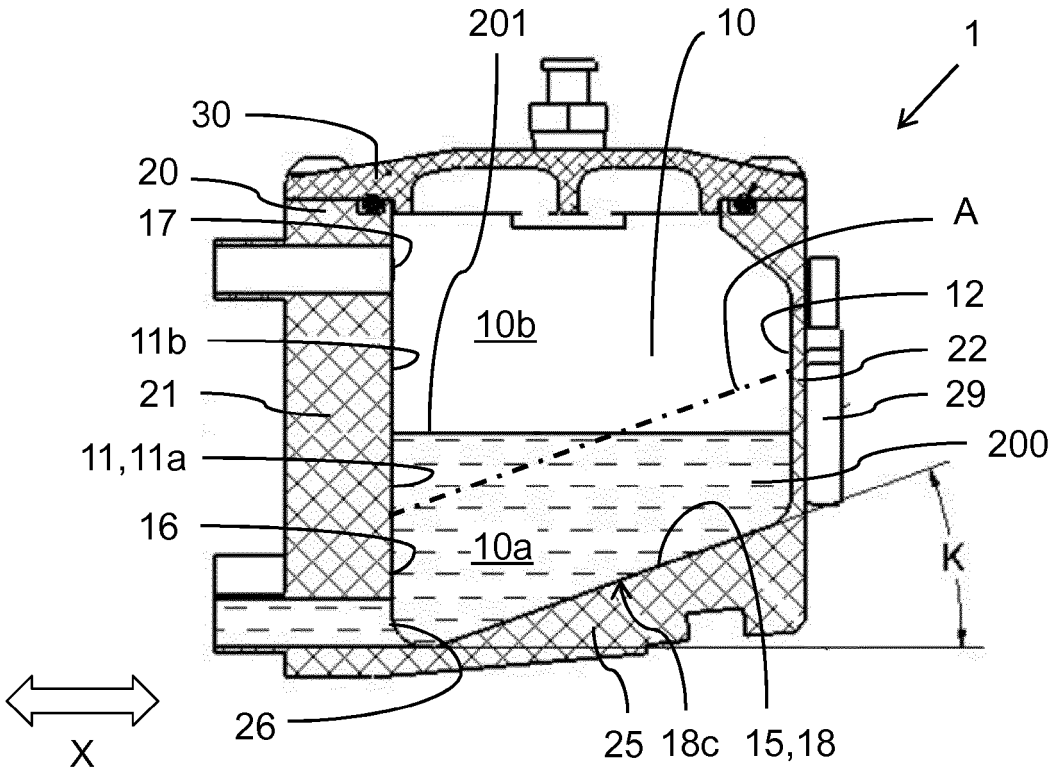
201
10
1
30
20
17
A
12
10b
11b
22
21
29
11,11a
200
16
10a
K
26
25
18c
15,18
X

Fig. 2b

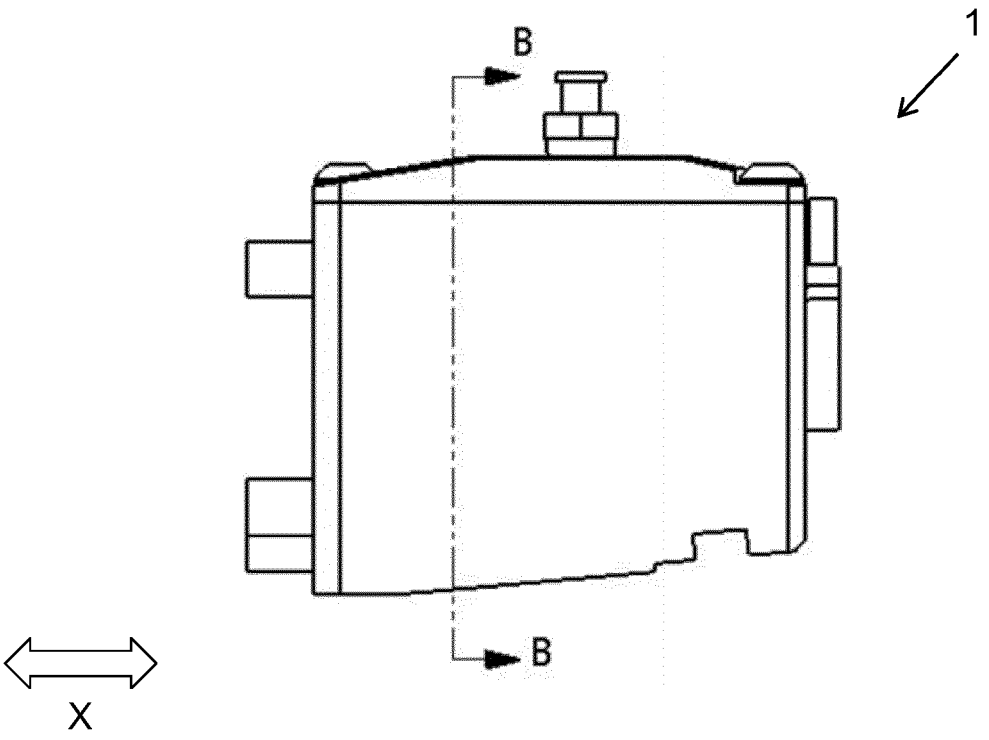
1
B
B
X

Fig. 3a

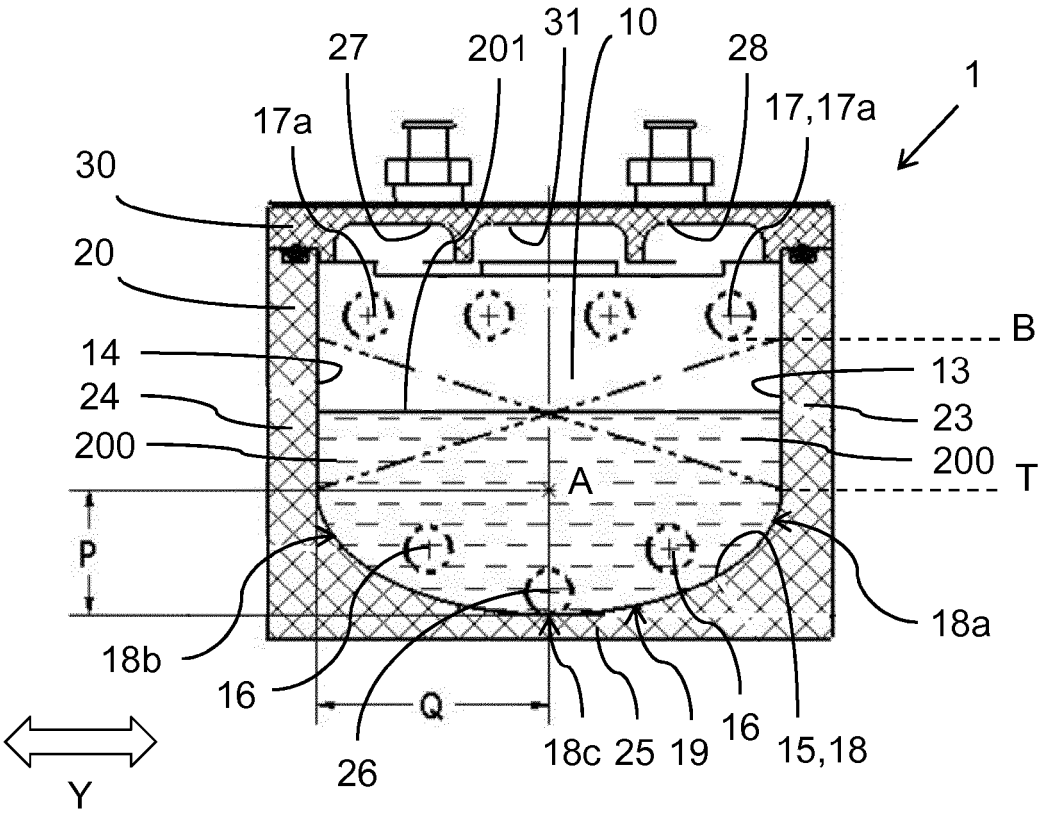
27
201
31
10
28
1
17a
17,17a
30
20
B
14
13
24
23
200
200
T
A
P
18a
18b
16
Q
26
18c
25
19
16
15,18
Y

Fig. 3b

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 18 21 1084

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 995 460 A2 (FUNAI ELECTRIC CO [JP]) 16 March 2016 (2016-03-16) * paragraph [0011] - paragraph [0013]; figure 1A *	1-15	INV. B41J2/175 B41J2/18
X	US 2004/021751 A1 (STEINMETZ CHARLIE [US] ET AL) 5 February 2004 (2004-02-05) * paragraphs [0002], [0069], [0079]; figures 5, 6, 8, 14, 22 *	1-15	
X	US 4 491 433 A (SHIURILA JOHN [US] ET AL) 1 January 1985 (1985-01-01) * column 3, line 66 - line 68; claim 1; figures 1, 5 * * column 4, line 1 - line 16 *	1-15	
A	US 2014/002551 A1 (SMITH ROBERT [GB] ET AL) 2 January 2014 (2014-01-02) * paragraphs [0006], [0022] - [0024]; figure 2 *	1-15	
A	EP 3 184 310 A1 (SEIKO EPSON CORP [JP]) 28 June 2017 (2017-06-28) * paragraph [0050]; figures 4, 5 *	1-15	TECHNICAL FIELDS SEARCHED (IPC) B41J
A	CN 205 890 219 U (HOPE CERAM MACHINERY CO LTD) 18 January 2017 (2017-01-18) * figures 1, 2 *	1-15	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	6 May 2019	Cavia Del Olmo, D

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 18 21 1084

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

06-05-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2995460 A2	16-03-2016	CA 2763339 A1	16-03-2013
		CN 102658723 A	12-09-2012
		EP 2447078 A1	02-05-2012
		EP 2995460 A2	16-03-2016
		US 2012120164 A1	17-05-2012
US 2004021751 A1	05-02-2004	AT 374697 T	15-10-2007
		BR PI0412615 A	10-04-2007
		BR PI0412616 A2	10-03-2009
		CN 1860030 A	08-11-2006
		CN 1860032 A	08-11-2006
		DE 602004009328 T2	10-07-2008
		EP 1670644 A1	21-06-2006
		ES 2293341 T3	16-03-2008
		JP 2007500621 A	18-01-2007
		US 2004021751 A1	05-02-2004
		WO 2005011987 A1	10-02-2005
US 4491433 A	01-01-1985	DE 3430460 A1	07-03-1985
		FR 2550996 A1	01-03-1985
		JP S6076349 A	30-04-1985
		US 4491433 A	01-01-1985
US 2014002551 A1	02-01-2014	CN 103476592 A	25-12-2013
		EP 2670601 A1	11-12-2013
		US 2012194619 A1	02-08-2012
		US 2014002551 A1	02-01-2014
		WO 2012106134 A1	09-08-2012
EP 3184310 A1	28-06-2017	CN 106976317 A	25-07-2017
		EP 3184310 A1	28-06-2017
		JP 2017113891 A	29-06-2017
		US 2017173966 A1	22-06-2017
		US 2018264829 A1	20-09-2018
CN 205890219 U	18-01-2017	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82