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

(11) EP 2 116 380 A1

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
11.11.2009 Bulletin 2009/46

(21) Application number: **08734038.6**

(22) Date of filing: **02.02.2008**

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

(86) International application number:
PCT/CN2008/070240

(87) International publication number:
WO 2008/101425 (28.08.2008 Gazette 2008/35)

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR

(30) Priority: **24.02.2007 CN 200720048947 U**

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(54) INK CONTAINER FOR INK-JET PRINTER

(57) An ink container for an ink-jet printer includes an ink outlet, an air vent, an ink supply cavity and a first ink chamber. The air vent that is at a vertex portion of the first ink chamber in a perpendicular direction connects the first ink chamber with atmosphere. The ink outlet that is on a perpendicular sidewall of the ink supply cavity and close to the bottom connects the ink supply cavity with outside environment. A first ink tube is horizontally arranged above a central position of the ink supply cavity in perpendicular direction. One end of the first ink tube is connected to the ink supply cavity, and the other end is connected to the first ink chamber at a position lower than the first ink tube in the perpendicular direction. Based on this version, an ink cartridge with multiple chambers will be achieved by additionally increasing the number of ink chambers. The ink container is simple in the structure, and it can be prevented for ink from being disturbed by gas in each ink chamber during the preservation and transportation.

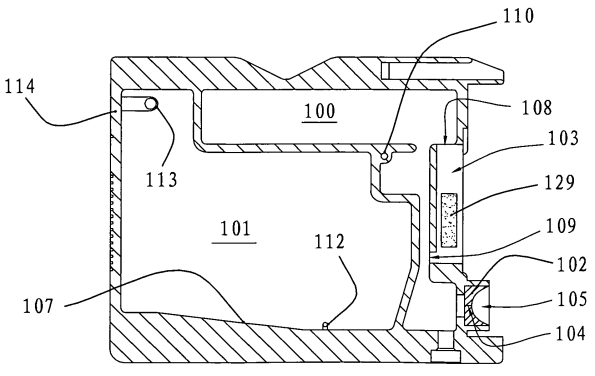

FIG. 4

EP 2 116 380 A1

Description

FIELD OF THE INVENTION

[0001] This invention relates to an ink container for an ink-jet printer, which is capable of being removably mounted on an ink-jet printer-carriage equipped with a printhead including nozzles for printing, and communicating with the nozzles through an ink feeding needle and respective ink flow paths. This application claims the priority of Chinese Patent Application 200720048947.5 filed on Feb 24, 2007, the subject matter of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] The printing process of an ink-jet printer is generally through providing an ink source by an ink container for storing ink, transferring ink to a printhead through respective flow channels, and ejecting ink from a nozzle on the printhead to recording media such as papers under control of printing signals, so as to complete recordation of characters and patterns. Common ink-jet printers sold in the market are classified into piezoelectric ink-jet printers and bubble-jet printers.

[0003] In piezoelectric ink-jet printers, there are one or more piezoelectric crystals arranged at both sides of the ink flow channels in the proximity of the printhead nozzle. The piezoelectric crystals are controlled by printing signals modulated with data, for creating deformation of constriction or expansion, squeezing ink in nozzles to form micro-droplets after ejection from the nozzles, and falling down onto recording media such as pages of papers, so as to form a recording point.

[0004] The printhead structures of bubble-jet printers are similar to those of piezoelectric Ink-jet printers. The difference between them is that a bubble-jet printer is provided with heating electrodes on the internal or external wall of ink flow channels in the proximity of the printhead nozzle. Electric pulse signals modulated with data are transmitted to the heating electrodes of the nozzle, so that the heating electrodes increase temperatures rapidly, and gasify ink in the proximity of the nozzle quickly to form bubbles. Pressure created by bubble expansion causes ink to form micro-droplets after ejection from the nozzle, and to fall down onto pages of papers. After the electric pulses disappear, ink in the nozzle is maintained flush with the nozzle outer surfaces by surface tension. Negative pressure formed after the printhead extracts ink introduces ink from the ink chamber into the ink flow channel in which the nozzle is located.

[0005] According to the configuring relationship of printhead with ink container, ink containers of the ink-jet printers also include two types. One is a unitary structural ink container in which an ink containing body (such as ink chamber) is integrated with the printhead; the other is a separate structural ink container in which an ink containing body is separated from the printhead. The unitary structural ink container comprises not only the printhead, but also comprises the ink chamber, wherein the printhead is arranged on the ink outlet of the ink container. In the separate structural ink container, the ink chamber and the printhead are separated from each other, the ink chamber only for storing ink, and the printhead being arranged on the printer carriage. The separate structural ink containers also comprise two types of ink containers in the form of pure chambers for storing ink and porous materials for storing ink, like sponge.

[0006] The separate structural ink container in the form of a pure chamber for storing ink without sponge is generally required to arrange a one-way on/off gas control valve at the air vent for adjusting the balance state between internal pressure of the ink container and outside atmosphere, so as to prevent ink from overflowing out of the air vent to outside of the ink container, while needed to arrange a one-way on/off ink control valve in the ink flow channel upstream from of the ink outlet. The air container, on one hand, is complicated in structure due to being provided with an air control valve and an ink control valve, and on the other hand, in the case where the ink container is subjected to turnover, tilting, vibrating and/or temperature change, the phenomenon of gas irregularly scattering between each of cavities will arise due to gas mixing with ink into fine bubbles between each of cavities in the ink container which are not affected by the ink control valve. Once entering into the ink container outlet, these scattering bubbles may move along the ink feeding needle of the ink-jet printer to the printhead nozzle, so as to form broken lines of the recording characters, without ink.

SUMMARY OF THE INVENTION

[0007] One object of the invention is to provide an ink container for an ink-jet printer, which container is simple in structure, and capable of preventing gas in the ink chamber and/or air exchanging cavity from flowing with ink into the ink outlet, even in the case where the ink container undergoes turnover, tilting, vibrating or temperature change during transportation.

[0008] The ink container for an ink-jet printer designed according to the object described above includes an ink outlet, an air vent, an ink supply cavity and a first ink chamber, the air vent being connected to the first ink chamber and outside atmosphere at a vertex portion of the first ink chamber in a perpendicular direction, the ink outlet being connected to the ink supply cavity and outside environment at a position which is on a sidewall of the ink supply cavity parallel to the perpendicular direction and close to the bottom of the ink supply cavity. The container also includes a first ink tube that is horizontally arranged above a central position of the ink supply cavity in the perpendicular direction, wherein the first ink tube at one end Is connected to the Ink supply cavity, and at the other end is connected to the first ink chamber at a position lower than the first ink tube in the perpendicular

direction.

[0009] Preferably, in the aforementioned ink container for an ink-jet printer, the other end of the first ink tube is connected to the first ink chamber at a lowest portion of the first Ink chamber in the perpendicular direction.

[0010] More preferably, the aforementioned ink container for an ink-jet printer further comprises a detecting cavity and float which can be floated or suspended in ink. The detecting cavity is overall located between the vertex portion and the lowest portion of the ink supply cavity in the perpendicular direction.

[0011] Most preferably, in the aforementioned ink container for an ink-jet printer, the axial direction of the first ink tube is perpendicular to ink flow direction in the ink outlet. The radial dimension of the first ink tube is between 0.5mm and 1.2mm, the length of the first ink tube is approximate to a width of an overlapped portion between the ink supply cavity and the location of the first ink tube.

[0012] An ink container for an ink-jet printer which is corresponding to the object described above is also provided. It includes an ink outlet, an air vent, an ink supply cavity, a first ink chamber and a second ink chamber, the ink outlet being connected to the ink supply cavity and outside environment at a bottom portion on a perpendicular sidewall of the ink supply cavity. The container also includes a first ink tube that is horizontally arranged above a central position of the ink supply cavity in the perpendicular direction, wherein the first ink tube at one end is connected to the ink supply cavity, and at the other end is connected to the first ink chamber at a position lower than the first ink tube in the perpendicular direction, and a second ink tube that is horizontally arranged in the first ink chamber, wherein the second ink tube at one end is connected to the first ink chamber, and at the other end is connected to the second ink chamber at a position lower than the second ink tube in the perpendicular direction, and wherein the second ink chamber is connected through the air vent to outside atmosphere at a vertex portion in the perpendicular direction.

[0013] Generally, in the ink container for an ink-jet printer of the aforementioned second solution, the second ink tube is located at a vertex portion of the first ink chamber in the perpendicular direction, the position of the other end of the first ink tube connected to the first ink chamber is located at a lowest portion of the first ink chamber in the perpendicular direction, and the position of the other end of the second ink tube connected the second ink chamber is located at a lowest portion of the second ink chamber in the perpendicular direction.

[0014] Preferably, the aforementioned ink container for an ink-jet printer of the second solution further comprises a detecting cavity and a float in the detecting cavity which can be floated or suspended in ink, wherein the detecting cavity is overall located between the vertex portion and lowest portion of the ink supply cavity In the perpendicular direction.

[0015] Preferably, in the ink container for an ink-jet printer of the second aforementioned solution, the axial direction of the first ink tube is perpendicular to ink flow direction in the ink outlet. The radial dimension of the first ink tube is between 0.5mm and 1.2mm, and the length of the first ink tube is approximate to a width of an overlapped portion between the ink supply cavity and the location of the first ink tube.

[0016] Preferably, in the aforementioned ink container for an ink-jet printer of the second solution, the axial direction of the second ink tube is perpendicular to ink flow direction in the ink outlet. The radial dimension of the second ink tube is between 0.5mm and 1.2mm, and the length of the second ink tube is approximate to a width of an overlapped portion between the first ink chamber and the location of the second ink tube.

[0017] Again, an ink container for an ink-jet printer corresponding to the object described above is provided, which comprises an ink outlet, an air vent, an ink supply cavity, a first ink chamber, a second ink chamber, and a third ink chamber, the ink outlet being connected to the ink supply cavity and outside environment at a bottom portion on a perpendicular sidewall of the ink supply cavity. The ink container also includes a first ink tube that is horizontally arranged above a central position of the ink supply cavity in the perpendicular direction, wherein the first ink tube at one end is connected to the ink supply cavity, and at the other end is connected to the first ink chamber at a position lower than the first ink tube in the perpendicular direction, and a second ink tube that is horizontally arranged in the first ink chamber, wherein the second ink tube at one end is connected to the first ink chamber, and at the other end is connected to the second ink chamber at a position lower than the second ink tube in the perpendicular direction, and a third ink tube that is horizontally arranged in the second ink chamber, wherein the third ink tube at one end is connected to the second ink chamber, and at the other end is connected to the third ink chamber at a position lower than the third ink tube in the perpendicular direction, and wherein the third ink chamber is connected through the air vent to outside atmosphere at a vertex portion in the perpendicular direction.

[0018] Optimally, in the ink container for an ink-jet printer of the aforementioned third solution, the second ink tube is located at a vertex portion of the first ink chamber in the perpendicular direction, the third ink tube is located at a vertex portion of the second ink chamber in the perpendicular direction, the other end of the first ink tube is connected to the first ink chamber at a lowest portion of the first ink chamber in the perpendicular direction, the other end of the second ink tube is connected to the second ink chamber at a lowest portion of the second ink chamber in the perpendicular direction, and the other end of the third ink tube is connected to the third ink chamber at a lowest portion of the third ink chamber in the perpendicular direction.

[0019] Preferably, the ink container for an ink-jet printer of the aforementioned third solution further comprises a detecting cavity and a float in the detecting cavity which

can be floated or suspended in ink, wherein the detecting cavity is overall located between the vertex portion and lowest portion of the ink supply cavity in the perpendicular direction.

[0020] More preferably, in the ink container for an ink-jet printer of the aforementioned third solution, the axial direction of the first ink tube is perpendicular to ink flow direction in the ink outlet. The radial dimension of the first ink tube is between 0.5mm and 1.2mm, and its length approximate to a width of an overlapped portion between the ink supply cavity and the location of the first ink tube.

[0021] More preferably, in the ink container for an ink-jet printer of the aforementioned third solution, the axial direction of the second ink tube is perpendicular to ink flow direction in the ink outlet. The radial dimension of the second ink tube is between 0.5mm and 1.2mm, and the length of the second ink tube is approximate to a width of an overlapped portion between the first ink chamber and the location of the second ink tube.

[0022] More preferably, in the ink container for an ink-jet printer of the aforementioned third solution, the axial direction of the third ink tube is perpendicular to ink flow direction in the ink outlet. The radial dimension of the third ink tube is between 0.5mm and 1.2mm, and the length of the third ink tube is approximate to a width of an overlapped portion between the second ink chamber and the location of the third ink tube.

[0023] Again, an ink container for an ink-jet printer corresponding to the object described above is provided, which comprises an ink outlet, an air vent, an ink supply cavity, a first ink chamber, a second ink chamber, and a third ink chamber, the ink outlet being connected to the ink supply cavity and outside environment at a bottom portion on a perpendicular sidewall of the ink supply cavity. The container further comprises a venting cavity, and a first ink tube that is horizontally arranged above a central position of the ink supply cavity in the perpendicular direction, wherein the first ink tube at one end is connected to the ink supply cavity, and at the other end is connected to the first ink chamber at a position lower than the first ink tube in the perpendicular direction, and a second ink tube that is horizontally arranged in the first ink chamber, wherein the second ink tube at one end is connected to the first ink chamber, and at the other end is connected to the second ink chamber at a position lower than the second ink tube in the perpendicular direction, and a third ink tube that is horizontally arranged in the second ink chamber, wherein the third ink tube at one end is connected to the second ink chamber, and at the other end is connected to the third ink chamber at a position lower than the third ink tube in the perpendicular direction, and a fourth ink tube which is horizontally arranged in the third ink chamber, wherein the fourth ink tube at one end is connected to the third ink chamber, and at the other end is connected to the venting cavity at a position lower than the fourth ink tube in the perpendicular direction, and wherein the venting cavity is connected through the air vent to outside atmosphere at a vertex portion in the perpendicular direction.

[0024] Preferably, in the ink container for an ink-jet printer of the aforementioned fourth solution, the second ink tube is located at the vertex portion of the first ink chamber in the perpendicular direction, the third ink tube is located at the vertex portion of the second ink chamber in the perpendicular direction, the position of the other end of the first ink tube connected to the first ink chamber is located at the at lowest point of the first ink chamber in the perpendicular direction, the position of the other end of the second ink tube connected to the second ink chamber is located at the lowest portion of the second ink chamber in the perpendicular direction, and the position of the other end of the third ink tube connected to the third ink chamber is located at the lowest portion of the third ink chamber in the perpendicular direction.

[0025] Preferably, the ink container for an ink-jet printer of the aforementioned fourth solution further comprises a detecting cavity and float which can be floated or suspended in ink. The detecting cavity is overall located between the vertex portion and the lowest portion of the ink supply cavity in the perpendicular direction.

[0026] More preferably, in the ink container for an ink-jet printer of the aforementioned fourth solution, the axial direction of the first ink tube is perpendicular to ink flow direction in the ink outlet, the radial dimension of the first ink tube being between 0.5mm and 1.2mm, and the length of the first ink tube is approximate to a width of an overlapped portion between the ink supply cavity and the location of the first ink tube.

[0027] More preferably, in the ink container for an ink-jet printer of the aforementioned fourth solution, the axial direction of the second ink tube is perpendicular to ink flow direction in the ink outlet, the radial dimension of the second ink tube being between 0.5mm and 1.2mm, and the length of the second ink tube is approximate to a width of an overlapped portion between the first ink chamber and the location of the second ink tube.

[0028] Most preferably, in the ink container for an ink-jet printer of the aforementioned fourth solution, the axial direction of the third ink tube is perpendicular to ink flow direction in the ink outlet, the radial dimension of the third ink tube being between 0.5mm and 1.2mm, and the length of the third ink tube is approximate to a width of an overlapped portion between the second ink chamber and the location of the third ink tube.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029]

Figure 1 is an exploded schematic view of an embodiment of an ink container for an ink-jet printer of this invention.

Figure 2 is a perspective view of an embodiment of an ink container for an ink-jet printer of this invention.

Figure 3 is another perspective view of an embodiment of an ink container for an ink-jet printer of this

invention.

Figure 4 Is a sectional view of an embodiment of an ink container for an ink-jet printer of this invention.

Figure 5 is a sectional view of a second embodiment of an ink container for an ink-jet printer of this invention.

Figure 6 is a sectional view of a third embodiment of an ink container for an ink-jet printer of this invention.

Figure 7 is a sectional view of a fourth embodiment of an ink container for an ink-jet printer of this invention.

Figure 8 is a perspective view of the fourth embodiments of an ink container for an ink-jet printer of this invention, and it is also a reference view for the second and third embodiments.

[0030] An ink cartridge of this invention will be described in detail with reference to the figures.

DETAILED DESCRIPTION OF THE INVENTION

First embodiment

[0031] An ink container for an ink-jet printer of this invention will be described in detail with reference to the figures. In these figures, the same reference numbers are used to designate the same parts, features or structures. The particular structures or parts during describing the embodiments are only illustrative examples of ink containers as understood by those skilled in the art according to this invention, and those skilled in the art can also design a variety of the same or similar technical construction without departing from the technical scope and spirit of the ink container. Therefore, it is undesirable if these illustrative examples are used to restrict the protection scope of the ink container for an ink-jet printer of this invention defined by the claims, but rather, the same or similar solution of the ink container for an ink-jet printer of this invention still belongs to the protection scope of claims of the ink container for an ink-jet printer of this invention.

[0032] With reference to figures 1, 2, 3, and 4, which are structural views of a first embodiment of this invention, an ink container A for an ink-jet printer as shown in figures 1, 2, 3, and 4 has the same posture as when it mounted on the ink-jet printer, that is, the ink outlet 105 and ink flow direction therein being toward a horizontal direction, while the cartridge cover 2 is located at a side of the cartridge body 1. For describing easily, the configuration relationships described below between each member or element of the ink container A are consistent with and based on the posture of the ink container A as shown in figures 1, 2, 3, and 4.

[0033] In figure 1, ink container A includes a cartridge body 1 and a cartridge cover 2 which both are made of materials like plastic by injection-molding. The cartridge cover 2 can be formed as a movable sidewall of the cartridge body 1. The cartridge body 1 is divided into a plurality of cavities by arranging a plurality of respective division walls in the cartridge body 1. The aforementioned cavities become containers for containing ink after the cartridge cover 2 is fixed to the cartridge body 1 in a manner of gluing or direct melting connection.

[0034] With reference to figures 2, 3, and 4, an ink supply cavity 100 and a first ink chamber 101 are formed on the cartridge body 1 after the cartridge body 1 employs the aforementioned division walls.

[0035] Sidewall 106 extends parallel to the perpendicular direction and partially defines the ink supply cavity 100. An ink outlet 105 is arranged on a bottom portion of the sidewall 106 such that it is proximate close to the bottom wall 107 of the ink supply cavity 100 along the perpendicular direction. The ink outlet 105 connects the ink supply cavity 100 with outside environment. In the case where the ink supply cavity 100 contains ink, the ink outlet 105 is generally sealed with a rubber seal valve 102. In the state with the ink container A mounted on the ink-jet printer, the ink feeding needle extends through a gap 104 in the center of the rubber seal valve 102 and into the ink outlet 105, so as to extract ink from the ink supply cavity 100. The ink outlet 105 and ink flow direction in the outlet 105 are parallel to the horizontal direction. A first ink tube 110 is horizontally arranged above a central position in the ink supply cavity 100 along the perpendicular direction. The axial direction of the first ink tube 110 is perpendicular to ink flow direction in the ink outlet 105. The radial dimension of the first ink tube 110 is selected to be any value in the range of 0.5mm to 1.2mm, so that it is advantageous to prevent air from forming free flow therein, the length of the first ink tube 110 being approximate to a width of an overlapped portion between the ink supply cavity 100 and the first ink tube 110. In particular, the first ink tube 110 extends substantially between the two cavity walls of the ink supply cavity 100, leaving only a small gap. One end of the first ink tube 110 is connected to the ink supply cavity 100, and the other end is connected to the first ink chamber 101 through a first ink delivery trough 111 which is arranged on the outer wall of the cartridge body 1 and sealed by a seal film, and a first connecting aperture 112 which is in the first ink chamber 101 in the perpendicular direction lower than the first ink tube 110 and is also arranged at the lowest portion of the first ink chamber 101 along the perpendicular direction. Here, the first connecting aperture 112 is located the lowest portion in the first ink chamber 101 in the perpendicular direction, which means that the position of the first connecting aperture 112 is close to the ink chamber bottom wall 107, and the main object is to extract ink in the first ink chamber 101 at the lowest portion in the first ink chamber 101 along the perpendicular direction, so as to substantially use all of the ink therein to avoid residual ink.

[0036] The first ink chamber 101 at the vertex portion in the perpendicular direction is connected through an air port 113 to an air vent 115 which is on the outer surface of another sidewall 114 of the cartridge body 1 opposite

to the sidewall 106. The air vent 115 is connected to outside atmosphere. Between the air vent 115 and the air port 113, there is additionally arranged a relative longer labyrinth irregular trough or serpentine trough 116 on the outer surface of the cartridge sidewall 114. The serpentine trough 116 generally employs a sealed air flow channel which is formed after being sealed with plastic or aluminum films. Therefore, the air vent 115 and the air port 113 are interconnected through the serpentine trough 116. Here, the air port 113 being located at the vertex portion of the first ink chamber 101 in the perpendicular direction has a relative broad meaning, that is, based on the predetermined ink volume of the ink container, so long as the air port 113 is higher than the ink level in the first ink chamber 101, then because an ink flow path from the ink cavity 100 to the ink outlet 105 during printing is formed in the ink container A after the ink feeding needle of the ink-jet printer extracts ink, so that ink in the first ink chamber 101 can be prevented from entering back into the air vent 115 along the air port 113, that is to say, the air port 113 being located in use at a higher position in the first ink chamber 101 in the perpendicular direction is also included in the meaning.

[0037] A detecting cavity 103 is provided on the sidewall 106 and close to the ink supply cavity 100, the detecting cavity 103 is flatter than the ink supply cavity 100 along the horizontal direction. The outer wall of the detecting cavity 103 parallel to the sidewall 106 is made of film, and another pair of walls parallel to each other are made of transparent materials, apparently, it is desirable that the cartridge body 1 is made of transparent plastics. A float 129 is arranged in the detecting cavity 103 (See figure 4). In the state of the detecting cavity 103 being full of ink, the float 129 is floated on the level of ink. The detecting cavity 103 is maintained in connection with the ink supply cavity 100 via an upper through-hole 108 and a lower through-hole 109 arranged on the upper and lower cavity walls in the perpendicular direction. The detecting cavity 103 is overall located between the vertex portion and the lowest portion of the ink supply cavity 100 in the perpendicular direction. Therefore, in the case where the ink level in the ink supply cavity 100 is higher than the upper through-hole 108 of the detecting cavity 103 in the perpendicular direction, the detecting cavity 103 can be full of ink, and the float 129 can be floated in ink in the detecting cavity 103. As ink in the detecting cavity 103 changes due to ink consumption, the position of the float 129 will move downwardly along the perpendicular direction of the detecting cavity 103. This position change of the float 129 cooperates with an optic-electric detecting mechanism arranged on the ink-jet printer, so as to obtain information about ink reserves in the ink supply cavity 100.

Second embodiment

[0038] With reference to figure 5, and with reference to figures of the first embodiment, for the purpose of preventing excessive gas from entering into the ink supply cavity 100 after gas-liquid exchange and affecting the floating environment of the float 129 in the detecting cavity 103, and the ink purity output from the ink outlet 105, the following adjustment is made to the structure of the ink container A in the present embodiment based on the first embodiment. On one hand, the volume of the first ink chamber 101 is reduced, and on the other hand, a second ink chamber 117 is added in the ink container A. With such modification, the present embodiment has the same technical features as the first embodiment, and also has its own structural features compared to the first embodiment. For the purpose of simplicity of description, the same technical features in this embodiment as those in the first embodiment are omitted, for which those skilled in the art can refer to the description of the aforementioned first embodiment, and the difference from the first embodiment will be described in detail. The same technical features in this embodiment as the first embodiment still employ the same reference numbers as those in the figures of the first embodiment, and the different technical features employ new numbers different from those in the figures of the first embodiment.

[0039] In this embodiment, there are two ink chambers arranged in the ink container A, i.e., a first Ink chamber 101 and a second ink chamber 117, and the constructional relationship of the connection between the ink supply cavity 100 and the first ink chamber 101 is reserved through the first ink tube 110, while the relationship between the first ink chamber 101 and the chamber bottom wall 107 is adjusted respectively, so that the bottom wall is replaced by a respective division wall inside the ink container A after the volume of the first ink chamber 101 is reduced, the position of first connecting aperture 112 is respectively moved upwardly a distance, and at the same time, the technical feature existing in the first embodiment - "The first ink chamber 101 at the vertex portion in the perpendicular direction is connected through an air port 113 to an air vent 115 which is on the outer surface of another sidewall 114 of the cartridge body 1 opposite to the sidewall 106" - is replaced by the following technical features.

[0040] With reference to figure 5 (and in conjunction with figure 8), there is a second ink tube 118 arranged horizontally at the vertex portion of the first ink chamber 101 in the perpendicular direction. One end of the second ink tube 118 is connected to the first ink chamber 101, and the other end is connected to the second ink chamber 117 through a second ink delivery trough 119 which is arranged on the outer wall and sealed by a seal film, and a third connecting aperture 120 which is in the second ink chamber 117 in the perpendicular direction lower than the second ink tube 118 and also arranged at the lowest portion of the second ink chamber 117 along the perpendicular direction. The second ink chamber 117 at its vertex in the perpendicular direction is connected through an air port 113 to an air vent 115 which is on the outer surface of another sidewall 114 of the cartridge body 1

opposite to the sidewall 106.

Third embodiment

[0041] This embodiment is a solution obtained by modification further based on the second embodiment, the technical features of which are adjusted similarly to the second embodiment. Therefore, for the same reason as the second embodiment, the technical foundation will be not described, for which please refer to the description of the first and second embodiment. Here, only structural features of this embodiment are described.

[0042] With reference to figure 6 (and in conjunction with figure 8), based on the second embodiment, there is added a third ink chamber 121 inside the ink container A of this embodiment. After three ink chambers, i.e., a first ink chamber 101, a second ink chamber 117, and a third ink chamber 121 are arranged in the ink container A, a constructional relationship of connection between the first ink chamber 101 and the second ink chamber 117 is reserved through the second ink tube 118, while the technical feature existing in the second embodiment - "the second ink chamber 117 at its vertex in the perpendicular is connected through the air port 113 to the air vent 115 on the out surface of another sidewall 114 of the cartridge body 1 opposite to the sidewall 106" - is replaced by the following technical features.

[0043] There is a third ink tube 122 arranged horizontally at the vertex portion of the second ink chamber 117 in the perpendicular direction. One end of the third ink tube 122 is connected to the second ink chamber 117, and the other end is connected to the third ink chamber 121 through a third ink delivery trough 123 which is arranged on the outer wall of the cartridge body 1 and sealed by a seal film, and a fourth connecting aperture 124 which is in the third ink chamber 121 in the perpendicular direction lower than the third ink tube 122 and also arranged at the lowest portion of the third ink chamber 121 along the perpendicular direction. The third ink chamber 121 at its vertex in the perpendicular direction is connected through an air port 113 to an air vent 115 which is on the outer surface of another sidewall 114 of the cartridge body 1 opposite to the sidewall 106.

Fourth embodiment

[0044] This embodiment is a solution obtained by modification based on the third embodiment, the technical features of which are adjusted similarly to the third embodiment. Therefore, only structural features of this embodiment are described without repeating the same content.

[0045] With reference to figure 7 (and in conjunction with figure 8), based on the third embodiment, there is added a venting cavity 125 inside the ink container A of this embodiment. After the venting cavity 125 are arranged in the ink container A, a constructional relationship of connection between the second ink chamber 117 and the third ink chamber 121 is reserved through the third ink tube 122, while the technical feature existing in the third embodiment - "the third ink chamber 121 at its vertex in the perpendicular direction is connected through the air port 113 to the air vent 115 on the out surface of another sidewall 114 of the cartridge body 1 opposite to the sidewall 106" - is replaced by the following technical features.

[0046] There is a fourth ink tube 126 arranged horizontally at the vertex portion of the third ink chamber 121 in the perpendicular direction. One end of the fourth ink tube 126 is connected to the third ink chamber 121, and the other end is connected to the venting cavity 125 through a fourth ink delivery trough 127 which is arranged on the outer wall of the cartridge body 1 and sealed by a seal film, and a fifth connecting aperture 128 which is in the venting cavity 125 in the perpendicular direction lower than the fourth ink tube 126 and also arranged at the lowest portion of the venting cavity 125 along the perpendicular direction. The venting cavity 125 at the vertex portion in the perpendicular direction is connected through an air port 113 to an air vent 115 which is on the outer surface of another sidewall 114 of the cartridge body 1 opposite to the sidewall 106.

Applicability in industry

[0047] The inventive ink container employs horizontal ink tubes of a length and a radial dimension as ink paths interconnecting each ink chamber, and locates ports of the ink tubes connecting to each ink chamber at different positions in the perpendicular direction, such that during the preservation and transportation of the ink container after initial ink filling or ink refilling and closure of the ink outlet and the air vent, a state of gas not exchanging between each chamber is maintained by immersing at least one of the ink tubes and their respective ports into ink regardless of whatever state the ink container is maintained upright, titled, upset or turnover. Therefore, in the state of preservation and transportation with the ink outlet and the air vent being sealed, the ink container can not only achieve the object of preventing gas in the ink chambers and/or the venting cavity from entering into the ink outlet or the ink chamber connected to the ink outlet, but also achieve the object by a simple structure, i.e., adjusting the positions of the ink tubes and their ports.

Claims

1. An ink container (A) for an ink-jet printer, comprising:

   an ink outlet (105), an air vent (115), an ink supply cavity (100) and a first ink chamber (101), the air vent (115) being connected to the first ink chamber (101) and outside atmosphere at a vertex portion of the first ink chamber (101) in a perpendicular direction, the ink outlet (105) con-

nected to the ink supply cavity (100) and outside atmosphere at a position which is on a sidewall (106) of the ink supply cavity parallel to the perpendicular direction and close to the bottom of the ink supply cavity, **characterized in that** a first ink tube (110) is horizontally arranged above a central position of the ink supply cavity (100) in the perpendicular direction, wherein the first ink tube (110) at one end is connected to the ink supply cavity (100), and at the other end is connected to the first ink chamber (101) at a position lower than the first ink tube in the perpendicular direction.

2. The ink container (A) for an ink-jet printer according to claim 1, **characterized in that:**

the other end of the first ink tube (110) is connected to the first ink chamber (101) at a lowest portion of the first ink chamber (101) in the perpendicular direction.

3. The ink container (A) for an ink-jet printer according to claim 1 or 2, further comprising:

a detecting cavity (103) and a float (129) in the detecting cavity (103) which can be floated or suspended in ink, wherein the detecting cavity (103) is overall located between the vertex portion and lowest portion of the ink supply cavity (100) in the perpendicular direction.

4. The ink container (A) for an ink-jet printer according to claim 3, **characterized in that:**

the axial direction of the first ink tube (110) is perpendicular to ink flow direction in the ink outlet (105), the radial dimension of the first ink tube (110) is from 0.5mm to 1.2mm, and the length of the first ink tube (110) is approximate to a width of an overlapped portion between the ink supply cavity (100) and the location of the first ink tube (110).

5. An ink container (A) for an ink-jet printer, comprising:

an ink outlet (105), an air vent (115), an ink supply cavity (100), a first ink chamber (101) and a second ink chamber (117), the ink outlet (105) being connected to the ink supply cavity and outside atmosphere at a bottom portion on a perpendicular sidewall (106) of the ink supply cavity (100), **characterized in that** a first ink tube (110) is horizontally arranged above a central position of the ink supply cavity (100) in the perpendicular direction, wherein the first ink tube (110) at one end is connected to the ink supply cavity (100), and at the other end is connected to the first ink chamber (101) at a position lower than the first ink tube (110) in the perpendicular direction, and a second ink tube (118) is horizontally arranged in the first ink chamber (101), wherein the second ink tube (118) at one end is connected to the first ink chamber (101), and at the other end is connected to the second ink chamber (117) at a position lower than the second ink tube (118) in the perpendicular direction, and wherein the second ink chamber (117) is connected through the air vent (115) to outside atmosphere at a vertex portion in the perpendicular direction.

6. The ink container (A) for an ink-jet printer according to claim 5, **characterized in that:**

the second ink tube (118) is located at a vertex portion of the first ink chamber (101) in the perpendicular direction, the position of the other end of the first ink tube (110) connected to the first ink chamber (101) is located at a lowest portion of the first ink chamber (101) in the perpendicular direction, and the position of the other end of the second ink tube (118) connected the second ink chamber (117) is located at a lowest portion of the second ink chamber (117) in the perpendicular direction.

7. The ink container (A) for an ink-jet printer according to claim 5 or 6, further comprising:

a detecting cavity (103) and a float (129) in the detecting cavity (103) which can be floated or suspended in ink, wherein the detecting cavity (103) is overall located between the vertex portion and lowest portion of the ink supply cavity (100) in the perpendicular direction.

8. The ink container (A) for an ink-jet printer according to claim 7, **characterized in that:**

the axial direction of the first ink tube (110) is perpendicular to ink flow direction in the ink outlet (105), the radial dimension of the first ink tube (110) is from 0.5mm to 1.2mm, and the length of the first ink tube (110) is approximate to a width of an overlapped portion between the ink supply cavity (100) and the location of the first ink tube (110);
the axial direction of the second ink tube (118) is perpendicular to ink flow direction in the ink outlet (105), the radial dimension of the second ink tube (118) is from 0.5mm to 1.2mm, and the length of the second ink tube (118) is approximate to a width of an overlapped portion between the first ink chamber (101) and the location of the second ink tube (118).

9. An ink container (A) for an ink-jet printer, comprising:

an ink outlet (105), an air vent (115), an ink supply cavity (100), a first ink chamber (101), a second ink chamber (117), and a third ink chamber (121), the ink outlet (105) being connected to the ink supply cavity (100) and outside atmosphere at a bottom portion on a perpendicular sidewall of the ink supply cavity (100), **characterized in that** a first ink tube (110) is horizontally arranged above a central position of the ink supply cavity (100) in the perpendicular direction, wherein the first ink tube (110) at one end is connected to the ink supply cavity (100), and at the other end is connected to the first ink chamber (101) at a position lower than the first ink tube (110) in the perpendicular direction, and a second ink tube (118) is horizontally arranged in the first ink chamber (101), wherein the second ink (118) tube at one end is connected to the first ink chamber (101), and at the other end is connected to the second ink chamber (117) at a position lower than the second ink tube (118) in the perpendicular direction, and a third ink tube (122) is horizontally arranged in the second ink chamber (117), wherein the third ink tube (122) at one end is connected to the second ink chamber (117), and at the other end is connected to the third ink chamber (121) at a position lower than the third ink tube (122) in the perpendicular direction, and wherein the third ink chamber (121) is connected through the air vent (115) to outside atmosphere at a vertex portion in the perpendicular direction.

10. The ink container (A) for an ink-jet printer according to claim 9, **characterized in that:**

the second ink tube (118) is located at a vertex portion of the first ink chamber (101) in the perpendicular direction, the third ink tube (122) is located at a vertex portion of the second ink chamber (117) in the perpendicular direction, the other end of the first ink tube (110) is connected to the first ink chamber (101) at a lowest portion of the first ink chamber (101) in the perpendicular direction, the other end of the second ink tube (118) is connected to the second ink chamber (117) at a lowest portion of the second ink chamber (117) in the perpendicular direction, and the other end of the third ink tube (122) is connected to the third ink chamber (121) at a lowest portion of the third ink chamber (121) in the perpendicular direction.

11. The ink container (A) for an ink-jet printer according to claim 9 or 10, further comprising:

a detecting cavity (103) and a float (129) in the detecting cavity (103) which can be floated or suspended in ink, wherein the detecting cavity (103) is overall located between the vertex portion and lowest portion of the ink supply cavity (100) in the perpendicular direction.

12. The ink container (A) for an ink-jet printer according to claim 11, **characterized in that:**

the axial direction of the first ink tube (110) is perpendicular to ink flow direction in the ink outlet (105), the radial dimension of the first ink tube (110) is from 0.5mm to 1.2mm, and the length of the first ink tube (110) is approximate to a width of an overlapped portion between the ink supply cavity (100) and the location of the first ink tube (110);
the axial direction of the second ink tube (118) is perpendicular to ink flow direction in the ink outlet (105), the radial dimension of the second ink tube (118) is from 0.5mm to 1.2mm, and the length of the second ink tube (118) is approximate to a width of an overlapped portion between the first ink chamber (101) and the location of the second ink tube (118);
the axial direction of the third ink tube (122) is perpendicular to ink flow direction in the ink outlet (105), the radial dimension of the third ink tube (122) is from 0.5mm to 1.2mm, and the length of the third ink tube (122) is approximate to a width of an overlapped portion between the second ink chamber (117) and the location of the third ink tube (122).

13. An ink container (A) for an ink-jet printer, comprising:

an ink outlet (105), an air vent (115), an ink supply cavity (100), a first ink chamber (101), a second ink chamber (117), and a third ink chamber (121), the ink outlet (105) being connected to the ink supply cavity (100) and outside atmosphere at a bottom portion on a perpendicular sidewall (106) of the ink supply cavity (100), **characterized by** further comprising a venting cavity (125), and in that a first ink tube (110) is horizontally arranged above a central position of the ink supply cavity (100) in the perpendicular direction, wherein the first ink tube (110) at one end is connected to the ink supply cavity (100), and at the other end is connected to the first ink chamber (101) at a position lower than the first ink tube (110) in the perpendicular direction, and a second ink tube (118) is horizontally arranged in the first ink chamber (101), wherein the second ink tube (118) at one end is connected to the first ink chamber (101), and at the other end is connected to the second ink chamber (117)

at a position lower than the second ink tube (118) in the perpendicular direction, and a third ink tube (122) is horizontally arranged in the second ink chamber (117), wherein the third ink (122) tube at one end is connected to the second ink chamber (117), and at the other end is connected to the third ink chamber (121) at a position lower than the third ink tube (122) in the perpendicular direction, and a fourth ink tube (126) is horizontally arranged in the third ink chamber (121), wherein the fourth ink tube (126) at one end is connected to the third ink chamber (121), and at the other end is connected to the venting cavity (125) at a position lower than the fourth ink tube (126) in the perpendicular direction, and wherein the venting cavity (125) is connected through the air vent (115) to outside atmosphere at a vertex portion in the perpendicular direction.

14. The ink container (A) for an ink-jet printer according to claim 13, **characterized in that:**

the second ink tube (118) is located at the vertex portion of the first ink chamber (101) in the perpendicular direction, the third ink tube (122) is located at the vertex portion of the second ink chamber (117) in the perpendicular direction, the position of the other end of the first ink tube (110) connected to the first ink chamber (101) is located at the at lowest point of the first ink chamber (101) in the perpendicular direction, the position of the other end of the second ink tube (118) connected to the second ink chamber (117) is located at the lowest portion of the second ink chamber (117) in the perpendicular direction, and the position of the other end of the third ink tube (122) connected to the third ink chamber (121) is located at the lowest portion of the third ink chamber (121) in the perpendicular direction.

15. The ink container (A) for an ink-jet printer according to claim 13 or 14, further comprising:

a detecting cavity (103) and a float (129) in the detecting cavity (103) which can be floated or suspended in ink, wherein the detecting cavity (103) is overall located between the vertex portion and lowest portion of the ink supply cavity (100) in the perpendicular direction.

16. The ink container (A) for an ink-jet printer according to claim 15, **characterized in that:**

the axial direction of the first ink tube (110) is perpendicular to ink flow direction in the ink outlet (105), the radial dimension of the first ink tube (110) is from 0.5mm to 1.2mm, and the length of the first ink tube (110) is approximate to a width of an overlapped portion between the ink supply cavity (100) and the location of the first ink tube (110);
the axial direction of the second ink tube (118) is perpendicular to ink flow direction in the ink outlet (105), the radial dimension of the second ink tube (118) is from 0.5mm to 1.2mm, and the length of the second ink tube (118) is approximate to a width of an overlapped portion between the first ink chamber (101) and the location of the second ink tube (118);
the axial direction of the third ink tube (122) is perpendicular to ink flow direction in the ink outlet (105), the radial dimension of the third ink tube (122) is from 0.5mm to 1.2mm, and the length of the third ink tube (122) is approximate to a width of an overlapped portion between the second ink chamber (117) and the location of the third ink tube (122).

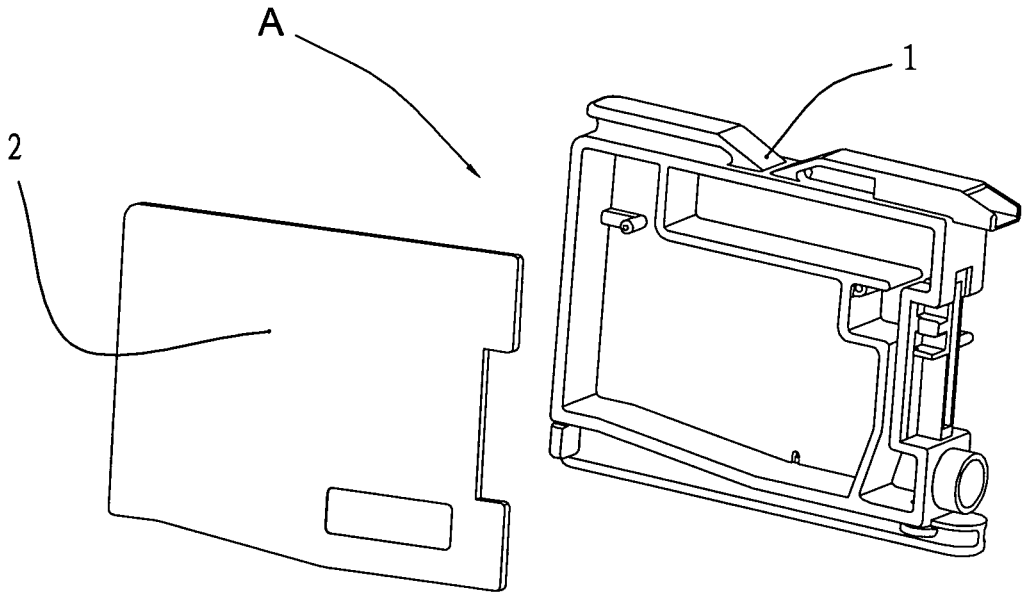

FIG. 1

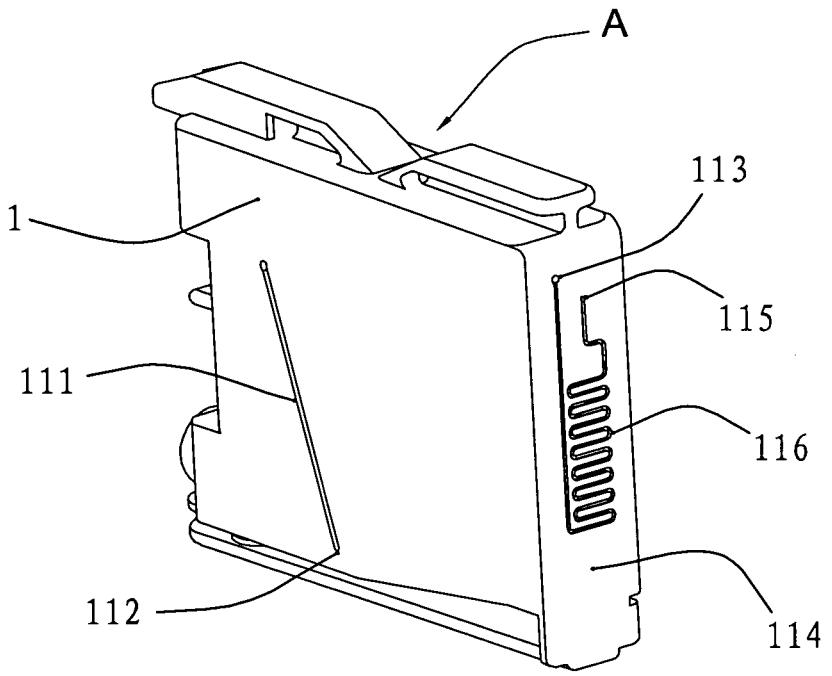

FIG. 2

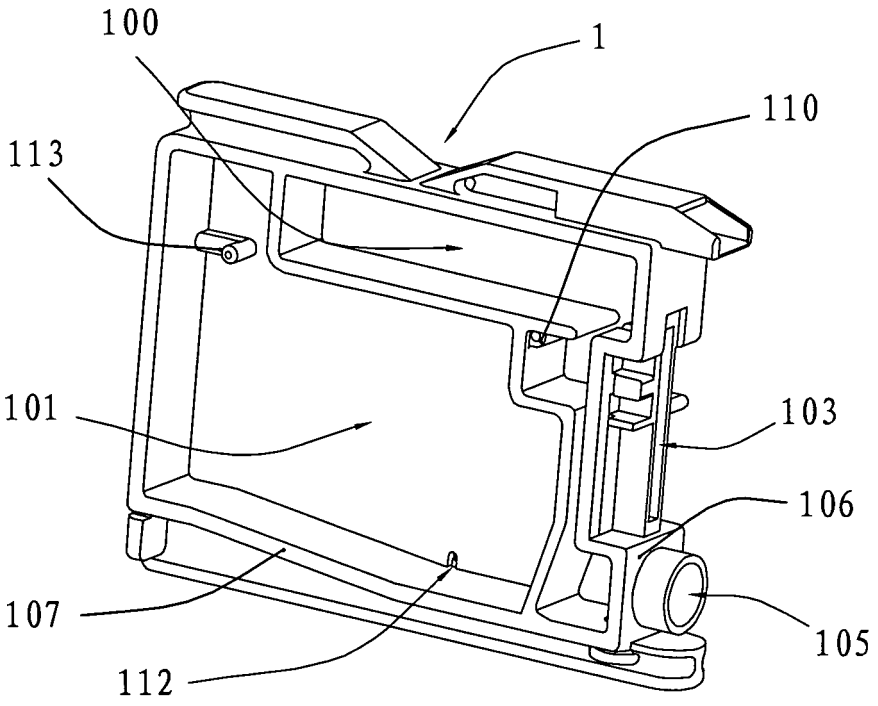
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FIG. 3

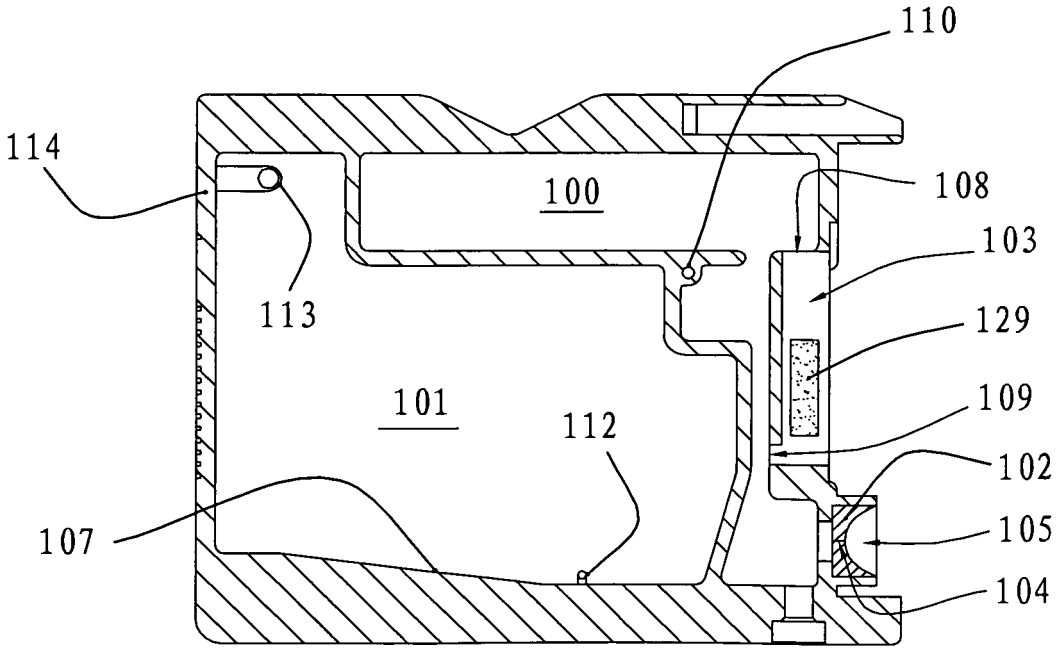
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FIG. 4

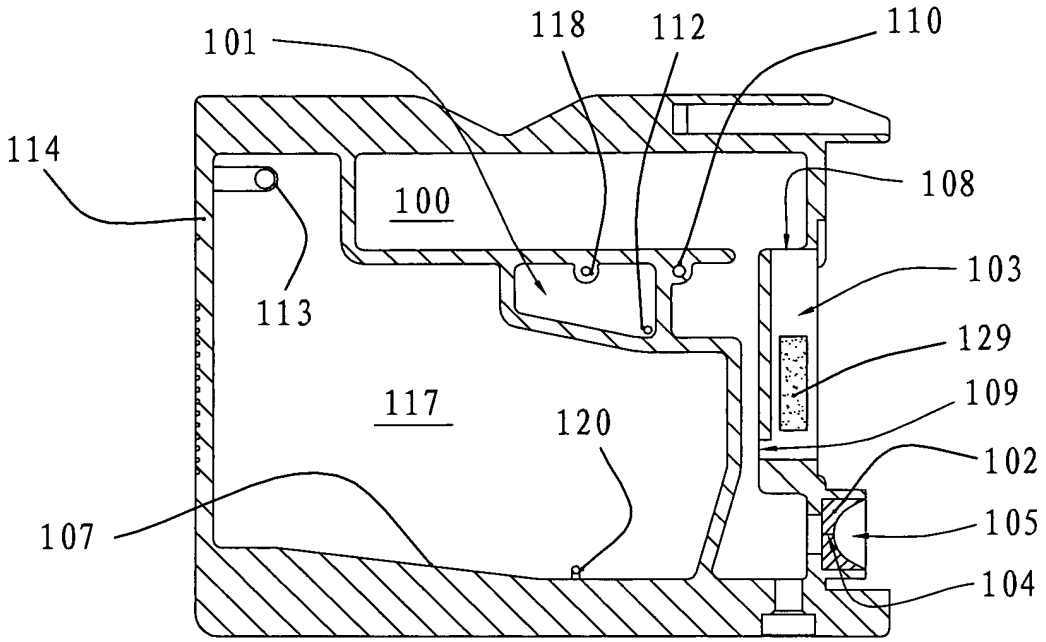
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FIG. 5

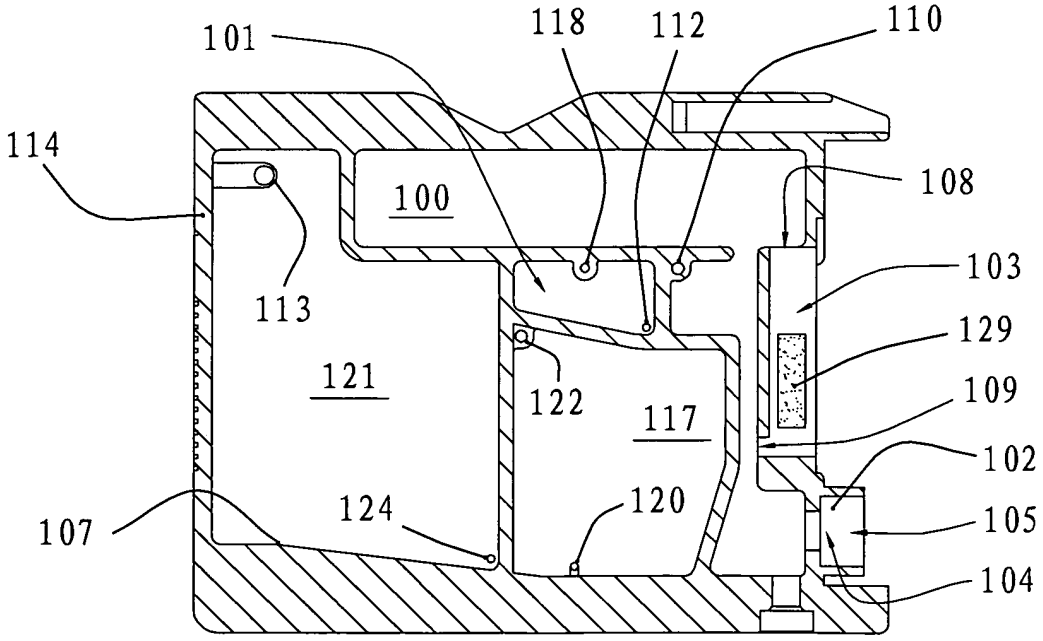
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FIG. 6

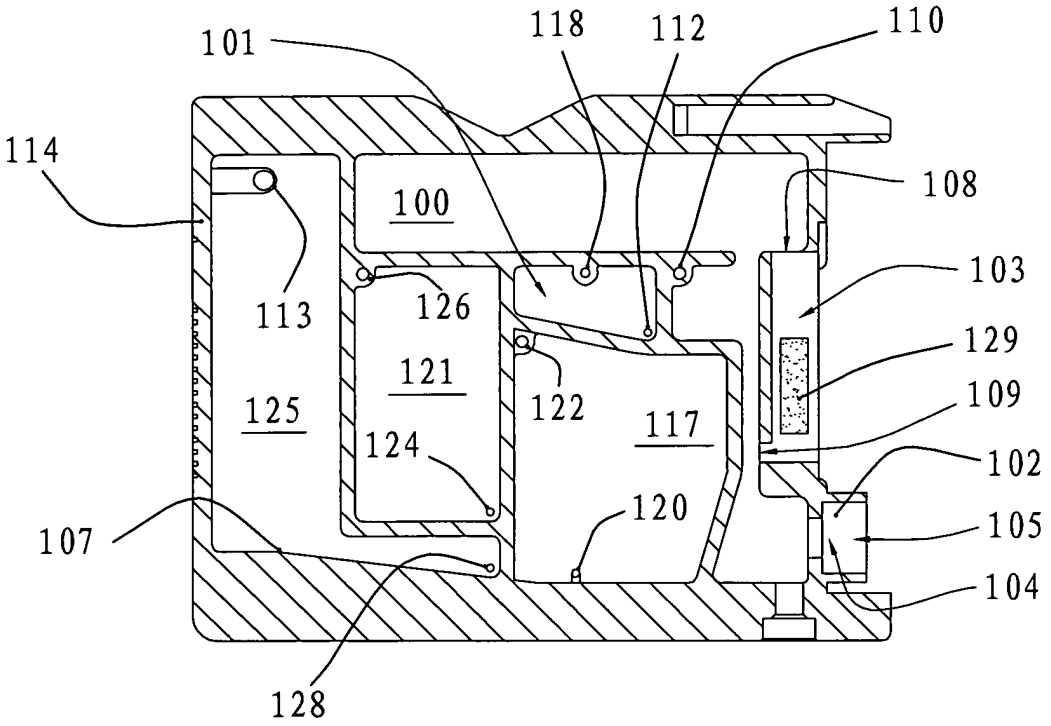
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FIG. 7

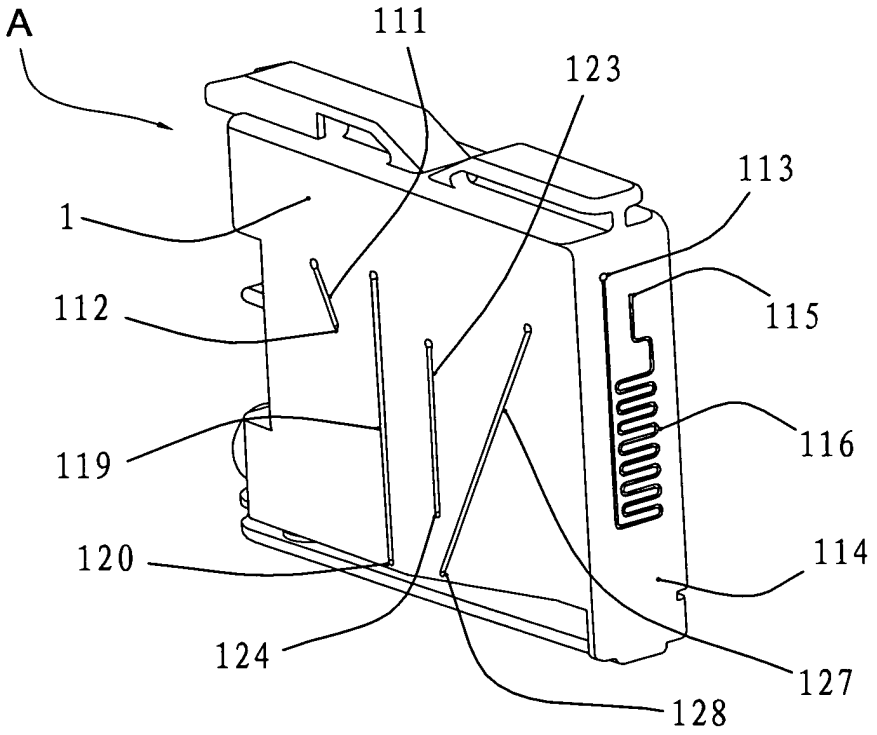
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FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2008/070240

A. CLASSIFICATION OF SUBJECT MATTER

B41J2/175 (2006.01) i

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)

IPC: B41J2/-; G01D15/-; G03G15/-

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)

EPODOC, WPI, PAJ, CPRS, CNKI: cartridge , air+ , ink+ , chamber , tank , cavity , tube , pipe , wall

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 2726878 Y (NINESTAR IMAGE CO LTD) 21 Sep.2005 (21.09.2005) see the whole document	1-16
A	US 20050012794 A1 (Tat Kong Chau) 20 Jan. 2005 (20.01.2005) see the whole document	1-16
A	JP 7-102201 A (CANON KK) 18 Apr. 1995 (18.04.1995) see the whole document	1-16

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&"document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 Apr.2008 (23.04.2008)	**29 May 2008 (29.05.2008)**
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer ZHU, Ying Telephone No. (86-10)62085067

Form PCT/ISA/210 (second sheet) (April 2007)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2008/070240

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1380429 A2 (SEIKO EPSON CORP) 14 Jan. 2004 (14.01.2004) see the whole document	1-16
A	CN 2843850 Y (PRINT-RITE TECHNOLOGY DEVELOPMENT CO., LTD OF ZHUHAI) 06 Dec.2006 (06.12.2006) see the whole document	1-16
A	CN 2806143 Y (ZHUHAI GREE MAGNETO ELECTRIC C) 16 Aug.2006 (16.08.2006) see the whole document	1-16

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2008/070240

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
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JP 7-102201 A	18.04.1995	EP 646465 A2	05.04.1995
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		JP 3772859 B2	10.05.2006
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CN 2806143 Y	16.08.2006	none	

Form PCT/ISA/210 (patent family annex) (April 2007)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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