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Attorneys for Plaintiffs Seiko Epson Corporation,
Epson America, Inc., and Epson Portland Inc.

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF OREGON
PORTLAND DIVISION

SEIKO EPSON CORPORATION,
a Japan corporation; **EPSON AMERICA,**
INC., a California corporation; and **EPSON**
PORTLAND INC., an Oregon corporation,

Plaintiffs,

v.

NANO BUSINESS & TECHNOLOGY,
INC., an Oregon corporation,

Defendant.

Civil No. 3:16-cv-2211

COMPLAINT FOR:
PATENT INFRINGEMENT
and BREACH OF CONTRACT
DEMAND FOR JURY TRIAL

Plaintiffs Seiko Epson Corporation, Epson America, Inc., and Epson Portland Inc., for their Complaint herein, allege as follows

NATURE OF THE ACTION

1. This is an action for patent infringement arising under the patent laws of the United States, 35 U.S.C. § 1 *et. seq.*, and for breach of contract arising under the laws of the State of Oregon.

RELATED ACTIONS

2. This action is related to five legal proceedings, all of which were pending before this Court and were assigned to the Honorable Anna J. Brown. All five proceedings were concluded by settlement, entry of consent orders and/or by entry of defaults and default judgments, with the last of the proceedings concluding on June 15, 2012 when the cases were closed by the Court. One of the two patents (the '917 patent, discussed below) asserted in this case was litigated in each of the five related proceedings against the same or overlapping groups of products that are accused of infringement in this action. The five related proceedings are as follows:

- a. *Seiko Epson Corporation, et al. v. Glory South Software Manufacturing Inc., et al.*, Civil No. 06-236-BR (D. Or.), closed June 15, 2012;
- b. *Seiko Epson Corporation, et al. v. Glory South Software Manufacturing Inc., et al.*, Civil No. 06-477-BR (D. Or.), closed June 15, 2012;
- c. *Seiko Epson Corporation, et al. v. Abacus 24-7 LLC, et al.*, Civil No. 09-477-BR (D. Or.), closed June 15, 2012;
- d. *Seiko Epson Corporation, et al. v. E-Babylon, Inc., et al.*, Civil No. 07-896-BR (D. Or.), closed February 27, 2012; and

e. *Seiko Epson Corporation, et al. v. Inkjetmadness.com, Inc., et al.*, Civil No. 08-452-BR (D. Or.), closed February 27, 2012.

3. In addition, this action is related to *In the Matter of CERTAIN INK CARTRIDGES AND COMPONENTS THEREOF*, Investigation No. 337-TA-946, United States International Trade Commission, Washington, D.C. ("ITC"), which has been adjudicated by the ITC in a final determination (Commission Opinion, May 26, 2016) (the "337-TA-946 ITC Investigation") and in which the Commission issued a General Exclusion Order, certain Cease and Desist Orders, and a Consent Order against the Defendant in this action, Nano Business & Technology, Inc. ("Nano Digital" or "Defendant"). The other of the two patents (the '749 patent, discussed below) asserted in this case was litigated in the 337-TA-946 ITC Investigation against the same or overlapping groups of products that are accused of infringement in this action. In addition, Nano Digital entered into a contract, the "Settlement Agreement" (discussed below), with Plaintiffs in this action to resolve the 337-TA-946 ITC Investigation, which forms the basis of the breach of contract claim alleged herein. The '917 and '749 patents are both subjects of the Settlement Agreement between Defendant and Plaintiffs.

4. In addition, this action is related to *In the Matter of CERTAIN INK CARTRIDGES AND COMPONENTS THEREOF*, Investigation No. 337-TA-565, United States International Trade Commission, Washington, D.C., which has been adjudicated by the ITC in a final determination (Commission Opinion, October 19, 2007) (the "337-TA-565 ITC Investigation") in which the Commission issued a General Exclusion Order, a Limited Exclusion Order and certain Cease and Desist Orders. The ITC's final determination was upheld in its entirety in a *per curiam* judgment by the Federal Circuit and on June 1, 2009 the United States Supreme Court denied a Petition for Writ of *Certiorari* for review of the Federal Circuit

decision. The '917 patent asserted in this case was litigated in the 337-TA-565 ITC Investigation against the same or overlapping groups of products that are accused of infringement in this action.

THE PARTIES

5. Plaintiff Seiko Epson Corporation ("Seiko Epson") is a corporation organized and existing under the laws of Japan. Its principal place of business is located at 3-3-5 Owa Suwa-Shi Nagano-Ken, 392-8502, Japan.

6. Plaintiff Epson America, Inc. ("Epson America") is a corporation organized and existing under the laws of the State of California. Its principal place of business is located at 3840 Kilroy Airport Way, Long Beach, California 90806. As the North American sales, marketing and customer service affiliate of Seiko Epson, Epson America is the exclusive licensee of the Epson Patents described below for distributing in the United States Epson ink cartridges that embody the inventions contained in the Epson Patents, including cartridges manufactured by Epson Portland Inc.

7. Plaintiff Epson Portland Inc. ("Epson Portland") is a corporation organized and existing under the laws of the State of Oregon. Its principal place of business is located at 3950 NW Alcock Place, Hillsboro, Oregon 97124. Epson Portland is the exclusive licensee of the Epson Patents described below for manufacturing in the United States Epson ink cartridges that embody the inventions contained in the Epson Patents. Seiko Epson, Epson America and Epson Portland are sometimes referred to collectively herein as "Epson" or "Plaintiffs."

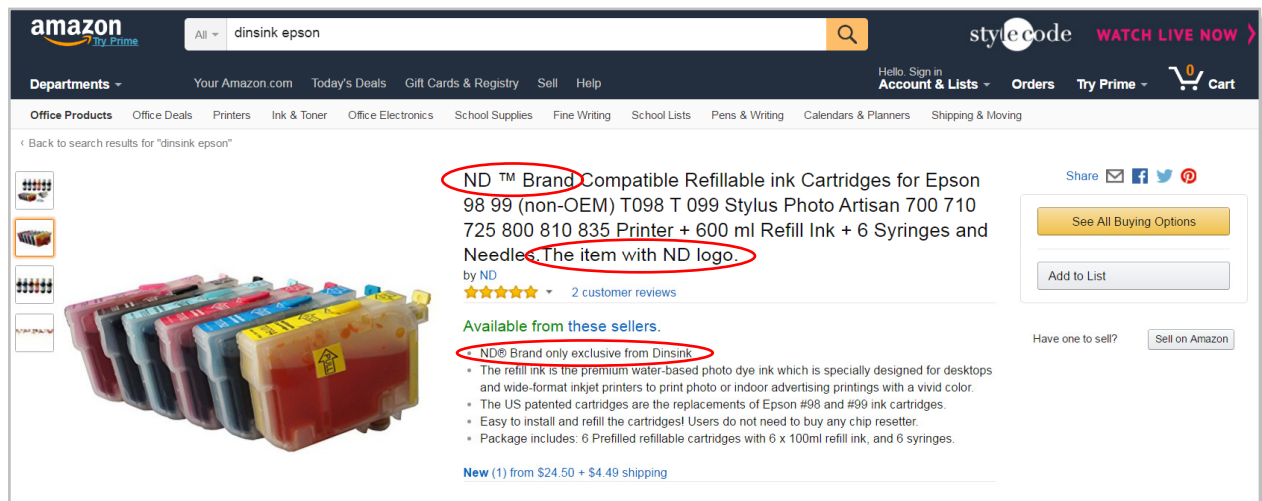
8. Plaintiffs produce and sell ink cartridges that operate with Epson ink jet printers utilizing Epson's patented technology and designs in the United States and in this judicial district.

9. On information and belief, defendant Nano Business & Technology, Inc. ("Nano Digital" or "Defendant") is a corporation organized and existing under the laws of the State of Oregon. Based on information and belief, and according to Nano Digital's Amended Annual Report that Nano Digital filed with the Oregon Secretary of State on October 13, 2016, Nano Digital's primary and principal place of business is located at 1915 Arena Ct., West Linn, Oregon, 97068. According to Google Maps and Google Maps Street View the foregoing address is located in a residential neighborhood, rather than in a commercial or business district. The aforementioned Amended Annual Report was filed by Wei Li, who, according to the Amended Annual Report is Nano Digital's registered agent, president, secretary and owner. Wei Li, as Nano Digital's registered agent, president, secretary and owner and/or officer, also filed similar Amended Annual Reports at least in each of years 2015, 2014, 2013, 2012 and 2011. Each Amended Annual Report, as well as the Oregon Secretary of State website, shows that Nano Digital has been an ongoing business in Oregon since November 21, 2003, when it filed its Articles of Incorporation. *See http://egov.sos.state.or.us/br/pkg_web_name_srch_inq.show_detl?p_be_rsn=1003344&p_srce=BR_INQ&p_print=FALSE.*

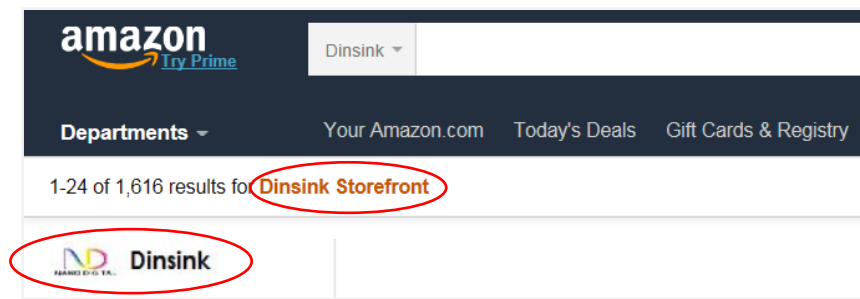
10. On information and belief, Nano Digital does business on-line as "Nano Digital Ink" and "Nano Ink Spot" through at least its website *www.nanodigital.com*. On information and belief, Nano Digital sells infringing ink cartridges under the "Nano Digital" and "ND" brands and the "ND" logo, which is shown below:



In addition, on information and belief, and after a reasonable investigation, Nano Digital is also doing business online through its on-line stores and/or listings at Amazon.com using at least the on-line seller names "dinsink," and "ink727," and on eBay.com using at least the on-line seller name "nano-refill-ink." For example, in the annotated screen capture below of an Amazon.com listing, visited on November 22, 2016, Nano Digital offers for sale infringing ink cartridges for Epson printers and describes the infringing ink cartridges as "ND TM Brand Compatible Refillable ink Cartridges for Epson 98 99 (non-OEM) T098 T 099 Stylus Photo Artisan 700 710 725 800 810 835 Printer + 600 ml Refill Ink + 6 Syringes and Needles. The item with ND logo" and explains that these infringing ink cartridges are "ND® Brand only exclusive from Dinsink."



The "Dinsink Storefront" on Amazon.com proudly displays Nano Digital's "ND" logo next to the "Dinsink" seller name, as indicated by the annotations shown in the screen capture below of the Dinsink Storefront visited on Nov. 22, 2016:



11. On June 12, 2015, Nano Digital entered into a contract with Epson to settle claims of patent infringement, including claims for infringement of the patents asserted here, brought by Epson in an action filed in the United States International Trade Commission, U.S. ITC Inv. No. 337-TA-946 (the "Settlement Agreement"). In the Settlement Agreement, Nano Digital identified itself and its address as: "Nano Business and Technology, Inc., 4287 SE International Way, Suite C, Milwaukie, OR 97222." The settlement agreement was signed by Jie Wang as Nano Digital's CEO and President. In addition, on June 25, 2015, Nano Digital and Epson filed in the ITC an Amended Joint Motion to terminate the ITC Investigation as to Nano Digital and Zhuhai Nano Digital Technology Co., Ltd. (a Chinese entity related to Nano Digital which was also a named respondent in the ITC Investigation), based on the Settlement Agreement, an Amended Consent Order Stipulation filed in the ITC, and an Amended Proposed Consent Order (later entered by the ITC and prohibiting Nano Digital from infringing Epson's patents).¹ The Amended Joint Motion and Amended Consent Order Stipulation were also signed on behalf of Nano Digital by Jie Wang as its CEO and President and identified the same foregoing Milwaukie, Oregon address. Infringing Nano Digital ink cartridges were shipped by Nano Digital from the same foregoing Milwaukie, Oregon address in fulfillment of ink cartridge purchases made by Epson from Nano Digital's Amazon.com and eBay.com listings identified in the preceding paragraph in support of the investigation leading to this Complaint. Attached as Exhibit A to this Complaint is a true and correct copy of the public version of the Amended Joint Motion filed in the ITC which includes as attachments the public versions of the Settlement

¹ Nano Digital and Epson had initially filed their joint motion to terminate the ITC Investigation, together with a consent order stipulation and a proposed consent order, on June 18, 2015. The Amended Joint Motion filed on June 25, 2015 modified certain provisions of the consent order stipulation and the proposed consent order based on requests from the ITC

Agreement, Amended Consent Order Stipulation, and Amended Proposed Consent Order.

Attached as Exhibit B to this Complaint is a true and correct copy of the public version of Order No. 10 entered by the ITC Administrative Judge, issuing an Initial Determination granting the Amended Joint Motion and approving the Amended Consent Order Stipulation and Amended Proposed Consent Order. Attached as Exhibit C to this Complaint is a true and correct copy of the Consent Order issued by the ITC against Nano Digital.

JURISDICTION AND VENUE

12. The causes of action for patent infringement arise under the patent laws of the United States, 35 U.S.C. § 271. This Court has subject matter jurisdiction over the claims for patent infringement pursuant to 28 U.S.C. §§ 1331 and 1338(a).

13. This Court has personal jurisdiction of the Defendant at least because Defendant regularly conducts business in this judicial district, maintains its principal place of business in this judicial district, is incorporated under the laws of Oregon and resides in this judicial district, and has committed acts of direct and indirect patent infringement in this judicial district, including those complained of herein. Venue is proper in this district under 28 U.S.C. §§ 1391(b), (c) and 1400(b).

14. This Court has supplemental jurisdiction of Plaintiffs' claims for breach of contract pursuant to 28 U.S.C. § 1367. Plaintiffs' claims for breach of the Settlement Agreement are so related to and intertwined with Plaintiffs' claims for patent infringement as to constitute the same case and controversy between the parties. The breach of contract action arises directly out of the Settlement Agreement entered into between Plaintiffs and Defendant on June 12, 2015 to resolve claims of patent infringement, including claims of infringement in this district, and to

Commission Investigative Attorney.

resolve the 337-TA-946 ITC Investigation brought by Plaintiffs in the ITC. The Settlement Agreement provides that it "shall be construed and enforced under and in accordance with the laws of the United States and the State of Oregon" and that "[a]ny dispute arising between the parties related to the making or performance of th[e] Agreement shall be resolved by the United States District Court for the District of Oregon."

15. Venue is proper for the breach of contract claim in this district under 28 U.S.C. §§ 1391(b) and (c).

FIRST CLAIM FOR RELIEF

(Patent Infringement—35 U.S.C. § 271)

INFRINGEMENT OF U.S. PATENT NO. 6,502,917

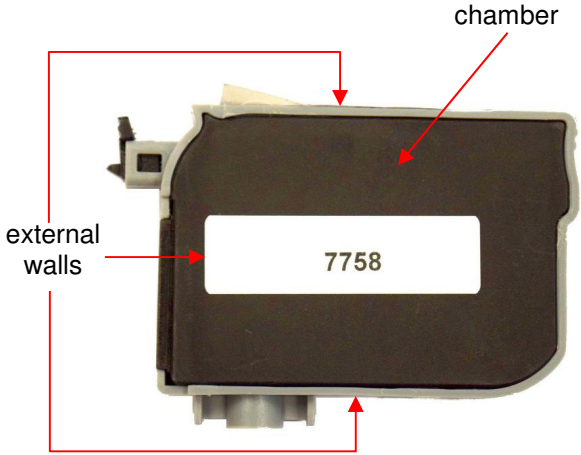
16. Epson incorporates by reference each and every allegation contained in Paragraphs 1 through 15 as though fully set forth at length here.

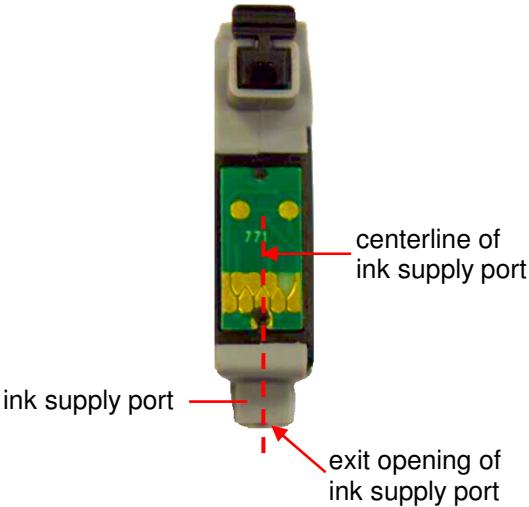
17. Epson owns all right, title, and interest in, including the right to sue thereon and the right to recover for infringement thereof, United States Patent No. 6,502,917, which was duly and legally issued to Seiko Epson by the United States Patent and Trademark Office on January 7, 2003. Attached as Exhibit D to this Complaint is a true and correct copy of the 6,502,917 patent. On February 3, 2009, reexamination certificate 6,502,917 C1 was duly and legally issued to Seiko Epson by the United States Patent and Trademark Office. Attached as Exhibit E to this Complaint is a true and correct copy of the reexamination certificate. The original patent and the reexamination certificate are collectively referred to herein as the "'917 patent." The '917 patent relates generally to ink cartridges for printers.

18. The '917 patent is valid and enforceable.

19. On information and belief after conducting a reasonable investigation, Nano Digital has infringed and is infringing the '917 patent, as defined by numerous claims of the patent in violation of 35 U.S.C. § 271(a) by making, using, importing, offering to sell, and selling in this judicial district and elsewhere aftermarket ink cartridges that operate with Epson ink jet printers, including but not limited to ink cartridges having model nos. T0441, T0442, T0443, T0444, T0481, T0482, T0483, T0484, T0485, T0486, T0541, T0542, T0543, T0544, T0546, T0547, T0548, T0549, T0601, T0602, T0603, T0604, T0691, T0692, T0693, T0694, T0771, T0772, T0773, T0774, T0775, T0776, T0781, T0781, T0782, T0782, T0783, T0784, T0785, T0786, T0791, T0792, T0793, T0794, T0795, T0796, T0870, T0871, T0872, T0873, T0874, T0877, T0878, T0879, T0881, T0882, T0883, T0884, T0981, T0991, T0992, T0993, T0994, T0995, T0996, T1241, T1242, T1243, T1244, T1251, T1252, T1253, T1254, T1261, T1261, T1262, T1263, T1264, T2001XL, T2002XL, T2003XL, T2004XL, T2521, T2522, T2523, and T2524, as well as others that are no more than colorably different from the foregoing (collectively, the "Accused '917 Ink Cartridges"). The specific models of Accused '917 Ink Cartridges identified above were obtained by Epson during its investigation leading to this Complaint. The Accused '917 Ink Cartridges were shipped by Nano Digital in packaging having or including with the shipment the "Nano Digital" and "ND" brand and logo identified above in paragraph 10. The "Nano Digital" and "ND" brand and logo also appear, in certain instances, on the ink cartridge label or on the instructions included with the ink cartridge.

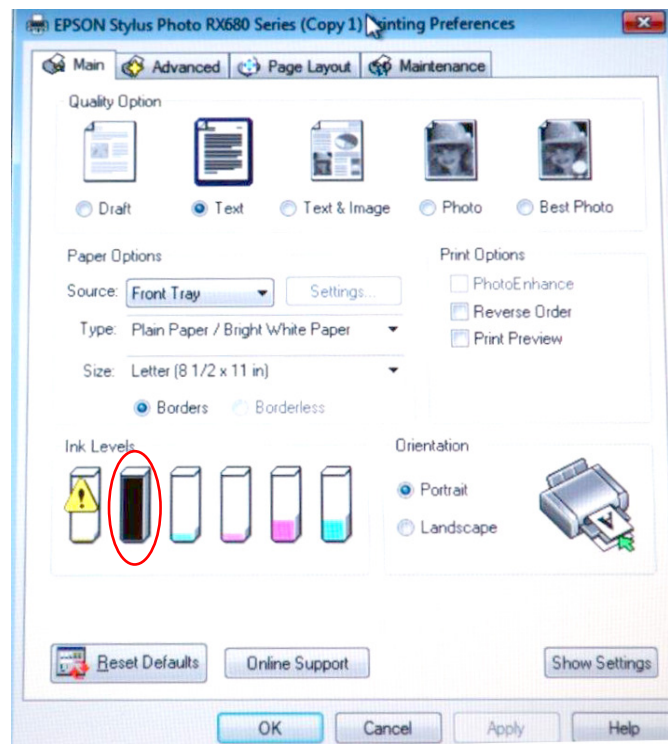
20. As a non-limiting example, set forth below is a claim chart with a description of Nano Digital's infringement of exemplary claim 9 of the '917 patent by the Accused '917 Ink Cartridges:

Claim 9 of the '917 Patent	Where found in the Accused '917 Ink Cartridges
<p>[9a] An ink cartridge for mounting on a carriage of an ink jet printing apparatus and for supplying ink to a printhead of said ink jet printing apparatus through an ink supply needle, the ink cartridge comprising:</p>	<p>Each of the Accused '917 Ink Cartridges is an ink cartridge for mounting on the carriage of an Epson ink jet printer (an ink jet printing apparatus). Defendant markets and sells the Accused '917 Ink Cartridges as being compatible with one or more specific Epson ink jet printers. When mounted, each of the Accused '917 Ink Cartridges supplies ink to the printhead of the ink jet printer through an ink supply needle of the printer (the needle, which is part of the carriage inside the ink jet printer and not part of the cartridge, has a passage that allows ink to pass from the ink cartridge through the needle). Accordingly, the Accused '917 Ink Cartridges literally meet the preamble of claim 9 of the '917 patent.</p>
<p>[9b] a plurality of external walls defining at least some of a chamber;</p>	<p>Each of the Accused '917 Ink Cartridges includes several external walls that define a chamber, and therefore also at least some of a chamber. These features are shown below using a representative Nano Digital ink cartridge from among the Accused '917 Ink Cartridges (Model No. T0771) (Control No. 7758 has been assigned to this cartridge by Epson for identification purposes) that, for infringement purposes, is representative of and represents all ink cartridges in the Accused '917 Ink Cartridges:</p>  <p>Accordingly, the Accused '917 Ink Cartridges literally meet this limitation of claim 9 of the '917 patent.</p>
<p>[9c] an ink supply port for receiving said ink supply needle, the ink supply port having an exit opening</p>	<p>Each of the Accused '917 Ink Cartridges includes an ink-supply port (i.e., a structure with an opening for the movement of ink) in the bottom of the cartridge. The ink</p>

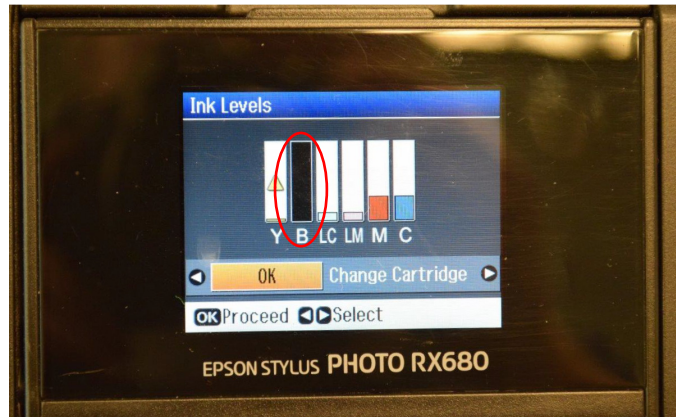
<p>and a centerline and communicating with the chamber;</p>	<p>supply port receives the ink-supply needle of the printer when the cartridge is mounted. The ink supply port is the conduit that allows the ink to leave the cartridge. Consequently, the ink supply port communicates with the chamber. The ink supply port also has a centerline and an exit opening at its end outside the cartridge. These features can be seen as shown below using the same representative Nano Digital ink cartridge (Model No. T0771; Control No. 7758):</p>  <p>Accordingly, the Accused '917 Ink Cartridges literally meet this limitation of claim 9 of the '917 patent.</p>
<p>[9d] a semiconductor storage device storing information about the ink carried by said cartridge; and</p>	<p>Each of the Accused '917 Ink Cartridges includes a chip (a semiconductor storage device) on the back of a printed circuit board (the circuit board is mounted on the front wall of the ink cartridge). The chip stores information about the ink carried by the cartridge. Testing of the representative Nano Digital ink cartridge (Model No. T0771; Control No. 7758), designed for use in an Epson Stylus Photo RX 680 printer, confirms that the chip stores information about the ink, for example, the quantity of ink remaining in the ink cartridge. The following photographs show that the printer utility window on the computer (i.e., the computer to which the printer is connected) and the printer's on-board monitor displayed that the level of ink in the representative Nano Digital ink cartridge (Model No. T0771; Control No. 7758) had decremented after printing a number of pages.</p>

In addition, after removing and reinstalling the ink cartridge into the printer, the computer's printer utility window and the printer's on-board monitor continued to display the same level of ink in the ink cartridge. This testing confirms that the chip on the representative Nano Digital ink cartridge (Model No. T0771; Control No. 7758) stores information about the ink carried by the cartridge, namely the amount of remaining ink.

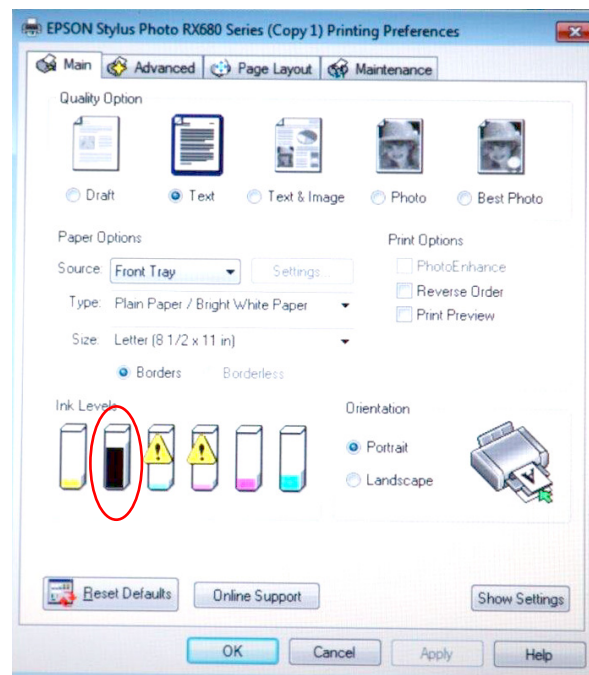
Ink level of the representative Nano Digital black-ink ink cartridge (Model No. T0771; Control No. 7758) shown on computer's printer utility window before printing (showing full):



Ink level of the representative Nano Digital black-ink ink cartridge (Model No. T0771; Control No. 7758) shown on printer's on-board monitor before printing (showing full):



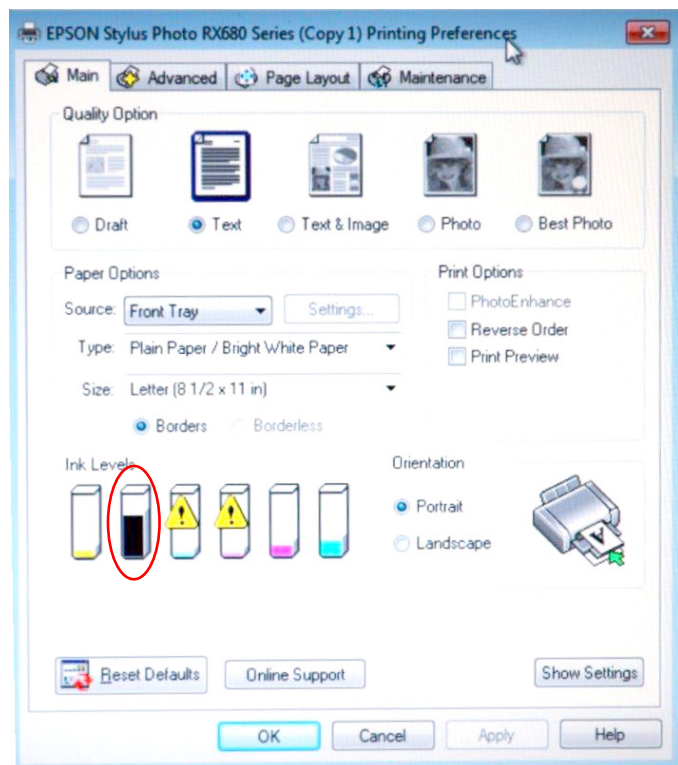
Ink level of the representative Nano Digital black-ink ink cartridge (Model No. T0771; Control No. 7758) shown on computer's printer utility window after printing (showing partial depletion):



Ink level of the representative Nano Digital black-ink ink cartridge (Model No. T0771; Control No. 7758) shown on printer's on-board monitor after printing (showing partial depletion):

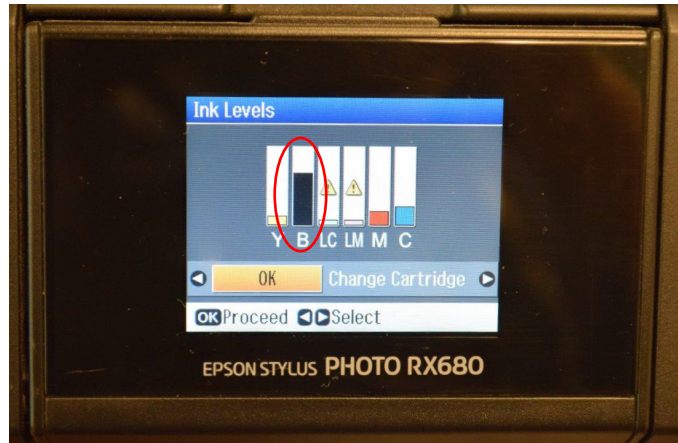


Ink level of the representative Nano Digital black-ink ink cartridge (Model No. T0771; Control No. 7758) shown on computer's printer utility window after the ink cartridge was removed from and reinstalled in the printer (showing the same level of partial depletion as before the ink cartridge was removed):



Ink level of the representative Nano Digital black-ink ink cartridge (Model No. T0771; Control No. 7758) shown on printer's on-board monitor after the ink cartridge was removed from and reinstalled in the printer (showing the

same level of partial depletion):



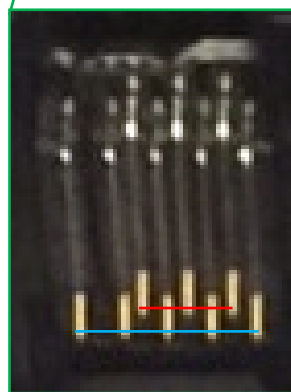
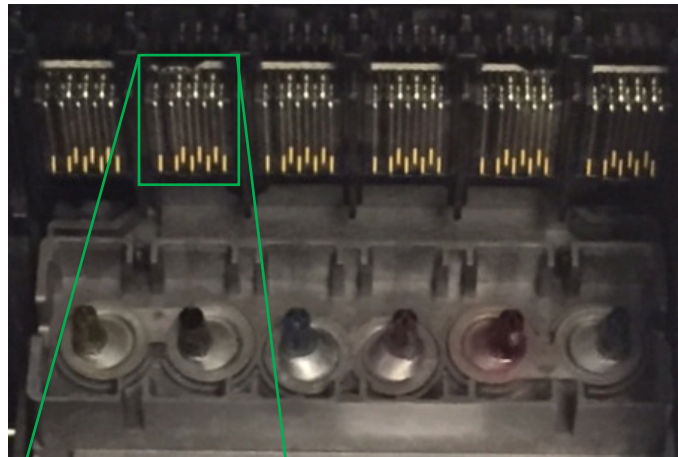
The testing of the representative Nano Digital ink cartridge (Model No. T0771; Control No. 7758) is applicable to each of the Accused '917 Ink Cartridges. Accordingly, the Accused '917 Ink Cartridges literally meet this limitation of claim 9 of the '917 patent.

[9e] a plurality of contacts for connecting said semiconductor storage device to the ink jet printing apparatus, the contacts being formed in a plurality of rows so that one of said rows is closer to said exit opening of said ink supply port than an other of said rows, the row of said contacts which is closest to said exit opening of said ink supply port being longer than the row of said contacts which is furthest from said exit opening of said ink supply port.

Each of the Accused '917 Ink Cartridges includes a plurality of contacts for connecting the chip (the semiconductor storage device) to the ink jet printer (ink jet printing apparatus). The testing described above with respect to the preceding limitation confirms that there is an electrical connection between the chip and the ink jet printer. The contacts are the discrete portions of conductive material on the cartridge that are present there to make an electrical connection between the cartridge and the printer (i.e., they contact the printer-side contact forming members when the cartridge is installed in the printer). The contacts allow communication between the chip and the printer through corresponding printer-side contact forming members. Every Epson ink jet printer has printer-side contact forming members, as seen, for example, in the Epson Stylus Photo RX 680 discussed with respect to the preceding limitation. The printer-side contact forming members are configured in two rows with one row above the other row. In addition, the lower row is longer than the upper row. When an ink cartridge from the Accused '917 Ink Cartridges is fully inserted into the printer and in an installed position, the printer-side contact forming members come into contact and make an electrical connection with the cartridge contacts

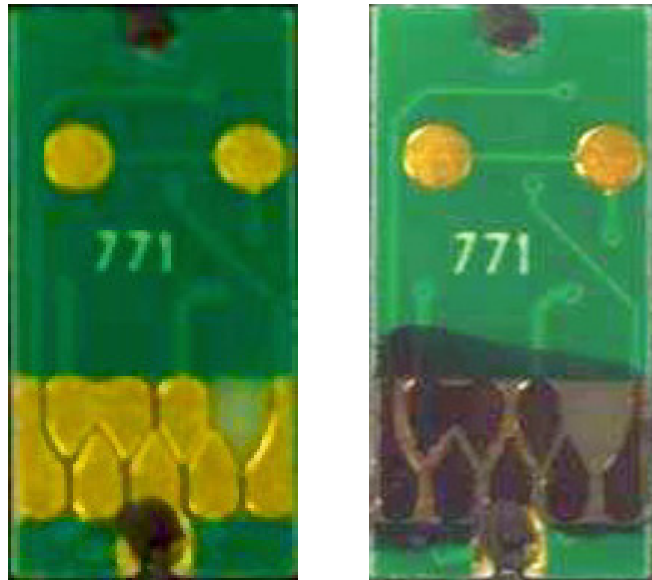
(i.e., the discrete portions located on the larger pattern of electrically conductive material on the cartridge). The contacts are formed in two rows, one above the other. Consequently, the lower row is closer to the exit opening of the ink supply port than the upper row, and the lower row is longer than the upper row. The above described features are shown in the photos below.

Shown below are the printer-side contact forming members of an Epson Stylus Photo RX 680 printer, an exemplary printer with which the exemplary Nano Digital ink cartridge (Control No. 7758 works). The contact forming members are formed in two rows, one above the other, with the lower row of contact forming members longer than the upper row, as can be seen below:

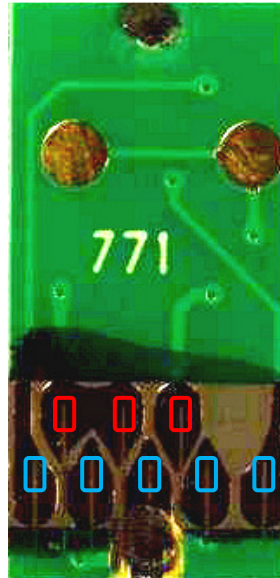


Shown at left is an enlarged view of the printer-side contact forming members of the Epson Stylus Photo RX 680 printer that accepts the representative Nano Digital (black ink) ink cartridge (Model No. T0771; Control No. 7758). The printer-side contact forming members are arranged in two rows with the lower row (shown with a blue line) longer than the upper row (shown with a red line).

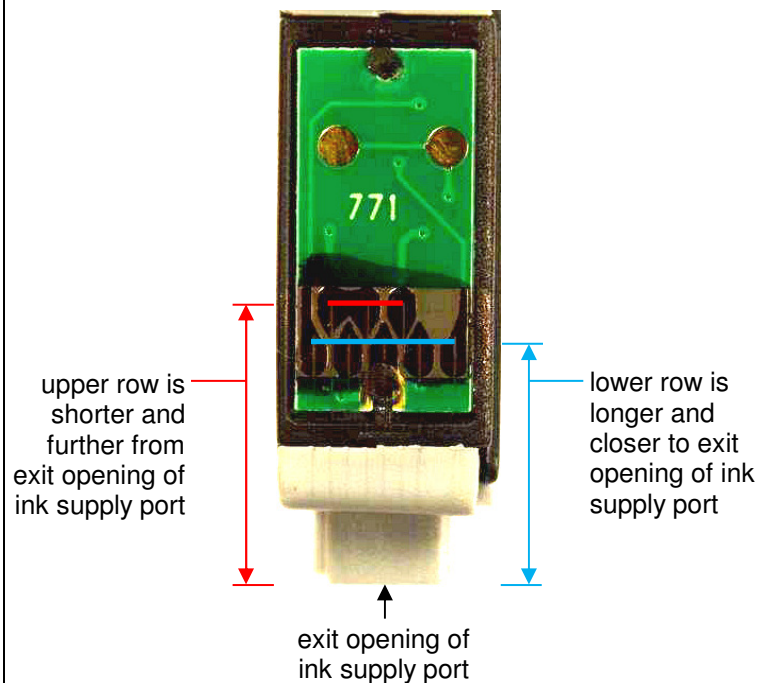
The contacts of the representative Nano Digital ink cartridge (Model No. T0771; Control No. 7758) are shown below. The contacts are located on the gold colored metallic conductive pattern seen below. To confirm the location and arrangement of the contacts, the conductive pattern was marked with black ink, the cartridge was installed in and then removed from the printer (which caused the printer's contact forming members to leave scratch marks on the conductive pattern thereby removing a portion of the black ink that was applied and therefore indicating the location of the contacts), and the conductive pattern was then photographed. For example, the conductive pattern of the representative Nano Digital ink cartridge (Model No. T0771; Control No. 7758) before marking with black ink is shown on the left and after marking with black ink is shown on the right:



The resulting marks left by the printer's contact forming members on the conductive material of the ink cartridge show the arrangement of the contacts of the ink cartridge. These are shown below with red boxes (top row of contacts) and blue boxes (bottom of row of contacts).



As shown below, the lower row of contacts is longer and closer to the exit opening of the ink supply port (blue line) than the upper row of contacts, which is shorter and further from the exit opening of the ink supply port (red line):



Accordingly, the Accused '917 Ink Cartridges literally meet this limitation of claim 9 of the '917 patent.

21. On information and belief after conducting a reasonable investigation, Defendant has and is actively, knowingly and intentionally aiding and abetting and inducing infringement of the '917 patent in violation of 35 U.S.C. § 271(b) by non-parties, including end-users, despite Defendant's knowledge of the '917 patent, including through its participation in the 337-TA-946 ITC Investigation, and its knowledge of the ITC's adjudication of validity and infringement of the '917 patent, as well as other Epson patents asserted in earlier ITC Investigations and the earlier Oregon District Court Actions.

22. On information and belief, Defendant is contributing to the infringement of the '917 patent in violation of 35 U.S.C. § 271(c) by non-parties by offering to sell or selling within the United States or importing into the United States components of the patented inventions set forth in the '917 patent. The components constitute a material part of the inventions. Defendant knows that such components are especially made or especially adapted for use in an infringement of the '917 patent. The components are not a staple article or commodity of commerce suitable for substantial noninfringing use.

23. By reason of Defendant's infringing activities, Epson has suffered, and will continue to suffer, substantial damages in an amount to be proven at trial.

24. Defendant's acts complained of herein have damaged and will continue to damage Epson irreparably. Epson has no adequate remedy at law for these wrongs and injuries. Epson is therefore entitled to a preliminary and permanent injunction restraining and enjoining Defendant and its agents, servants, and employees, and all persons acting thereunder, in concert with, or on their behalf, from infringing the claims of the '917 patent.

25. Defendant is not licensed or otherwise authorized to make, use, import, sell, or offer to sell any ink cartridge or process/method claimed in the '917 patent, and Defendant's

conduct is, in every instance, without Epson's consent.

26. On information and belief, Defendant's infringement has been and continues to be willful.

SECOND CLAIM FOR RELIEF

(Patent Infringement—35 U.S.C. § 271)

INFRINGEMENT OF U.S. PATENT NO. 8,794,749

27. Epson incorporates by reference each and every allegation contained in Paragraphs 1 through 15 as though fully set forth at length here.

28. Epson owns all right, title, and interest in, including the right to sue thereon and the right to recover for infringement thereof, United States Patent No. 8,794,749 (the "'749 patent"), which was duly and legally issued to Seiko Epson by the United States Patent and Trademark Office on August 5, 2014. The '749 patent relates generally to ink cartridges for printers. Attached as Exhibit F to this Complaint is a true and correct copy of the '749 patent.

29. The '749 patent is valid and enforceable.

30. On information and belief after conducting a reasonable investigation, Nano Digital has infringed and is infringing the '749 patent, as defined by numerous claims of the patent in violation of 35 U.S.C. § 271(a) by making, using, importing, offering to sell, and selling in this judicial district and elsewhere aftermarket ink cartridges that operate with Epson ink jet printers, including but not limited to ink cartridges having model nos. T0541, T0542, T0543, T0544, T0546, T0547, T0548, T0549, T0691, T0692, T0693, T0694, T0771, T0772, T0773, T0774, T0775, T0776, T0781, T0781, T0782, T0782, T0783, T0784, T0785, T0786, T0791, T0792, T0793, T0794, T0795, T0796, T0870, T0871, T0872, T0873, T0874, T0877, T0878, T0879, T0881, T0882, T0883, T0884, T0981, T0991, T0992, T0993, T0994, T0995, T0996,

T1241, T1242, T1243, T1244, T1251, T1252, T1253, T1254, T1261, T1261, T1262, T1263, T1264, T2001XL, T2002XL, T2003XL, T2004XL, T2521, T2522, T2523, T2524, T273XL Series, T273XL020, T273XL120, T273XL220, T273XL320, T273XL420, T277XL Series, T676XL1, T676XL2, T676XL3, and T676XL4, as well as others that are no more than colorably different from the foregoing (collectively, the "Accused '749 Ink Cartridges"). The specific models of Accused '749 Ink Cartridges identified above were obtained by Epson during its investigation leading to this Complaint. The Accused '749 Ink Cartridges were shipped by Nano Digital in packaging having or including with the shipment the "Nano Digital" and "ND" brand and logo identified above in paragraph 10. The "Nano Digital" and "ND" brand and logo also appear, in certain instances, on the ink cartridge label or on the instructions included with the ink cartridge.

31. As a non-limiting example, set forth below is a claim chart with a description of Nano Digital's infringement of exemplary claim 1 of the '749 patent by the Accused '749 Ink Cartridges:

Claim 1 of the '749 Patent	Where found in the Accused '749 Ink Cartridges
[1a] A printing material container adapted to be attached to a printing apparatus by being inserted into the printing apparatus in an insertion direction, the printing apparatus having a print head and a plurality of apparatus-side electrical contact members, the printing material container comprising:	<p>Each of the Accused '749 Ink Cartridges is a printing material container (an ink cartridge) adapted to be attached to an Epson ink jet printing apparatus. Each of the Accused '749 Ink Cartridges is inserted, in an insertion direction, into an Epson ink jet printer. All Epson ink jet printers that accept the Accused '749 Ink Cartridges have a print head and a plurality of printer-side (apparatus-side) electrical contact members.</p> <p>These features are shown below using a representative Nano Digital ink cartridge from among the Accused '749 Ink Cartridges (Model No. T1261) (Control No. 7805 has been assigned to this cartridge by Epson for identification purposes) that, for purposes of infringement, is representative of and represents all ink cartridges in the</p>

Accused '749 Ink Cartridges.

The representative Nano Digital ink cartridge (Model No. T1261; Control No. 7805) is adapted to be attached to an Epson WorkForce WF-3520 ink jet printer by being inserted in an insertion direction, as shown in the following photographs:

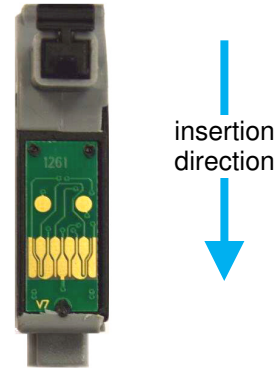


Nano Digital ink cartridge,
Model No. T1261, Control No. 7805



Epson WorkForce WF-3520 ink jet printer

The following photograph depicts the insertion direction (blue arrow) in which the Nano Digital ink cartridge (Model No. T1261; Control No. 7805) is inserted into the Epson WorkForce WF-3520 ink jet printer:

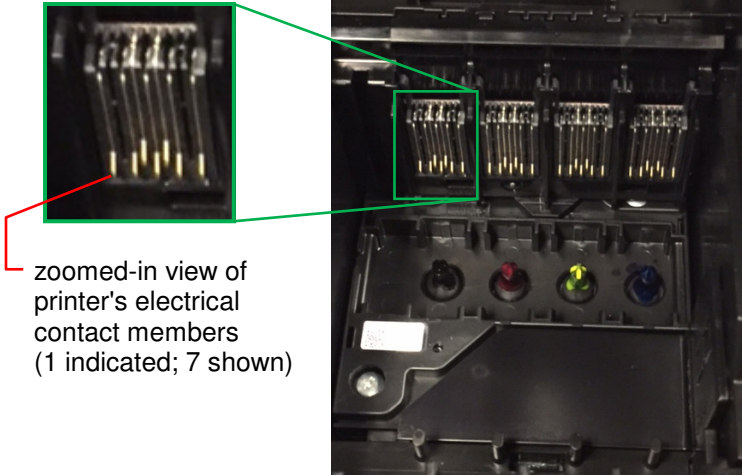



The following photograph shows the Nano Digital ink cartridge (Model No. T1261; Control No. 7805), a black-ink cartridge, attached in the Epson WorkForce WF-3520 ink jet printer after the cartridge has been inserted into the printer in the insertion direction (the magenta, yellow and cyan cartridges, genuine Epson cartridges used to fill the remaining slots of the cartridge holder, can also be seen):

Nano Digital ink cartridge (Model No. T1261; Control No. 7805) installed in the Epson printer



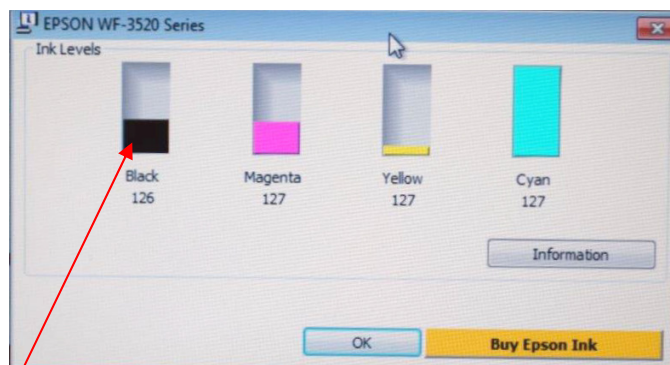
The Epson ink jet printers that accept the Accused '749 Ink Cartridges each include a print head for printing and multiple printer-side electrical contact members for each ink cartridge accepted by the printer. These features are shown below for the printer's cartridge holder slot that accepts the representative Nano Digital black-ink ink cartridge (Model No. T1261; Control No. 7805) (the printer's electrical contact members for the magenta, yellow, and cyan cartridges can also be seen in the right photo):

	 <p>zoomed-in view of printer's electrical contact members (1 indicated; 7 shown)</p> <p>Accordingly, the Accused '749 Ink Cartridges literally meet the preamble of claim 1 of the '749 patent.</p>
<p>[1b] an ink supply opening, having an exit, adapted to supply ink from the ink cartridge to the printing apparatus;</p>	<p>Each of the Accused '749 Ink Cartridges comprises an ink supply opening having an exit. When attached, the ink supply opening of each of the Accused '749 Ink Cartridges is adapted to supply ink from the cartridge to the Epson ink jet printer that accepts the cartridge. The following photograph depicts the exit of the ink supply opening of the representative Nano Digital ink cartridge (Model No. T1261; Control No. 7805):</p>  <p>exit of ink supply opening (shown here with anti-leak film undisturbed and in place)</p> <p>Accordingly, the Accused '749 Ink Cartridges literally meet this limitation of claim 1 of the '749 patent.</p>
<p>[1c] a low voltage electronic device adapted to receive and function with a low voltage, the low voltage electronic device comprising a memory device;</p>	<p>Each of the Accused '749 Ink Cartridges comprises a low voltage electronic device that comprises a memory device adapted to receive and function with a low voltage. The low voltage electronic device is an integrated circuit ("IC") chip located on the back of a printed circuit board that is mounted on a wall of the ink cartridge, as shown below in the representative Nano Digital ink cartridge (Model No. T1261; Control No. 7805):</p>

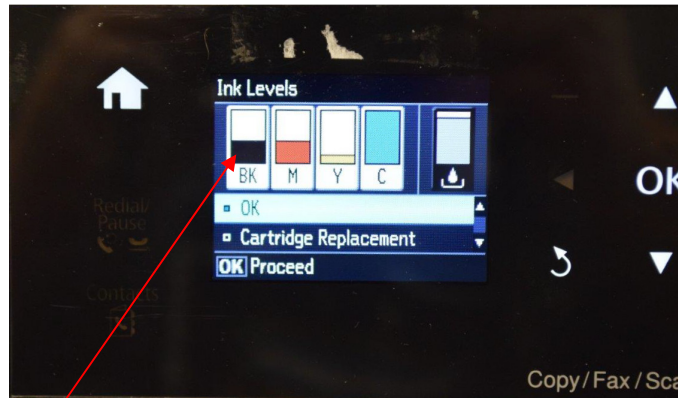


printed circuit board
(green) with low voltage
electronic device located
on back

In addition, the presence of a low voltage electronic device (i.e., an IC chip comprising a memory device) is further confirmed through testing demonstrating that the Epson ink jet printers that accept the Accused '749 Ink Cartridges read the remaining ink level and other descriptive information about the ink cartridge from the ink cartridge's memory device, and display that information on the display screen of a connected computer and on the printer's display screen. The following photographs show the display of such information on the computer display screen and the printer's display screen for the representative Nano Digital ink cartridge (Model No. T1261; Control No. 7805) containing black ink, attached to an Epson WorkForce WF-3520 ink jet printer:



memory device shows, on the computer's display screen, the amount of black ink remaining in the representative Nano Digital ink cartridge (Model No. T1261; Control No. 7805)




memory device shows, on the printer's display screen, the amount of black ink remaining in the representative Nano Digital ink cartridge (Model No. T1261; Control No. 7805)

All Epson ink jet printers that accept the Accused '749 Ink Cartridges have similar circuitry and programming in terms of the voltages and signals they apply to their contact forming members and, consequently, to the corresponding contact portions of the Accused '749 Ink Cartridges (the contact portions are located on the gold-colored metallic terminals of the ink cartridge shown above). In particular, Epson printers apply a maximum voltage of approximately 4 volts (a low voltage as compared to the high voltage discussed in the next limitation) to certain of their contact forming members that in turn correspond to certain of the contact portions of the Accused '749 Ink Cartridges that are connected to the low voltage electronic device comprising a memory device. Consequently, the low voltage electronic device is adapted to receive and function with a low voltage.

Accordingly, the Accused '749 Ink Cartridges literally meet this limitation of claim 1 of the '749 patent.

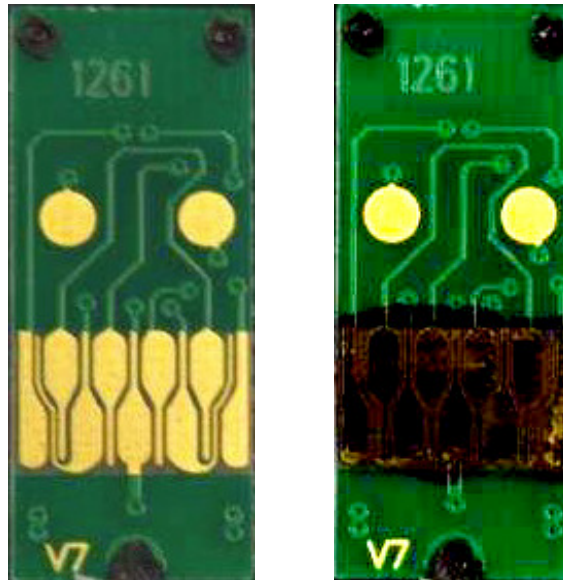
[1d] a high voltage electronic device adapted to receive and function with a high voltage, which is a higher voltage than the low voltage of the low voltage electronic device; and

Each of the Accused '749 Ink Cartridges comprises a high voltage electronic device that is adapted to receive and function with a voltage that is a higher voltage than the voltage of the low voltage electronic device. The high voltage electronic device may be, for example, a resistor, or one or more other coupled electronic components, that is/are capable of receiving and functioning with a high voltage. The high voltage electronic device is located on the back of a printed circuit board that is mounted on a wall of the ink cartridge, as shown below in the

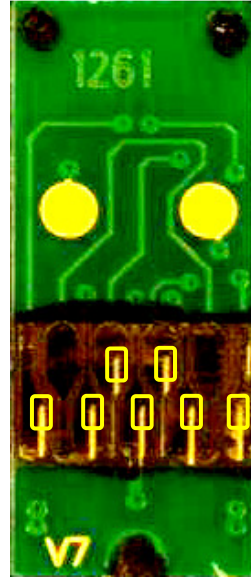
	<p>representative Nano Digital ink cartridge (Model No. T1261; Control No. 7805):</p> <div data-bbox="889 323 1373 688">  <p>printed circuit board (green) with high voltage electronic device located on back</p> </div> <p>All Epson ink jet printers that accept the Accused '749 Ink Cartridges have similar circuitry and programming in terms of the voltages and signals they apply to their contact forming members and, consequently, to the corresponding contact portions of the Accused '749 Ink Cartridges (the contact portions are located on the gold terminals of the ink cartridge shown above). In particular, Epson printers apply a voltage of approximately 42 volts (a high voltage as compared to the low voltage of approximately 4 volts applied to the low voltage electronic device discussed in the preceding limitation) to two of their contact forming members that in turn correspond to two of the contact portions of the Accused '749 Ink Cartridges that are connected to the high voltage electronic device. Consequently, the high voltage electronic device is adapted to receive and function with a high voltage.</p> <p>Accordingly, the Accused '749 Ink Cartridges literally meet this limitation of claim 1 of the '749 patent.</p>
<p>[1e] a plurality of container-side terminals having contact portions adapted and positioned to contact corresponding apparatus-side contact forming members so that electrical communication is enabled between the container and the printing apparatus, the contact portions of the terminals including a plurality of low</p>	<p>Each of the Accused '749 Ink Cartridges comprises a plurality of container-side terminals that have contact portions. The contact portions are adapted and positioned on the cartridge so that, when the cartridge is attached to the printer, the contact portions of the cartridge's terminals contact corresponding printer-side contact forming members so that electrical communication is enabled between the cartridge and the printer.</p>

voltage electronic device contact portions electrically coupled to the low voltage electronic device, and a first high voltage electronic device contact portion and a second high voltage electronic device contact portion, each electrically coupled to the high voltage electronic device, wherein:

As seen with respect to limitation 1c above, the terminals of the Accused '749 Ink Cartridges are the gold colored metallic portions on the green printed circuit board. The contact portions are located on these gold colored metallic portions. To confirm the location and arrangement of the terminals' contact portions, the terminals were marked with black ink, the cartridge was installed in and then removed from the printer (which caused the printers' contact forming members to leave scratch marks on the terminals thereby removing a portion of the black ink that was applied and therefore indicating the location of the contact portions), and the terminals were then photographed. For example, the terminals of the representative Nano Digital ink cartridge (Model No. T1261; Control No. 7805) before marking with black ink is shown on the left and after marking with black ink is shown on the right:

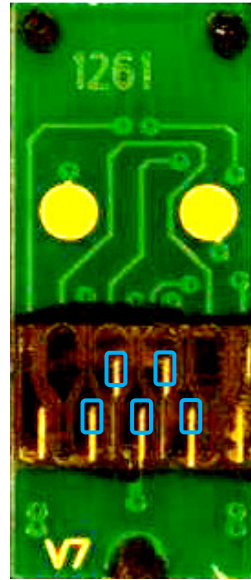


The resulting marks left by the printer's contact forming members on the terminals show the location and arrangement of the contact portions. These are indicated below with annotated yellow boxes superimposed on the terminals to indicate the location of the contact portions (there are a total of seven contact portions, with two contact portions in a top row and five contact portions in a bottom row):

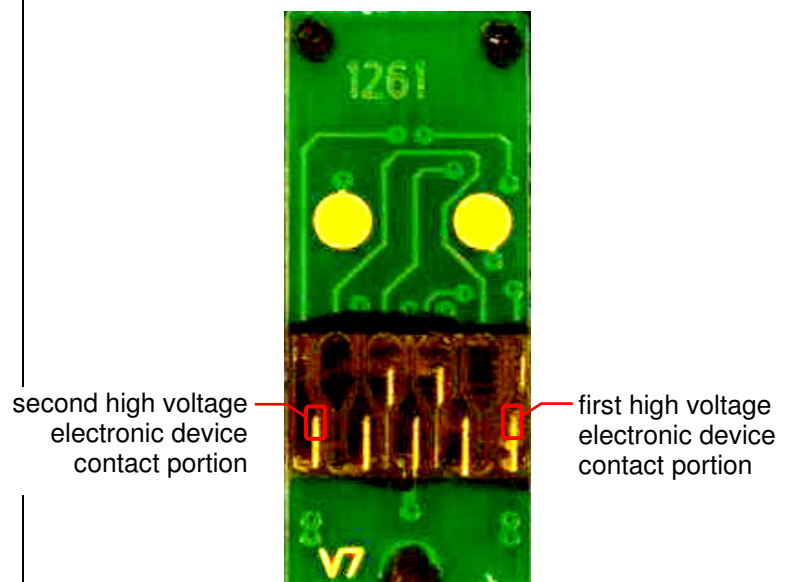


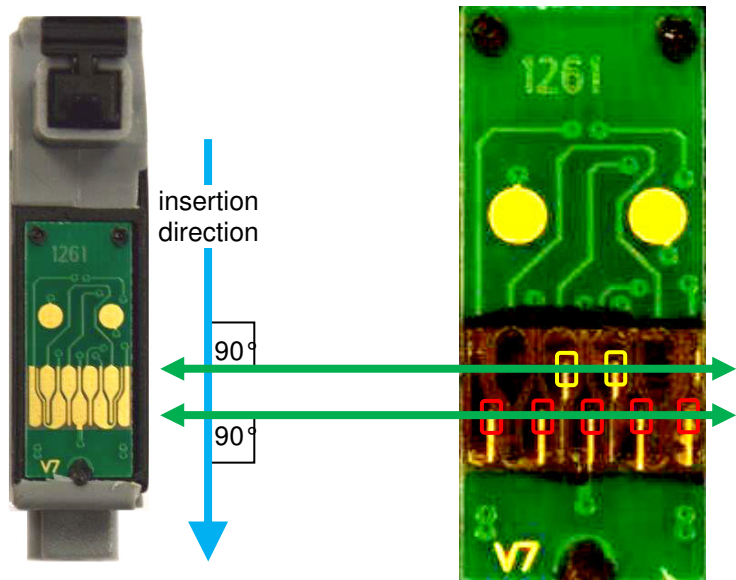
The contact portions shown above correspond to their printer-side contact forming members so that electrical communication is enabled between the ink cartridge and the printer, e.g., so the printer can read remaining ink level and other information from the memory device as described above with respect to limitation 1c.

The above shown contact portions include a plurality of low voltage electronic device contact portions that are electrically coupled to the low voltage electronic device (specifically, the IC chip comprising a memory device). Each low voltage electronic device contact portion is electrically coupled by the terminal it appears on and by other circuitry to the memory device located on the back of the green printed circuit board. The following photograph shows the low voltage electronic device contact portions (there are five such low voltage electronic device contact portions, as indicated by superimposed blue boxes):



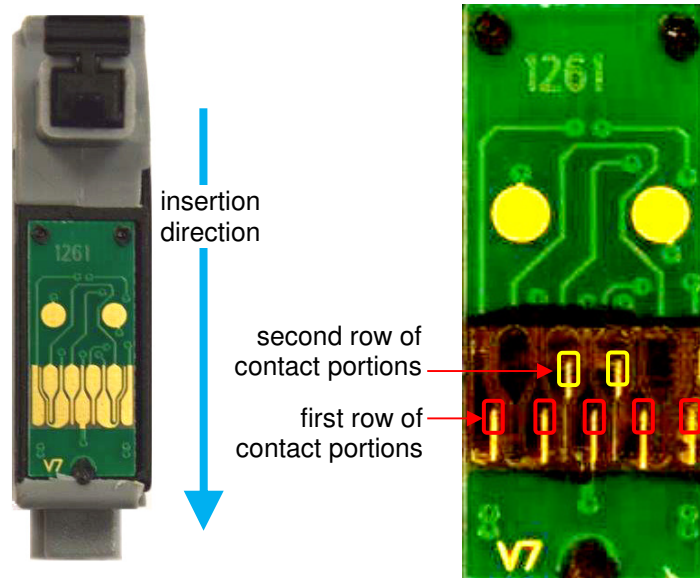
The contact portions of the Accused '749 Ink Cartridges' terminals also include first and second high voltage electronic device contact portions that are each electrically coupled to the high voltage electronic device discussed above with respect to limitation 1d. Each high voltage electronic device contact portion is electrically coupled by the terminal it appears on and by other circuitry to the high voltage electronic device on the back of the printed circuit board. The following photograph shows the high voltage electronic device contact portions (there are two such high voltage electronic device contact portions, as indicated by superimposed red boxes):



	Accordingly, the Accused '749 Ink Cartridges literally meet this limitation of claim 1 of the '749 patent.
[1f] the contact portions are arranged in a first row of contact portions and in a second row of contact portions, the first row of contact portions and the second row of contact portions extending in a row direction which is generally orthogonal to the insertion direction,	<p>The contact portions of each of the Accused '749 Ink Cartridges are arranged in a first row of contact portions and in a second row of contact portions that both extend in a row direction which is generally orthogonal to the insertion direction. The following photographs of the representative Nano Digital ink cartridge (Model No. T1261; Control No. 7805) show the first row and second row of contact portions extending in a row direction which is generally orthogonal to the insertion direction in which the Accused '749 Ink Cartridges are inserted into Epson ink jet printers that accept the Accused '749 Ink Cartridges. The right photo shows an enlarged and annotated view of the printed circuit board shown in the left photo.</p>  <p>first row of contact portions (red squares) and second row of contact portions (yellow squares), each extending in a row direction (green arrows) orthogonal to cartridge insertion direction (blue arrow)</p> <p>Accordingly, the Accused '749 Ink Cartridges literally meet this limitation of claim 1 of the '749 patent.</p>
[1g] the first row of contact portions is disposed at a location that is further in the insertion direction than	In each of the Accused '749 Ink Cartridges, the first row of contact portions is disposed at a location that is further in the insertion direction than the second row of contact

the second row of contact portions, and,

portions. The following photographs show the first row of contact portions (red boxes) disposed at a location that is further in the cartridge insertion direction than the second row of contact portions (yellow boxes) (i.e., the first row is deeper in the printer than the second row).



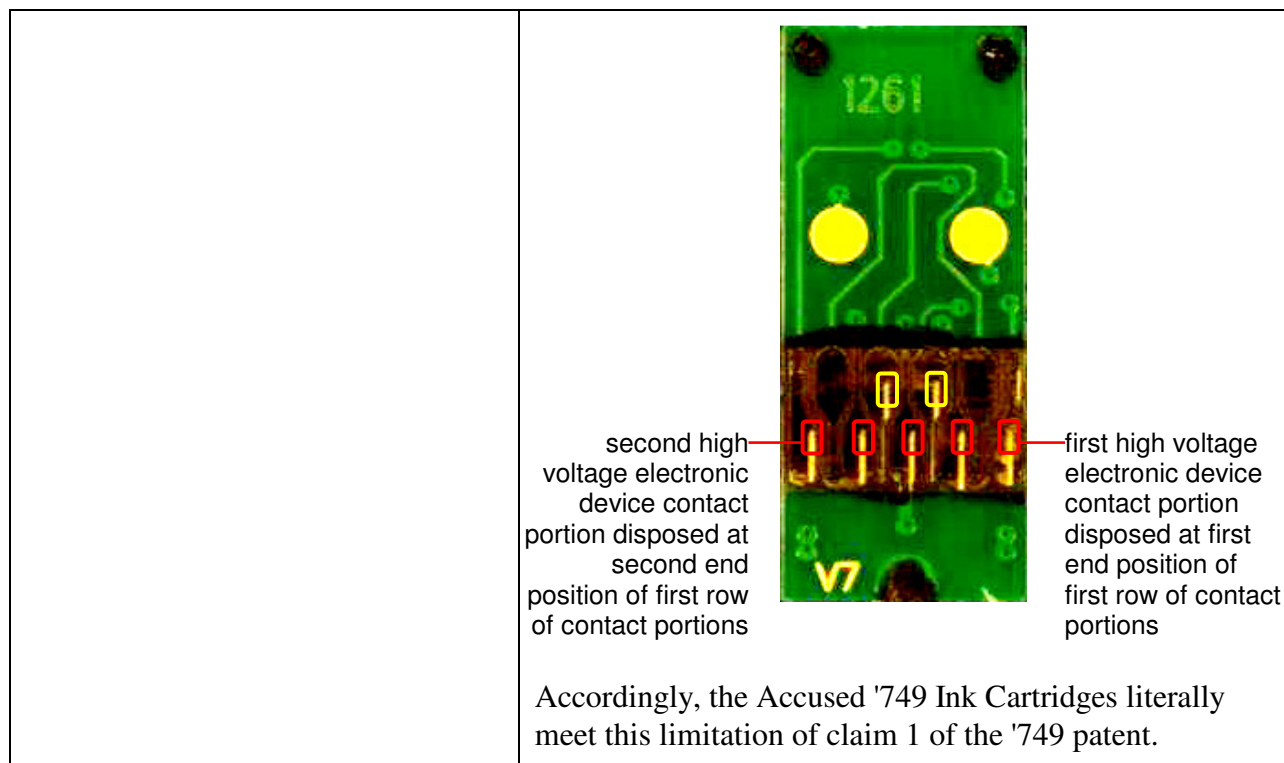
first row of contact portions (red squares) disposed further in insertion direction (blue arrow) than second row of contact portions (yellow squares)

Accordingly, the Accused '749 Ink Cartridges literally meet this limitation of claim 1 of the '749 patent.

[1h] the first row of contact portions has a first end position and a second end position at opposite ends thereof, the first high voltage electronic device contact portion is disposed at the first end position of the first row of contact portions and the second high voltage electronic device contact portion is disposed at the second end position of the first row of contact portions.

In each of the Accused '749 Ink Cartridges, the first row of contact portions has a first end position and a second end position at opposite ends thereof, the first high voltage electronic device contact portion is disposed at the first end position of the first row of contact portions, and the second high voltage electronic device contact portion is disposed at the second end position of the first row of contact portions.

The following photograph shows the first and second high voltage contact portions disposed, respectively, at the first and second end positions at opposite ends of the first row of contact portions.



32. On information and belief, Defendant has and is actively, knowingly and intentionally aiding and abetting and inducing infringement of the '749 patent by non-parties in violation of U.S.C. § 271(b), including end-users, despite Defendant's knowledge of the '749 patent, including through its participation in the 337-TA-946 ITC Investigation, and its knowledge of the ITC's adjudication of validity and infringement of the '749 patent, as well as other Epson patents asserted in earlier ITC Investigations and the earlier Oregon District Court Actions.

33. On information and belief, Defendant is contributing to the infringement of the '749 patent in violation of 35 U.S.C. § 271(c) by non-parties by offering to sell or selling within the United States or importing into the United States components of the patented inventions set forth in the '749 patent. The components constitute a material part of the inventions. Defendant knows that such components are especially made or especially adapted for use in an infringement

of the '749 patent. The components are not a staple article or commodity of commerce suitable for substantial noninfringing use.

34. By reason of Defendant's infringing activities, Epson has suffered, and will continue to suffer, substantial damages in an amount to be proven at trial.

35. Defendant's acts complained of herein have damaged and will continue to damage Epson irreparably. Epson has no adequate remedy at law for these wrongs and injuries. Epson is therefore entitled to a preliminary and permanent injunction restraining and enjoining Defendant and its agents, servants, and employees, and all persons acting thereunder, in concert with, or on their behalf, from infringing the claims of the '749 patent.

36. Defendant is not licensed or otherwise authorized to make, use, import, sell, or offer to sell any ink cartridge or process/method claimed in the '749 patent, and Defendant's conduct is, in every instance, without Epson's consent.

37. On information and belief, Defendant's infringement has been and continues to be willful.

THIRD CLAIM FOR RELIEF

BREACH OF CONTRACT

38. Epson incorporates by reference each and every allegation contained in Paragraphs 1 through 15 as though fully set forth at length here.

39. The Settlement Agreement between Epson and Nano Digital established a contractual relationship between Epson and Nano Digital with respect to the '917 and '749 patents, as well as other patents. A true and correct copy of the public version of the Settlement Agreement is included as Exhibit 1 to the Amended Joint Motion attached to this Complaint as Exhibit A (see paragraph 11).

- 40. Nano Digital has been, and is, in breach of the Settlement Agreement.
- 41. Nano Digital's actions have resulted in damage to Epson.

PRAYER FOR RELIEF

WHEREFORE, Epson prays for judgment against Defendant as follows:

- A. That the Epson Patents are valid and enforceable;
- B. That Defendant has infringed and is infringing the Epson Patents;
- C. That such infringement is willful;
- D. That Defendant and its subsidiaries, affiliates, parents, successors, assigns, officers, agents, representatives, servants, and employees, and all persons in active concert or participation with it, be preliminarily and permanently enjoined from continued infringement of the Epson Patents;
- E. That Defendant be ordered to pay Epson its damages caused by Defendant's infringement of the Epson Patents and that such damages be trebled, together with interest thereon;
- F. That this case be declared exceptional pursuant to 35 U.S.C. § 285 and that Epson be awarded its reasonable attorneys' fees, litigation expenses and expert witness fees, and costs;
- G. That Nano Digital has been, and is, in breach of the Settlement Agreement;
- H. That Nano Digital be ordered to pay Epson its damages caused by Nano Digital's breach of the Settlement Agreement, including attorneys fees; and
- I. That Epson have such other and further relief as the Court deems just and proper.

JURY TRIAL DEMAND

Pursuant to Fed. R. Civ. P. 38(b), Plaintiffs request a trial by jury of all issues so triable.

DATED: November 22, 2016

SCHWABE, WILLIAMSON & WYATT, P.C.

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*Attorneys for Plaintiffs Seiko Epson Corporation,
Epson America, Inc., and Epson Portland Inc.*

PUBLIC VERSION

UNITED STATES INTERNATIONAL TRADE COMMISSION
WASHINGTON, D.C.

Before the Honorable Dee Lord
Administrative Law Judge

In the Matter of

CERTAIN INK CARTRIDGES AND
COMPONENTS THEREOF

Investigation No. 337-TA-946

**AMENDED JOINT MOTION TO TERMINATE INVESTIGATION AS TO
RESPONDENTS ZHUHAI NANO DIGITAL TECHNOLOGY CO., LTD. AND
NANO BUSINESS & TECHNOLOGY, INC.
BASED UPON A SETTLEMENT AGREEMENT AND CONSENT ORDER**

On June 18, 2015, Complainants Epson Portland, Inc., Epson America, Inc. and Seiko Epson Corporation (collectively "Complainants") and Respondents Zhuhai Nano Digital Technology Co., Ltd. ("Zhuhai Nano") and Nano Business & Technology, Inc. ("Nano Business") filed a Joint Motion to Terminate Investigation as to Respondents Zhuhai Nano and Nano Business based upon a Settlement Agreement and Consent Order pursuant to Commission Rule of Practice and Procedure 210.21(b) and (c) (19 C.F.R. §§ 210.21(b) and (c)) (the "Initial Joint Motion to Terminate"). (Motion Docket No. 946-003.) Complainants and Respondents Zhuhai Nano and Nano Business now hereby submit this Amended Joint Motion to Terminate this Investigation as to Respondents Zhuhai Nano and Nano Business based upon the Settlement Agreement, Amended Consent Order Stipulation and Amended Proposed Consent Order submitted concurrently herewith (the "Amended Joint Motion to Terminate"), in place of the above-referenced Initial Joint Motion to Terminate.

Before filing the Initial Joint Motion to Terminate, Complainants consulted with the Commission Investigative Attorney, who stated that he would provide the position of the Office

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of Unfair Import Investigations after reviewing the filed papers in more detail. After reviewing the filed papers, the Commission Investigative Attorney requested certain modifications to the Consent Order Stipulation and Proposed Consent Order. The Amended Consent Order Stipulation and Amended Proposed Consent Order submitted herewith incorporate the modifications requested by the Commission Investigative Attorney.

Pursuant to Commission Rule 210.21(b), a copy of the executed Settlement Agreement is attached. An executed Amended Consent Order Stipulation and an Amended Proposed Consent Order are also attached. There are no other agreements, written or oral, express or implied, between Complainants and Respondents Zhuhai Nano and Nano Business concerning the subject matter of this investigation.

The Amended Consent Order Stipulation contains the admissions, waivers, statements, and other requirements pursuant to Commission Rule 210.21(c)(3). The Proposed Consent Order contains the terms specified by Commission Rule 210.21(c)(4). The parties submit that entry of the Proposed Consent Order will simplify and streamline the issues in this Investigation without causing any prejudice to the remaining Respondents. Further, termination of this Investigation as to Respondents Zhuhai Nano and Nano Business is in the interest of the public and administrative economy.

Pursuant to Commission Rule 210.16(c)(2), Complainants declare their intent to seek a general exclusion order as a part of this Investigation.

Complainants have consulted with the Commission Investigative Attorney regarding this Amended Joint Motion to Terminate. The Commission Investigative Attorney will provide the position of the Office of Unfair Import Investigations after reviewing the attached papers in more detail.

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Accordingly, Complainants and Respondents Zhuhai Nano and Nano Business respectfully request that the Administrative Law Judge issue an initial determination terminating this Investigation as to Respondent Zhuhai Nano and Nano Business on the basis of the Settlement Agreement, Amended Consent Order Stipulation and Amended Proposed Consent Order.

DATED: June 25, 2015

Respectfully submitted,

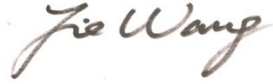


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PUBLIC VERSION



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EXHIBIT 1

PUBLIC VERSION

SETTLEMENT AGREEMENT

This Settlement Agreement ("Agreement") is entered into as of this 12th day of June, 2015 (the "Effective Date"), by and between Seiko Epson Corporation, Epson America, Inc. and Epson Portland Inc. (collectively, "Epson"), on the one hand, and Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc. (collectively, "Nano Digital"), on the other hand.

I. Recitals

1. Complainant Seiko Epson Corporation ("Seiko Epson") is a corporation organized and existing under the laws of Japan. It is in the business of manufacturing and selling a wide variety of consumer, commercial and industrial products, including ink cartridges for use with Epson printers. Subject to the exclusive licenses set forth below, it owns all right, title, and interest in, including the right to sue thereon and the right to recover for infringement thereof, United States Patent No. 6,502,917 (the "'917 patent"), which was duly and legally issued to Seiko Epson by the United States Patent and Trademark Office on January 7, 2003; United States Patent No. 6,550,902 (the "'902 patent"), which was duly and legally issued to Seiko Epson by the United States Patent and Trademark Office on April 22, 2003; United States Patent No. 6,955,422 (the "'422 patent"), which was duly and legally issued to Seiko Epson by the United States Patent and Trademark Office on October 18, 2005; U.S. Patent No. 7,008,053 (the "'053 patent"), which was duly and legally issued to Seiko Epson by the United States Patent and Trademark Office on March 7, 2006; U.S. Patent No. 7,011,397 (the "'397 patent"), which was duly and legally issued to Seiko Epson by the United States Patent and Trademark Office on March 14, 2006; U.S. Patent No. 8,366,233 (the "'233 patent"), which was duly and legally issued to Seiko Epson by the

PUBLIC VERSION

United States Patent and Trademark Office on February 5, 2013; U.S. Patent No. 8,454,116 (the "'116 patent'"), which was duly and legally issued to Seiko Epson by the United States Patent and Trademark Office on June 4, 2013; U.S. Patent No. 8,794,749 (the "'749 patent'"), which was duly and legally issued to Seiko Epson by the United States Patent and Trademark Office on August 5, 2014; U.S. Patent No. 8,801,163 (the "'163 patent'"), which was duly and legally issued to Seiko Epson by the United States Patent and Trademark Office on August 12, 2014; and U.S. Patent No. 8,882,513 (the "'513 patent'"), which was duly and legally issued to Seiko Epson by the United States Patent and Trademark Office on November 11, 2014. The '917, '902, '422, '053, '397, '233, '166, '749, '163 and '513 patents (collectively, the "Epson Patents") all relate generally to ink cartridges for printers.

2. Complainant Epson America, Inc. ("Epson America") is a corporation organized and existing under the laws of the State of California. It is the exclusive licensee of the right to distribute ink cartridges in the United States that are covered by the Epson Patents.

3. Complainant Epson Portland Inc. ("Epson Portland") is a corporation organized and existing under the laws of the State of Oregon. It is the exclusive licensee of the right to manufacture ink cartridges in the United States that are covered by the Epson Patents.

4. Respondent Nano Business & Technology, Inc. is a corporation organized and existing under the laws of the State of Oregon. It is in the business, among others, of importing and selling aftermarket ink cartridges in the United States, including those for use with Epson printers.

5. Respondent Zhuhai Nano Digital Technology Co., Ltd. is a corporation organized and existing under the laws of China. It is in the business, among others, of

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manufacturing, selling and exporting aftermarket ink cartridges for sale in the United States, including aftermarket ink cartridges for use with Epson printers.

6. On or about October 19, 2007, the United States International Trade Commission issued a General Exclusion Order in Investigation No. 337-TA-565 and, on or about April 16, 2012, the United States International Trade Commission issued a General Exclusion Order (Modified) in Investigation No. 337-TA-565, together barring entry for consumption into the United States of ink cartridges and components thereof that are covered by certain claims of certain patents, including the '917, '902, '422, '053, '397 patents.

7. On or about December 23, 2014, Epson filed a complaint naming Nano Digital and others as Respondents before the United States International Trade Commission, Investigation No. 337-TA-946 (hereafter, "ITC Investigation"), alleging the unlawful importation into the United States, the sale for importation into the United States and/or the sale within the United States after importation, of ink cartridges and components thereof that infringe the one or more of the '233, '166, '749, '163 and '513 patents.

8. Epson and Nano Digital mutually desire to settle and compromise the disputes between them related to the ITC Investigation and the Epson Patents, subject to and upon the terms and conditions hereinafter set forth.

II. Agreement

NOW, THEREFORE, for and in consideration of the foregoing, and the mutual covenants, promises and agreements hereinafter set forth, and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the parties hereby covenant, promise and agree as follows:

A. Representations

Nano Digital hereby represents and warrants as follows:

PUBLIC VERSION

1. Nano Digital and/or its Affiliates¹ have imported into the United States, sold for importation into the United States and/or sold within the United States after importation, ink cartridges for use with Epson printers and components thereof that Epson alleges infringe one or more of the Epson patents (hereinafter, the "Accused Products").

2. The Accused Products include but are not limited to the products identified in Attachment A to this Agreement, which sets forth a non-exhaustive list of the model numbers of ink cartridges for use with Epson printers and components thereof that have been imported into the United States, sold for importation into the United States and/or sold within the United States after importation by Nano Digital and/or its Affiliates and that Epson alleges infringe one or more of the Epson patents.

3. The Accused Products include but are not limited to any ink cartridges and components thereof imported into the United States, sold for importation into the United States and/or sold within the United States after importation by Nano Digital and/or its Affiliates, that are substitutes for any of the Epson ink cartridge models identified in Attachment B to this Agreement.

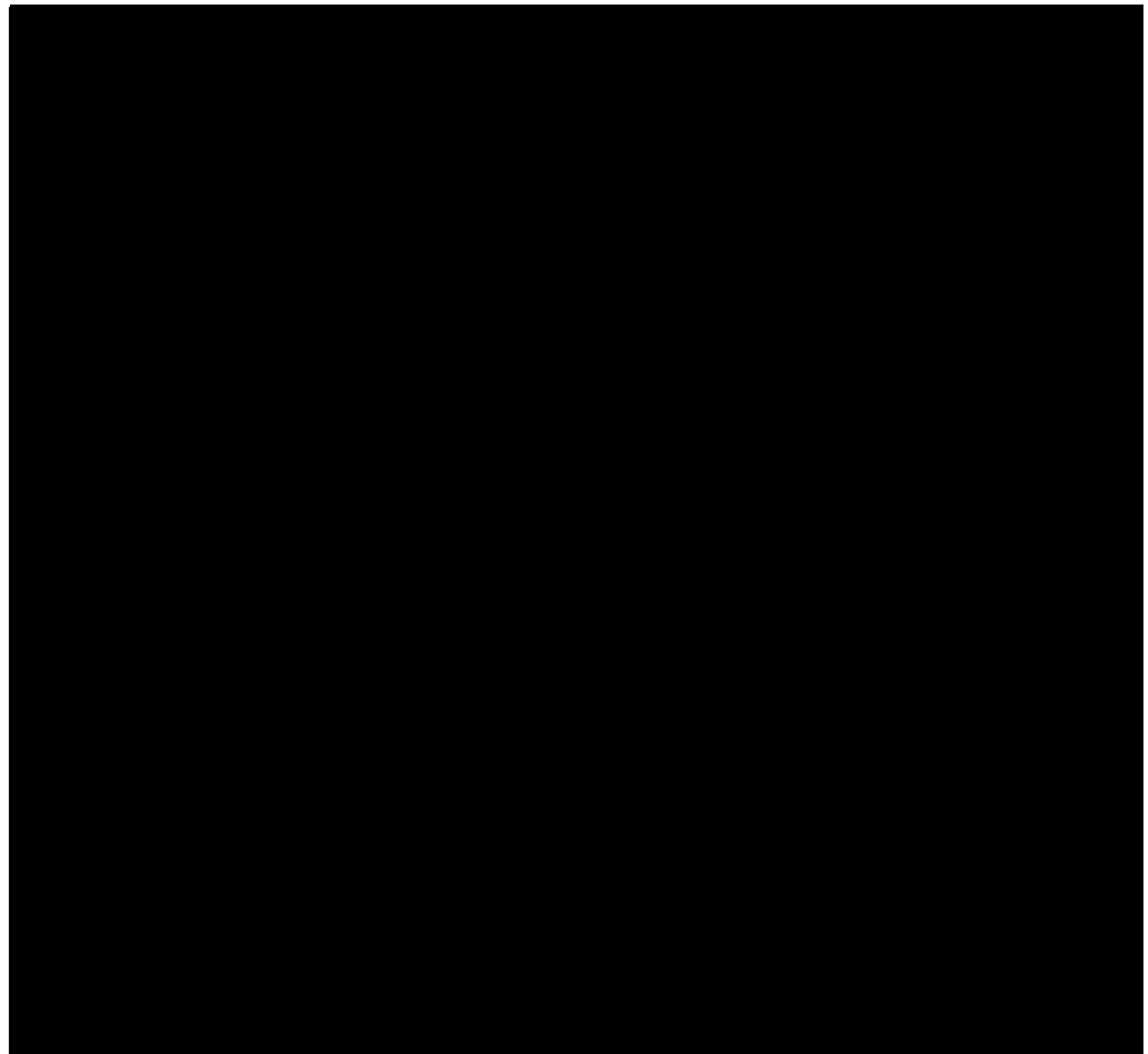
4. The Accused Products include but are not limited to any ink cartridges and components thereof imported into the United States, sold for importation into the United States and/or sold within the United States after importation by Nano Digital and/or its Affiliates, that are compatible with any of the Epson printer models identified in Attachment C to this Agreement.

5. The parties agree that ink, if sold alone, and not as part of an ink cartridge, ink supply system or component that Epson alleges infringes one or more of the Epson patents, is not an Accused Product.

¹ As referred to herein, "Affiliates" means any individuals or entities that, in whatever country organized or resident, directly, or indirectly through one or more intermediaries, control, are controlled by, or are under common control with, Nano Digital.

B. Undertakings

2. Nano Digital hereby agrees to execute the Consent Order Stipulation, in the form of Attachment D hereto, to be promptly filed along with a Motion to Terminate in the ITC Investigation. The terms of the Consent Order Stipulation are hereby incorporated by reference and the provisions thereof shall be considered terms of this Agreement.



III. Releases

1. Seiko Epson Corporation, Epson America, Inc. and Epson Portland Inc., jointly and severally, release and acquit Zhuhai Nano Digital Technology Co., Ltd., Nano Business & Technology, Inc., and their Affiliates, and their directors, officers, representatives, employees, attorneys and agents (the “Released Parties”) from any and all claims, causes of action, demands, damages, costs, attorneys' fees or other expenses of any kind, including claims for patent infringement of the Epson Patents, based upon or arising out of their importation or sale of Accused Products by Nano Digital at any time up to the Effective Date of this Agreement. This Release does not extend to anyone other than the Released Parties, nor does it authorize or license anyone to sell Accused Products, before or after the Effective date. Epson reserves the right to pursue its patent rights against any third-parties.

2. Zhuhai Nano Digital Technology Co., Ltd., Nano Business & Technology, Inc., and their Affiliates release Seiko Epson Corporation, Epson America, Inc. and Epson Portland Inc., and their respective directors, officers, representatives, employees, attorneys and agents, from any and all claims, counterclaims, causes of action, demands, damages, costs, attorneys' fees, or other expenses of any kind arising out of or relating to the Epson Patents, and/or the filing and prosecution of the ITC Investigation.

PUBLIC VERSION

IV. General Provisions

1. Each party shall bear its own costs related to this Agreement, including those arising from the ITC Investigation.

2. Each party represents that this Agreement has been duly executed and delivered by such party and that it constitutes a legal, valid and binding obligation of such party and that it is enforceable against such party in accordance with its terms.

3. Each individual signing this Agreement on behalf of a corporation or other entity represents and warrants that he has full power and authority for such corporation or entity to enter into this Agreement and to bind such corporation or entity to the terms hereof.

4. Nano Digital's admissions and representations contained in this Agreement shall continue without expiration date.

5. This Agreement shall be construed and enforced under and in accordance with the laws of the United States and the State of Oregon. Any dispute arising between the parties related to the making or performance of this Agreement shall be resolved by the United States District Court for the District of Oregon. Notwithstanding the foregoing, any action to enforce the terms of the ITC Consent Order attached hereto as Attachment D may be brought before the International Trade Commission or United States Customs and Border Protection.

6. In the event any action, motion, or other proceeding be instituted by a party to enforce any of the terms and provisions contained herein, the prevailing party in such action shall be entitled to reasonable attorneys' fees, other costs and expenses.

7. Each party hereby knowingly and voluntarily acknowledges that such party was not fraudulently or otherwise wrongfully induced to enter into this Agreement. Each party hereto acknowledges that, except as expressly specified herein, no other party, or agent or attorney of any other party, has made any promise, representation, or warranty, express or

PUBLIC VERSION

implied, concerning the subject matter hereof, whether to induce any party to execute this Agreement or otherwise, and each party acknowledges that it is not executing this Agreement, or any document or instrument provided for herein, in reliance on any promise, representation or warranty not contained in this Agreement or in any such instrument.

8. This Agreement may be changed, modified or amended only by an instrument in writing duly executed by each of the parties hereto.

9. This Agreement and the terms of this Agreement are confidential and shall not be disclosed to anyone except as provided herein. This Agreement and the terms of this Agreement may only be disclosed: (i) as required by law; (ii) as ordered by a court; (iii) In the ITC Investigation, in connection with a motion to terminate it as to Nano Digital, based upon a Consent Order; or (iv) in any action involving a party hereto to enforce this Agreement or any aspect of it, or to invoke any rights or benefits conferred by or under it.

10. This Agreement, and the attachments, injunctions, judgments and orders provided for herein, contain the entire agreement and understanding concerning the subject matter hereof between the parties hereto, and shall supersede and replace and are substituted for any and all prior negotiations, agreements, and proposed agreements, written or oral, concerning the subject matter hereto.

11. The failure of any party to insist upon strict performance of any obligation of another party hereunder, irrespective of the length of time for which such failure continues, shall not be a waiver of its right to demand strict compliance in the future. No consent or waiver, expressed or implied by any party to or of any breach or default in the performance of any obligation hereunder by another party shall constitute a consent or waiver to or of any other breach or default in the performance of the same or any obligation hereunder.

12. This Agreement and any of the rights and obligations thereof are fully assignable by Seiko Epson, Epson America and Epson Portland. This Agreement and any of

PUBLIC VERSION

the rights and obligations set forth herein may not be assigned or otherwise transferred by Nano Digital without the prior written consent of Seiko Epson.

13. All notices required or permitted to be made or given pursuant to this Agreement shall be in writing and sent by first class mail, postage prepaid, and addressed to the last known address set forth below. Notices sent by Registered or Certified mail, Return Receipt Requested, shall be presumed to have been received.

If to Seiko Epson, Epson America and/or Epson Portland:

Mr. Timothy Smith
Intellectual Property Division
SEIKO EPSON CORPORATION
80 Harashinden, Hirooka,
Shiojiri, Nagano 399-0785
Telephone: 81 263-52-2552
Facsimile: 81-263-52-4764

Alf Anderson, Esq.
Assistant General Counsel
Epson America, Inc.
3840 Kilroy Airport Way
Long Beach, California 90806
Telephone: 562-290-4306
Facsimile: 562-290-4313

Harold A. Barza, Esq. & Tigran Guledjian, Esq.
Quinn Emanuel Urquhart & Sullivan, LLP
865 S. Figueroa Street, 10th Floor
Los Angeles, California 90017
Telephone: 213-443-3000
Facsimile: 213-443-3100

If to Nano Digital:

Jie Wang, Ph.D.
CEO, President
Zhuhai Nano Digital Technology Co. Ltd.
3 Pingxi 5th Road, Nanping Hi-Tech Industrial Park
Zhuhai, Guangdong 519060, China
Telephone: 503-664-4038
Facsimile: 86 756-696-9369

Jie Wang, Ph.D.
CEO, President

PUBLIC VERSION

Nano Business and Technology, Inc.
4287 SE International Way, Suite C
Milwaukie, OR 97222
Telephone: 503-664-4038
Facsimile: 86 756-696-9369

14. The headings used in this Agreement are for convenient reference only and shall not be used to interpret this Agreement.

15. This Agreement may be executed in multiple counterparts, each of which shall be deemed an original and all of which will constitute but one and the same instrument. Photocopy signatures and facsimile signatures will be deemed originals.

16. This Agreement shall be binding upon and inure to the benefit of the parties hereto, and their successors and permitted assignees. Except as aforesaid and as set forth in Section III above, and except to the extent persons or entities have been released hereunder, this Agreement shall not be deemed to confer any rights upon, or obligate the parties hereto, to any person or entity not a party hereto.

17. Each of the parties agrees to execute such additional documents and do or perform such further acts or things that shall be reasonably necessary or appropriate to give full effect to all of the purposes and provisions of this Agreement.

18. Each of the parties hereto represents that it has read and that it understands the provisions of this Agreement, has received advice with respect thereto from independent counsel of its own choice, has signed the Agreement and the other documents contemplated herein, freely and without duress, and that it has fully authority to execute the same. For the purpose of resolving any disputes arising out of this Agreement, this Agreement shall be deemed to have been drafted by all of the parties hereto.

IN WITNESS WHEREOF, this Agreement has been executed as of the date set forth above.

PUBLIC VERSION

SEIKO EPSON CORPORATION

By: 井上茂樹

Name: Shigeki Inoue

Title: Managing Director

Intellectual Property Division

Seiko Epson Corporation

EPSON AMERICA, INC.

By: _____

Name: _____

Title: _____

EPSON PORTLAND INC.

By: Randal A. McEvers

Name: Randal A. McEvers

Title: Executive Director

ZHUHAI NANO DIGITAL TECHNOLOGY CO., LTD.

By: Jie Wang

Name: JIE WANG

Title: CEO, President

PUBLIC VERSION

SEIKO EPSON CORPORATION

By: 

Name: Shigeki Inoue

Title: Managing Director

Intellectual Property Division

Seiko Epson Corporation

EPSON AMERICA, INC.

By: 

Name: Andrea Zoeckler

Title: Senior Vice President, CFO

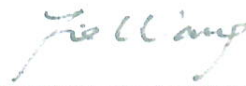
EPSON PORTLAND INC.

By: _____

Name: _____

Title: _____

ZHUHAI NANO DIGITAL TECHNOLOGY CO., LTD.

By: 

Name: JIE WANG

Title: CEO, President

PUBLIC VERSION

NANO BUSINESS & TECHNOLOGY, INC.

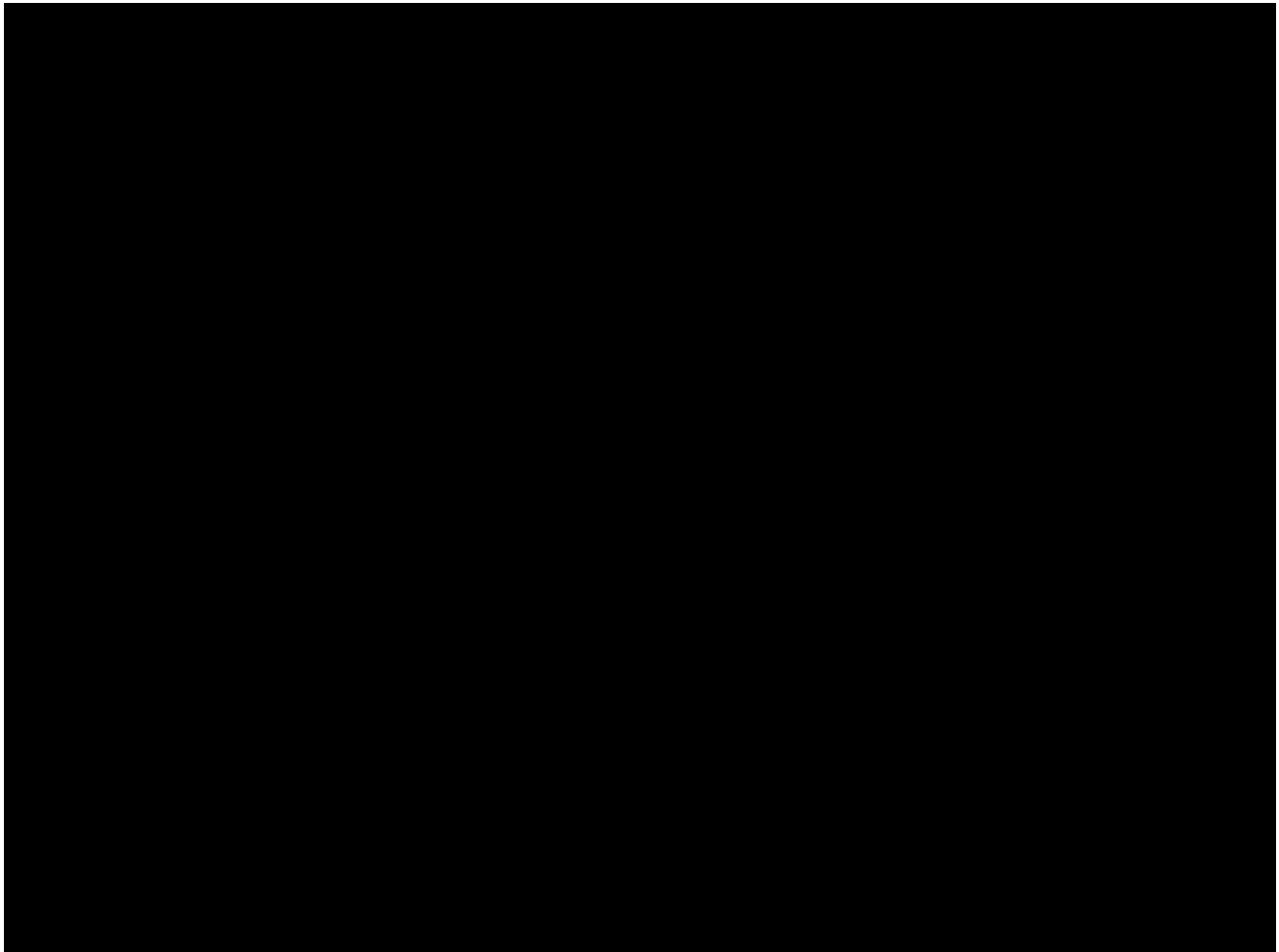
By 

Name: JIE WANG

Title: CEO, President

PUBLIC VERSION

ATTACHMENT A



PUBLIC VERSION

ATTACHMENT B

T200120	T689100	T710100
T200220	T689200	T710200
T200320	T689300	T710300
T200420	T689400	T710400
T200XL120	T692100	T710500
T200XL220	T692200	T710600
T200XL320	T692300	T676120
T200XL420	T692400	T676220
T223120	T692500	T676320
T223XL120	T693100	T676420
T252120	T693200	T711XXL120
T252220	T693300	T711XXL200
T252320	T693400	T711XXL320
T252420	T693500	T711XXL420
T252XL120	T694100	T786120
T252XL220	T694200	T786220
T252XL320	T694300	T786320
T252XL420	T694400	T786420
T254XL120	T694500	T786XL120
T273020	T715100	T786XL220
T273120	T715200	T786XL320
T273220	T715300	T786XL420
T273320	T715400	T068120
T273420	T715500	T068220
T273XL020	T715600	T068320
T273XL120	T715700	T068420
T273XL220	T715800	T069120
T273XL320	T715A00	T069220
T273XL420	T715A00	T069320
T277120	T715B00	T069420
T277220	T715B00	T077120
T277320	T725100	T077220
T277420	T725200	T077320
T277520	T725300	T077420
T277620	T725400	T077520
T277XL120	T725A00	T077620
T277XL220	T730100	T078120
T277XL320	T730200	T078220
T277XL420	T730300	T078320
T277XL520	T730400	T078420
T277XL620	T730A00	T078520
T596100	T591100	T078620
T596200	T591200	T079120
T596300	T591300	T079220

PUBLIC VERSION

T596400	T591400	T079320
T596500	T591500	T079420
T596600	T591600	T079520
T596700	T591700	T079620
T596800	T591800	T087020
T596900	T591900	T087120
T596A00	T124120	T087220
T596B00	T124220	T087320
T596C00	T124320	T087420
T636100	T124420	T087720
T636200	T125120	T087820
T636300	T125220	T087920
T636400	T125320	T088120
T636500	T125420	T088220
T636600	T126120	T088320
T636700	T126220	T088420
T636800	T126320	T096120
T636900	T126420	T096220
T636A00	T127120	T096320
T636B00	T127220	T096420
T642100	T127320	T096520
T642200	T127420	T096620
T642300	T157120	T096720
T642400	T157220	T096820
T642500	T157320	T096920
T642600	T157420	T097120
T642700	T157520	T098120
T642800	T157620	T098220
T642900	T157720	T098320
T642A00	T157820	T098420
T642B00	T157920	T098520
T642C00	T159020	T098620
T653100	T159120	T099220
T653200	T159220	T099320
T653300	T159320	T099420
T653400	T159420	T099520
T653500	T159720	T099620
T653600	T159820	T653900
T653700	T159920	T653A00
T653800		T653B00

PUBLIC VERSION

ATTACHMENT C

Expression Home XP-200	Expression XP-820	WorkForce WF-2520
Expression Home XP-300	Sure Lab D3000	WorkForce WF-2530
Expression Home XP-310	SureColor F2000	WorkForce WF-2540
Expression Home XP-400	SureColor S30670	WorkForce WF-3620
Expression Home XP-410	SureColor S50670	WorkForce WF-3640
Expression Photo XP-850	SureColor S70670	WorkForce WF-7110
Expression Photo XP-860	SureColor T3000	WorkForce WF-7610
Expression Premium XP-520	SureColor T3270	WorkForce WF-7620
Expression Premium XP-600	SureColor T5000	WorkForce WF-M1030
Expression Premium XP-610	SureColor T5270	WorkForce WF-M1560
Expression Premium XP-620	SureColor T5270D	WorkForce Pro WP-4010
Expression Premium XP-800	SureColor T7000	WorkForce Pro WP-4020
Expression Premium XP-810	SureColor T7270	WorkForce Pro WP-4023
Expression Premium XP-950	SureColor T7270D	WorkForce Pro WP-4520
Artisan 50	Stylus N10	WorkForce Pro WP-4533
Artisan 700	Stylus N11	WorkForce Pro WP-4590
Artisan 710	Stylus NX 110	WorkForce Pro WP-4090
Artisan 725	Stylus NX 115	WorkForce Pro WP-4530
Artisan 730	Stylus NX100	WorkForce Pro WP-4540
Artisan 800	Stylus NX105	WorkForce Pro WF-4630
Artisan 810	Stylus NX200	WorkForce Pro WF-4640
Artisan 835	Stylus NX215	WorkForce Pro WF-5110
Artisan 837	Stylus NX300	WorkForce Pro WF-5190
Artisan 1430	Stylus NX305	WorkForce Pro WF-5620
Stylus C120	Stylus NX400	WorkForce Pro WF-5690
Stylus CX4400	Stylus NX415	Stylus Photo RX580
Stylus CX4450	Stylus NX510	Stylus Photo RX595
Stylus CX5000	Stylus NX515	Stylus Photo RX680
Stylus CX6000	Stylus Photo 1400	Stylus Pro 7700
Stylus CX7000F	Stylus Photo R260	Stylus Pro 7890
Stylus CX7450	Stylus Photo R280	Stylus Pro 7900
Stylus CX8400	Stylus Photo R380	Stylus Pro 9700
Stylus CX9400Fax	Stylus Photo R1900	Stylus Pro 9890
Stylus CX9475Fax	Stylus Photo R2880	Stylus Pro 9900
Stylus NX125	WorkForce 435	Stylus Pro WT7900
Stylus NX127	WorkForce 520	Stylus Pro 11880
Stylus NX130	WorkForce 545	WorkForce 30
Stylus NX230	WorkForce 630	WorkForce 40
Stylus NX330	WorkForce 633	WorkForce 310
Stylus NX420	WorkForce 635	WorkForce 315
Stylus NX430	WorkForce 645	WorkForce 500
Stylus NX530	WorkForce 840	WorkForce 600
Stylus NX625	WorkForce 845	WorkForce 610
Stylus Photo R2000	WorkForce WF-3520	WorkForce 615

PUBLIC VERSION

Stylus Photo R3000	WorkForce WF-3530	WorkForce 1100
Stylus Pro 4900	WorkForce WF-3540	WorkForce 323
WorkForce 60	WorkForce WF-7010	WorkForce 325
WorkForce 320	WorkForce WF-7510	WorkForce WF-7520

PUBLIC VERSION
ATTACHMENT D

UNITED STATES INTERNATIONAL TRADE COMMISSION
WASHINGTON, D.C.

Before the Honorable Dee Lord
Administrative Law Judge

In the Matter of

CERTAIN INK CARTRIDGES AND
COMPONENTS THEREOF

Investigation No. 337-TA-946

CONSENT ORDER STIPULATION

WHEREAS, the United States International Trade Commission on January 21, 2015 (80 *Fed. Reg.* 4313 (January 27, 2015)), instituted the above-captioned investigation under Section 337 of the Tariff Act of 1930, as amended, (19 U.S.C. § 1337) based upon the allegations contained in the complaint and amended complaint filed by Complainants Epson Portland Inc., Epson America, Inc. and Seiko Epson Corporation (collectively, "Complainants"), which allege unfair acts in the importation into the United States, the sale for importation and the sale within the United States after importation of certain ink cartridges and components thereof, by, among others, Respondents Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc. (collectively, "Nano Digital");

WHEREAS, Nano Digital is willing to accept entry of the Consent Order submitted concurrently herewith by the International Trade Commission and agrees to all waivers and other provisions as required by 19 C.F.R. § 210.21; and

WHEREAS, Nano Digital agrees to all terms set forth in the Consent Order.

PUBLIC VERSION

IT IS HEREBY STIPULATED by Nano Digital in support of the Joint Motion for an Order Terminating the Investigation as to Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc. by Entry of a Consent Order as follows:

1. The Commission has *in rem* jurisdiction over the accused ink cartridges and components thereof that are the subject of the amended complaint in this investigation. The Commission also has *in personam* jurisdiction over Nano Digital for purposes of this Stipulation and the proposed Consent Order by virtue of Nano Digital's having appeared through counsel in this proceeding. Nothing in this Stipulation or the proposed Consent Order shall be construed as meaning that Nano Digital has submitted to the jurisdiction of any other court.

2. Nano Digital expressly waives all right to seek judicial review or otherwise challenge the validity of the Consent Order.

3. Nano Digital will cooperate with and will not seek to impede by litigation or other means the Commission's efforts to gather information under Subpart I of the Commission's Rules of Practice and Procedure, 19 C.F.R. Subchapter C, Part 210.

4. The enforcement, modification and revocation of the Consent Order will be carried out pursuant to Subpart I of the Commission's Rules of Practice and Procedure, 19 C.F.R. Subchapter C, Part 210.

5. The Consent Order shall not apply with respect to any claim of an intellectual property right that has expired or been found or adjudicated invalid or unenforceable by the Commission or a court or agency of competent jurisdiction, provided that such finding or judgment has become final and nonreviewable.

PUBLIC VERSION

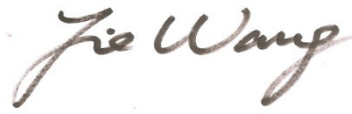
6. Nano Digital will not seek to challenge the validity or enforceability of the patents that form the basis for the complaint and amended complaint in any administrative or judicial proceeding to enforce the Consent Order.

7. This Consent Order Stipulation and Consent Order are in the public interest.
Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc.

IT IS SO STIPULATED.

Date: June 12, 2015

ZHUHAI NANO DIGITAL
TECHNOLOGY CO., LTD.

By: 
JIE WANG, CEO, President

Date: June 12, 2015

NANO BUSINESS & TECHNOLOGY,
INC.

By: 
JIE WANG, CEO, President

PUBLIC VERSION

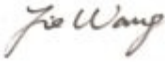
AGREEMENT TO SUBSTITUTE A NEW EXHIBIT D TO SETTLEMENT AGREEMENT

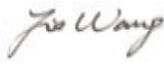
Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc. hereby agree that the Amended Stipulation for Consent Order sent to them with this email shall be substituted for the Exhibit D Stipulation for Consent Order attached to that certain Settlement Agreement between Seiko Epson Corporation, Epson America, Inc. and Epson Portland Inc., on the one hand, and hand, and Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc., on the other hand, effective as of June 12, 2015, and that such Settlement Agreement remains in full force and effect with this modification.

Agreed to,

Zuhau Nano Digital Technology Co., Ltd,

Nano Business and Technology, Inc.,

BY 
Its: CEO, President

By: 
Its: CEO, President

PUBLIC VERSION
ATTACHMENT D

UNITED STATES INTERNATIONAL TRADE COMMISSION
WASHINGTON, D.C.

Before the Honorable Dee Lord
Administrative Law Judge

In the Matter of

CERTAIN INK CARTRIDGES AND
COMPONENTS THEREOF

Investigation No. 337-TA-946

AMENDED CONSENT ORDER STIPULATION

WHEREAS, the United States International Trade Commission on January 21, 2015 (80 *Fed. Reg.* 4313 (January 27, 2015)), instituted the above-captioned investigation under Section 337 of the Tariff Act of 1930, as amended, (19 U.S.C. § 1337) based upon the allegations contained in the complaint filed by Complainants Epson Portland Inc., Epson America, Inc. and Seiko Epson Corporation (collectively, "Complainants"), which allege unfair acts in the importation into the United States, the sale for importation and the sale within the United States after importation of certain ink cartridges and components thereof, by, among others, Respondents Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc. (collectively, "Nano Digital"), in violation of Section 337 with respect to claims 1, 4 and 10 of United States Patent No. 8,366,233 (the "'233 patent"), claims 1, 5, 9, 14, 16, 18, 21, 24, 25 and 28 of United States Patent No. 8,454,116 (the "'116 patent"), claims 1, 3, 14, 15, 17, 18, 20, 30, 36, 49, 60 and 61 of United States Patent No. 8,794,749 (the "'749 patent"), claims 1, 6 and 13 of United States Patent No. 8,801,163 (the "'163 patent"), and/or claims 1, 3, 7, 14, 15 and 19 of United States Patent No. 8,882,513 (the "'513 patent");

PUBLIC VERSION

WHEREAS, Nano Digital is willing to accept entry of the Consent Order submitted concurrently herewith by the International Trade Commission and agrees to all waivers and other provisions as required by 19 C.F.R. § 210.21; and

WHEREAS, Nano Digital agrees to all terms set forth in the Consent Order.

IT IS HEREBY STIPULATED by Nano Digital in support of the Joint Motion for an Order Terminating the Investigation as to Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc. by Entry of a Consent Order as follows:

1. The Commission has subject matter jurisdiction over this investigation. The Commission has *in rem* jurisdiction over the accused ink cartridges and components thereof that are the subject of the complaint in this investigation. The Commission also has *in personam* jurisdiction over Nano Digital for purposes of this Stipulation and the proposed Consent Order by virtue of Nano Digital's having appeared in this proceeding. Nothing in this Stipulation or the proposed Consent Order shall be construed as meaning that Nano Digital has submitted to the jurisdiction of any other court.

2. Nano Digital, including its officers, directors, employees, agents, and any entity or individual acting on its behalf and with its authority, agrees, upon entry of the Consent Order, that it will not sell for importation, import into the United States or sell in the United States after importation, directly or indirectly, or aid, abet, encourage, participate in, or induce the sale for importation, importation into the United States or sale in the United States after importation of ink cartridges or components thereof that infringe claims 1, 4 and 10 of the '233 patent, claims 1, 5, 9, 14, 16, 18, 21, 24, 25 and 28 of the '116 patent, claims 1, 3, 14, 15, 17, 18, 20, 30, 36, 49, 60 and 61 of the '749 patent, claims 1, 6 and 13 of the '163 patent, and/or claims 1, 3, 7, 14, 15 and 19 of the '513 patent.

PUBLIC VERSION

3. Nano Digital does not have any existing U.S. inventories of accused ink cartridges or components thereof.

4. Nano Digital expressly waives all right to seek judicial review or otherwise challenge the validity of the Consent Order.

5. Nano Digital will cooperate with and will not seek to impede by litigation or other means the Commission's efforts to gather information under Subpart I of the Commission's Rules of Practice and Procedure, 19 C.F.R. Subchapter C, Part 210.

6. The enforcement, modification and revocation of the Consent Order will be carried out pursuant to Subpart I of the Commission's Rules of Practice and Procedure, 19 C.F.R. Subchapter C, Part 210.

7. The signing of this Stipulation is for settlement purposes only and does not constitute admission by Nano Digital that an unfair act has been committed.

8. The Consent Order shall have the same force and effect and may be enforced, modified, or revoked in the same manner as is provided in section 337 of the Tariff Act of 1930 and this part for other Commission actions, and the Commission may require periodic compliance reports pursuant to subpart I of this part to be submitted by Nano Digital.

9. The Consent Order shall not apply with respect to any claim of an intellectual property right that has expired or been found or adjudicated invalid or unenforceable by the Commission or a court or agency of competent jurisdiction, provided that such finding or judgment has become final and nonreviewable.

10. Nano Digital will not seek to challenge the validity or enforceability of the patents that form the basis for the complaint in any administrative or judicial proceeding to enforce the Consent Order.

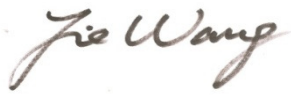
PUBLIC VERSION

11. This Consent Order Stipulation and Consent Order are in the public interest.

IT IS SO STIPULATED.

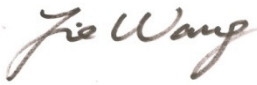
Date: June 24, 2015

ZHUHAI NANO DIGITAL
TECHNOLOGY CO., LTD.

By: 
Its: CEO, President

Date: June 24, 2015

NANO BUSINESS & TECHNOLOGY,
INC.

By: 
Its: CEO, President

PUBLIC VERSION

EXHIBIT 2

PUBLIC VERSION

UNITED STATES INTERNATIONAL TRADE COMMISSION
WASHINGTON, D.C.

Before the Honorable Dee Lord
Administrative Law Judge

In the Matter of

CERTAIN INK CARTRIDGES AND
COMPONENTS THEREOF

Investigation No. 337-TA-946

AMENDED CONSENT ORDER STIPULATION

WHEREAS, the United States International Trade Commission on January 21, 2015 (80 *Fed. Reg.* 4313 (January 27, 2015)), instituted the above-captioned investigation under Section 337 of the Tariff Act of 1930, as amended, (19 U.S.C. § 1337) based upon the allegations contained in the complaint filed by Complainants Epson Portland Inc., Epson America, Inc. and Seiko Epson Corporation (collectively, "Complainants"), which allege unfair acts in the importation into the United States, the sale for importation and the sale within the United States after importation of certain ink cartridges and components thereof, by, among others, Respondents Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc. (collectively, "Nano Digital"), in violation of Section 337 with respect to claims 1, 4 and 10 of United States Patent No. 8,366,233 (the "'233 patent"), claims 1, 5, 9, 14, 16, 18, 21, 24, 25 and 28 of United States Patent No. 8,454,116 (the "'116 patent"), claims 1, 3, 14, 15, 17, 18, 20, 30, 36, 49, 60 and 61 of United States Patent No. 8,794,749 (the "'749 patent"), claims 1, 6 and 13 of United States Patent No. 8,801,163 (the "'163 patent"), and/or claims 1, 3, 7, 14, 15 and 19 of United States Patent No. 8,882,513 (the "'513 patent");

PUBLIC VERSION

WHEREAS, Nano Digital is willing to accept entry of the Consent Order submitted concurrently herewith by the International Trade Commission and agrees to all waivers and other provisions as required by 19 C.F.R. § 210.21; and

WHEREAS, Nano Digital agrees to all terms set forth in the Consent Order.

IT IS HEREBY STIPULATED by Nano Digital in support of the Joint Motion for an Order Terminating the Investigation as to Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc. by Entry of a Consent Order as follows:

1. The Commission has subject matter jurisdiction over this investigation. The Commission has *in rem* jurisdiction over the accused ink cartridges and components thereof that are the subject of the complaint in this investigation. The Commission also has *in personam* jurisdiction over Nano Digital for purposes of this Stipulation and the proposed Consent Order by virtue of Nano Digital's having appeared in this proceeding. Nothing in this Stipulation or the proposed Consent Order shall be construed as meaning that Nano Digital has submitted to the jurisdiction of any other court.

2. Nano Digital, including its officers, directors, employees, agents, and any entity or individual acting on its behalf and with its authority, agrees, upon entry of the Consent Order, that it will not sell for importation, import into the United States or sell in the United States after importation, directly or indirectly, or aid, abet, encourage, participate in, or induce the sale for importation, importation into the United States or sale in the United States after importation of ink cartridges or components thereof that infringe claims 1, 4 and 10 of the '233 patent, claims 1, 5, 9, 14, 16, 18, 21, 24, 25 and 28 of the '116 patent, claims 1, 3, 14, 15, 17, 18, 20, 30, 36, 49, 60 and 61 of the '749 patent, claims 1, 6 and 13 of the '163 patent, and/or claims 1, 3, 7, 14, 15 and 19 of the '513 patent.

PUBLIC VERSION

3. Nano Digital does not have any existing U.S. inventories of accused ink cartridges or components thereof.

4. Nano Digital expressly waives all right to seek judicial review or otherwise challenge the validity of the Consent Order.

5. Nano Digital will cooperate with and will not seek to impede by litigation or other means the Commission's efforts to gather information under Subpart I of the Commission's Rules of Practice and Procedure, 19 C.F.R. Subchapter C, Part 210.

6. The enforcement, modification and revocation of the Consent Order will be carried out pursuant to Subpart I of the Commission's Rules of Practice and Procedure, 19 C.F.R. Subchapter C, Part 210.

7. The signing of this Stipulation is for settlement purposes only and does not constitute admission by Nano Digital that an unfair act has been committed.

8. The Consent Order shall have the same force and effect and may be enforced, modified, or revoked in the same manner as is provided in section 337 of the Tariff Act of 1930 and this part for other Commission actions, and the Commission may require periodic compliance reports pursuant to subpart I of this part to be submitted by Nano Digital.

9. The Consent Order shall not apply with respect to any claim of an intellectual property right that has expired or been found or adjudicated invalid or unenforceable by the Commission or a court or agency of competent jurisdiction, provided that such finding or judgment has become final and nonreviewable.

10. Nano Digital will not seek to challenge the validity or enforceability of the patents that form the basis for the complaint in any administrative or judicial proceeding to enforce the Consent Order.

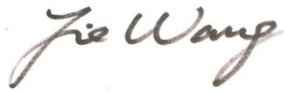
PUBLIC VERSION

11. This Consent Order Stipulation and Consent Order are in the public interest.

IT IS SO STIPULATED.

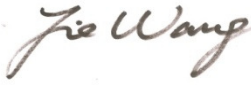
Date: June 24, 2015

ZHUHAI NANO DIGITAL
TECHNOLOGY CO., LTD.

By: 
Its: CEO, President

Date: June 24, 2015

NANO BUSINESS & TECHNOLOGY,
INC.

By: 
Its: CEO, President

PUBLIC VERSION

EXHIBIT 3

PUBLIC VERSION

UNITED STATES INTERNATIONAL TRADE COMMISSION
WASHINGTON, D.C.

Before the Honorable Dee Lord
Administrative Law Judge

In the Matter of

CERTAIN INK CARTRIDGES AND
COMPONENTS THEREOF

Investigation No. 337-TA-946

AMENDED [PROPOSED] CONSENT ORDER

The United States International Trade Commission on January 21, 2015 (80 *Fed. Reg.* 4313 (January 27, 2015)), instituted the above-captioned investigation under Section 337 of the Tariff Act of 1930, as amended, (19 U.S.C. § 1337) naming numerous respondents, including Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc. (collectively, "Nano Digital"), based upon the allegations contained in the complaint filed by Complainants Epson Portland Inc., Epson America, Inc. and Seiko Epson Corporation (collectively, "Complainants" or "Epson") that allege unfair acts in the importation into the United States, the sale for importation, and the sale within the United States after importation of certain ink cartridges and components thereof in violation of Section 337 with respect to claims 1, 4 and 10 of United States Patent No. 8,366,233 (the "'233 patent"), claims 1, 5, 9, 14, 16, 18, 21, 24, 25 and 28 of United States Patent No. 8,454,116 (the "'116 patent"), claims 1, 3, 14, 15, 17, 18, 20, 30, 36, 49, 60 and 61 of United States Patent No. 8,794,749 (the "'749 patent"), claims 1, 6 and 13 of United States Patent No. 8,801,163 (the "'163 patent"), and/or claims 1, 3, 7, 14, 15 and 19 of United States Patent No. 8,882,513 (the "'513 patent").

Nano Digital has executed a Consent Order Stipulation in which it agrees to the entry of this Consent Order and to all waivers and other provisions as required by Commission Rule of Practice

PUBLIC VERSION

and Procedure 210.21(c) (19 C.F.R. § 210.21(c)). Complainants and Nano Digital have filed a Joint Motion to Terminate the Investigation as to Respondents Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc. based on a Consent Order.

IT IS HEREBY ORDERED THAT:

1. Upon the entry of this Consent Order, Nano Digital shall not sell for importation, import into the United States or sell in the United States after importation, directly or indirectly, or aid, abet, encourage, participate in, or induce the sale for importation, importation into the United States or sale in the United States after importation of ink cartridges or components thereof that infringe claims 1, 4 and 10 of the '233 patent, claims 1, 5, 9, 14, 16, 18, 21, 24, 25 and 28 of the '116 patent, claims 1, 3, 14, 15, 17, 18, 20, 30, 36, 49, 60 and 61 of the '749 patent, claims 1, 6 and 13 of the '163 patent, and/or claims 1, 3, 7, 14, 15 and 19 of the '513 patent, except under consent or license from Complainants.

2. This Consent Order shall be applicable to and binding upon Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc., their officers, directors, agents, servants, attorneys, employees, affiliates, and all persons, firms, or corporations acting or claiming to act on its behalf or under its direction or authority.

3. Nano Digital shall be precluded from seeking judicial review or otherwise challenging or contesting the validity of this Consent Order.

4. Nano Digital shall cooperate with and shall not seek to impede by litigation or other means the Commission's efforts to gather information under Subpart I of the Commission's Rules of Practice and Procedure, 19 C.F.R. Part 210.

PUBLIC VERSION

5. Nano Digital and its officers, directors, employees, agents, and any entity or individual acting on its behalf and with its authority shall not seek to challenge the validity or enforceability of the claims of the '233, '116, '749, '163 and '513 patents in any administrative or judicial proceeding to enforce the Consent Order.

6. When any of the '233, '116, '749, '163 and '513 patents expires, this Consent Order shall become null and void as to such expired patent.

7. This Consent Order shall become null and void as to any claim of any intellectual property right that is held invalid or unenforceable by a court or agency of competent jurisdiction or as to any article that has been found or adjudicated not to infringe the asserted right in a final decision, no longer subject to appeal.

8. This investigation is hereby terminated with respect to Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc.; provided, however, that enforcement, modification, or revocation of the Consent Order shall be carried out pursuant to Subpart I of the Commission's Rules of Practice and Procedure, 19 C.F.R. part 210.

By Order of the Commission

Secretary to the Commission

Issued: _____, 2015

CERTAIN INK CARTRIDGES AND COMPONENTS THEREOF**Inv. No. 337-TA-946****CERTIFICATE OF SERVICE**

I, Daniil Chernichenko, hereby certify that on June 25, 2015, copies of the foregoing document were served upon the following parties as indicated:

The Honorable Lisa R. Barton Acting Secretary U.S. International Trade Commission 500 E Street, SW Washington, D.C. 20436	<input type="checkbox"/> Via First Class Mail <input checked="" type="checkbox"/> Via Hand Delivery (2 copies) <input type="checkbox"/> Via Overnight Courier <input type="checkbox"/> Via Electronic Mail <input checked="" type="checkbox"/> Via EDIS
The Honorable Dee Lord Administrative Law Judge U.S. International Trade Commission 500 E Street, SW Washington, D.C. 20436 Email: Edward.Jou@usitc.gov	<input type="checkbox"/> Via First Class Mail <input checked="" type="checkbox"/> Via Hand Delivery (2 copies) <input type="checkbox"/> Via Overnight Courier <input checked="" type="checkbox"/> Via Electronic Mail
Brian Koo Office of Unfair Import Investigations U.S. International Trade Commission 500 E Street, SW Washington, D.C. 20436 Email: Brian.Koo@usitc.gov	<input type="checkbox"/> Via First Class Mail <input type="checkbox"/> Via Hand Delivery <input type="checkbox"/> Via Overnight Courier <input checked="" type="checkbox"/> Via Electronic Mail
Zhuhai Nano Digital Technology Co., Ltd. No. 3 Factory Building, 2/F 3 Pingxi 5 th Road Nanping State Hi-Tech Park Zhuhai, Guangdong China 519060 Email: wang_j@nanodigitalinkjet.com	<input checked="" type="checkbox"/> Via FedEx <input type="checkbox"/> Via Hand Delivery <input type="checkbox"/> Via Overnight Courier <input checked="" type="checkbox"/> Via Electronic Mail
Nano Business & Technology, Inc., d/b/a Nano Digital, d/b/a Nano Ink Spot, d/b/a Dinsink 650 North State Street Lake Oswego, OR 97034 USA Email: wang_j@nanodigitalinkjet.com	<input checked="" type="checkbox"/> Via FedEx <input type="checkbox"/> Via Hand Delivery <input type="checkbox"/> Via Overnight Courier <input checked="" type="checkbox"/> Via Electronic Mail
Zhuhai National Resources & Jingjie Imaging Products Co., Ltd., d/b/a Ink-Tank Workshop 2, 1-3/F, No. 3 Qingwan 3 rd Rd. Qingwan Industrial Zone, Zhuhai, Guangdong China 519040	<input checked="" type="checkbox"/> Via FedEx <input type="checkbox"/> Via Hand Delivery <input type="checkbox"/> Via Overnight Courier <input type="checkbox"/> Via Electronic Mail
Huebon Co., Ltd. Room 1207, Wing Tuck Commercial Centre	<input checked="" type="checkbox"/> Via FedEx <input type="checkbox"/> Via Hand Delivery

CERTAIN INK CARTRIDGES AND COMPONENTS THEREOF**Inv. No. 337-TA-946**

177-183 Wing Lok Street Sheung Wan, Hong Kong	<input type="checkbox"/> Via Overnight Courier <input type="checkbox"/> Via Electronic Mail
Chancen Co., Ltd. Room 1207, Wing Tuck Commercial Centre 177-183 Wing Lok Street Sheung Wan, Hong Kong China	<input checked="" type="checkbox"/> Via FedEx <input type="checkbox"/> Via Hand Delivery <input type="checkbox"/> Via Overnight Courier <input type="checkbox"/> Via Electronic Mail
Zhuhai Rich Imaging Technology Co., Ltd. Block 1, 3-5/F 3Qingwan 3 rd Rd. Qingwan Industrial Zone Sanzao, Zhuhai, Guangdong China 519040	<input checked="" type="checkbox"/> Via FedEx <input type="checkbox"/> Via Hand Delivery <input type="checkbox"/> Via Overnight Courier <input type="checkbox"/> Via Electronic Mail
Shanghai Orink Infotech International Co., Ltd. Room 307 No. 275-8 East Guoding Road Shanghai China 200433	<input checked="" type="checkbox"/> Via FedEx <input type="checkbox"/> Via Hand Delivery <input type="checkbox"/> Via Overnight Courier <input type="checkbox"/> Via Electronic Mail
Orink Infotech International Co., Ltd. Unit 1205, 12 F/L Sino Plaza, 255 Gloucester Road Causeway Bay, Hong Kong China	<input checked="" type="checkbox"/> Via FedEx <input type="checkbox"/> Via Hand Delivery <input type="checkbox"/> Via Overnight Courier <input type="checkbox"/> Via Electronic Mail
Ourway Image Co., Ltd., Room 403, 4/F Rirong Edifice, Building 5 No. 291 Remin West Road Xiangzhou, Zhuhai, China	<input checked="" type="checkbox"/> Via FedEx <input type="checkbox"/> Via Hand Delivery <input type="checkbox"/> Via Overnight Courier <input type="checkbox"/> Via Electronic Mail
Zinyaw LLC, d/b/a TonerPirate.com 1321 Upland Dr. #1359 Houston, TX 77043 USA	<input checked="" type="checkbox"/> Via FedEx <input type="checkbox"/> Via Hand Delivery <input type="checkbox"/> Via Overnight Courier <input type="checkbox"/> Via Electronic Mail
Yotat Group Co., Ltd. Flat/Room 704, Bright Way Tower 33 Mong Kok Road Kowloon, Hong Kong China	<input checked="" type="checkbox"/> Via FedEx <input type="checkbox"/> Via Hand Delivery <input type="checkbox"/> Via Overnight Courier <input type="checkbox"/> Via Electronic Mail
Yotat (Zhuhai) Technology Co., Ltd. No. 127 Peoples East Road Xiangzhou, Zhuhai China	<input checked="" type="checkbox"/> Via FedEx <input type="checkbox"/> Via Hand Delivery <input type="checkbox"/> Via Overnight Courier <input type="checkbox"/> Via Electronic Mail

CERTAIN INK CARTRIDGES AND COMPONENTS THEREOF**Inv. No. 337-TA-946**

Kingway Image Co., Ltd. 4/F, Building 1 No. 1 Ping Dong Road 2 Nanping Industry Park Zhuhai China	<input checked="" type="checkbox"/> Via FedEx <input type="checkbox"/> Via Hand Delivery <input type="checkbox"/> Via Overnight Courier <input type="checkbox"/> Via Electronic Mail
Zhuhai Chinamate Technology Co., Ltd. Room 1504/1508/1511 No. 125 Renmin East Road Xiangzhou, Zhuhai China	<input checked="" type="checkbox"/> Via FedEx <input type="checkbox"/> Via Hand Delivery <input type="checkbox"/> Via Overnight Courier <input type="checkbox"/> Via Electronic Mail
InkPro2day, LLC 1200 Santee Street, Suite 1006 Los Angeles, CA 90015 USA	<input checked="" type="checkbox"/> Via FedEx <input type="checkbox"/> Via Hand Delivery <input type="checkbox"/> Via Overnight Courier <input type="checkbox"/> Via Electronic Mail
Dongguan OcBestjet Printer Consumables Co., Ltd. Block F01, 4/F, Jingyefang Industrial Park No. 351, Jian'an Road, Wusha Village, Chang'an Town Dongguan China	<input checked="" type="checkbox"/> Via FedEx <input type="checkbox"/> Via Hand Delivery <input type="checkbox"/> Via Overnight Courier <input type="checkbox"/> Via Electronic Mail
OcBestjet Consumables (HK) Co., Ltd. RM 2301, 23 F/L, Worldwide House 19 Des Voeux Road Central Hong Kong China	<input checked="" type="checkbox"/> Via FedEx <input type="checkbox"/> Via Hand Delivery <input type="checkbox"/> Via Overnight Courier <input type="checkbox"/> Via Electronic Mail
Aomya Printer Consumables (Zhuhai) Co., Ltd. Rm. #412, Henghe Business Building No. 313 East Renmin Road Xiangzhou, Zhuhai, Guangdong China	<input checked="" type="checkbox"/> Via FedEx <input type="checkbox"/> Via Hand Delivery <input type="checkbox"/> Via Overnight Courier <input type="checkbox"/> Via Electronic Mail
Zhuhai Richeng Development Co., Ltd. d/b/a Richeng Technology Building No. 5, Nanshan Industrial Zone, 10 Shihua 3 rd Street, Jida, Zhuhai China 519015	<input checked="" type="checkbox"/> Via FedEx <input type="checkbox"/> Via Hand Delivery <input type="checkbox"/> Via Overnight Courier <input type="checkbox"/> Via Electronic Mail

/s/ Daniil Chernichenko
Daniil Chernichenko

PUBLIC VERSION

UNITED STATES INTERNATIONAL TRADE COMMISSION

Washington, D.C.

In the Matter of

**CERTAIN INK CARTRIDGES AND
COMPONENTS THEREOF**

Inv. No. 337-TA-946

**ORDER NO. 10: INITIAL DETERMINATION GRANTING JOINT MOTION TO
TERMINATE INVESTIGATION AS TO RESPONDENTS ZHUHAI
NANO TECHNOLOGY CO., LTD. AND NANO BUSINESS &
TECHNOLOGY, INC. BASED UPON A SETTLEMENT
AGREEMENT AND CONSENT ORDER**

(July 8, 2015)

On June 18, 2015, Complainants Epson Portland Inc., Epson America, Inc. and Seiko Epson Corporation (collectively, “Epson”) and Respondents Zhuhai Nano Digital Technology, Co., Ltd. (China) and Nano Business and Technology, Inc. (USA) (collectively, “Nano Digital”) filed a joint motion to terminate the Investigation as to Nano Digital based upon a settlement agreement and a consent order (Motion Docket No. 946-003). On June 25, 2015, Epson and Nano Digital filed an amended motion attaching an amended consent order stipulation and proposed consent order. The Commission Investigative Staff (“Staff”) filed a response in support of the motion on July 6, 2015. There are no other active parties in this Investigation.¹

¹ Respondents Huebon Co., Ltd., Chanchen Co., Ltd., Yotat Group Co., Ltd., Ourway Image Co., Ltd., Shanghai Orink Infotech International Co., Ltd., Orink Infotech International Co., Ltd., Kingway Image Co., Ltd., Zhuhai Chinamate Technology Co., Ltd., Yotat (Zhuhai) Technology Co., Ltd., Zhuhai Richeng Development Co., Ltd., Dongguan OcBestjet Printer Consumables Co., Ltd., OcBestjet Printer Consumables (HK) Co., Ltd., Zinyaw LLC, InkPro2day, LLC, Aomya Printer Consumables (Zhuhai) Co., Ltd., Zhuhai National Resources & Jingjie Imaging Products Co., Ltd., and Zhuhai Rich Imaging Technology Co., Ltd. were found in default pursuant to Order No. 9 (June 18, 2015).

PUBLIC VERSION**I. BACKGROUND**

The Commission instituted this Investigation by publication of a notice in the *Federal Register* on January 27, 2015. 80 Fed. Reg. 4314-16. On May 14, 2015, Epson filed a motion for an order to show cause why all the Respondents in this Investigation should not be found in default for their failure to respond to the Complaint and Notice of Investigation. On May 22, 2015, Nano Digital submitted correspondence and exhibits via the Commission's electronic filing system (EDIS) addressing certain issues in the Investigation and purporting to explain its late filing. On June 2, 2015, I held a teleconference regarding Nano Digital's participation in this Investigation, and I issued Order No. 7, ordering Nano Digital to comply with certain deadlines. On June 18, 2015, I issued an Initial Determination (Order No. 9) finding all the Respondents other than Nano Digital in default. On that same day, Epson and Nano Digital filed the present motion, indicating that they have entered into a settlement agreement, effective June 12, 2015, which is attached hereto as Exhibit A. In addition, Epson and Nano Digital have agreed to a consent order stipulation, dated June 24, 2015, attached hereto as Exhibit B.² The parties have also agreed to a proposed consent order, attached hereto as Exhibit C.³

II. ANALYSIS

Commission Rule 210.21(a)(2) states that "[a]ny party may move at any time to terminate an investigation in whole or in part as to any or all respondents on the basis of a settlement, a licensing or other agreement, . . . or a consent order." 19 C.F.R. § 210.21(a)(2). Commission Rule 210.21(b)(1) provides that in order for an investigation to be terminated as to a respondent

² Although Epson and Nano Digital filed confidential and public versions of their consent order stipulation, there are no redactions in the public version. See Motion Docket No. 946-003, Exhibit 2 (Confidential and Public Versions)

³ Although Epson and Nano Digital filed confidential and public versions of their proposed consent order, there are no redactions in the public version. See Motion Docket No. 946-003, Exhibit 3 (Confidential and Public Versions)

PUBLIC VERSION

on the basis of a licensing or other settlement agreement, the motion for termination must include: (1) “copies of the licensing or other settlement agreement,” including both a public and a confidential version if necessary; (2) “any supplemental agreements, any documents referenced in the motion or attached agreements;” and (3) “a statement that there are no other agreements, written or oral, express or implied, between the parties concerning the subject matter of the investigation.” 19 C.F.R. § 210.21(b)(1). Commission Rule 210.21(c)(1)(ii) provides in relevant part that “[i]n investigations under Section 337 of the Tariff Act of 1930, a proposal to terminate by consent order shall be submitted as a motion to the administrative law judge with a stipulation that incorporates a proposed consent order.” 19 C.F.R. § 210.21(c)(1)(ii). Commission Rule 210.21(c)(3) sets forth the information that must be included in the consent order stipulation. 19 C.F.R. § 210.21(c)(3). Commission Rule 210.21(c)(4) sets forth the information that must be included in the proposed consent order. 19 C.F.R. § 210.21(c)(4). A consent order may not include terms beyond or inconsistent with those set forth by Commission Rule 210.21(c)(4). *Id.*

I find that the motion complies with Commission Rule 210.21(b)(1) requiring a confidential and public version of the parties’ settlement agreement. *See* Motion Docket No. 946-003, Exhibit 1 (Confidential and Public Versions). Consistent with Commission Rule 210.21(b)(1), Epson and Nano Digital state that there are no other agreements, written or oral, express or implied between them concerning the subject matter of this Investigation. Motion at 2. The agreement appears to fully resolve the dispute underlying this Investigation between Epson and Nano Digital. Staff Response at 5-6.

I further find that the Amended Consent Order Stipulation and the Proposed Consent Order are consistent with the relevant Commission Rules. *See* 19 U.S.C. §§ 210.21(c)(3)-(4). The Staff reviewed the statements in the Consent Order Stipulation and found that it meets the

PUBLIC VERSION

requirements of Commission Rule 210.21(c)(3). Staff Response at 6-8. The Staff also reviewed the provisions of the Proposed Consent Order and found that it does not appear to have terms beyond, or materially inconsistent with those provided for in Commission Rule 210.21(c)(4). *Id.* at 8-11.

Epson and Nano Digital further submit that terminating this Investigation as to Nano Digital is in the public interest. Motion at 2. Commission Rule 210.50(b)(2) provides:

Regarding terminations by settlement agreement, consent order, or arbitration agreement under § 210.21 (b), (c) or (d), the parties may file statements regarding the impact of the proposed termination on the public interest, and the administrative law judge may hear argument. . . . Thereafter, the administrative law judge shall consider and make appropriate findings in the initial determination regarding the effect of the proposed settlement on the public health and welfare, competitive conditions in the U.S. economy, the production of like or directly competitive articles in the United States, and U.S. consumers.

19 C.F.R. § 210.50(b)(2). I find no evidence that partial termination of this Investigation on the basis of the settlement agreement would impose any undue burdens on public health and welfare, competitive conditions in the U.S. economy, the production of like or directly competitive articles in the United States, or U.S. consumers. *See* Staff Response at 11. To the contrary, I find that partial termination is in the public interest, which favors settlement to avoid needless litigation and to conserve public resources. *See Certain Navigation Products, Including GPS Devices, Navigation and Display Systems, Radar Systems, Navigational Aids, Mapping Systems and Related Software*, Inv. No. 337-TA-900, Order No. 27, 2014 WL 426161, at *2 (Aug. 21, 2014).

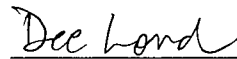
III. CONCLUSION

Accordingly, it is my Initial Determination that Motion Docket No. 946-003 is GRANTED and the Investigation is terminated as to Nano Digital. This Initial Determination, along with supporting documentation, is hereby certified to the Commission. This Initial

PUBLIC VERSION

Determination shall become the determination of the Commission unless a party files a petition for review of the Initial Determination pursuant to Commission Rule 210.43(a), or the Commission, pursuant to Commission Rule 210.44, orders, on its own motion, a review of the Initial Determination or certain issues contained herein. 19 C.F.R. § 210.42(d).

SO ORDERED.



Dee Lord
Administrative Law Judge

PUBLIC VERSION

Exhibit A

SETTLEMENT AGREEMENT

This Settlement Agreement ("Agreement") is entered into as of this 12th day of June, 2015 (the "Effective Date"), by and between Seiko Epson Corporation, Epson America, Inc. and Epson Portland Inc. (collectively, "Epson"), on the one hand, and Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc. (collectively, "Nano Digital"), on the other hand.

I. Recitals

1. Complainant Seiko Epson Corporation ("Seiko Epson") is a corporation organized and existing under the laws of Japan. It is in the business of manufacturing and selling a wide variety of consumer, commercial and industrial products, including ink cartridges for use with Epson printers. Subject to the exclusive licenses set forth below, it owns all right, title, and interest in, including the right to sue thereon and the right to recover for infringement thereof, United States Patent No. 6,502,917 (the "917 patent"), which was duly and legally issued to Seiko Epson by the United States Patent and Trademark Office on January 7, 2003; United States Patent No. 6,550,902 (the "902 patent"), which was duly and legally issued to Seiko Epson by the United States Patent and Trademark Office on April 22, 2003; United States Patent No. 6,955,422 (the "422 patent"), which was duly and legally issued to Seiko Epson by the United States Patent and Trademark Office on October 18, 2005; U.S. Patent No. 7,008,053 (the "053 patent"), which was duly and legally issued to Seiko Epson by the United States Patent and Trademark Office on March 7, 2006; U.S. Patent No. 7,011,397 (the "397 patent"), which was duly and legally issued to Seiko Epson by the United States Patent and Trademark Office on March 14, 2006; U.S. Patent No. 8,366,233 (the "233 patent"), which was duly and legally issued to Seiko Epson by the

United States Patent and Trademark Office on February 5, 2013; U.S. Patent No. 8,454,116 (the "'116 patent'"), which was duly and legally issued to Seiko Epson by the United States Patent and Trademark Office on June 4, 2013; U.S. Patent No. 8,794,749 (the "'749 patent'"), which was duly and legally issued to Seiko Epson by the United States Patent and Trademark Office on August 5, 2014; U.S. Patent No. 8,801,163 (the "'163 patent'"), which was duly and legally issued to Seiko Epson by the United States Patent and Trademark Office on August 12, 2014; and U.S. Patent No. 8,882,513 (the "'513 patent'"), which was duly and legally issued to Seiko Epson by the United States Patent and Trademark Office on November 11, 2014. The '917, '902, '422, '053, '397, '233, '166, '749, '163 and '513 patents (collectively, the "Epson Patents") all relate generally to ink cartridges for printers.

2. Complainant Epson America, Inc. ("Epson America") is a corporation organized and existing under the laws of the State of California. It is the exclusive licensee of the right to distribute ink cartridges in the United States that are covered by the Epson Patents.

3. Complainant Epson Portland Inc. ("Epson Portland") is a corporation organized and existing under the laws of the State of Oregon. It is the exclusive licensee of the right to manufacture ink cartridges in the United States that are covered by the Epson Patents.

4. Respondent Nano Business & Technology, Inc. is a corporation organized and existing under the laws of the State of Oregon. It is in the business, among others, of importing and selling aftermarket ink cartridges in the United States, including those for use with Epson printers.

5. Respondent Zhuhai Nano Digital Technology Co., Ltd. is a corporation organized and existing under the laws of China. It is in the business, among others, of

manufacturing, selling and exporting aftermarket ink cartridges for sale in the United States, including aftermarket ink cartridges for use with Epson printers.

6. On or about October 19, 2007, the United States International Trade Commission issued a General Exclusion Order in Investigation No. 337-TA-565 and, on or about April 16, 2012, the United States International Trade Commission issued a General Exclusion Order (Modified) in Investigation No. 337-TA-565, together barring entry for consumption into the United States of ink cartridges and components thereof that are covered by certain claims of certain patents, including the '917, '902, '422, '053, '397 patents.

7. On or about December 23, 2014, Epson filed a complaint naming Nano Digital and others as Respondents before the United States International Trade Commission, Investigation No. 337-TA-946 (hereafter, "ITC Investigation"), alleging the unlawful importation into the United States, the sale for importation into the United States and/or the sale within the United States after importation, of ink cartridges and components thereof that infringe the one or more of the '233, '166, '749, '163 and '513 patents.

8. Epson and Nano Digital mutually desire to settle and compromise the disputes between them related to the ITC Investigation and the Epson Patents, subject to and upon the terms and conditions hereinafter set forth.

II. Agreement

NOW, THEREFORE, for and in consideration of the foregoing, and the mutual covenants, promises and agreements hereinafter set forth, and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the parties hereby covenant, promise and agree as follows:

A. Representations

Nano Digital hereby represents and warrants as follows:

1. Nano Digital and/or its Affiliates¹ have imported into the United States, sold for importation into the United States and/or sold within the United States after importation, ink cartridges for use with Epson printers and components thereof that Epson alleges infringe one or more of the Epson patents (hereinafter, the "Accused Products").

2. The Accused Products include but are not limited to the products identified in Attachment A to this Agreement, which sets forth a non-exhaustive list of the model numbers of ink cartridges for use with Epson printers and components thereof that have been imported into the United States, sold for importation into the United States and/or sold within the United States after importation by Nano Digital and/or its Affiliates and that Epson alleges infringe one or more of the Epson patents.

3. The Accused Products include but are not limited to any ink cartridges and components thereof imported into the United States, sold for importation into the United States and/or sold within the United States after importation by Nano Digital and/or its Affiliates, that are substitutes for any of the Epson ink cartridge models identified in Attachment B to this Agreement.

4. The Accused Products include but are not limited to any ink cartridges and components thereof imported into the United States, sold for importation into the United States and/or sold within the United States after importation by Nano Digital and/or its Affiliates, that are compatible with any of the Epson printer models identified in Attachment C to this Agreement.

5. The parties agree that ink, if sold alone, and not as part of an ink cartridge, ink supply system or component that Epson alleges infringes one or more of the Epson patents, is not an Accused Product.

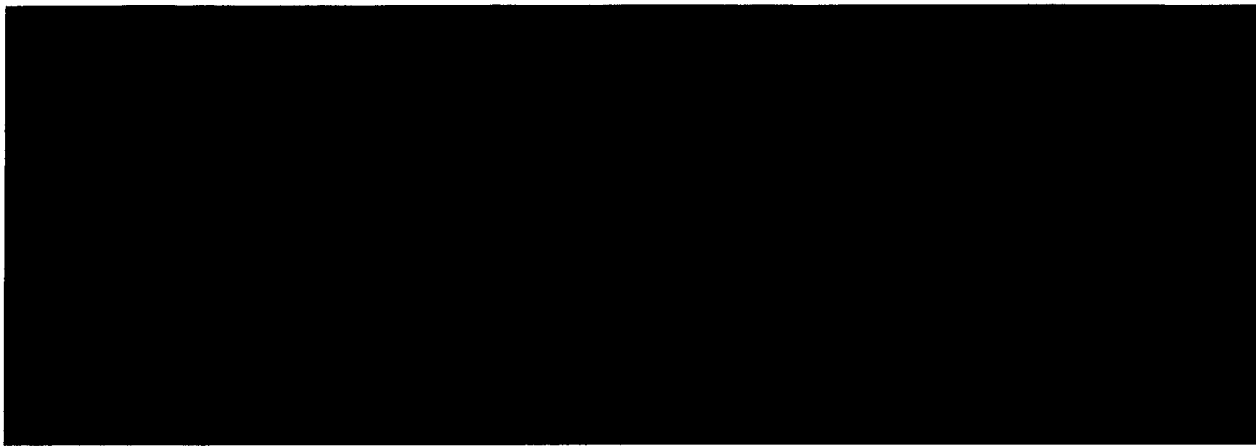
¹ As referred to herein, "Affiliates" means any individuals or entities that, in whatever country organized or resident, directly, or indirectly through one or more intermediaries, control, are controlled by, or are under common control with, Nano Digital.

B. Undertakings



2. Nano Digital hereby agrees to execute the Consent Order Stipulation, in the form of Attachment D hereto, to be promptly filed along with a Motion to Terminate in the ITC Investigation. The terms of the Consent Order Stipulation are hereby incorporated by reference and the provisions thereof shall be considered terms of this Agreement.





III. Releases

1. Seiko Epson Corporation, Epson America, Inc. and Epson Portland Inc., jointly and severally, release and acquit Zhuhai Nano Digital Technology Co., Ltd., Nano Business & Technology, Inc., and their Affiliates, and their directors, officers, representatives, employees, attorneys and agents (the “Released Parties”) from any and all claims, causes of action, demands, damages, costs, attorneys’ fees or other expenses of any kind, including claims for patent infringement of the Epson Patents, based upon or arising out of their importation or sale of Accused Products by Nano Digital at any time up to the Effective Date of this Agreement. This Release does not extend to anyone other than the Released Parties, nor does it authorize or license anyone to sell Accused Products, before or after the Effective date. Epson reserves the right to pursue its patent rights against any third-parties.

2. Zhuhai Nano Digital Technology Co., Ltd., Nano Business & Technology, Inc., and their Affiliates release Seiko Epson Corporation, Epson America, Inc. and Epson Portland Inc., and their respective directors, officers, representatives, employees, attorneys and agents, from any and all claims, counterclaims, causes of action, demands, damages, costs, attorneys’ fees, or other expenses of any kind arising out of or relating to the Epson Patents, and/or the filing and prosecution of the ITC Investigation.

IV. General Provisions

1. Each party shall bear its own costs related to this Agreement, including those arising from the ITC Investigation.

2. Each party represents that this Agreement has been duly executed and delivered by such party and that it constitutes a legal, valid and binding obligation of such party and that it is enforceable against such party in accordance with its terms.

3. Each individual signing this Agreement on behalf of a corporation or other entity represents and warrants that he has full power and authority for such corporation or entity to enter into this Agreement and to bind such corporation or entity to the terms hereof.

4. Nano Digital's admissions and representations contained in this Agreement shall continue without expiration date.

5. This Agreement shall be construed and enforced under and in accordance with the laws of the United States and the State of Oregon. Any dispute arising between the parties related to the making or performance of this Agreement shall be resolved by the United States District Court for the District of Oregon. Notwithstanding the foregoing, any action to enforce the terms of the ITC Consent Order attached hereto as Attachment D may be brought before the International Trade Commission or United States Customs and Border Protection.

6. In the event any action, motion, or other proceeding be instituted by a party to enforce any of the terms and provisions contained herein, the prevailing party in such action shall be entitled to reasonable attorneys' fees, other costs and expenses.

7. Each party hereby knowingly and voluntarily acknowledges that such party was not fraudulently or otherwise wrongfully induced to enter into this Agreement. Each party hereto acknowledges that, except as expressly specified herein, no other party, or agent or attorney of any other party, has made any promise, representation, or warranty, express or

implied, concerning the subject matter hereof, whether to induce any party to execute this Agreement or otherwise, and each party acknowledges that it is not executing this Agreement, or any document or instrument provided for herein, in reliance on any promise, representation or warranty not contained in this Agreement or in any such instrument.

8. This Agreement may be changed, modified or amended only by an instrument in writing duly executed by each of the parties hereto.

9. This Agreement and the terms of this Agreement are confidential and shall not be disclosed to anyone except as provided herein. This Agreement and the terms of this Agreement may only be disclosed: (i) as required by law; (ii) as ordered by a court; (iii) In the ITC Investigation, in connection with a motion to terminate it as to Nano Digital, based upon a Consent Order; or (iv) in any action involving a party hereto to enforce this Agreement or any aspect of it, or to invoke any rights or benefits conferred by or under it.

10. This Agreement, and the attachments, injunctions, judgments and orders provided for herein, contain the entire agreement and understanding concerning the subject matter hereof between the parties hereto, and shall supersede and replace and are substituted for any and all prior negotiations, agreements, and proposed agreements, written or oral, concerning the subject matter hereto.

11. The failure of any party to insist upon strict performance of any obligation of another party hereunder, irrespective of the length of time for which such failure continues, shall not be a waiver of its right to demand strict compliance in the future. No consent or waiver, expressed or implied by any party to or of any breach or default in the performance of any obligation hereunder by another party shall constitute a consent or waiver to or of any other breach or default in the performance of the same or any obligation hereunder.

12. This Agreement and any of the rights and obligations thereof are fully assignable by Seiko Epson, Epson America and Epson Portland. This Agreement and any of

the rights and obligations set forth herein may not be assigned or otherwise transferred by Nano Digital without the prior written consent of Seiko Epson.

13. All notices required or permitted to be made or given pursuant to this Agreement shall be in writing and sent by first class mail, postage prepaid, and addressed to the last known address set forth below. Notices sent by Registered or Certified mail, Return Receipt Requested, shall be presumed to have been received.

If to Seiko Epson, Epson America and/or Epson Portland:

Mr. Timothy Smith
Intellectual Property Division
SEIKO EPSON CORPORATION
80 Harashinden, Hirooka,
Shiojiri, Nagano 399-0785
Telephone: 81 263-52-2552
Facsimile: 81-263-52-4764

Alf Anderson, Esq.
Assistant General Counsel
Epson America, Inc.
3840 Kilroy Airport Way
Long Beach, California 90806
Telephone: 562-290-4306
Facsimile: 562-290-4313

Harold A. Barza, Esq. & Tigran Guledjian, Esq.
Quinn Emanuel Urquhart & Sullivan, LLP
865 S. Figueroa Street, 10th Floor
Los Angeles, California 90017
Telephone: 213-443-3000
Facsimile: 213-443-3100

If to Nano Digital:

Jie Wang, Ph.D.
CEO, President
Zhuhai Nano Digital Technology Co. Ltd.
3 Pingxi 5th Road, Nanping Hi-Tech Industrial Park
Zhuhai, Guangdong 519060, China
Telephone: 503-664-4038
Facsimile: 86 756-696-9369

Jie Wang, Ph.D.
CEO, President

Nano Business and Technology, Inc.
4287 SE International Way, Suite C
Milwaukie, OR 97222
Telephone: 503-664-4038
Facsimile: 86 756-696-9369

14. The headings used in this Agreement are for convenient reference only and shall not be used to interpret this Agreement.

15. This Agreement may be executed in multiple counterparts, each of which shall be deemed an original and all of which will constitute but one and the same instrument. Photocopy signatures and facsimile signatures will be deemed originals.

16. This Agreement shall be binding upon and inure to the benefit of the parties hereto, and their successors and permitted assignees. Except as aforesaid and as set forth in Section III above, and except to the extent persons or entities have been released hereunder, this Agreement shall not be deemed to confer any rights upon, or obligate the parties hereto, to any person or entity not a party hereto.

17. Each of the parties agrees to execute such additional documents and do or perform such further acts or things that shall be reasonably necessary or appropriate to give full effect to all of the purposes and provisions of this Agreement.

18. Each of the parties hereto represents that it has read and that it understands the provisions of this Agreement, has received advice with respect thereto from independent counsel of its own choice, has signed the Agreement and the other documents contemplated herein, freely and without duress, and that it has fully authority to execute the same. For the purpose of resolving any disputes arising out of this Agreement, this Agreement shall be deemed to have been drafted by all of the parties hereto.

IN WITNESS WHEREOF, this Agreement has been executed as of the date set forth above.

SEIKO EPSON CORPORATION

By: 

Name: Shigeki Inoue

Title: Managing Director

Intellectual Property Division

Seiko Epson Corporation

EPSON AMERICA, INC.

By: _____

Name: _____

Title: _____


EPSON PORTLAND INC.

By: 

Name: Randal A. McEvers

Title: Executive Director

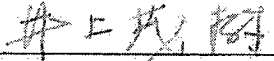
ZHUHAI NANO DIGITAL TECHNOLOGY CO., LTD.

By: 

Name: JIE WANG

Title: CEO, President

SEIKO EPSON CORPORATION

By: 

Name: Shigeki Inoue

Title: Managing Director

Intellectual Property Division

Seiko Epson Corporation

EPSON AMERICA, INC.

By: 

Name: Andrea Zoeckler

Title: Senior Vice President, CFO

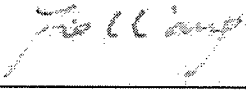
EPSON PORTLAND INC.

By: _____

Name: _____

Title: _____

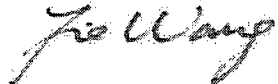
ZHUHAI NANO DIGITAL TECHNOLOGY CO., LTD.

By: 

Name: JIE WANG

Title: CEO, President

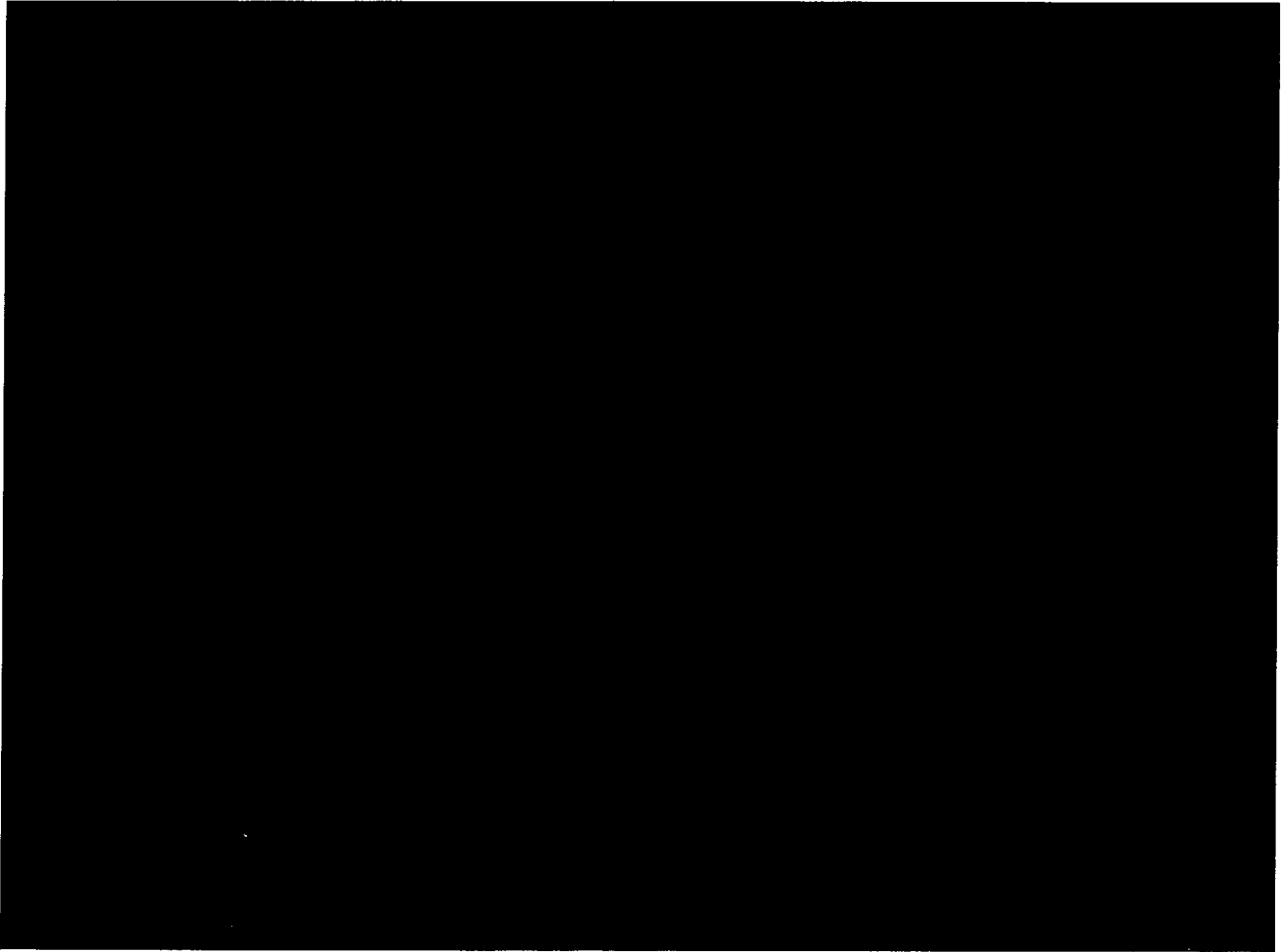
NANO BUSINESS & TECHNOLOGY, INC.

By 

Name: JIE WANG

Title: CEO, President

ATTACHMENT A



ATTACHMENT B

T200120	T689100	T710100
T200220	T689200	T710200
T200320	T689300	T710300
T200420	T689400	T710400
T200XL120	T692100	T710500
T200XL220	T692200	T710600
T200XL320	T692300	T676120
T200XL420	T692400	T676220
T223120	T692500	T676320
T223XL120	T693100	T676420
T252120	T693200	T711XXL120
T252220	T693300	T711XXL200
T252320	T693400	T711XXL320
T252420	T693500	T711XXL420
T252XL120	T694100	T786120
T252XL220	T694200	T786220
T252XL320	T694300	T786320
T252XL420	T694400	T786420
T254XL120	T694500	T786XL120
T273020	T715100	T786XL220
T273120	T715200	T786XL320
T273220	T715300	T786XL420
T273320	T715400	T068120
T273420	T715500	T068220
T273XL020	T715600	T068320
T273XL120	T715700	T068420
T273XL220	T715800	T069120
T273XL320	T715A00	T069220
T273XL420	T715A00	T069320
T277120	T715B00	T069420
T277220	T715B00	T077120
T277320	T725100	T077220
T277420	T725200	T077320
T277520	T725300	T077420
T277620	T725400	T077520
T277XL120	T725A00	T077620
T277XL220	T730100	T078120
T277XL320	T730200	T078220
T277XL420	T730300	T078320
T277XL520	T730400	T078420
T277XL620	T730A00	T078520
T596100	T591100	T078620
T596200	T591200	T079120
T596300	T591300	T079220

T596400	T591400	T079320
T596500	T591500	T079420
T596600	T591600	T079520
T596700	T591700	T079620
T596800	T591800	T087020
T596900	T591900	T087120
T596A00	T124120	T087220
T596B00	T124220	T087320
T596C00	T124320	T087420
T636100	T124420	T087720
T636200	T125120	T087820
T636300	T125220	T087920
T636400	T125320	T088120
T636500	T125420	T088220
T636600	T126120	T088320
T636700	T126220	T088420
T636800	T126320	T096120
T636900	T126420	T096220
T636A00	T127120	T096320
T636B00	T127220	T096420
T642100	T127320	T096520
T642200	T127420	T096620
T642300	T157120	T096720
T642400	T157220	T096820
T642500	T157320	T096920
T642600	T157420	T097120
T642700	T157520	T098120
T642800	T157620	T098220
T642900	T157720	T098320
T642A00	T157820	T098420
T642B00	T157920	T098520
T642C00	T159020	T098620
T653100	T159120	T099220
T653200	T159220	T099320
T653300	T159320	T099420
T653400	T159420	T099520
T653500	T159720	T099620
T653600	T159820	T653900
T653700	T159920	T653A00
T653800		T653B00

ATTACHMENT C

Expression Home XP-200	Expression XP-820	WorkForce WF-2520
Expression Home XP-300	Sure Lab D3000	WorkForce WF-2530
Expression Home XP-310	SureColor F2000	WorkForce WF-2540
Expression Home XP-400	SureColor S30670	WorkForce WF-3620
Expression Home XP-410	SureColor S50670	WorkForce WF-3640
Expression Photo XP-850	SureColor S70670	WorkForce WF-7110
Expression Photo XP-860	SureColor T3000	WorkForce WF-7610
Expression Premium XP-520	SureColor T3270	WorkForce WF-7620
Expression Premium XP-600	SureColor T5000	WorkForce WF-M1030
Expression Premium XP-610	SureColor T5270	WorkForce WF-M1560
Expression Premium XP-620	SureColor T5270D	WorkForce Pro WP-4010
Expression Premium XP-800	SureColor T7000	WorkForce Pro WP-4020
Expression Premium XP-810	SureColor T7270	WorkForce Pro WP-4023
Expression Premium XP-950	SureColor T7270D	WorkForce Pro WP-4520
Artisan 50	Stylus N10	WorkForce Pro WP-4533
Artisan 700	Stylus N11	WorkForce Pro WP-4590
Artisan 710	Stylus NX 110	WorkForce Pro WP-4090
Artisan 725	Stylus NX 115	WorkForce Pro WP-4530
Artisan 730	Stylus NX100	WorkForce Pro WP-4540
Artisan 800	Stylus NX105	WorkForce Pro WF-4630
Artisan 810	Stylus NX200	WorkForce Pro WF-4640
Artisan 835	Stylus NX215	WorkForce Pro WF-5110
Artisan 837	Stylus NX300	WorkForce Pro WF-5190
Artisan 1430	Stylus NX305	WorkForce Pro WF-5620
Stylus C120	Stylus NX400	WorkForce Pro WF-5690
Stylus CX4400	Stylus NX415	Stylus Photo RX580
Stylus CX4450	Stylus NX510	Stylus Photo RX595
Stylus CX5000	Stylus NX515	Stylus Photo RX680
Stylus CX6000	Stylus Photo 1400	Stylus Pro 7700
Stylus CX7000F	Stylus Photo R260	Stylus Pro 7890
Stylus CX7450	Stylus Photo R280	Stylus Pro 7900
Stylus CX8400	Stylus Photo R380	Stylus Pro 9700
Stylus CX9400Fax	Stylus Photo R1900	Stylus Pro 9890
Stylus CX9475Fax	Stylus Photo R2880	Stylus Pro 9900
Stylus NX125	WorkForce 435	Stylus Pro WT9900
Stylus NX127	WorkForce 520	Stylus Pro 11880
Stylus NX130	WorkForce 545	WorkForce 30
Stylus NX230	WorkForce 630	WorkForce 40
Stylus NX330	WorkForce 633	WorkForce 310
Stylus NX420	WorkForce 635	WorkForce 315
Stylus NX430	WorkForce 645	WorkForce 500
Stylus NX530	WorkForce 840	WorkForce 600
Stylus NX625	WorkForce 845	WorkForce 610
Stylus Photo R2000	WorkForce WF-3520	WorkForce 615

Stylus Photo R3000	WorkForce WF-3530	WorkForce 1100
Stylus Pro 4900	WorkForce WF-3540	WorkForce 323
WorkForce 60	WorkForce WF-7010	WorkForce 325
WorkForce 320	WorkForce WF-7510	WorkForce WF-7520

**UNITED STATES INTERNATIONAL TRADE COMMISSION
WASHINGTON, D.C.**

**Before the Honorable Dee Lord
Administrative Law Judge**

In the Matter of

CERTAIN INK CARTRIDGES AND
COMPONENTS THEREOF

Investigation No. 337-TA-946

CONSENT ORDER STIPULATION

WHEREAS, the United States International Trade Commission on January 21, 2015 (80 *Fed. Reg.* 4313 (January 27, 2015)), instituted the above-captioned investigation under Section 337 of the Tariff Act of 1930, as amended, (19 U.S.C. § 1337) based upon the allegations contained in the complaint and amended complaint filed by Complainants Epson Portland Inc., Epson America, Inc. and Seiko Epson Corporation (collectively, "Complainants"), which allege unfair acts in the importation into the United States, the sale for importation and the sale within the United States after importation of certain ink cartridges and components thereof, by, among others, Respondents Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc. (collectively, "Nano Digital");

WHEREAS, Nano Digital is willing to accept entry of the Consent Order submitted concurrently herewith by the International Trade Commission and agrees to all waivers and other provisions as required by 19 C.F.R. § 210.21; and

WHEREAS, Nano Digital agrees to all terms set forth in the Consent Order.

IT IS HEREBY STIPULATED by Nano Digital in support of the Joint Motion for an Order Terminating the Investigation as to Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc. by Entry of a Consent Order as follows:

1. The Commission has *in rem* jurisdiction over the accused ink cartridges and components thereof that are the subject of the amended complaint in this investigation. The Commission also has *in personam* jurisdiction over Nano Digital for purposes of this Stipulation and the proposed Consent Order by virtue of Nano Digital's having appeared through counsel in this proceeding. Nothing in this Stipulation or the proposed Consent Order shall be construed as meaning that Nano Digital has submitted to the jurisdiction of any other court.

2. Nano Digital expressly waives all right to seek judicial review or otherwise challenge the validity of the Consent Order.

3. Nano Digital will cooperate with and will not seek to impede by litigation or other means the Commission's efforts to gather information under Subpart I of the Commission's Rules of Practice and Procedure, 19 C.F.R. Subchapter C, Part 210.

4. The enforcement, modification and revocation of the Consent Order will be carried out pursuant to Subpart I of the Commission's Rules of Practice and Procedure, 19 C.F.R. Subchapter C, Part 210.

5. The Consent Order shall not apply with respect to any claim of an intellectual property right that has expired or been found or adjudicated invalid or unenforceable by the Commission or a court or agency of competent jurisdiction, provided that such finding or judgment has become final and nonreviewable.

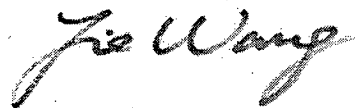
6. Nano Digital will not seek to challenge the validity or enforceability of the patents that form the basis for the complaint and amended complaint in any administrative or judicial proceeding to enforce the Consent Order.

7. This Consent Order Stipulation and Consent Order are in the public interest.
Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc.

IT IS SO STIPULATED.

Date: June 12, 2015

ZHUHAI NANO DIGITAL
TECHNOLOGY CO., LTD.

By: 
JIE WANG, CEO, President

Date: June 12, 2015

NANO BUSINESS & TECHNOLOGY,
INC.

By: 
JIE WANG, CEO, President

PUBLIC VERSION

AGREEMENT TO SUBSTITUTE A NEW EXHIBIT D TO SETTLEMENT AGREEMENT

Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc. hereby agree that the Amended Stipulation for Consent Order sent to them with this email shall be substituted for the Exhibit D Stipulation for Consent Order attached to that certain Settlement Agreement between Seiko Epson Corporation, Epson America, Inc. and Epson Portland Inc., on the one hand, and hand, and Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc., on the other hand, effective as of June 12, 2015, and that such Settlement Agreement remains in full force and effect with this modification.

Agreed to,

Zuhai Nano Digital Technology Co., Ltd,

Nano Business and Technology, Inc.,

BY


Its: CEO, President

By:


Its: CEO, President

PUBLIC VERSION
ATTACHMENT D

UNITED STATES INTERNATIONAL TRADE COMMISSION
WASHINGTON, D.C.

Before the Honorable Dee Lord
Administrative Law Judge

In the Matter of

CERTAIN INK CARTRIDGES AND
COMPONENTS THEREOF

Investigation No. 337-TA-946

AMENDED CONSENT ORDER STIPULATION

WHEREAS, the United States International Trade Commission on January 21, 2015 (80 *Fed. Reg.* 4313 (January 27, 2015)), instituted the above-captioned investigation under Section 337 of the Tariff Act of 1930, as amended, (19 U.S.C. § 1337) based upon the allegations contained in the complaint filed by Complainants Epson Portland Inc., Epson America, Inc. and Seiko Epson Corporation (collectively, "Complainants"), which allege unfair acts in the importation into the United States, the sale for importation and the sale within the United States after importation of certain ink cartridges and components thereof, by, among others, Respondents Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc. (collectively, "Nano Digital"), in violation of Section 337 with respect to claims 1, 4 and 10 of United States Patent No. 8,366,233 (the "'233 patent"), claims 1, 5, 9, 14, 16, 18, 21, 24, 25 and 28 of United States Patent No. 8,454,116 (the "'116 patent"), claims 1, 3, 14, 15, 17, 18, 20, 30, 36, 49, 60 and 61 of United States Patent No. 8,794,749 (the "'749 patent"), claims 1, 6 and 13 of United States Patent No. 8,801,163 (the "'163 patent"), and/or claims 1, 3, 7, 14, 15 and 19 of United States Patent No. 8,882,513 (the "'513 patent");

PUBLIC VERSION

WHEREAS, Nano Digital is willing to accept entry of the Consent Order submitted concurrently herewith by the International Trade Commission and agrees to all waivers and other provisions as required by 19 C.F.R. § 210.21; and

WHEREAS, Nano Digital agrees to all terms set forth in the Consent Order.

IT IS HEREBY STIPULATED by Nano Digital in support of the Joint Motion for an Order Terminating the Investigation as to Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc. by Entry of a Consent Order as follows:

1. The Commission has subject matter jurisdiction over this investigation. The Commission has *in rem* jurisdiction over the accused ink cartridges and components thereof that are the subject of the complaint in this investigation. The Commission also has *in personam* jurisdiction over Nano Digital for purposes of this Stipulation and the proposed Consent Order by virtue of Nano Digital's having appeared in this proceeding. Nothing in this Stipulation or the proposed Consent Order shall be construed as meaning that Nano Digital has submitted to the jurisdiction of any other court.

2. Nano Digital, including its officers, directors, employees, agents, and any entity or individual acting on its behalf and with its authority, agrees, upon entry of the Consent Order, that it will not sell for importation, import into the United States or sell in the United States after importation, directly or indirectly, or aid, abet, encourage, participate in, or induce the sale for importation, importation into the United States or sale in the United States after importation of ink cartridges or components thereof that infringe claims 1, 4 and 10 of the '233 patent, claims 1, 5, 9, 14, 16, 18, 21, 24, 25 and 28 of the '116 patent, claims 1, 3, 14, 15, 17, 18, 20, 30, 36, 49, 60 and 61 of the '749 patent, claims 1, 6 and 13 of the '163 patent, and/or claims 1, 3, 7, 14, 15 and 19 of the '513 patent.

PUBLIC VERSION

3. Nano Digital does not have any existing U.S. inventories of accused ink cartridges or components thereof.

4. Nano Digital expressly waives all right to seek judicial review or otherwise challenge the validity of the Consent Order.

5. Nano Digital will cooperate with and will not seek to impede by litigation or other means the Commission's efforts to gather information under Subpart I of the Commission's Rules of Practice and Procedure, 19 C.F.R. Subchapter C, Part 210.

6. The enforcement, modification and revocation of the Consent Order will be carried out pursuant to Subpart I of the Commission's Rules of Practice and Procedure, 19 C.F.R. Subchapter C, Part 210.

7. The signing of this Stipulation is for settlement purposes only and does not constitute admission by Nano Digital that an unfair act has been committed.

8. The Consent Order shall have the same force and effect and may be enforced, modified, or revoked in the same manner as is provided in section 337 of the Tariff Act of 1930 and this part for other Commission actions, and the Commission may require periodic compliance reports pursuant to subpart I of this part to be submitted by Nano Digital.

9. The Consent Order shall not apply with respect to any claim of an intellectual property right that has expired or been found or adjudicated invalid or unenforceable by the Commission or a court or agency of competent jurisdiction, provided that such finding or judgment has become final and nonreviewable.

10. Nano Digital will not seek to challenge the validity or enforceability of the patents that form the basis for the complaint in any administrative or judicial proceeding to enforce the Consent Order.

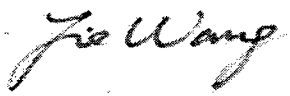
PUBLIC VERSION

11. This Consent Order Stipulation and Consent Order are in the public interest.

IT IS SO STIPULATED.


Date: June 24, 2015

ZHUHAI NANO DIGITAL
TECHNOLOGY CO., LTD.

By: 
Its: CEO, President

Date: June 24, 2015

NANO BUSINESS & TECHNOLOGY,
INC.

By: 
Its: CEO, President

PUBLIC VERSION

Exhibit B

PUBLIC VERSION

UNITED STATES INTERNATIONAL TRADE COMMISSION
WASHINGTON, D.C.

Before the Honorable Dee Lord
Administrative Law Judge

In the Matter of

CERTAIN INK CARTRIDGES AND
COMPONENTS THEREOF

Investigation No. 337-TA-946

AMENDED CONSENT ORDER STIPULATION

WHEREAS, the United States International Trade Commission on January 21, 2015 (80 *Fed. Reg.* 4313 (January 27, 2015)), instituted the above-captioned investigation under Section 337 of the Tariff Act of 1930, as amended, (19 U.S.C. § 1337) based upon the allegations contained in the complaint filed by Complainants Epson Portland Inc., Epson America, Inc. and Seiko Epson Corporation (collectively, "Complainants"), which allege unfair acts in the importation into the United States, the sale for importation and the sale within the United States after importation of certain ink cartridges and components thereof, by, among others, Respondents Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc. (collectively, "Nano Digital"), in violation of Section 337 with respect to claims 1, 4 and 10 of United States Patent No. 8,366,233 (the "'233 patent"), claims 1, 5, 9, 14, 16, 18, 21, 24, 25 and 28 of United States Patent No. 8,454,116 (the "'116 patent"), claims 1, 3, 14, 15, 17, 18, 20, 30, 36, 49, 60 and 61 of United States Patent No. 8,794,749 (the "'749 patent"), claims 1, 6 and 13 of United States Patent No. 8,801,163 (the "'163 patent"), and/or claims 1, 3, 7, 14, 15 and 19 of United States Patent No. 8,882,513 (the "'513 patent");

PUBLIC VERSION

WHEREAS, Nano Digital is willing to accept entry of the Consent Order submitted concurrently herewith by the International Trade Commission and agrees to all waivers and other provisions as required by 19 C.F.R. § 210.21; and

WHEREAS, Nano Digital agrees to all terms set forth in the Consent Order.

IT IS HEREBY STIPULATED by Nano Digital in support of the Joint Motion for an Order Terminating the Investigation as to Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc. by Entry of a Consent Order as follows:

1. The Commission has subject matter jurisdiction over this investigation. The Commission has *in rem* jurisdiction over the accused ink cartridges and components thereof that are the subject of the complaint in this investigation. The Commission also has *in personam* jurisdiction over Nano Digital for purposes of this Stipulation and the proposed Consent Order by virtue of Nano Digital's having appeared in this proceeding. Nothing in this Stipulation or the proposed Consent Order shall be construed as meaning that Nano Digital has submitted to the jurisdiction of any other court.

2. Nano Digital, including its officers, directors, employees, agents, and any entity or individual acting on its behalf and with its authority, agrees, upon entry of the Consent Order, that it will not sell for importation, import into the United States or sell in the United States after importation, directly or indirectly, or aid, abet, encourage, participate in, or induce the sale for importation, importation into the United States or sale in the United States after importation of ink cartridges or components thereof that infringe claims 1, 4 and 10 of the '233 patent, claims 1, 5, 9, 14, 16, 18, 21, 24, 25 and 28 of the '116 patent, claims 1, 3, 14, 15, 17, 18, 20, 30, 36, 49, 60 and 61 of the '749 patent, claims 1, 6 and 13 of the '163 patent, and/or claims 1, 3, 7, 14, 15 and 19 of the '513 patent.

PUBLIC VERSION

3. Nano Digital does not have any existing U.S. inventories of accused ink cartridges or components thereof.

4. Nano Digital expressly waives all right to seek judicial review or otherwise challenge the validity of the Consent Order.

5. Nano Digital will cooperate with and will not seek to impede by litigation or other means the Commission's efforts to gather information under Subpart I of the Commission's Rules of Practice and Procedure, 19 C.F.R. Subchapter C, Part 210.

6. The enforcement, modification and revocation of the Consent Order will be carried out pursuant to Subpart I of the Commission's Rules of Practice and Procedure, 19 C.F.R. Subchapter C, Part 210.

7. The signing of this Stipulation is for settlement purposes only and does not constitute admission by Nano Digital that an unfair act has been committed.

8. The Consent Order shall have the same force and effect and may be enforced, modified, or revoked in the same manner as is provided in section 337 of the Tariff Act of 1930 and this part for other Commission actions, and the Commission may require periodic compliance reports pursuant to subpart I of this part to be submitted by Nano Digital.

9. The Consent Order shall not apply with respect to any claim of an intellectual property right that has expired or been found or adjudicated invalid or unenforceable by the Commission or a court or agency of competent jurisdiction, provided that such finding or judgment has become final and nonreviewable.

10. Nano Digital will not seek to challenge the validity or enforceability of the patents that form the basis for the complaint in any administrative or judicial proceeding to enforce the Consent Order.


PUBLIC VERSION

11. This Consent Order Stipulation and Consent Order are in the public interest.

IT IS SO STIPULATED.


Date: June 24, 2015

ZHUHAI NANO DIGITAL
TECHNOLOGY CO., LTD.

By: 
Its: CEO, President

Date: June 24, 2015

NANO BUSINESS & TECHNOLOGY,
INC.

By: 
Its: CEO, President

PUBLIC VERSION

Exhibit C

PUBLIC VERSION

UNITED STATES INTERNATIONAL TRADE COMMISSION
WASHINGTON, D.C.

Before the Honorable Dee Lord
Administrative Law Judge

In the Matter of

CERTAIN INK CARTRIDGES AND
COMPONENTS THEREOF

Investigation No. 337-TA-946

AMENDED [PROPOSED] CONSENT ORDER

The United States International Trade Commission on January 21, 2015 (80 *Fed. Reg.* 4313 (January 27, 2015)), instituted the above-captioned investigation under Section 337 of the Tariff Act of 1930, as amended, (19 U.S.C. § 1337) naming numerous respondents, including Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc. (collectively, "Nano Digital"), based upon the allegations contained in the complaint filed by Complainants Epson Portland Inc., Epson America, Inc. and Seiko Epson Corporation (collectively, "Complainants" or "Epson") that allege unfair acts in the importation into the United States, the sale for importation, and the sale within the United States after importation of certain ink cartridges and components thereof in violation of Section 337 with respect to claims 1, 4 and 10 of United States Patent No. 8,366,233 (the "'233 patent'"), claims 1, 5, 9, 14, 16, 18, 21, 24, 25 and 28 of United States Patent No. 8,454,116 (the "'116 patent'"), claims 1, 3, 14, 15, 17, 18, 20, 30, 36, 49, 60 and 61 of United States Patent No. 8,794,749 (the "'749 patent'"), claims 1, 6 and 13 of United States Patent No. 8,801,163 (the "'163 patent'"), and/or claims 1, 3, 7, 14, 15 and 19 of United States Patent No. 8,882,513 (the "'513 patent").

Nano Digital has executed a Consent Order Stipulation in which it agrees to the entry of this Consent Order and to all waivers and other provisions as required by Commission Rule of Practice

PUBLIC VERSION

and Procedure 210.21(c) (19 C.F.R. § 210.21(c)). Complainants and Nano Digital have filed a Joint Motion to Terminate the Investigation as to Respondents Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc. based on a Consent Order.

IT IS HEREBY ORDERED THAT:

1. Upon the entry of this Consent Order, Nano Digital shall not sell for importation, import into the United States or sell in the United States after importation, directly or indirectly, or aid, abet, encourage, participate in, or induce the sale for importation, importation into the United States or sale in the United States after importation of ink cartridges or components thereof that infringe claims 1, 4 and 10 of the '233 patent, claims 1, 5, 9, 14, 16, 18, 21, 24, 25 and 28 of the '116 patent, claims 1, 3, 14, 15, 17, 18, 20, 30, 36, 49, 60 and 61 of the '749 patent, claims 1, 6 and 13 of the '163 patent, and/or claims 1, 3, 7, 14, 15 and 19 of the '513 patent, except under consent or license from Complainants.

2. This Consent Order shall be applicable to and binding upon Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc., their officers, directors, agents, servants, attorneys, employees, affiliates, and all persons, firms, or corporations acting or claiming to act on its behalf or under its direction or authority.

3. Nano Digital shall be precluded from seeking judicial review or otherwise challenging or contesting the validity of this Consent Order.

4. Nano Digital shall cooperate with and shall not seek to impede by litigation or other means the Commission's efforts to gather information under Subpart I of the Commission's Rules of Practice and Procedure, 19 C.F.R. Part 210.

PUBLIC VERSION

5. Nano Digital and its officers, directors, employees, agents, and any entity or individual acting on its behalf and with its authority shall not seek to challenge the validity or enforceability of the claims of the '233, '116, '749, '163 and '513 patents in any administrative or judicial proceeding to enforce the Consent Order.

6. When any of the '233, '116, '749, '163 and '513 patents expires, this Consent Order shall become null and void as to such expired patent.

7. This Consent Order shall become null and void as to any claim of any intellectual property right that is held invalid or unenforceable by a court or agency of competent jurisdiction or as to any article that has been found or adjudicated not to infringe the asserted right in a final decision, no longer subject to appeal.

8. This investigation is hereby terminated with respect to Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc.; provided, however, that enforcement, modification, or revocation of the Consent Order shall be carried out pursuant to Subpart I of the Commission's Rules of Practice and Procedure, 19 C.F.R. part 210.

By Order of the Commission

Secretary to the Commission

Issued: _____, 2015

**CERTAIN INK CARTRIDGES AND COMPONENTS
THEREOF**

Inv. No. 337-TA-946

PUBLIC CERTIFICATE OF SERVICE

I, Lisa R. Barton, hereby certify that the attached **PUBLIC ORDER** has been served by hand upon the Commission Investigative Attorney, Brian Koo, Esq., and the following parties as indicated, on

JUL 08 2015



Lisa R. Barton, Secretary
U.S. International Trade Commission
500 E Street, SW, Room 112
Washington, DC 20436

**On Behalf of Complainants Epson Portland Inc., Epson
America, Inc., and Seiko Epson Corporation:**

Paul F. Brinkman, Esq.
QUINN EMANUEL URQUHART & SULLIVAN, LLP
777 6th Street NW, 11th Floor
Washington, DC 20001-3706

- ☐ Via Hand Delivery
☒ Via Express Delivery
☐ Via First Class Mail
☐ Other: _____

Respondents:

Zhuhai Nano Digital Technology Co., Ltd.
No. 3 Factory Building, 2/F
3 Pingxi 5th Road
Nanping State Hi-Tech Park
Zhuhai, Guangdong
China 519060

- ☐ Via Hand Delivery
☒ Via Express Delivery
☐ Via First Class Mail
☐ Other: _____

Nano Business & Technology, Inc., d/b/a Nano Digital,
d/b/a Nano Ink Spot, d/b/a Dinsink
650 North State Street
Lake Oswego, OR 97034

- ☐ Via Hand Delivery
☒ Via Express Delivery
☐ Via First Class Mail
☐ Other: _____

Zhuhai National Resources & Jingjie Imaging Products Co., Ltd.,
d/b/a Ink-Tank
Workshop 2, 1-3/F, No. 3 Qingwan 3rd Rd.
Qingwan Industrial Zone, Zhuhai, Guangdong
China 519040

- ☐ Via Hand Delivery
☒ Via Express Delivery
☐ Via First Class Mail
☐ Other: _____

**CERTAIN INK CARTRIDGES AND COMPONENTS
THEREOF****Inv. No. 337-TA-946**

Certificate of Service – Page 2

Huebon Co., Ltd.
Room 1207, Wing Tuck Commercial Centre
177-183 Wing Lok Street
Sheung Wan, Hong Kong

- ☐ Via Hand Delivery
☒ Via Express Delivery
☐ Via First Class Mail
☐ Other: _____

Chancen Co., Ltd.
Room 1207, Wing Tuck Commercial Centre
177-183 Wing Lok Street
Sheung Wan, Hong Kong

- ☐ Via Hand Delivery
☒ Via Express Delivery
☐ Via First Class Mail
☐ Other: _____

Zhuhai Rich Imaging Technology Co., Ltd.
Block 1, 3-5/F
3 Qingwan 3rd Rd.
Qingwan Industrial Zone
Sanzao, Zhuhai, Guangdong
China 519040

- ☐ Via Hand Delivery
☒ Via Express Delivery
☐ Via First Class Mail
☐ Other: _____

Shanghai Orink Infotech International Co., Ltd.
Room 307
No. 275-8 East Guoding Road
Shanghai
China 200433

- ☐ Via Hand Delivery
☒ Via Express Delivery
☐ Via First Class Mail
☐ Other: _____

Orink Infotech International Co., Ltd.
Unit 1205, 12F/L
Sino Plaza, 255 Gloucester Road
Causeway Bay, Hong Kong

- ☐ Via Hand Delivery
☒ Via Express Delivery
☐ Via First Class Mail
☐ Other: _____

Ourway Image Co., Ltd., Room 403, 4/F
Rirong Edifice, Building 5
No. 291 Remin West road
Xiangzhou, Zhuhai, China

- ☐ Via Hand Delivery
☒ Via Express Delivery
☐ Via First Class Mail
☐ Other: _____

Zinyaw LLC, d/b/a TonerPirate.com
1321 Upland Dr. #1359
Houston, TX 77043

- ☐ Via Hand Delivery
☒ Via Express Delivery
☐ Via First Class Mail
☐ Other: _____

Yotat Group Co., Ltd.
Flat/Room 704, Bright Way Tower
33 Mong Kok Road
Kowloon, Hong Kong

- ☐ Via Hand Delivery
☒ Via Express Delivery
☐ Via First Class Mail
☐ Other: _____

**CERTAIN INK CARTRIDGES AND COMPONENTS
THEREOF****Inv. No. 337-TA-946****Certificate of Service – Page 3**

Yotat (Zhuhai) Technology Co., Ltd.
No. 127 Peoples East Road
Xiangzhou, Zhuhai, China

- ☐ Via Hand Delivery
☒ Via Express Delivery
☐ Via First Class Mail
☐ Other: _____

Kingway Image Co., Ltd.
4/F, Building 1
No. 1 Ping Dong Road 2
Nanping Industry Park
Zhuhai, China

- ☐ Via Hand Delivery
☒ Via Express Delivery
☐ Via First Class Mail
☐ Other: _____

Zhuhai Chinamate Technology Co., Ltd.
Room 1504/1508/1511
No. 125 Renmin East Road
Xiangzhou, Zhuhai, China

- ☐ Via Hand Delivery
☒ Via Express Delivery
☐ Via First Class Mail
☐ Other: _____

InkPro2day, LLC
1200 Santee Street, Suite 1006
Los Angeles, CA 90015

- ☐ Via Hand Delivery
☒ Via Express Delivery
☐ Via First Class Mail
☐ Other: _____

Dongguan OcBestjet Printer Consumables Co., Ltd.
Block F01, 4/F, Jingyefang Industrial Park
No. 351, Jian'an Road, Wusha Village, Chang'an Town
Dongguan
China

- ☐ Via Hand Delivery
☒ Via Express Delivery
☐ Via First Class Mail
☐ Other: _____

OcBestjet Printer Consumables (HK) Co., Ltd.
RM 2301, 23 F/L, Worldwide House
19 Des Voeux Road Central
Hong Kong

- ☐ Via Hand Delivery
☒ Via Express Delivery
☐ Via First Class Mail
☐ Other: _____

Aomya Printer Consumables (Zhuhai) Co., Ltd.
Rm #412, Henghe Business Building
No. 313 East Renmin Road
Xiangzhou, Zhuhai, Guangdong
China

- ☐ Via Hand Delivery
☒ Via Express Delivery
☐ Via First Class Mail
☐ Other: _____

Zhuhai Richeng Development Co., Ltd.
d/b/a Richeng Technology
Building No. 5, Nanshan Industrial Zone,
10 Shihua 3rd Street, Jida, Zhuhai
China 519015

- ☐ Via Hand Delivery
☒ Via Express Delivery
☐ Via First Class Mail
☐ Other: _____

**CERTAIN INK CARTRIDGES AND COMPONENTS
THEREOF**

Inv. No. 337-TA-946

Certificate of Service – Page 4

Jie Wang, Ph.D.
CEO, Zhuhai Nano Digital Technology Co., Ltd.
29 Xianggong Road, Building 10
Jindi Business Park, Zhuhai
Guangdong 519030, China

- ☐ Via Hand Delivery
- ☒ Via Express Delivery
- ☐ Via First Class Mail
- ☐ Other: _____

CEO, Nano Business and Technology Inc.
4287 SE International Way, Suite C
Milwaukie, OR 97222

- ☐ Via Hand Delivery
- ☒ Via Express Delivery
- ☐ Via First Class Mail
- ☐ Other: _____

**UNITED STATES INTERNATIONAL TRADE COMMISSION
WASHINGTON, D.C.**

In the Matter of

CERTAIN INK CARTRIDGES AND
COMPONENTS THEREOF

Investigation No. 337-TA-946

CONSENT ORDER

The United States International Trade Commission on January 21, 2015 (80 *Fed. Reg.* 4314 (Jan. 27, 2015)), instituted the above-captioned investigation under Section 337 of the Tariff Act of 1930, as amended, (19 U.S.C. § 1337) naming numerous respondents, including Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc. (collectively, “Nano Digital”), based upon the allegations contained in the complaint filed by Complainants Epson Portland Inc., Epson America, Inc. and Seiko Epson Corporation (collectively, “Complainants” or “Epson”) that allege unfair acts in the importation into the United States, the sale for importation, and the sale within the United States after importation of certain ink cartridges and components thereof in violation of Section 337 with respect to claims 1, 4 and 10 of United States Patent No. 8,366,233 (the “233 patent”), claims 1, 5, 9, 14, 16, 18, 21, 24, 25 and 28 of United States Patent No. 8,454,116 (the “116 patent”), claims 1, 3, 14, 15, 17, 18, 20, 30, 36, 49, 60 and 61 of United States Patent No. 8,794,749 (the “749 patent”), claims 1, 6 and 13 of United States Patent No. 8,801,163 (the “163 patent”), and/or claims 1, 3, 7, 14, 15 and 19 of United States Patent No. 8,882,513 (the “513 patent”).

Nano Digital has executed a Consent Order Stipulation in which it agrees to the entry of this Consent Order and to all waivers and other provisions as required by Commission Rule of Practice

and Procedure 210.21(c) (19 C.F.R. § 210.21(c)). Complainants and Nano Digital have filed a Joint Motion to Terminate the Investigation as to Respondents Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc. based on a Consent Order.

IT IS HEREBY ORDERED THAT:

1. Upon the entry of this Consent Order, Nano Digital shall not sell for importation, import into the United States or sell in the United States after importation, directly or indirectly, or aid, abet, encourage, participate in, or induce the sale for importation, importation into the United States or sale in the United States after importation of ink cartridges or components thereof that infringe claims 1, 4 and 10 of the '233 patent, claims 1, 5, 9, 14, 16, 18, 21, 24, 25 and 28 of the '116 patent, claims 1, 3, 14, 15, 17, 18, 20, 30, 36, 49, 60 and 61 of the '749 patent, claims 1, 6 and 13 of the '163 patent, and/or claims 1, 3, 7, 14, 15 and 19 of the '513 patent, except under consent or license from Complainants.
2. This Consent Order shall be applicable to and binding upon Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc., their officers, directors, agents, servants, attorneys, employees, affiliates, and all persons, firms, or corporations acting or claiming to act on its behalf or under its direction or authority.
3. Nano Digital shall be precluded from seeking judicial review or otherwise challenging or contesting the validity of this Consent Order.
4. Nano Digital shall cooperate with and shall not seek to impede by litigation or other means the Commission's efforts to gather information under Subpart I of the Commission's Rules of Practice and Procedure, 19 C.F.R. Part 210.

5. Nano Digital and its officers, directors, employees, agents, and any entity or individual acting on its behalf and with its authority shall not seek to challenge the validity or enforceability of the claims of the '233, '116, '749, '163 and '513 patents in any administrative or judicial proceeding to enforce the Consent Order.

6. When any of the '233, '116, '749, '163 and '513 patents expires, this Consent Order shall become null and void as to such expired patent.

7. This Consent Order shall become null and void as to any claim of any intellectual property right that is held invalid or unenforceable by a court or agency of competent jurisdiction or as to any article that has been found or adjudicated not to infringe the asserted right in a final decision, no longer subject to appeal.

8. This investigation is hereby terminated with respect to Zhuhai Nano Digital Technology Co., Ltd. and Nano Business & Technology, Inc.; provided, however, that enforcement, modification, or revocation of the Consent Order shall be carried out pursuant to Subpart I of the Commission's Rules of Practice and Procedure, 19 C.F.R. Part 210.

By Order of the Commission.

A handwritten signature in black ink, appearing to read 'Lisa R. Barton', with a stylized flourish at the end.

Lisa R. Barton
Secretary to the Commission

Issued: August 5, 2015

**CERTAIN INK CARTRIDGES AND COMPONENTS
THEREOF**

Inv. No. 337-TA-946

PUBLIC CERTIFICATE OF SERVICE

I, Lisa R. Barton, hereby certify that the attached **ORDER** has been served by hand upon the Commission Investigative Attorney, Brian Koo, Esq., and the following parties as indicated, on **August 5, 2015**.



Lisa R. Barton, Secretary
U.S. International Trade Commission
500 E Street, SW, Room 112
Washington, DC 20436

**On Behalf of Complainants Epson Portland Inc., Epson
America, Inc., and Seiko Epson Corporation:**

Paul F. Brinkman, Esq.
QUINN EMANUEL URQUHART & SULLIVAN, LLP
777 6th Street NW, 11th Floor
Washington, DC 20001-3706

- ☐ Via Hand Delivery
☐ Via Express Delivery
☒ Via First Class Mail
☐ Other: _____

Respondents:

Zhuhai Nano Digital Technology Co., Ltd.
No. 3 Factory Building, 2/F
3 Pingxi 5th Road
Nanping State Hi-Tech Park
Zhuhai, Guangdong
China 519060

- ☐ Via Hand Delivery
☐ Via Express Delivery
☒ Via First Class Mail
☐ Other: _____

Nano Business & Technology, Inc., d/b/a Nano Digital,
d/b/a Nano Ink Spot, d/b/a Dinsink
650 North State Street
Lake Oswego, OR 97034

- ☐ Via Hand Delivery
☐ Via Express Delivery
☒ Via First Class Mail
☐ Other: _____



US006502917B1

(12) **United States Patent**
Shinada et al.

(10) **Patent No.:** **US 6,502,917 B1**
(45) **Date of Patent:** **Jan. 7, 2003**

(54) **INK-JET PRINTING APPARATUS AND INK CARTRIDGE THEREFOR**

(75) Inventors: **Satoshi Shinada; Fujio Akahane; Minoru Usui; Takao Kobayashi; Makoto Matsuzaki**, all of Nagano (JP)

(73) Assignee: **Seiko Epson Corporation**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/484,458**

(22) Filed: **Jan. 18, 2000**

Related U.S. Application Data

(63) Continuation-in-part of application No. PCT/JP99/02579, filed on May 18, 1999.

(30) **Foreign Application Priority Data**

May 18, 1998	(JP)	10-151882
May 18, 1998	(JP)	10-151883
Jun. 26, 1998	(JP)	10-180519
Sep. 21, 1998	(JP)	10-266109
Oct. 23, 1998	(JP)	10-301782
Mar. 24, 1999	(JP)	11-078843

(51) **Int. Cl.**⁷ **B41J 29/393; B41J 2/175**
(52) **U.S. Cl.** **347/19; 347/86**
(58) **Field of Search** **347/19, 86, 14, 347/23, 108, 85, 50, 87, 49**

(56) **References Cited**

U.S. PATENT DOCUMENTS

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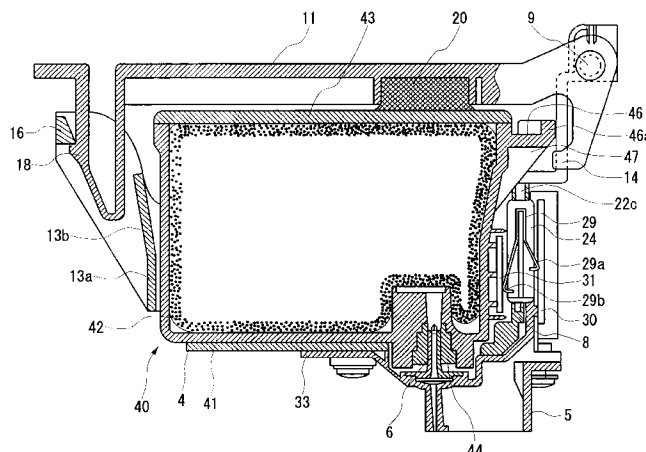
Assistant Examiner—Charles W. Stewart, Jr.

(74) *Attorney, Agent, or Firm*—Stroock & Stroock & Lavan LLP

(57) **ABSTRACT**

An ink jet type printing apparatus in which an ink supply needle is located near one side in a direction perpendicular to the reciprocated directions of a carriage, a circuit board is mounted on a wall of an ink cartridge in the vicinity of the side on which an ink supply port is formed and plural contacts for connecting to external control means are formed on the exposed surface of the circuit board.

38 Claims, 24 Drawing Sheets



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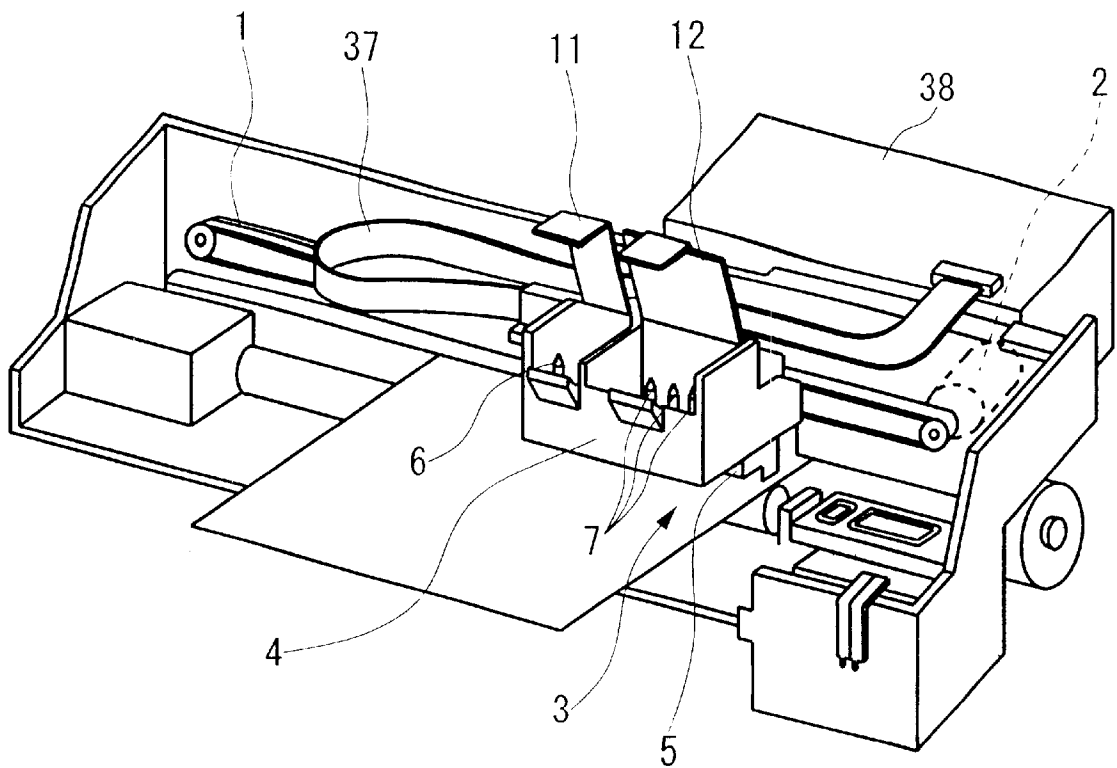


FIG. 1

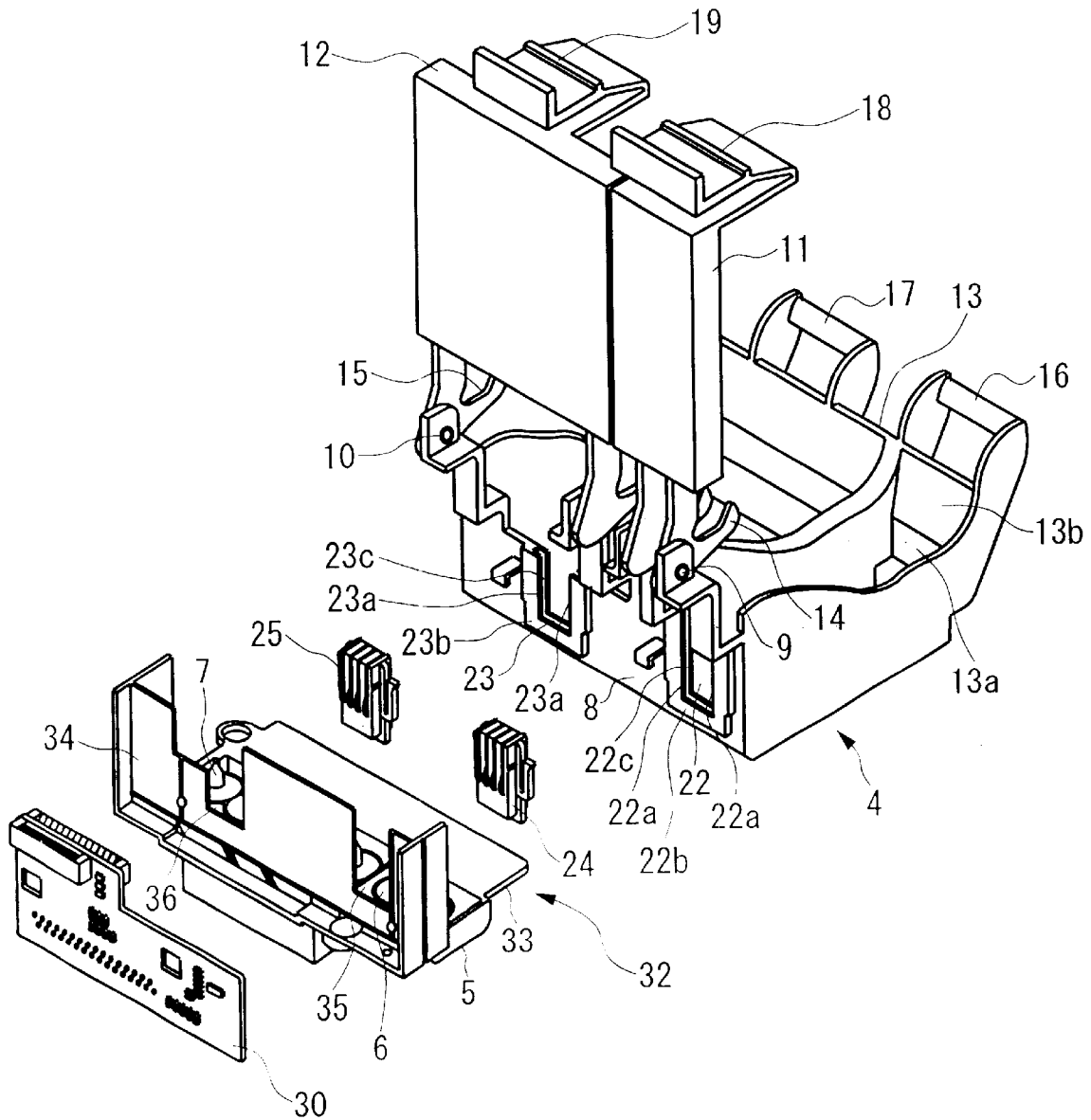


FIG. 2

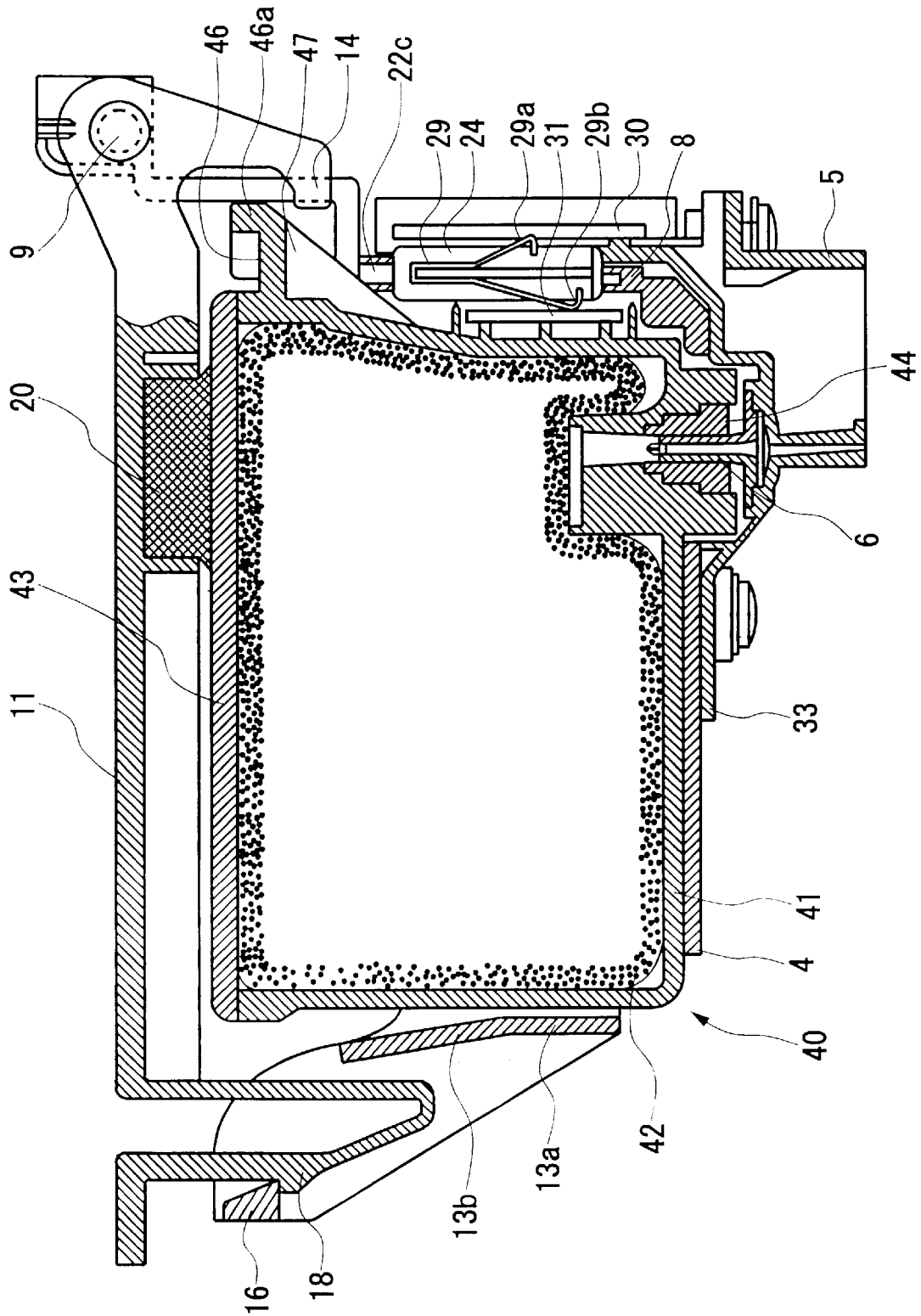


FIG. 3

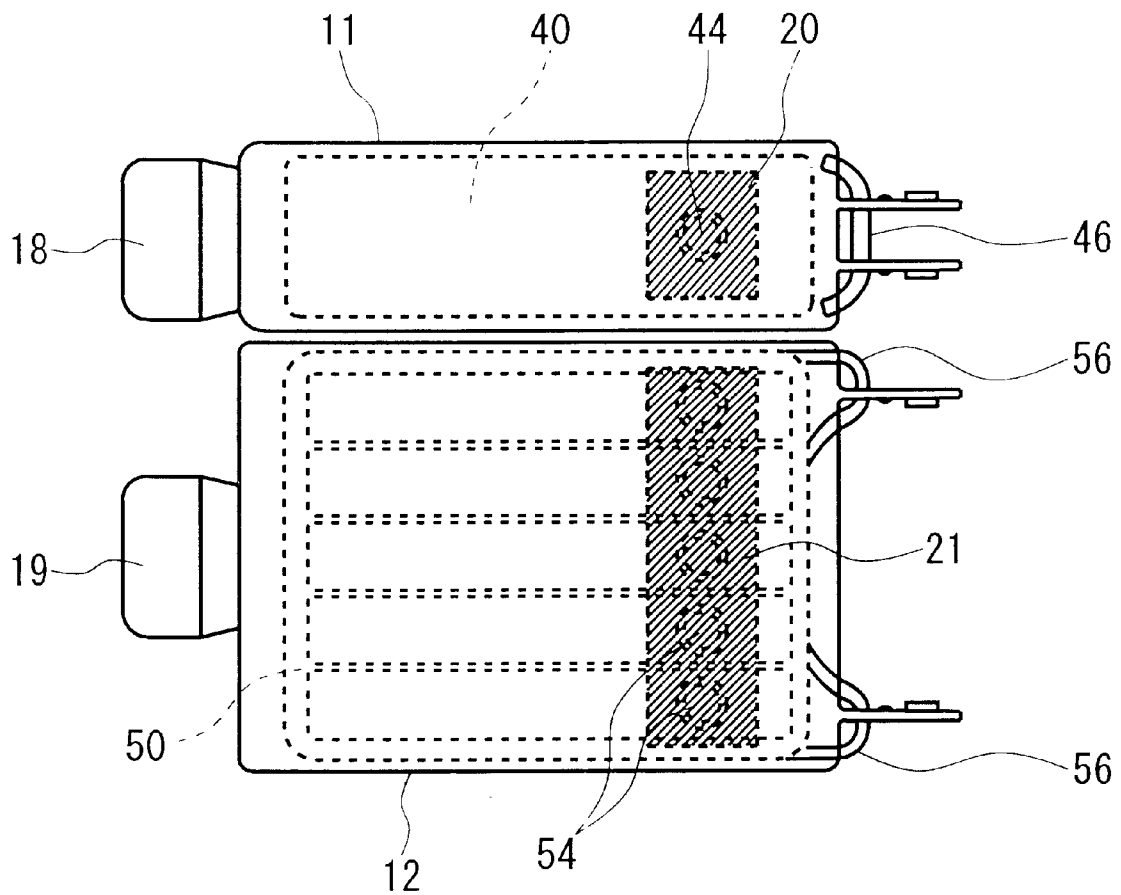


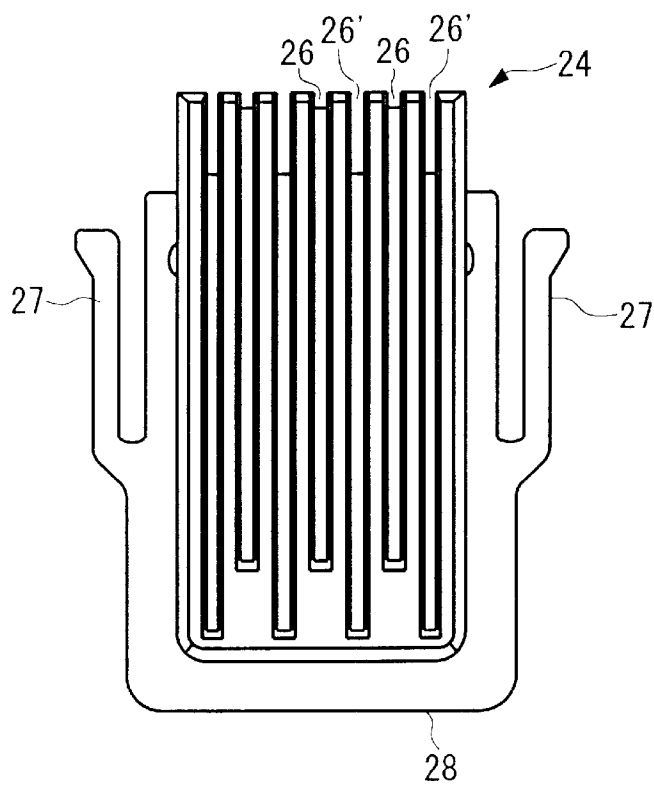
FIG. 4

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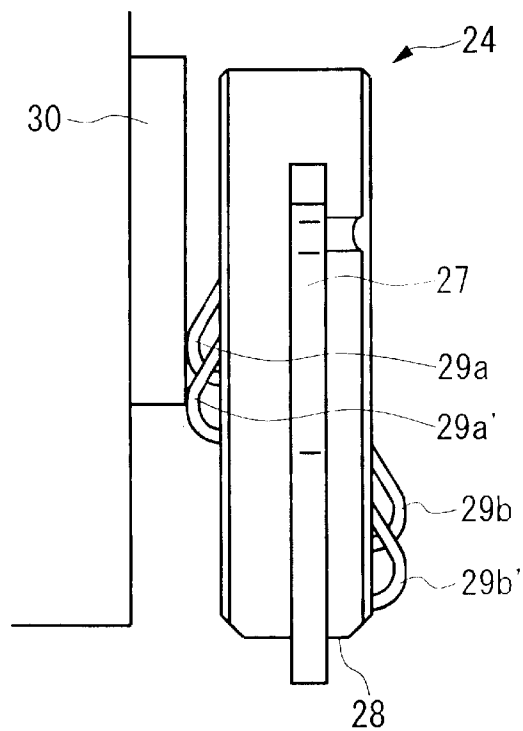
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(a)



(b)

FIG. 5

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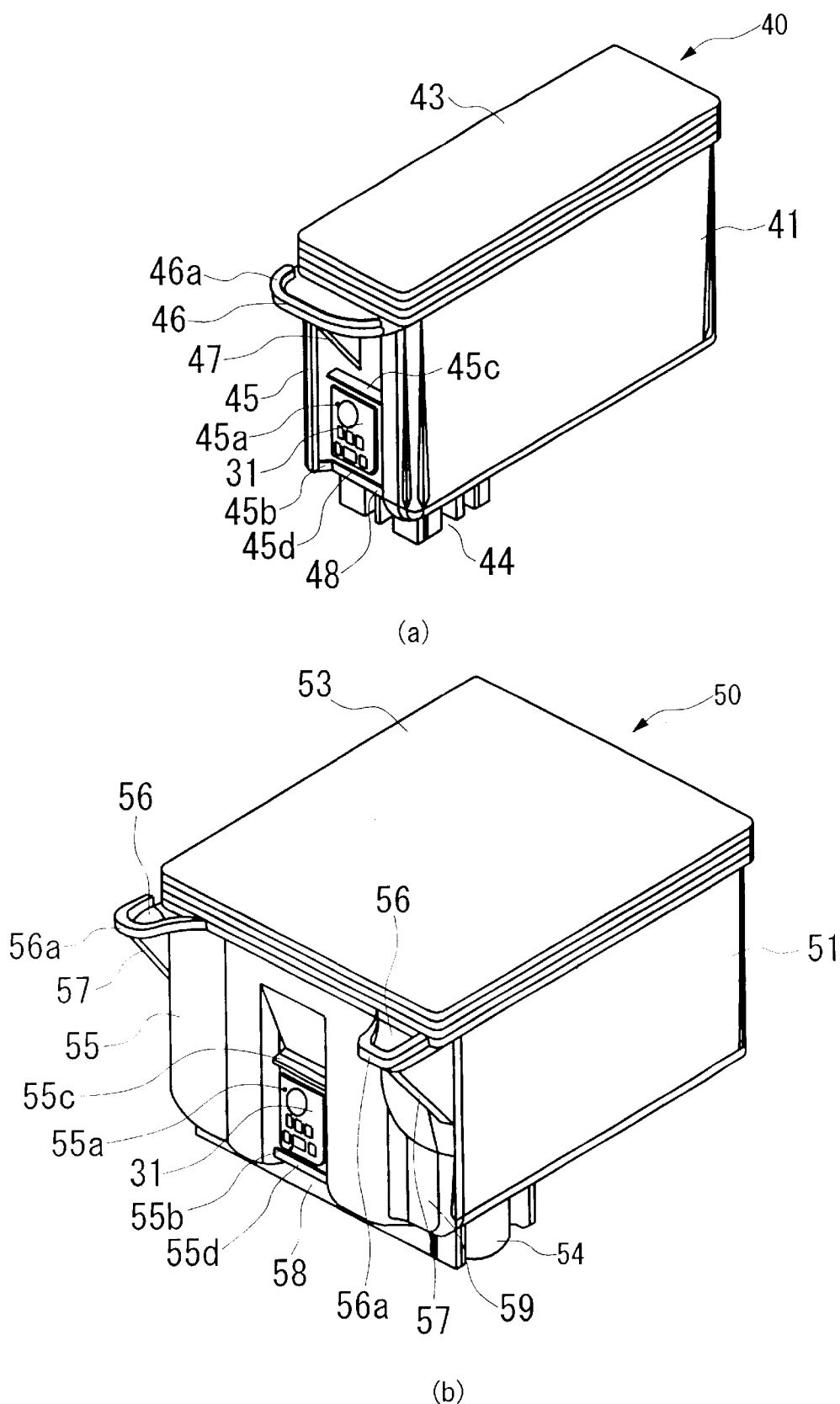


FIG. 6

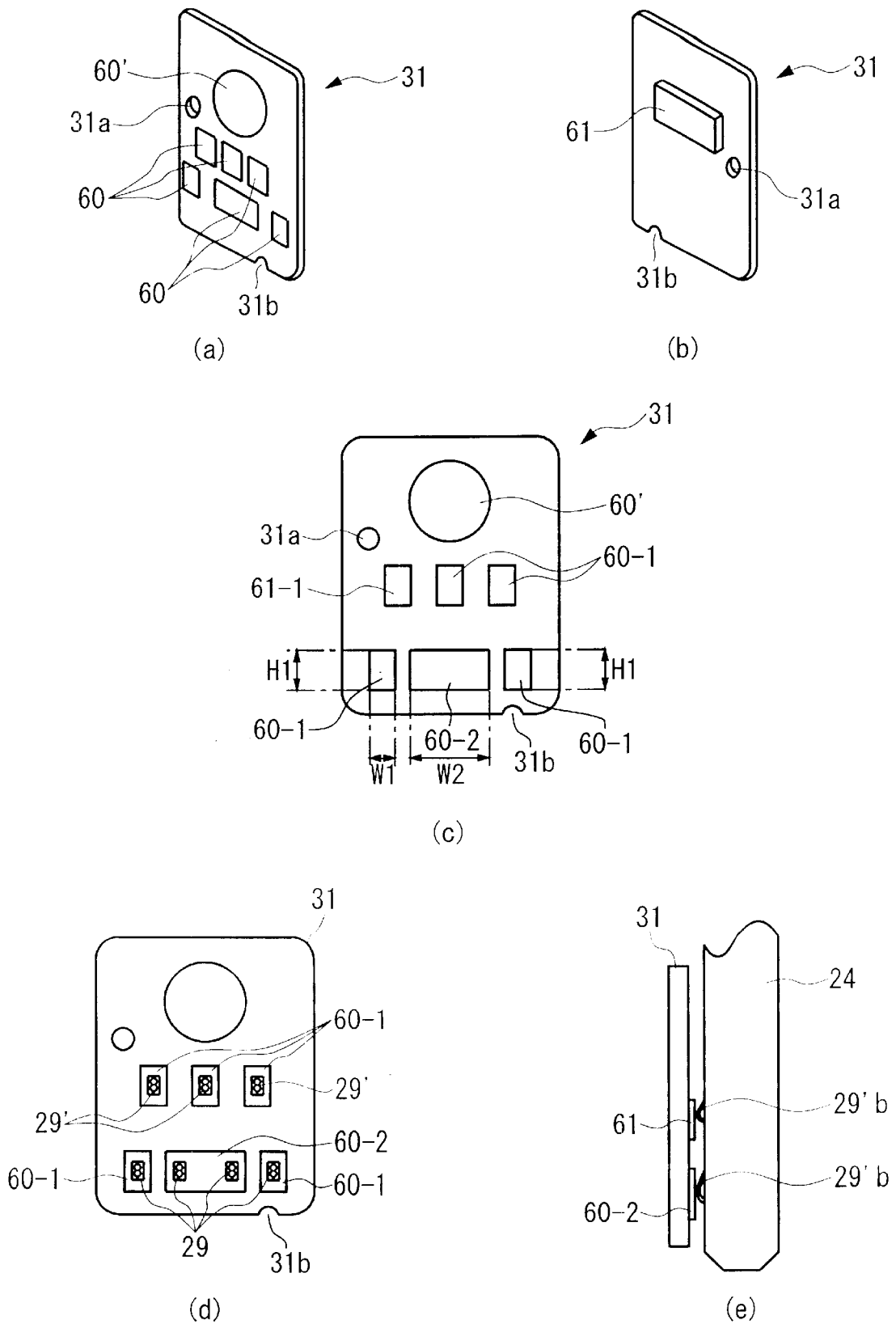


FIG. 7

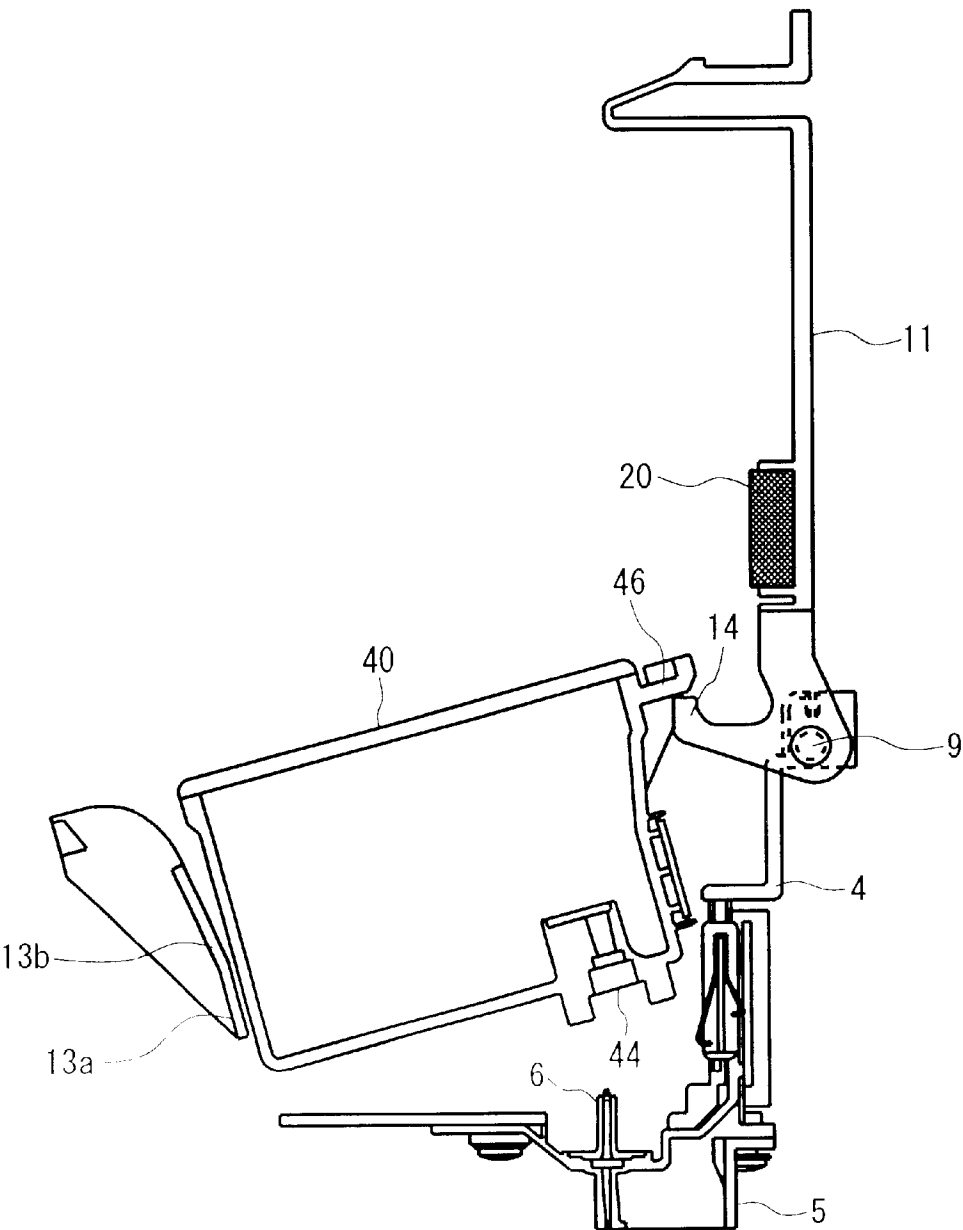


FIG. 8

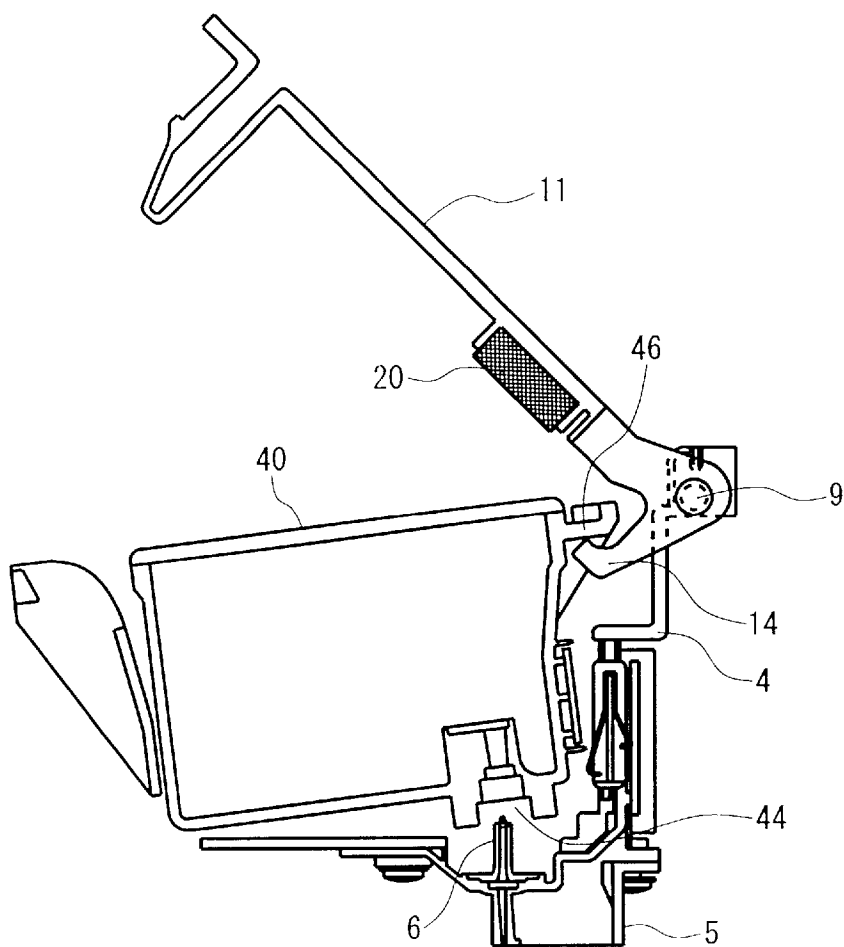


FIG. 9

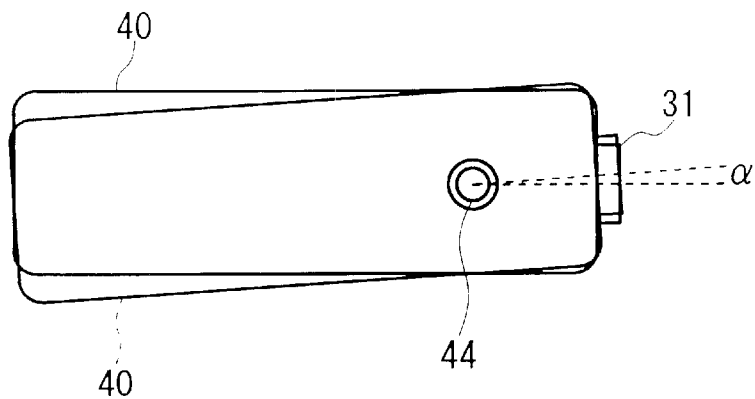


FIG. 10

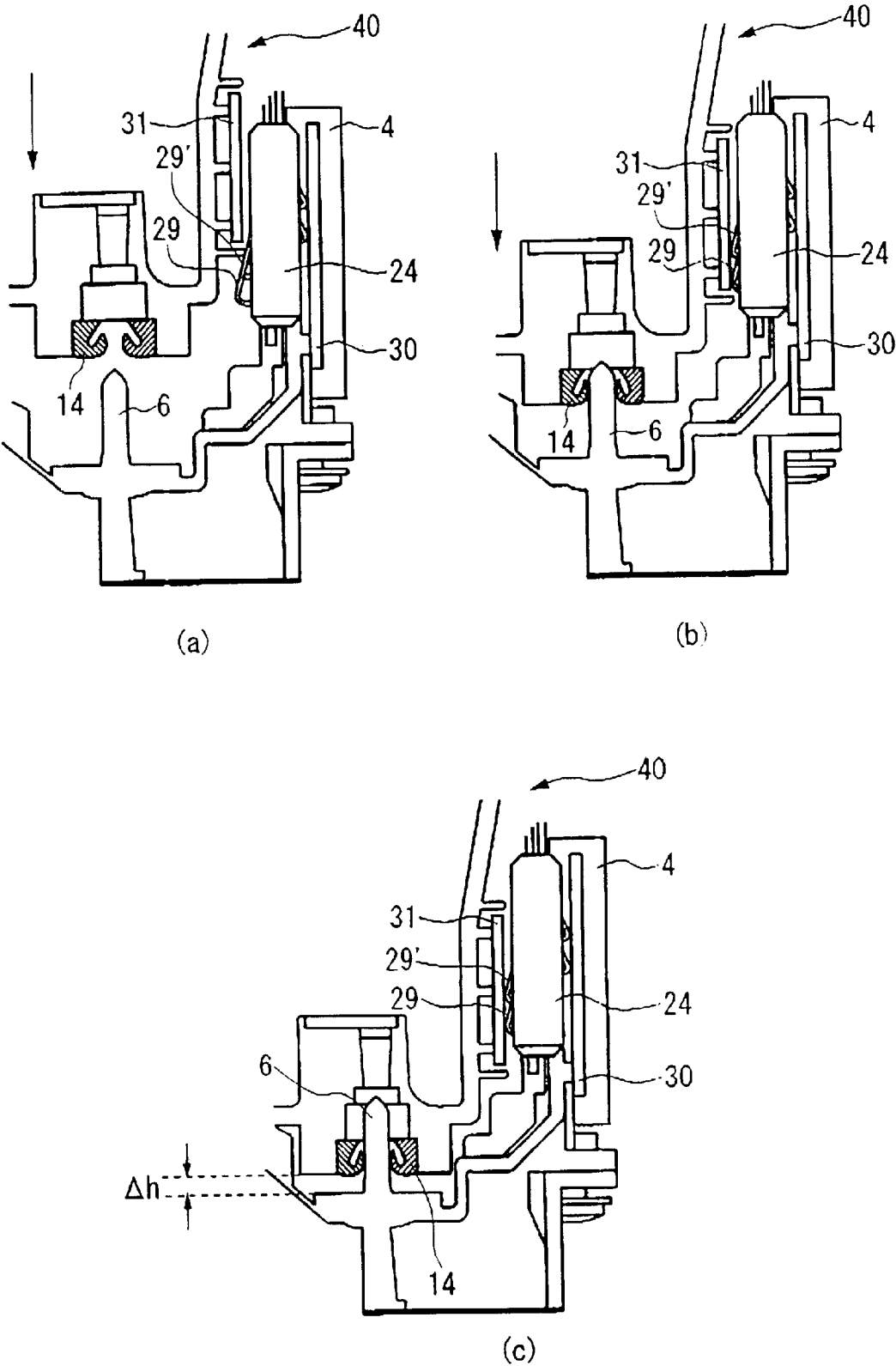
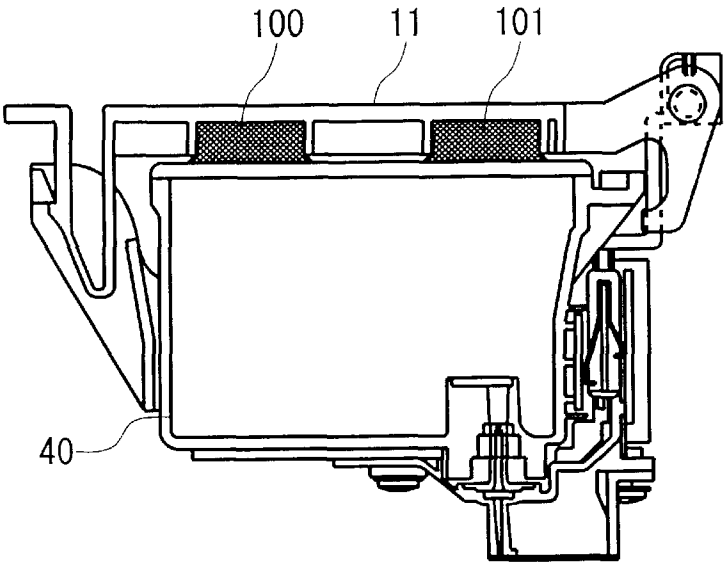
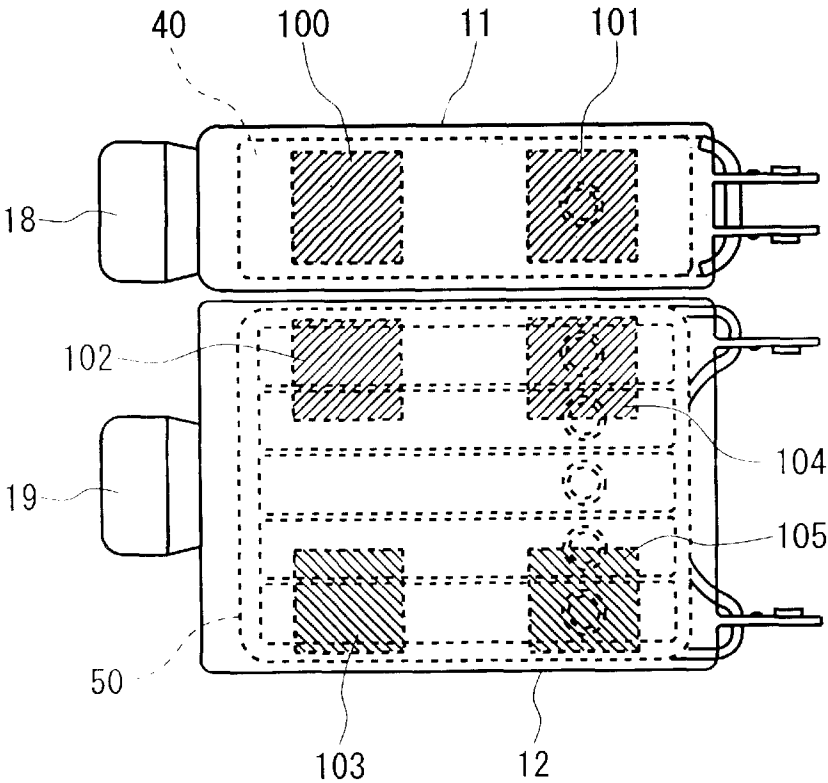


FIG. 11

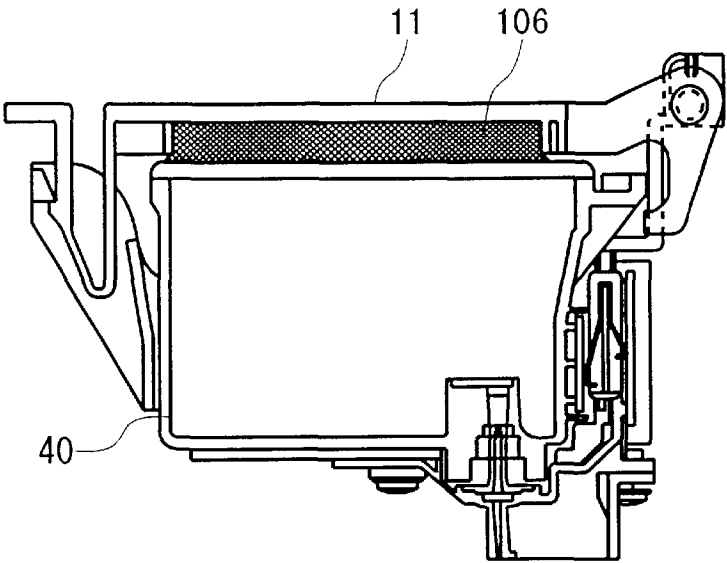


(a)

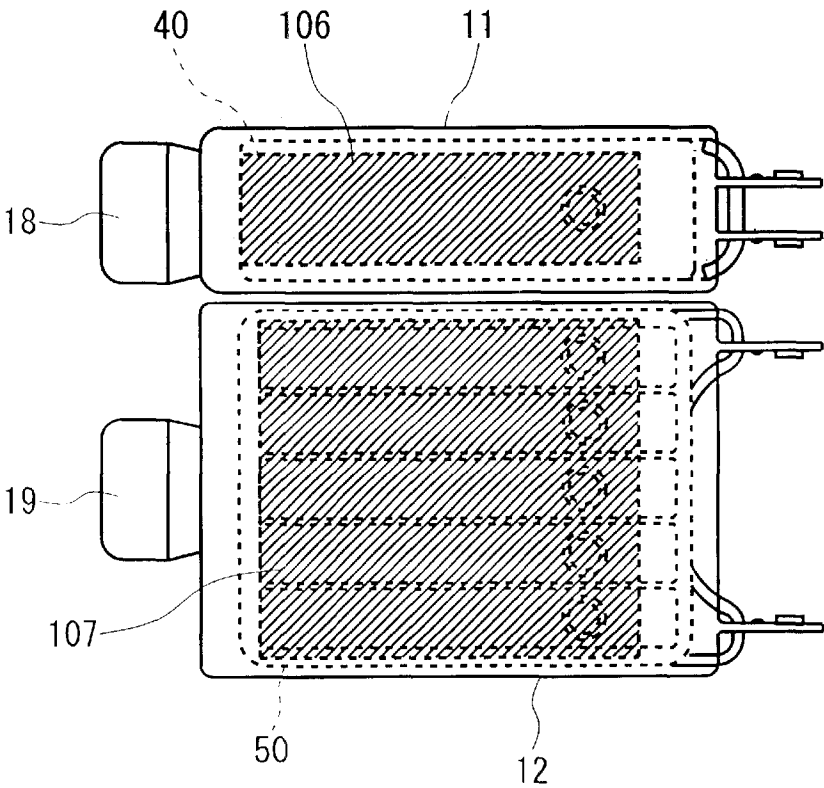


(b)

FIG. 12



(a)



(b)

FIG. 13

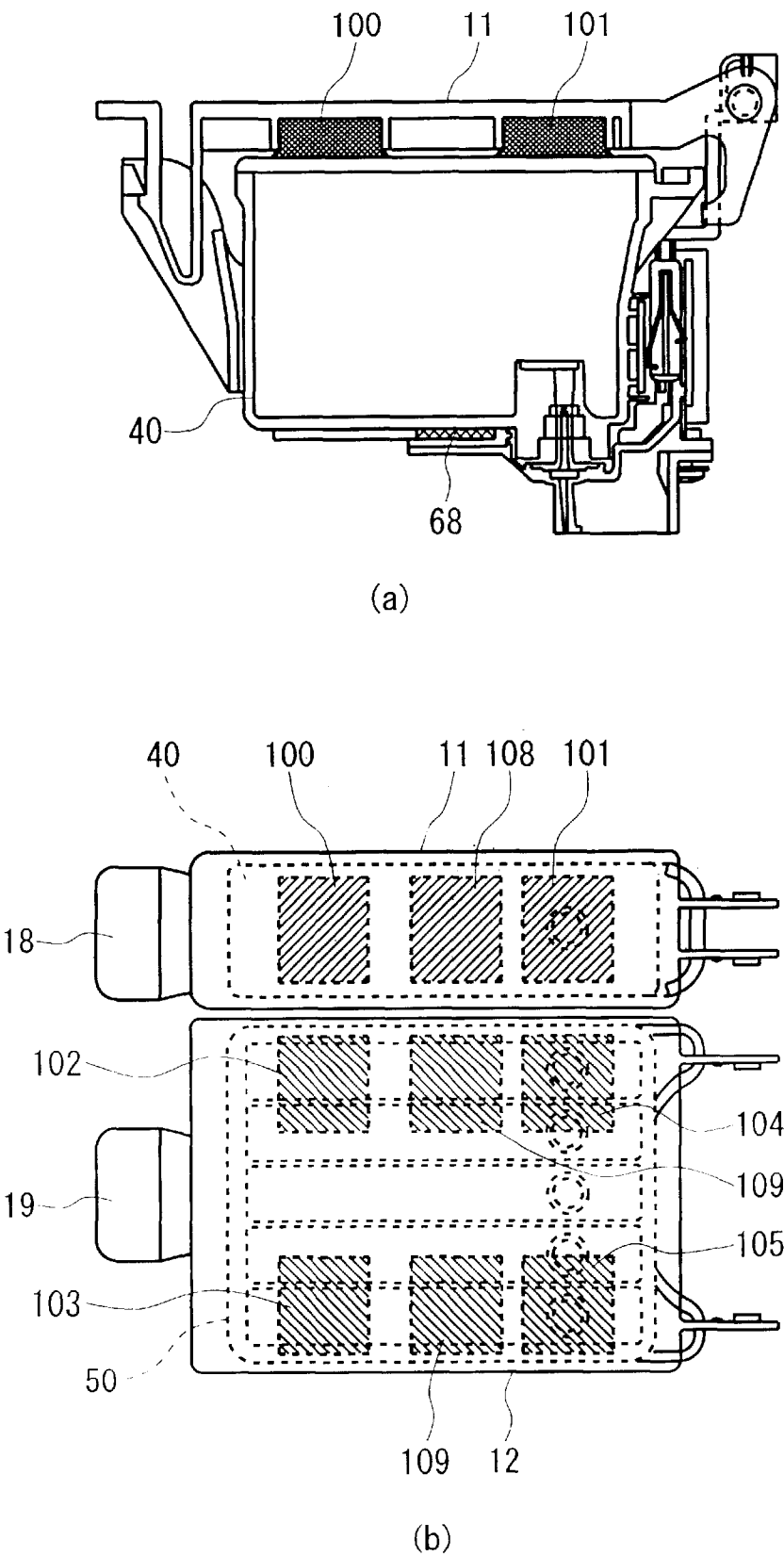


FIG. 14

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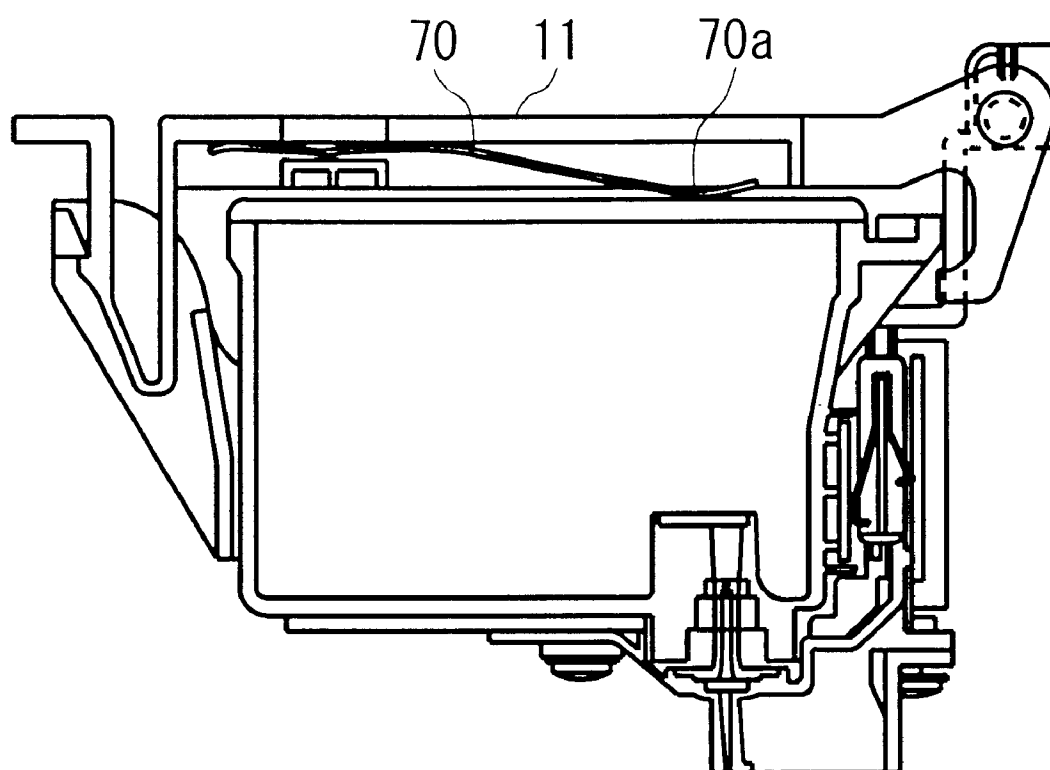


FIG. 15

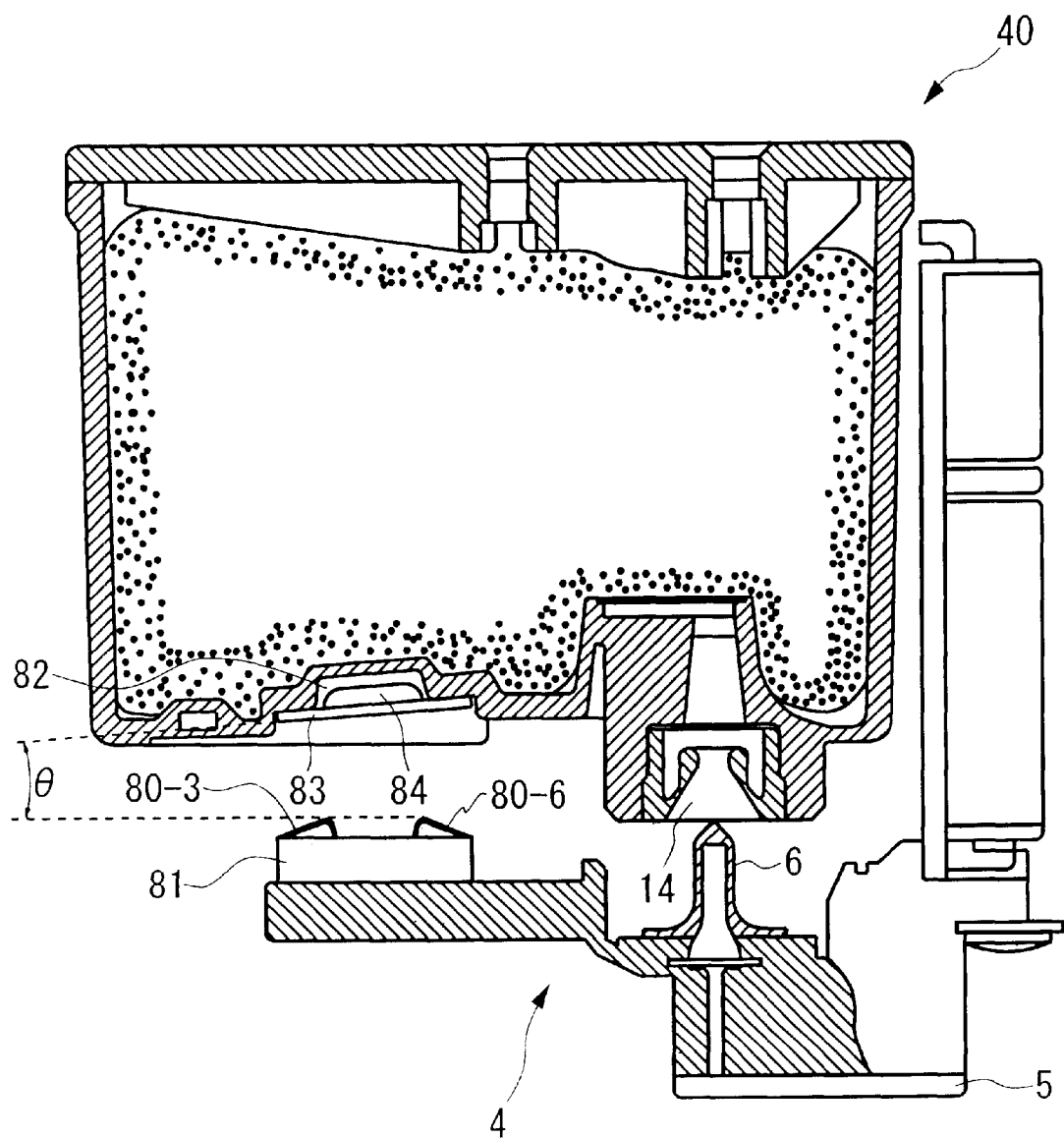
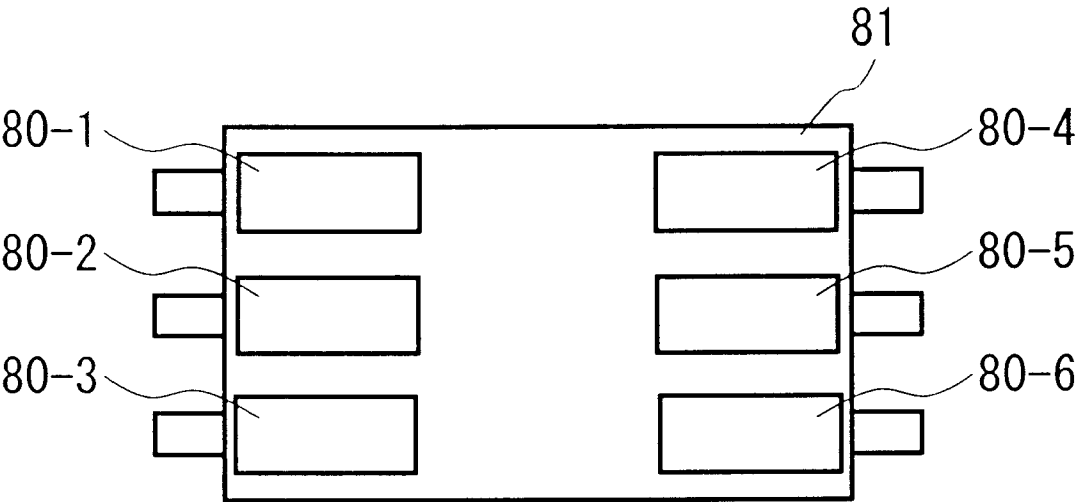
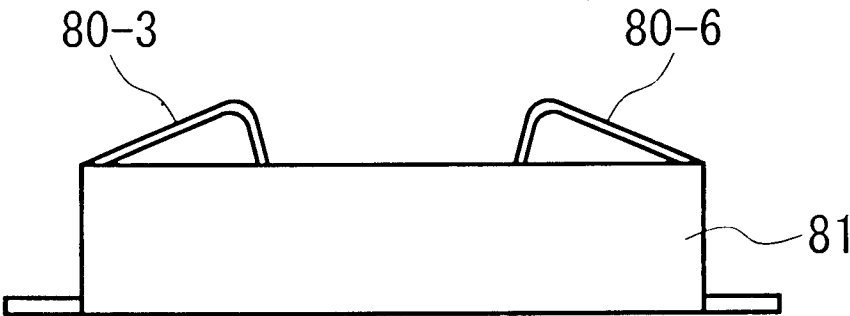


FIG. 16

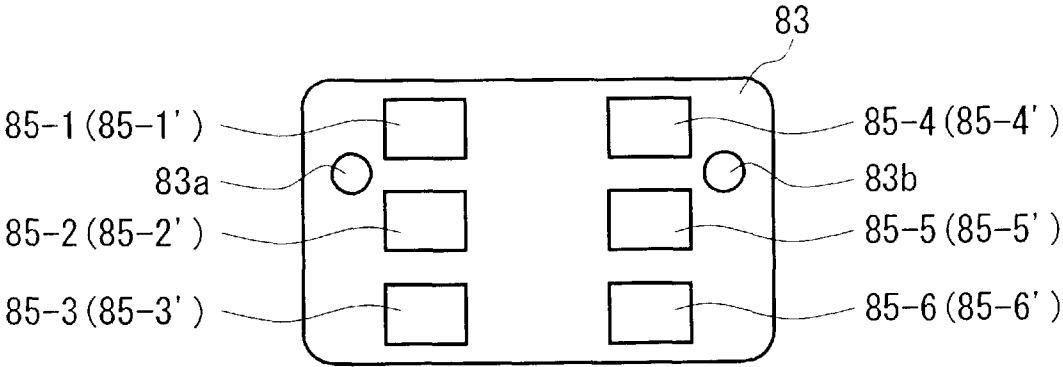


(a)

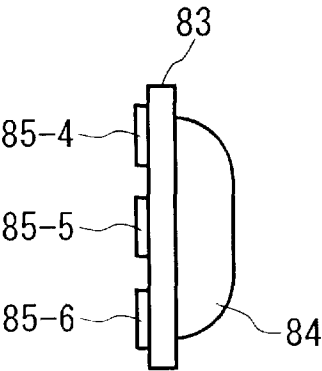


(b)

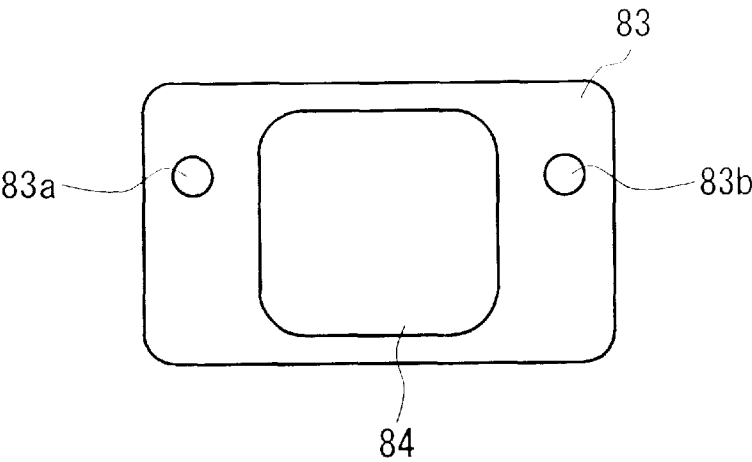
FIG. 17



(a)

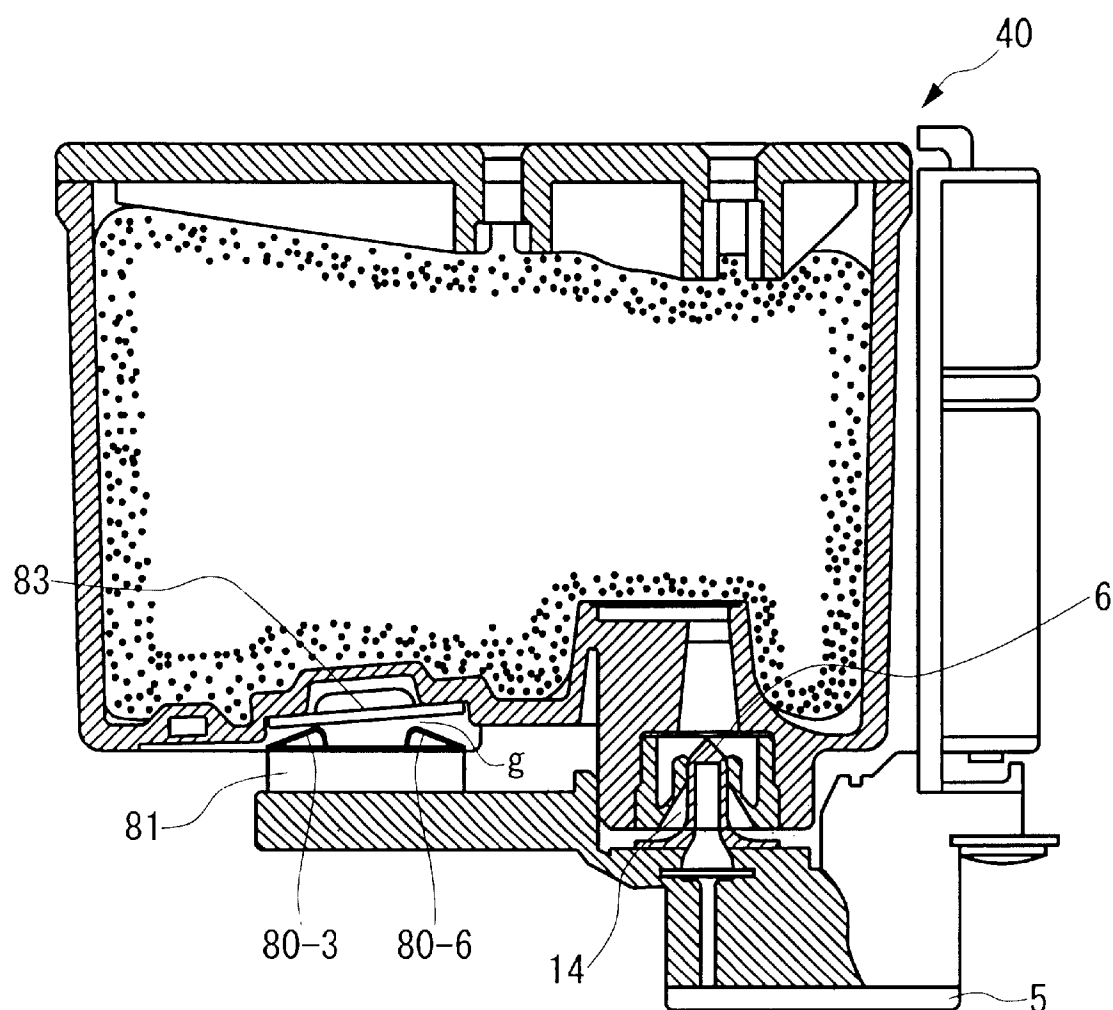


(b)



(c)

FIG. 18



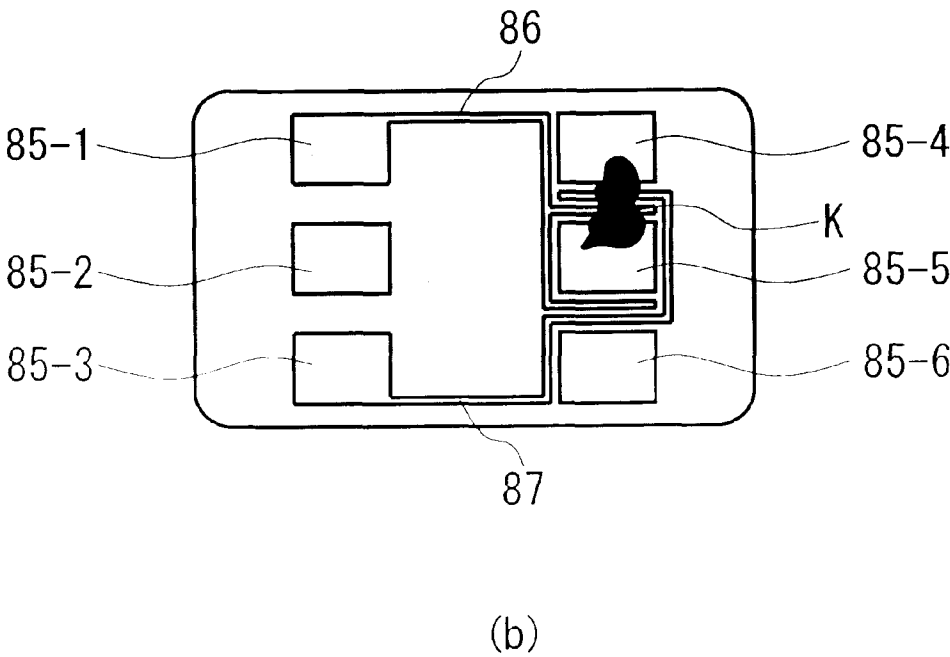
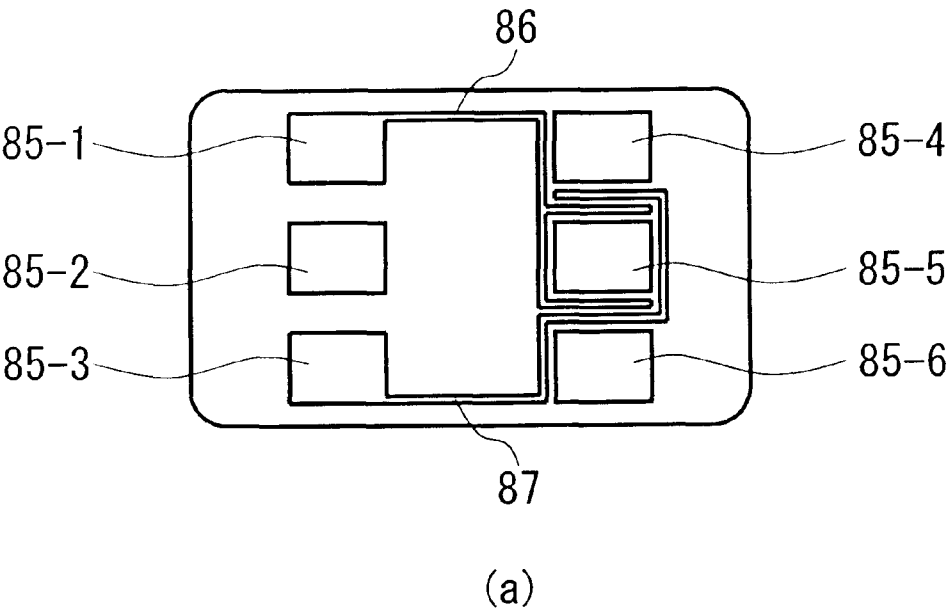


FIG. 20

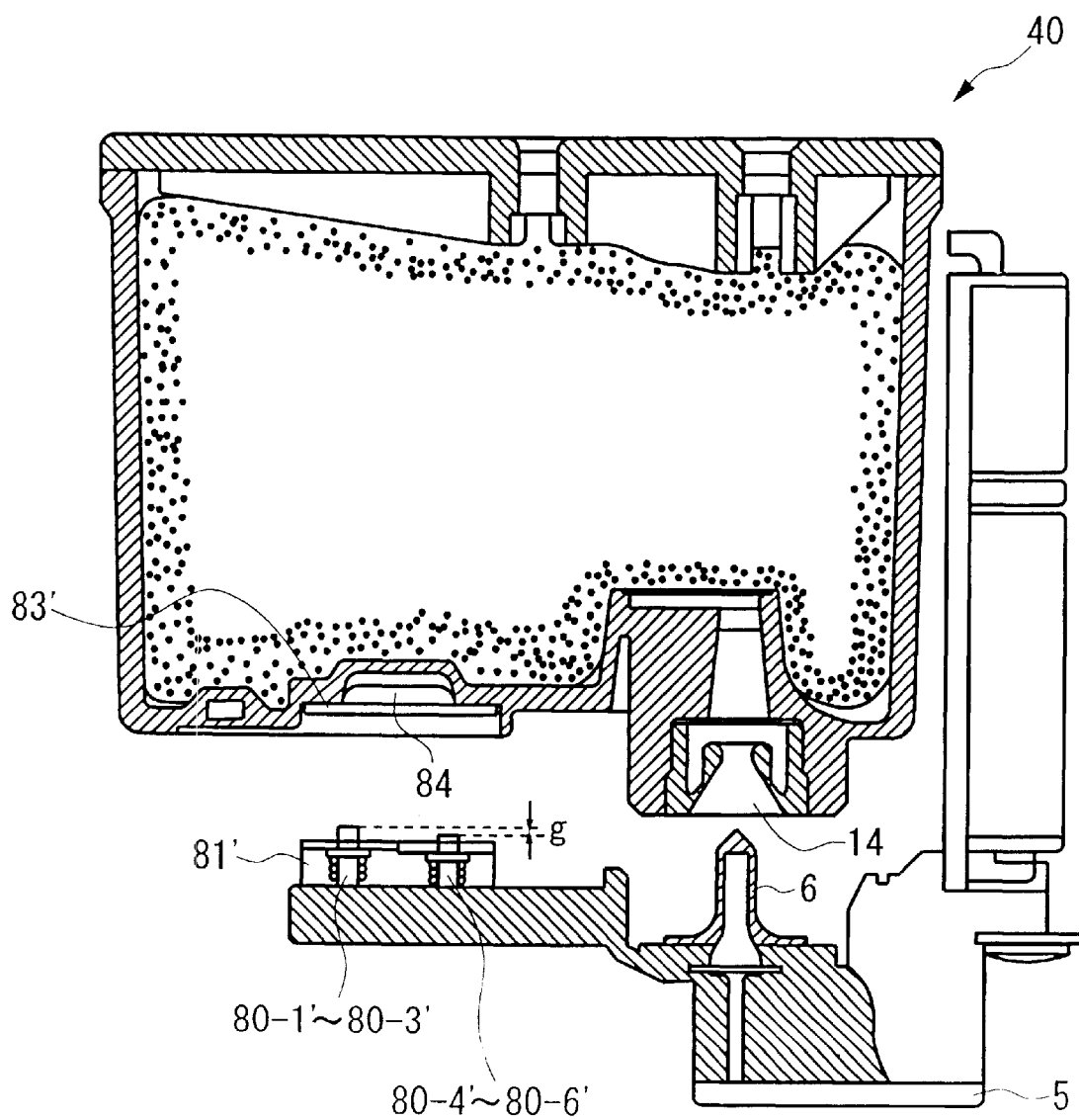


FIG. 21

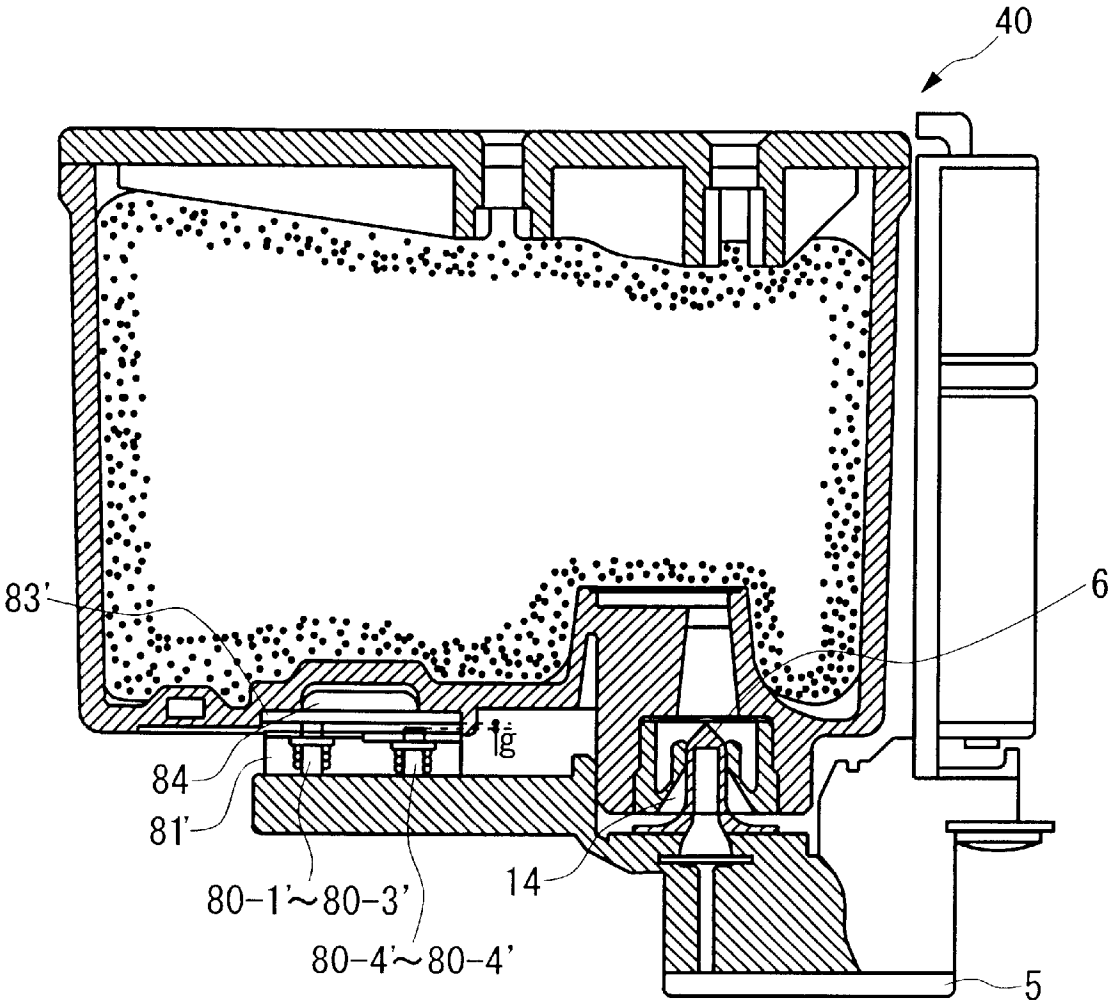
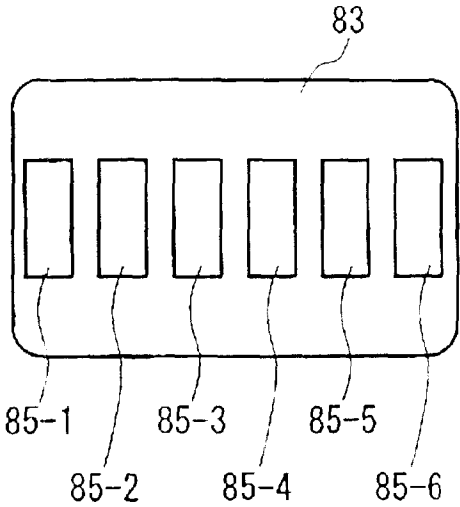
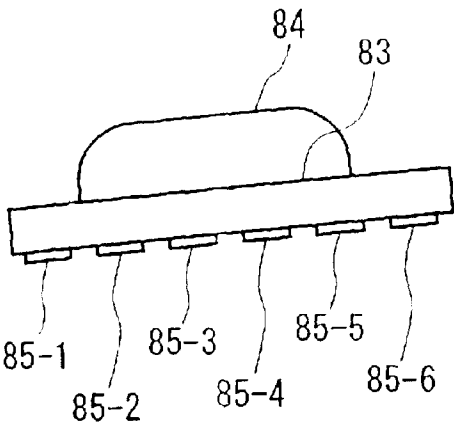


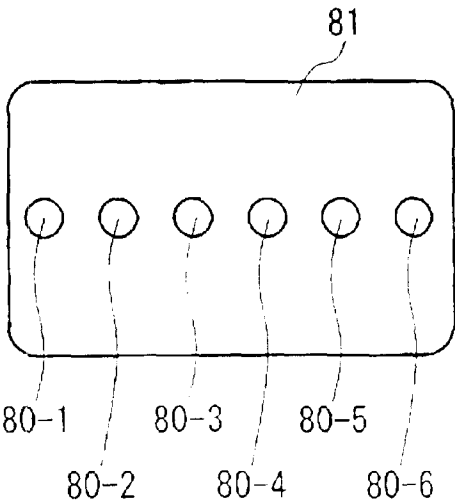
FIG. 22



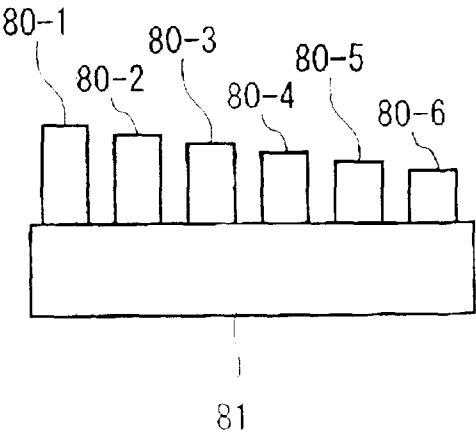
(a)



(b)



(c)



(d)

FIG. 23

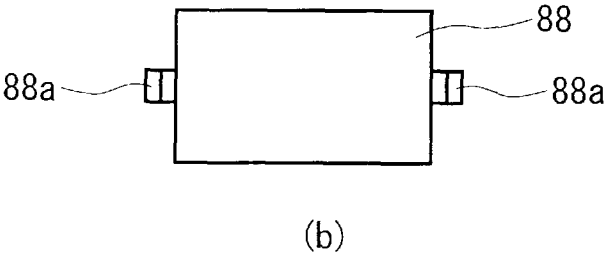
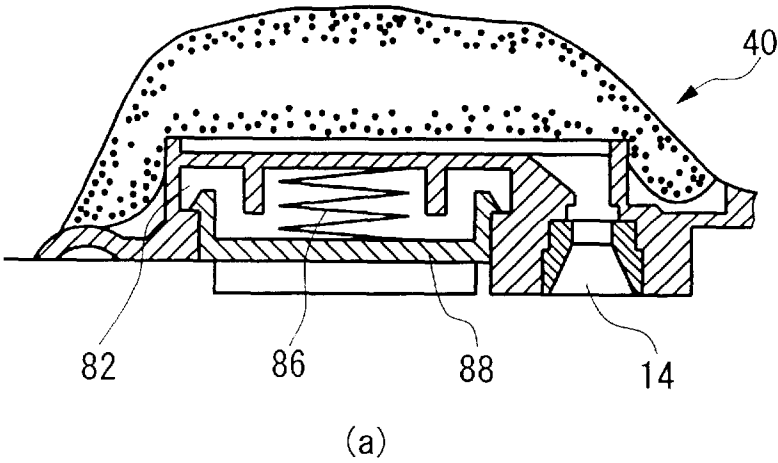


FIG. 24

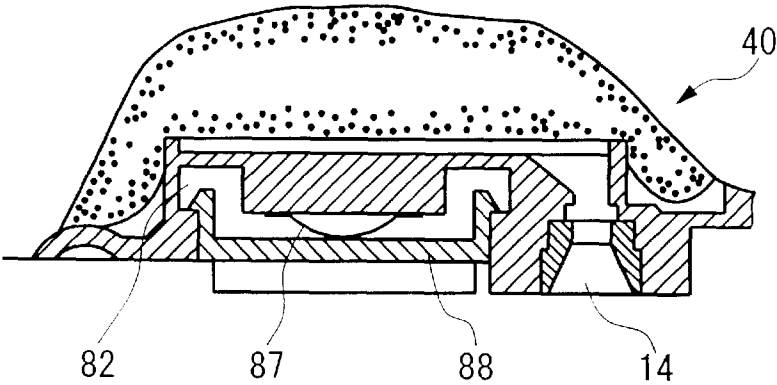
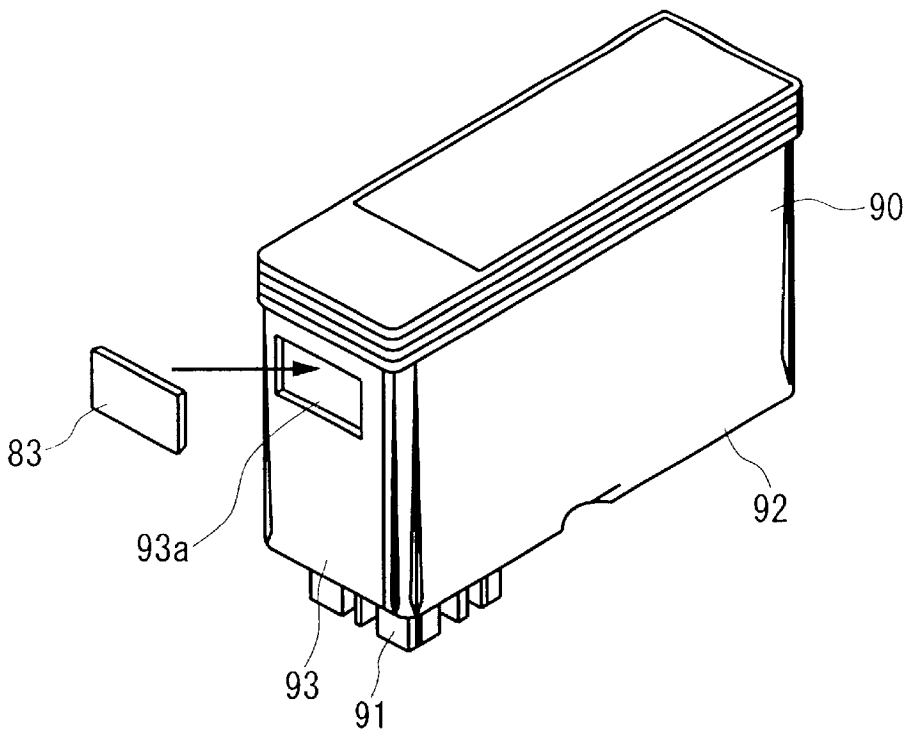
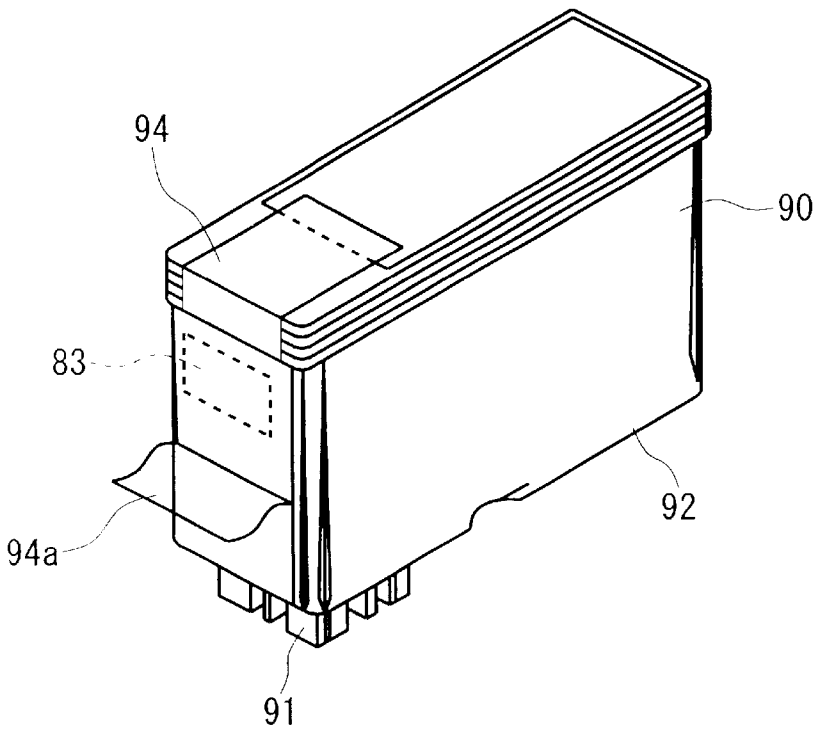


FIG. 25



(a)



(b)

FIG. 26

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**INK-JET PRINTING APPARATUS AND INK
CARTRIDGE THEREFOR**

**CROSS-REFERENCE TO RELATED
APPLICATIONS**

This is a continuation-in-part of PCT Application No. PCT/JP99/02579, filed May 18, 1999, which claims benefit of priority based on Japanese and PCT Application Ser. 10-151883, filed May 18, 1998, 10-151882, filed May 18, 1998, 10-180519, filed Jun. 26, 1998, 10-266109, filed Sep. 21, 1998, 10-301782, filed Oct. 23, 1998, and 11-78843, filed Mar. 24, 1999.

This is a Continuation-in-Part of PCT Application No. PCT/JP99/02579, filed May 18, 1999, which claims benefit of priority based on Japanese and PCT Application No. 10-151883, filed May 18, 1998, 10-151882, filed May 18, 1998, 10-180519, Jun. 26, 1998, 10-266109, Sep. 21, 1998, 10-301782, Oct. 23, 1998, 11-78843, Mar. 24, 1999.

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates to a printing apparatus to which ink is supplied from a replaceable ink cartridge for printing on a recording medium, ejecting an ink droplet from nozzle apertures and an ink cartridge suitable for the above printing apparatus.

2. Conventional Art

An ink-jet printing apparatus is known in which there is provided with a print head for supplying a driving signal to a piezoelectric vibrator or heating means to print data, pressurizing ink by energy generated by the piezoelectric vibrator or the heating means and thereby ejecting ink droplets from nozzle apertures and an ink cartridge housing ink for supplying ink to the above print head.

As the print quality depends upon the resolution of the print head and greatly depends upon the viscosity of ink, the degree of bleeding on a recording medium or the like, the characteristics of ink are improved to enhance the print quality. Even if the same ink is used, a driving method of a print head suitable for the characteristics of ink is improved to enhance the print quality. Further, a maintenance condition such as the cycle of no-medium-ejection or forced ejection in a capping state is improved to prevent the nozzle apertures from clogging.

As described above, the print quality of a printing apparatus can be enhanced when the ink characteristics and the driving method for a print head work together, not only by the ink characteristics. Although a result by such technical development can be applied to a newly manufactured ink-jet printing apparatus, the application to a printing apparatus already shipped from a manufacturer would be practically impossible when taking into consideration the cost, labor and others. This is because that the printing apparatus has to be carried to the manufacturer and storing means in which control data is recorded must be exchanged.

To cope with such a problem, as disclosed in Japanese Patent Publication No. 2594912 for example, there has been proposed a printing apparatus in which semiconductor storage means and an electrode connecting to the storage means are arranged on an ink cartridge, a group of electrodes is also arranged on the body of the printing apparatus, data stored in the semiconductor storage means is read, and recording operation is controlled in accordance with the data.

However, there is a problem that contact with the semiconductor storage means is failed because of rough opera-

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tion for attaching or detaching an ink cartridge by a user or play between a carriage and an ink cartridge, the reading of data is disabled because of electrification or the application of a signal at unsuitable timing and, in the worst case, data is lost and recording operation is disabled.

The present invention is made in view of such a problem and an object of which is to provide an ink-jet printing apparatus wherein data stored in semiconductor storage means can be prevented from being lost independent of unsuitable operation for attaching or detaching an ink cartridge.

Another object of the present invention is to provide an ink cartridge suitable for the above printing apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows an embodiment of a printing apparatus according to the present invention mainly in relation to its recording mechanism, and

FIG. 2 is an assembly perspective drawing showing an embodiment of a carriage in the above printing apparatus.

FIG. 3 shows an embodiment of the carriage in the above printing apparatus in a state in which an ink cartridge is installed,

FIG. 4 is a top view showing an embodiment of the carriage in the above printing apparatus in a state in which an ink cartridge is installed, and

FIGS. 5(a) and 5(b) show an embodiment of a contact mechanism of the above carriage.

FIGS. 6(a) and 6(b) show an embodiment of an ink cartridge suitable for the above printing apparatus,

FIGS. 7(a) to 7(c) show an embodiment of a circuit board mounted on the ink cartridge in relation to its superficial and rear structure and the size of an electrode and

FIGS. 7(d) and 7(e) show a state of contact with a contact,

FIGS. 8 and 9 show a process in which the above ink cartridge is installed,

FIG. 10 shows the quantity of the movement of mainly an ink supply port where an ink supply needle is inserted of the ink cartridge, and

FIGS. 11(a) to 11(c) show a process of contact between the circuit board of the ink cartridge and a contact of a holder.

FIGS. 12(a), 12(b) to FIGS. 14(a) and 14(b) are respectively sectional views and top views showing another embodiment of the present invention in a state in which the ink cartridge is installed, and

FIG. 15 is a sectional view showing another embodiment of the present invention in a state in which the ink cartridge is installed.

FIG. 16 is a sectional view showing another embodiment of the head holder and the ink cartridge respectively in the above printing apparatus,

FIGS. 17(a) and 17(b) are respectively a plan and a side view showing an embodiment of the contact provided to the above head holder, and

FIGS. 18(a) to 18(c) are respectively a front view, a side view and a rear view showing a contact board mounted on the above ink cartridge.

FIG. 19 is a sectional view showing first conduction in a process for inserting the ink cartridge, and

FIG. 20(a) is a plan showing the other embodiment of the contact mounted on the above ink cartridge and FIG. 20(b) shows a state in which ink adheres.

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FIG. 21 is a sectional view showing the other embodiment of the head holder and the ink cartridge respectively in the printing apparatus according to the present invention, and

FIG. 22 is a sectional view showing first conduction in the process for inserting the ink cartridge in the above printing apparatus.

FIGS. 23(a) to 23(d) are respectively plans and side views showing the other embodiment of the present invention in relation to the arrangement of the contacts, and

FIGS. 24(a) and 24(b) are respectively sectional views showing another embodiment of the mounting of the circuit board on the ink cartridge and a top view showing the structure of a mounting plate.

FIG. 25 is a sectional view showing another embodiment of the mounting of the circuit board on the ink cartridge.

FIGS. 26(a) and 26(b) show the other embodiment of the mounting of the circuit board.

THE BEST MODE FOR EMBODYING THE PRESENT INVENTION

FIG. 1 shows one embodiment of an ink-jet printing apparatus according to the present invention with respect to a printing mechanism. A holder 4 for installing a black ink cartridge 40 housing black ink described later and a color ink cartridge 50 housing color ink is disposed on an upper surface of a carriage 3 connecting to a driving motor 2 via a timing belt 1. A print head 5 to which ink is supplied from each ink cartridge is provided on the lower surface of the carriage 3.

FIG. 2 shows an embodiment of the carriage in a state in which the carriage is disassembled into a holder part and a head part and FIG. 3 is a sectional structural view sectioned at an ink supply port 44 of the black ink cartridge 40.

Ink supply needles 6 and 7 communicating with the print head 5 are vertically penetrated in the bottom of the carriage 3 so that they are located on the back side of the device, that is, on the side of the timing belt 1. Levers 11 and 12 are respectively mounted at the upper end of a vertical wall 8 opposite to each vicinity of the ink supply needles 6 and 7 out of the vertical wall forming the holder 4 so that the levers are respectively rotatable along shafts 9 and 10. A wall 13 located on the side of each free end of the levers 11 and 12 is composed of a vertical part 13a near the bottom and a sloped part 13b sloped outward in its upper area.

The levers 11 and 12 respectively extend from the vicinity of the shafts 9 and 10 so that projections 14 and 15 respectively fitted to overhangs 46 and 56 described later at the upper end of the ink cartridges 40 and 50 are approximately perpendicular to each body of the respective levers 11 and 12, and hook portions 18 and 19 elastically fitted to hooks 16 and 17 formed in the sloped part 13b of the holder 4 are respectively formed.

Elastic members 20 and 21 for elastically pressing at least the area opposite to the ink supply port 44 or 54 of each ink cartridge 40 or 50, as shown in FIG. 4, when the ink cartridge 40 is set in a normal position are provided to the back of each lever 11 or 12, that is, the face opposite to a cover 43 of the ink cartridge 40.

For these elastic members 20 and 21, material having the coefficient of friction of 0.5 or more for the respective covers 43 and 53 of the ink cartridges 40 and 50, for example, rubber the hardness of which is 10° to 70°, foamed material and a felt member and, further, gelled material are employed.

Windows 22 and 23 each upper part of which is open are respectively formed on the vertical wall 8 located near the

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ink supply needle. Further, continuous grooves 22c and 23c are respectively formed on vertical walls 22a and 23a and at the bottoms 22b and 23b to respectively form each window, and contact mechanisms 24 and 25 are respectively inserted into these grooves 22c and 23c and fixed therein.

As the contact mechanisms 24 and 25 are composed so that they have approximately the same structure, one contact mechanism 24 will be described below. As shown in FIGS. 5(a) and 5(b), two types of slits 26 and 26' different in depth are formed approximately at fixed pitch, the contact forming members 29 and 29' provided with conductivity and elasticity are fitted into each slit 26 or 26' of the body 28 provided with an elastically transformable pawl 27 on both sides. These contact forming members 29 and 29' are respectively located unevenly and fixed so that they are exposed on the superficial and rear sides of the body 28.

Areas 29a and 29'a exposed from each one face of the contact forming members 29 and 29' respectively elastically come in contact with the contact of a circuit board 30 by composing the contact mechanisms 24 and 25 as described above and fitting the circuit board 30 in front of a vertical wall 34 of a base 32, areas 29b and 29'b exposed from the other face respectively elastically come in contact with the contact of a circuit board 31 described later of the ink cartridges 40 and 50, and conduction is acquired.

In the meantime, the print head 5 is fixed to the bottom of the holder 4 via a horizontal part 33 of the base 32 composed together with the ink supply needles 6 and 7 so that the base is approximately L-type. Windows 35 and 36 are respectively formed in areas opposite to the contact mechanism 24 and 25 on the vertical wall 34 of the base 32 and the above circuit board 30 is held on its front side.

The circuit board 30 is connected to control means 38 via a flexible cable 37 shown in FIG. 1, supplies a driving signal for instructing the print head 5 to jet an ink droplet and comes in contact with the circuit board 31 of the ink cartridges 40 and 50 respectively via the contact mechanisms 24 and 25.

FIGS. 6(a) and 6(b) show an embodiment of the black ink cartridge 40 and the color ink cartridge 50, a porous number 42 impregnated with ink is respectively housed in containers 41 and 51 formed so that they are substantially parallelpiped and the respective upper faces are respectively sealed by the covers 43 and 53.

The ink supply ports 44 and 54 are respectively formed in positions opposite to the ink supply needles 6 and 7 when the ink cartridges are respectively installed in the holder 4 at the bottom of the respective containers 41 and 51, and overhang portions 46, 56 and 56 for fitting in the respective projections 14 and 15 of the levers 11 and 12 are integrated with the respective upper ends of the vertical walls 45 and 55 on the side of the ink supply ports. As shown in FIGS. 6(a) and 6(b), the overhang portions 46, 56 protrude from the housing of the ink cartridges 40, 50, respectively, in a direction perpendicular to a plane of the circuit board 31. The overhang portion 46 of the black ink cartridge 40 is continuously formed from one end to the other end, the overhang portion 56 of the color ink cartridge 50 are individually formed so that they are located on both sides and, further, triangular ribs 47 and 57 are respectively formed between each lower surface and the wall 45 or 55. A reference number 59 denotes a concave portion for preventing wrong insertion.

Concave portions 48 and 58 are respectively formed on the vertical walls 45 and 55 on the side of the ink supply ports so that the concave portions are respectively located in the center of the width of the ink cartridges 40 and 50 and

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the circuit boards **31** are respectively installed in the above concave portions.

As best shown in FIGS. **6(a)** and **6(b)**, the circuit boards **31** is attached on a side wall having the shorter width than the other side wall of the ink cartridges **40** and **50** and located on a central line of the ink supply ports **44** and **54**, respectively. The circuit board **31** is disposed substantially in parallel with the side wall. In addition, as shown in FIG. **6(b)**, the ink cartridge **50** is provided with a plurality of ink chambers for different ink, and the circuit board **31** is disposed substantially at a center of the total width of the plurality of the ink chambers. Because the circuit boards **31** are located as described above, the accurate positional relationship of the circuit boards **31** with the contact member of the printing apparatus can be assured when the ink cartridges **40** and **50** are mounted on the printing apparatus.

Further, it is preferable that the height or depth of the concave portions in which the circuit boards **31** are to be installed is higher than that of the circuit board **31**. Alternately, a plane of the circuit boards **31** is aligned with a surface of the side wall of the ink cartridge **40**, **50** on which the circuit boards **31** are disposed. Because of these arrangement, the circuit boards **31** can be prevented from being touched by a user's finger when the ink cartridge is mounted on the printing apparatus.

Contacts **60** in plural rows in a direction in which the cartridge is inserted, in two rows in this embodiment, are formed in a position respectively opposite to the contact forming members **29** and **29'** of the above contact mechanism **24** on the side of the surface when the circuit board is attached to the ink cartridge of the circuit board **31** as shown in FIG. **7(a)**. A semiconductor storage means **61** may be mounted at the rear surface of the circuit board **31** so that the semiconductor storage means is connected to these contacts **60** and, if necessary, is molded by ink-resistant material and is kept unexposed. The semiconductor storage means **61** may store data of the quantity of ink housed in the ink cartridge **40** or **50** to which the semiconductor storage means is provided, the manufacturing date of the ink, its trademark and the like. If required, the semiconductor storage means **61** stores data such as a maintenance status transmitted from the body of the printing apparatus. A reference number **60'** denotes an electrode used for a check during its manufacturing process. The electrode **60'** is grounded when used.

As shown in FIG. **7**, the electrodes **60** are distanced from an edge of the circuit board **31** or from a position of the circuit board where a contact member of the printing apparatus first comes into abutment when the ink cartridge is mounted on the printing apparatus. Such arrangement is advantageous in that the electrodes **60** on the circuit board **31** can be protected from a damage which might be given to the electrodes **60** when the circuit board **31** comes into abutment with the contact member of the printing apparatus. Further, since the electrodes **60** are distanced from the edge of the circuit board **31**, it is easy to control the position of the circuit board **31** with respect to the contact member of the printing apparatus.

Out of electrodes **60** formed on the circuit board **31**, for a small electrode **60-1** shown in FIG. **7(c)**, the height **H1** may be 1.8 mm and the width **W1** 1 mm, for a large electrode **60-2**, the height **H2** may be 1.8 mm and the width **W2** is 3 mm. Particularly, contact with the contact forming members **29** can be secured by forming the small electrode **60-1** in a rectangle in which the length in the inserted direction of the ink cartridge **40** or **50** is longer than that in the other direction, minimizing the width **W1** of the electrode even if

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there is a lift Δh between the ink cartridge **40** or **50** and the holder **4** as shown in FIG. **11(c)**.

On the circuit board **31** on which the semiconductor storage means **61** is mounted as described above, at least one through hole **31a** and a concave portion **31b** are formed, and projections **45a**, **45b**, **55a** and **55b** for positioning together with the through hole **31a** and the concave portion **31b** and overhangs **45c**, **45d**, **55c** and **55d** which are elastically in contact with the side of the circuit board **31** such as a rib and a pawl are respectively formed near the ink supply ports **44** and **45** in a direction in which the cartridge is inserted in the vertical direction of the circuit board **31** on the vertical walls **45** and **55** which are respectively the mounting faces of the ink cartridges **40** and **50**. In another arrangement, if desired, the circuit board **31** may be provided with at least one projection which engages with a concave portion or through-hole for positioning the circuit board **31** with respect to the ink cartridge.

Hereby, the circuit board can be readily installed, respectively fitting to the ribs **45c**, **45d**, **55c** and **55d** by pressing the semiconductor storage means **61** on the respective walls **45** and **55** of the cartridges **40** and **50**, regulating the position of the semiconductor storage means according to the projection. Hereby, the cartridge is not required to be thickened uselessly for forming a hole for a screw, filling ink of sufficient quantity is enabled, not screwing fastening in which work is relatively troublesome but not riveting in which work is easy can be applied and a manufacturing process can be simplified. The height of the ribs **45c**, **45d**, **55c** and **55d** may preferably be higher than a plane of the circuit board **31** when the circuit board is disposed on the ink cartridge, so that the circuit board **31** may be prevented from touching user's finger when he or she mounts the ink cartridge on the printing apparatus.

In this embodiment, when the cartridge **40** is installed with the lever **11** lifted up to an approximately vertical position, the overhang **46** formed on the side of the ink supply port is caught by the projection **14** of the lever **11**, the side of the other end is supported by the sloped part **13b** of the holder **4** and held in a state in which the side of the ink supply port is lifted as shown in FIG. **8**. In the above installation, if the ink cartridge **40** comes in abutment against the body of the printing apparatus, the circuit board **31** is protected by the overhang portion **46** in the upper part, as the circuit board **31** is also housed in the concave portion **48**, no shock directly operates on the circuit board **31** and damage is prevented.

When the lever **11** is closed in this state, the projection **14** is turned downward, the ink cartridge **40** is lowered, approximately keeping the posture when it is installed and the ink supply port **44** comes in contact with the tip end of the ink supply needle **6** as shown in FIG. **9**. As shown in FIG. **9**, the circuit board **31** is located at an opposite position of a fulcrum of the ink cartridge **40** when it is mounted on or removed from the holder of the printing apparatus. Further, as best shown in FIGS. **6**, **8** and **9**, the circuit board **31**, the ink supply port **44**, **54** and the overhang members **46**, **56** are located at the same side of the ink cartridges **41**, **51**, respectively. Owing to such structure, the positioning of the circuit board **31** with respect to the contact member of the printing apparatus is not largely affected by the quantity of a turn when the ink cartridge **40** is mounted on the holder of the printing apparatus.

As a part over the ink supply port **44** of the cartridge **40** is pressed by the elastic member **20** when the lever **11** is further turned in this state, the ink supply port **44** is pressed

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on the ink supply needle 6 by pressure amplified based upon the ratio of the length of the lever 11 and distance between the shaft 9 and the elastic member 20. When the lever 11 is pressed to the end, it is fixed by the hook 16 with the lever 11 always elastically pressing the cover 43 of the ink cartridge 40 on the side of the ink supply needle via the elastic member 20 as shown in FIG. 3.

Hereby, the ink cartridge 40 is elastically pressed under fixed pressure with the ink supply port 44 fitted to the ink supply needle 6 and a state in which the ink supply port 44 is fitted to the ink supply needle 6, holding them airtight is maintained independent of vibration in printing, shock and vibration due to the movement of a printing apparatus and others.

As the circuit board 31 is located in the center in the width of the cartridge 40 on the vertical wall 45 in the vicinity of the ink supply port, the vertical wall 45 on which the circuit board 31 is fixed is moved possibly in parallel with a locus on which the ink supply port 44 is regulated by the ink supply needle 6.

In the meantime, as the circuit board 31 is located in the vicinity of the ink supply needle 6 even if the cartridge 40 rattles when it is installed and a turn is caused with the ink supply needle 6 in the center, the quantity a of a turn is extremely small as shown in FIG. 10.

For the arrangement set forth above, the circuit board 31 is moved according to a preset path as shown in FIGS. 11(a) to 11(c), comes in contact with the contacts 29 and 29' of the contact mechanism 24 in defined order and in order grouped vertically, prevents data from being lost in the semiconductor storage means 61 due to the application of signals in unprepared order, the contact forming members 29 and 29' elastically come in contact with the contact 60 of the circuit board 31 in a state in which the ink cartridge 40 is securely installed, and the reading of data stored in the semiconductor storage means 61 and the writing of data on the side of the printing apparatus are enabled.

When the installation of the ink cartridge 40 or 50 is finished, the contact forming member 29a of the contact mechanism 24 comes in contact with the electrodes in the upper row out of the electrodes shown in FIGS. 7(d) and 7(e) and the contact forming member 29'a comes in contact with the electrodes in the lower row. Two contact forming members 29 are in contact with the electrode 60-2 arranged in the center in the lower row. The two contact forming members 29 touched to the electrodes 60-2 are grounded and it can be judged by detecting conduction between these on the side of the printing apparatus whether the ink cartridge 40 or 50 is installed or not. Further, as the width W2 of the electrode 60-2 is larger than that of the other electrode 60-1 and the electrode 60-2 is located on the central line of the ink supply port, the electrode 60-2 securely comes in contact with the contact forming member 29'. As the electrodes 60-1 and 60-2 are exposed and a user can check them easily in case the failure of contact is verified, the electrodes are simply wiped by cloth and others and conduction can be recovered. As shown in FIG. 7, the electrode 60-2 is disposed on the same side of the circuit board 31 as the other electrodes 60-1, 61-1 are formed.

When fitting to the hook 16 is released and the lever 11 is turned upward in case ink in the ink cartridge 40 is consumed, the projection 14 of the lever 11 is fitted to the lower part of the overhang portion 46 of the ink cartridge in the process as shown in FIG. 9. When the lever 11 is further turned in this state, the ink cartridge 40 is lifted by the lever 11 and fitting to the ink supply needle 6 is released. As the

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upper half of the ink cartridge 40 is exposed from the holder with the overhang 46 on the side of the ink supply port supported by the projection 14 of the lever 11 as shown in FIG. 8 when the turn of the lever 11 up to an approximately vertical position is finished, the ink cartridge can be easily extracted.

In the above embodiment, only the side of the ink supply port is pressed, however, it is more effective that elastic members 100,101 are provided in two locations in the longitudinal direction of the lever 11 as shown in FIGS. 12(a) and 12(b) and in the case of the wider cartridge 50 for color ink, elastic members 102 to 105 are provided in four locations, dispersing the elastic members in the direction of the width of the lever 12.

As shown in FIG. 13, when elastic members 106 and 107 in size covering the approximately overall face are mounted, the cartridges 40 and 50 can be more securely held by large frictional force. In this case, it is desirable that thickness and elastic modules are selected so that pressure on the side of the ink supply port is larger than that in the other area.

Further, as shown in FIG. 14, if elastic members 108 and 109 similar to the elastic members elastically pressing the upper surface are laid approximately in the center of the bottom of the holder 4, airtight capability between the ink supply port 44 or 54 and the ink supply needle 6 or 7 of the ink cartridge 40 or 50 can be maintained independent of vibration and shock.

Further, even if at least one plate spring 70 protruded at least on the side of the ink supply port is fixed to the side of a free end at the back of the lever 11 as shown in FIG. 15, the ink cartridge 40 can be fixed in the holder. In this case, it is more effective that non-slip and others are stuck on the side of the free end 70a of the plate spring 70 or on the cover of the ink cartridge.

FIG. 16 shows an embodiment in case a circuit board is arranged at the bottom in the vicinity of an ink supply port or an ink cartridge, an ink supply needle 6 communicating with a print head 5 is planted at the bottom of a carriage and a board 81 on which elastically transformable contacts 80-1, 80-2, . . . 80-6 formed by a spring are formed is provided in a position possibly adjacent to the ink supply needle 6 as shown in FIGS. 17(a) and 17(b).

In the meantime, an ink supply port 14 which can be fitted to the ink supply needle 6 is provided at the bottom of an ink cartridge 40, a concave portion 82 is formed in a position possibly close to the ink supply port 14 and in a position opposite to the contact board 81 and a circuit board 83 is fixed diagonally so that the circuit board has an angle θ with each vertex of the contacts 80-1 to 80-6. It is preferable that the circuit board 83 may be diagonal with respect to a plane perpendicular to a direction in which the ink cartridge is mounted on the printing apparatus.

Through holes 83a and 83b for a positioning are formed on the circuit board 83 as shown in FIG. 18(a), semiconductor storage means 84 is mounted on the surface on the side of an ink housing chamber, that is, at the back as shown in FIGS. 18(b) and 18(c) and contacts 85-1, 85-2, . . . 85-6 connected to the data input terminal and the driving power supply terminal of the semiconductor storage means 84 for acquiring conduction to the contacts 80-1 to 80-6 on the side of the carriage, are formed on the side of the exposed surface.

As the semiconductor storage means 84 is mounted at the rear surface of the circuit board 83 as described above, the degree of freedom in arranging the contacts is enhanced. The surface and the rear of the circuit board 83 can be effectively

utilized and electrodes to be the contacts **85-1**, **85-2**, . . . **85-6** can be formed in area to the extent that the reliability of connection can be secured. A molding agent can be readily applied to the surface on which the semiconductor storage means **84** is formed without considering whether application precision is high or not to prevent from adhering to the contacts **85-1**, **85-2**, . . . **85-6** and the manufacturing process can be simplified.

Further, because the semiconductor storage means **84** is mounted on the cartridge with the status hidden by the circuit board **83**, a user can be prevented from touching to the storage means unintentionally, liquid such as ink can be prevented from adhering to the storage means, and electrostatic destruction and an accident caused by a short circuit can be also prevented.

The semiconductor storage means **84** is connected to control means not shown of the printing apparatus via the contacts **85-1**, **85-2**, . . . **85-6** and the contacts **80-1** to **80-6**, data stored in the semiconductor storage means is read and data such as the quantity of ink consumed by printing operation is written to the means.

In another arrangement, the circuit board **83** may be diagonal with respect to a direction in which the ink cartridge **40** is mounted on the printing apparatus.

In this embodiment, when the ink cartridge **40** reaches the vicinity of the bottom of the carriage in case the ink cartridge **40** is installed, the ink supply needle **6** enters the ink supply port **14** as shown in FIG. **19**, forms a passage, the contacts **80-1** to **80-3** near one side of the circuit board **83** having an angle θ with a horizontal plane first come in contact with the contacts **85-1** to **85-3** and conduction is acquired.

When the cartridge **40** further is further lowered, the contacts **80-4** to **80-6** near the other side of the circuit board **83** come into contact with the contacts **85-4** to **85-6** and all contacts become conduction.

Therefore, power is supplied to the semiconductor storage means **84** through the contacts **80-1** to **80-3** and the contacts **85-1** to **85-3** by which conduction is first acquired so as to initialize the semiconductor storage means **84**. Data can be prevented from being lost by accessing to data stored in the semiconductor storage means **84** via the contacts **80-4** to **80-6** and the contacts **85-4** to **85-6** which become conduction after the above conduction is acquired.

In the meantime, when the ink cartridge **40** is pulled out from the carriage, termination processing can be executed by power still supplied by the contacts **80-1** to **80-3** and the contacts **85-1** to **85-3** and afterward, power can be turned off through the contacts **80-4** to **80-6** and the contacts **85-4** to **85-6** are first disconnected. When processing for the semiconductor storage means **84** finishes as described above, the ink supply needle **6** is pulled out from the ink supply port **14**.

FIG. **20(a)** shows the other embodiment of contacts **85-1** to **85-5** formed in an ink cartridge **40**. Conductive patterns **86** and **87** are formed between a column of contacts **85-1** to **85-3** by which conduction is first acquired when the ink cartridge **40** is inserted and a column of contacts **85-4** to **85-5** by which conduction is afterward acquired.

For example, the contacts **85-1** and **85-3** are selected as a detection terminal and two of the contacts **85-4** to **85-5**, that is, **85-4** and **85-5** may be selected as a power supply terminal.

In the arrangement described above, if ink **K** adheres across the terminals **85-4** and **85-5**, serving as a power supply terminal as shown in FIG. **20(b)**, resistance between the terminals **85-4** and **85-5** is detected by the contacts **85-1**

and **85-3**, by which conduction is first acquired together with the contacts **80-1** and **80-3** of the holder **4** when the ink cartridge is inserted. If the detected resistance is lower than a predetermined value, the supply of power to **80-4** and **80-5** by which conduction is next acquired together with the power supply terminals **85-4** and **85-5** is stopped and an accident caused by a short circuit due to the adhesion of ink **K** can be precluded.

FIG. **21** shows another preferred embodiment of the present invention in which a circuit board **83'** on which contacts **85-1'** to **85-6'** formed such as to be secured horizontally at the bottom of an ink cartridge **40** while the circuit board is always pressed upward by a spring or the like. A board **81'** on which two columns of contacts **80-1'** to **80-3'** and contacts **80-4'** to **80-6'** are formed is formed in such a manner that difference g in a level is made between the tip ends of the two columns is provided.

Also in this embodiment, as shown in FIG. **22**, as the first column of contacts **85-1'** to **85-3'** and the contacts **80-1'** and **80-3'** first become conduction. Next, the second column of contacts **80-4'** to **80-6'** respectively short in a stroke come in contact with the contacts **85-4'** and **85-6'** and conduction is acquired, so that the similar action and effect to those in the above embodiments are produced.

In the above embodiment, the contacts **80-1** to **80-6** and **85-1** to **85-6** are divided into plural columns and difference in time until conduction is acquired is provided between the columns. However, it is clear that the similar effect may be realized even if the contacts **80-1** to **80-6** and the contacts **85-1** to **85-6** are respectively arranged in one row as shown in FIGS. **23(a)** and **23(b)**, and a board **83** on which the contacts **85-1** to **85-6** are formed is angled as shown in FIGS. **23(c)** and **23(d)** so that the conducting time becomes different between the contact **80-1** and **85-1** on one side and the contact **80-6** and **85-6** on the other side. Similarly, if the position of each end of the contacts **80-1** to **80-6** is designed to be differentiated, so that the same function may be achieved.

In the above embodiments, the mode according to which the ink cartridge is mounted on the carriage is described as an example. However, it is apparent that a similar effect may be obtained even if the present invention is applied to a printing apparatus of a type in which an ink cartridge is housed in a cartridge housing area of the apparatus body and is connected to a print head via an ink supply tube.

That is, contacts have only to be formed in required positions on the exposed face of the ink cartridge and the above contacts **85-1** to **85-6** have only to be formed in touchable positions opposite to the contacts of the ink cartridge when the ink cartridge is installed.

In addition, the same effect may be accomplished even in an arrangement in which the board **83** is mounted at the bottom of the ink cartridge **40** via a mounting plate **88** having elastically transformable pawls **88a** protruding therefrom at least at both ends on the open sides of the mounting plate, after inserting a coil spring **86** or an arcuate plate spring **87** into a concave portion as shown in FIGS. **24** and **25**. Alternatively, the same effect may be obtained if the semiconductor storage means **84** is mounted on the mounting plate **88** thereby to form the contacts **85-1**, **85-2**, . . . **85-6**. According to this arrangement, if merely a jig is prepared, the pawls **88a** can be removed by the jig and the board **83** can be detached from the cartridge **40** in a factory while precluding unnecessary detachment by user.

Further, in the above embodiments, projections for positioning may be formed on the ink cartridge and the circuit

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board is positioned. However, the similar effect can be achieved in another arrangement in which a concave portion 93a is formed on a wall of an ink cartridge 90, a wall 93 adjacent to the bottom 92 on which an ink supply port 91 is formed, in this embodiment as shown in FIG. 26(a), a circuit board 83 is housed and fixed in the concave portion 93a.

If necessary, a film 94 which can be peeled from one end 94a may be also applied as shown in FIG. 26(b) and may be also sealed till the start of use.

According to the present invention, as the ink supply needle is located near one side in a direction perpendicular to the direction of the reciprocation of the carriage, the circuit board is mounted on the wall in the vicinity of the side on which the ink supply port is formed of the ink cartridge, the plural contacts for connecting to external control means are formed on the exposed surface of the circuit board and the semiconductor storage means is accessed from the external control means via the contacts, the circuit board is located on the side of the ink supply port and the face on which the circuit board is fixed is moved along the ink supply needle. Therefore, even if there is play between the carriage and the cartridge, the cartridge is moved according to a locus defined by the ink supply needle and the ink supply port, the contacts are connected to the external control means in a defined order and data stored in the semiconductor storage means can be securely prevented from being lost by the application of signals in an unprepared order.

What is claimed is:

1. An ink cartridge for mounting on a carriage of an inkjet printing apparatus and for supplying ink to a printhead of said ink jet printing apparatus through an ink supply needle, the ink cartridge comprising:

- a plurality of external walls, including a first wall and a second wall, defining at least some of a chamber;
- an ink supply port for receiving said ink supply needle, the ink supply port having a centerline and communicating with the chamber,
- a semiconductor storage device storing information about the ink carried by said cartridge; and
- a plurality of contacts for connecting the semiconductor storage device to the ink jet printing apparatus, the contacts being formed in a plurality of rows lying essentially in a plane parallel to the centerline of the ink supply port, each said row being centered relative to the centerline of said ink supply port.

2. The ink cartridge according to claim 1, wherein said semiconductor storage device is disposed on said second wall of said housing.

3. The ink cartridge according to claim 1, wherein said semiconductor storage device is disposed on said second wall of said housing in the vicinity of said ink supply port.

4. The ink cartridge according to claim 1, wherein said semiconductor storage device is disposed on said second wall which is perpendicular to said first wall of said housing.

5. The ink cartridge according to claim 1, wherein said contacts connecting said semiconductor storage device are disposed on a substrate which is substantially rectangular, and said semiconductor storage device is disposed on said second wall which is substantially perpendicular to said first wall, and said second wall has a shorter width than the other wall of said housing.

6. The ink cartridge according to claim 1, wherein said contacts connecting said semiconductor storage device are disposed substantially in parallel with said second wall which is perpendicular to said first wall of said housing.

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7. The ink cartridge according to claim 1, wherein said contacts connecting said semiconductor storage device are located at an opposite position of a fulcrum of the ink cartridge when it is mounted on or removed from the printing apparatus.

8. The ink cartridge according to claim 1, wherein said contacts connecting said semiconductor storage device are disposed on a substrate which is substantially rectangular and directs in a vertical orientation.

9. An ink cartridge for mounting on a cartridge of an ink jet printing apparatus and for supplying ink to a printhead of said ink jet printing apparatus through an ink supply needle, the ink cartridge comprising:

- a plurality of external walls defining at least some of a chamber;
- an ink supply port for receiving said ink supply needle, the ink supply port having an exit opening and a centerline and communicating with the chamber;
- a semiconductor storage device storing information about the ink carried by said cartridge; and
- a plurality of contacts for connecting said semiconductor storage device to the ink jet printing apparatus, the contacts being formed in a plurality of rows so that one of said rows is closer to said exit opening of said ink supply port than an other of said rows, the row of said contacts which is closest to said exit opening of said ink supply port being longer than the row of said contacts which is furthest from said exit opening of said ink supply port.

10. The ink cartridge according to claim 9, wherein the electrical contacts are arranged so that at least one contact is spaced apart from the central line of the ink supply port.

11. The ink cartridge according to claim 9, wherein said contacts, viewing the ink cartridge in a direction perpendicular to a plane of the contacts, lie on a centerline of said ink supply port.

12. The ink cartridge according to claim 9, wherein said wall on which said semiconductor storage device is disposed is located in the vicinity of said ink supply port.

13. The ink cartridge according to claim 12, wherein said semiconductor storage device is located on a center line of said wall of said housing on which said semiconductor storage device is disposed.

14. The ink cartridge according to claim 1, wherein, viewing the ink cartridge in a direction perpendicular to a plane of the contacts, the electrical contacts of each row are symmetrically disposed about the centerline of the ink supply port.

15. The ink cartridge according to claim 1, wherein the contact in the first row is narrower than the contact in the second row.

16. The ink cartridge according to claim 1, wherein the ink cartridge comprises a plurality of ink supply ports.

17. An ink cartridge for an ink jet printing apparatus having a printhead which ejects ink droplets onto recording medium, the ink cartridge comprising:

- a housing containing ink therein, said housing having a first wall and a second wall,
- an ink supply port formed on said first wall for directing ink in said housing to the printhead;
- a memory device storing information about the ink disposed on said housing; and
- a plurality of contacts disposed at a predetermined angle relative to a wall plane on a wall of said housing, the contacts allowing electrical communication between the memory device and the ink jet printing apparatus.

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18. The ink cartridge according to claim 17, wherein said memory device is disposed on the same wall as said ink supply port is formed.

19. The ink cartridge according to claim 17, wherein said semiconductor storage device is intersected by a plane 5 passing through a center line of said ink supply port.

20. The ink cartridge according to claim 17, wherein said memory device is disposed substantially at a center in the widthwise direction of said wall in the vicinity of said ink supply port.

21. The ink cartridge according to claim 17, wherein said memory device is disposed on a side wall of said housing.

22. The ink cartridge according to claim 17, wherein said housing is substantially rectangular, and said wall on which said memory device is disposed is a side wall having a shorter width than the other side wall of said housing.

23. The ink cartridge according to claim 17, wherein said memory device is diagonal with respect to a direction in which the ink cartridge is mounted on the printing apparatus.

24. The ink cartridge according to claim 17, wherein said memory device is diagonal with respect to a plane perpendicular to a direction in which the ink cartridge is mounted on the printing apparatus.

25. The ink cartridge according to claim 17, wherein said memory device comprises a storage device and a plurality of terminals which is grouped into at least two groups.

26. The ink cartridge according to claim 25, wherein said memory device comprises a first group of said terminals connect to said storage device and a second group of said terminals connect to contact members of the printing apparatus.

27. The ink cartridge according to claim 25, wherein said two groups of terminals come into contact with the contact members of the printing apparatus at a time interval.

28. A contact forming device formed on an ink cartridge holder, which contacts a memory device storing information of ink contained in an ink cartridge for an ink jet printing apparatus, the contact forming device comprising:

- a support member; and
- a plurality of elastic contact members formed on said support, each of said contact member contacts a respective terminal of the memory device of the ink cartridge when the ink cartridge is mounted on the printing

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apparatus, at least two of said plurality of contact members contact a single terminal of the memory device when the ink cartridge is mounted.

29. An ink jet printing apparatus, comprising:
a printhead for ejecting ink droplets onto a recording medium;

an ink container having an ink supply port for supplying ink contained therein to said printhead; and

at least one elastic member formed at a predetermined portion of the printing apparatus, said elastic member elastically engaging with said ink container when said ink container is mounted on the printing apparatus.

30. The printing apparatus according to claim 29, wherein said ink container comprises a memory device for storing information of ink disposed at a predetermined position of said ink container.

31. The printing apparatus according to claim 29, wherein said elastic member comprises two separate elastic materials disposed at different positions.

32. The printing apparatus according to claim 29, wherein said elastic member comprises a single elastic material covering a surface of said ink container substantially entirely.

33. The printing apparatus according to claim 29, wherein said elastic member comprises at least one elastic material which elastically engages with a bottom surface of said ink container.

34. The printing apparatus according to claim 29, wherein said elastic member comprises a plate spring.

35. The printing apparatus according to claim 29, wherein said elastic member comprises a porous member.

36. The printing apparatus according to claim 29, wherein said elastic member is disposed at a position confronting said ink supply port of said ink container.

37. The printing apparatus according to claim 29, wherein said elastic member comprises a first elastic material and a second elastic material disposed at an opposite side of said first elastic material.

38. The printing apparatus according to claim 29, wherein said elastic material is disposed on a lever member of an ink container holder.

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(12) **EX PARTE REEXAMINATION CERTIFICATE** (6643rd)**United States Patent****Shinada et al.**(10) **Number:** **US 6,502,917 C1**(45) **Certificate Issued:** **Feb. 3, 2009**(54) **INK-JET PRINTING APPARATUS AND INK CARTRIDGE THEREFOR**(56) **References Cited****U.S. PATENT DOCUMENTS**

(75) Inventors: **Satoshi Shinada**, Nagano (JP); **Fujio Akahane**, Nagano (JP); **Minoru Usui**, Nagano (JP); **Takao Kobayashi**, Nagano (JP); **Makoto Matsuzaki**, Nagano (JP)

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(73) Assignee: **Seiko Epson Corporation**, Tokyo (JP)**Reexamination Request:**

No. 90/008,791, Aug. 3, 2007

Reexamination Certificate for:

Patent No.: **6,502,917**
 Issued: **Jan. 7, 2003**
 Appl. No.: **09/484,458**
 Filed: **Jan. 18, 2000**

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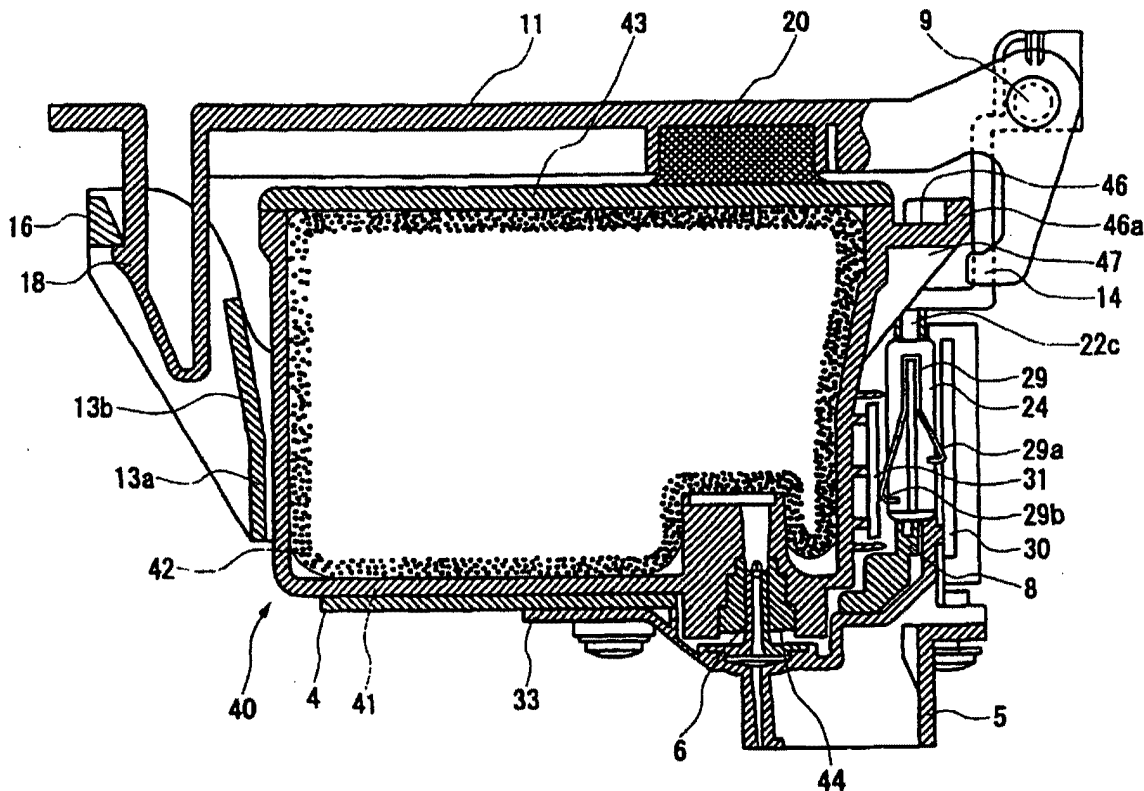
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Primary Examiner—Minh T Nguyen(57) **ABSTRACT**

An ink jet type printing apparatus in which an ink supply needle is located near one side in a direction perpendicular to the reciprocated directions of a carriage, a circuit board is mounted on a wall of an ink cartridge in the vicinity of the side on which an ink supply port is formed and plural contacts for connecting to external control means are formed on the exposed surface of the circuit board.

- (51) **Int. Cl.**
B41J 29/393 (2006.01)
B41J 2/175 (2006.01)
- (52) **U.S. Cl.** **347/19; 347/86**
- (58) **Field of Classification Search** None
 See application file for complete search history.



US 6,502,917 C1

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**EX PARTE
REEXAMINATION CERTIFICATE
ISSUED UNDER 35 U.S.C. 307**

THE PATENT IS HEREBY AMENDED AS
INDICATED BELOW.

Matter enclosed in heavy brackets [] appeared in the patent, but has been deleted and is no longer a part of the patent; matter printed in italics indicates additions made to the patent.

AS A RESULT OF REEXAMINATION, IT HAS BEEN DETERMINED THAT:

The patentability of claims 1, 8 is confirmed.

Claims 17-22 are cancelled.

Claims 2-6, 9 and 13 are determined to be patentable as amended.

Claims 10-12, 14 and 16, dependent on an amended claim, are determined to be patentable.

Claims 7, 15 and 23-38 were not reexamined.

2. The ink cartridge according to claim 1, wherein said semiconductor storage device is disposed on said second wall of said [housing] *chamber*.

3. The ink cartridge according to claim 1, wherein said semiconductor storage device is disposed on said second wall of said [housing] *chamber* in the vicinity of said ink supply port.

4. The ink cartridge according to claim 1, wherein said semiconductor storage device is disposed on said second wall which is perpendicular to said first wall of said [housing] *chamber*.

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5. The ink cartridge according to claim 1, wherein said contacts connecting said semiconductor storage device are disposed on a substrate which is substantially rectangular, and said semiconductor storage device is disposed on said second wall which is substantially perpendicular to said first wall, and said second wall has a shorter width than the other wall of said [housing] *chamber*.

6. The ink cartridge according to claim 1, wherein said contacts connecting said semiconductor storage device are disposed substantially in parallel with said second wall which is perpendicular to said first wall of said [housing] *chamber*.

9. An ink cartridge for mounting on a [cartridge] *carriage* of an ink jet printing apparatus and for supplying ink to a printhead of said ink jet printing apparatus through an ink supply needle, the ink cartridge comprising:

a plurality of external walls defining at least some of a chamber;

an ink supply port for receiving said ink supply needle, the ink supply port having an exit opening and a centerline and communicating with the chamber;

a semiconductor storage device storing information about the ink carried by said cartridge; and

a plurality of contacts for connecting said semiconductor storage device to the ink jet printing apparatus, the contacts being formed in a plurality of rows so that one of said rows is closer to said exit opening of said ink supply port than an other of said rows, the row of said contacts which is closest to said exit opening of said ink supply port being longer than the row of said contacts which is furthest from said exit opening of said ink supply port.

13. The ink cartridge according to claim 12, wherein said semiconductor storage device is located on a center line of said wall of said [housing] *chamber* on which said semiconductor storage device is disposed.

* * * * *



US008794749B2

(12) **United States Patent**
Asauchi

(10) **Patent No.:** **US 8,794,749 B2**
(45) **Date of Patent:** **Aug. 5, 2014**

(54) **PRINTING MATERIAL CONTAINER, AND BOARD MOUNTED ON PRINTING MATERIAL CONTAINER**

(71) Applicant: **Seiko Epson Corporation**, Tokyo (JP)

(72) Inventor: **Noboru Asauchi**, Nagano-ken (JP)

(73) Assignee: **Seiko Epson Corporation**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **13/902,171**

(22) Filed: **May 24, 2013**

(65) **Prior Publication Data**

US 2013/0258009 A1 Oct. 3, 2013

Related U.S. Application Data

(63) Continuation of application No. 13/608,658, filed on Sep. 10, 2012, now Pat. No. 8,454,116, which is a continuation of application No. 12/257,914, filed on Oct. 24, 2008, now Pat. No. 8,366,233, which is a continuation of application No. 12/040,308, filed on Feb. 29, 2008, now Pat. No. 7,484,825, which is a continuation of application No. 11/611,641, filed on Dec. 15, 2006, now Pat. No. 7,562,958.

(30) **Foreign Application Priority Data**

Dec. 26, 2005 (JP) 2005-372028
Aug. 11, 2006 (JP) 2006-220751

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

(52) **U.S. Cl.**
USPC 347/86; 347/19; 347/50; 439/67;
439/924.1

(58) **Field of Classification Search**

None

See application file for complete search history.

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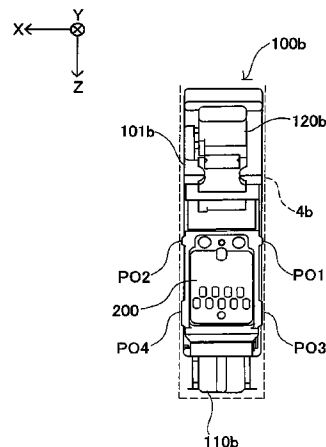
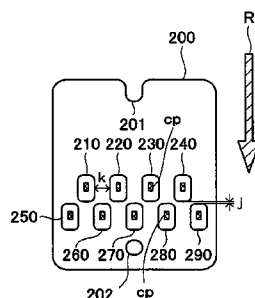
Primary Examiner — Michael Zarroli

(74) *Attorney, Agent, or Firm* — Stroock & Stroock & Lavan LLP

(57) **ABSTRACT**

A printing material container detachably attachable to a printing apparatus having apparatus-side terminals. The container can comprise an electrical device, a memory device and a plurality of terminals. First and second terminals can be coupled to the electrical device and a plurality of memory terminals can be coupled to the memory device. Terminal contact portions are present where the terminals contact a respective apparatus side contact forming member. A short detection contact portion can be positioned to contact a contact forming member that itself is coupled to a short detection circuit of the printing apparatus. The terminals can be arranged with the memory terminal contact portions located to the left of the second terminal contact portion and to the right of the first terminal contact portion. The contact portion that is second farthest to the right can be the third contact portion.

62 Claims, 22 Drawing Sheets



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Aug. 5, 2014

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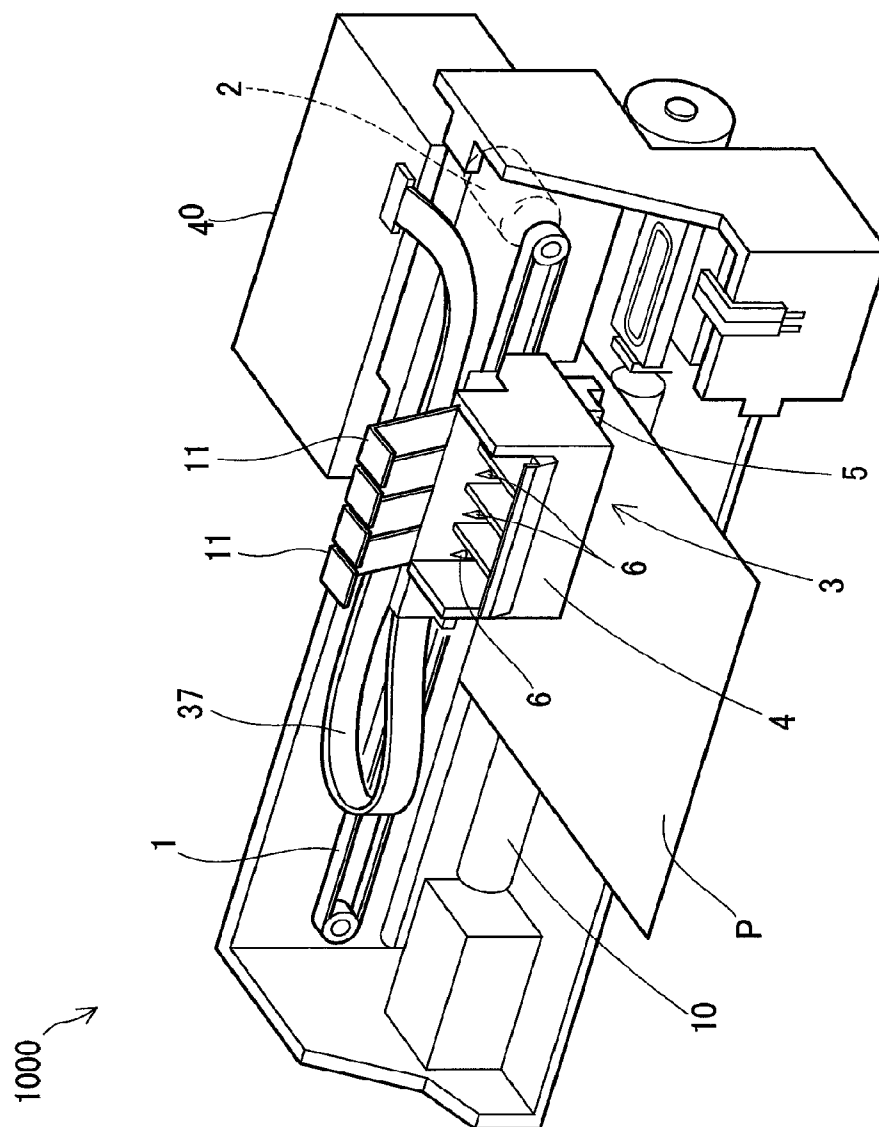


Fig. 1

U.S. Patent

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Fig.2

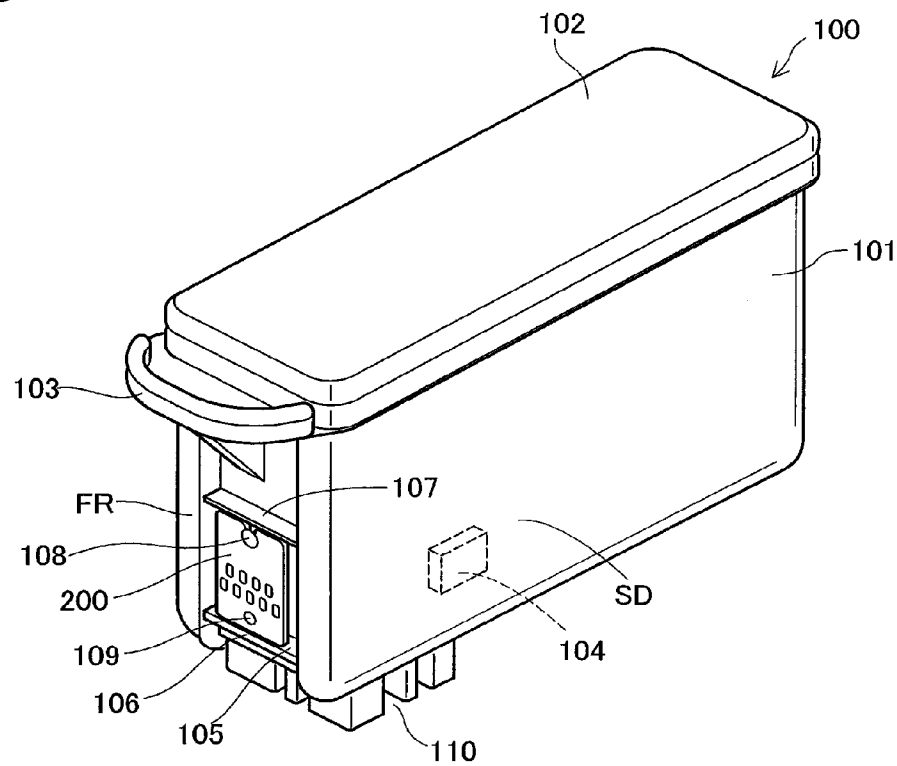


Fig.3A

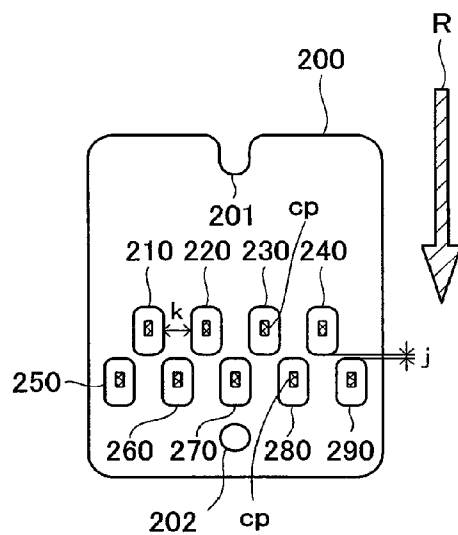


Fig.3B

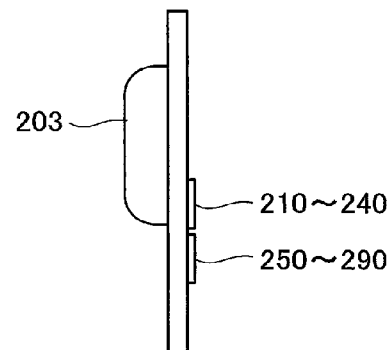
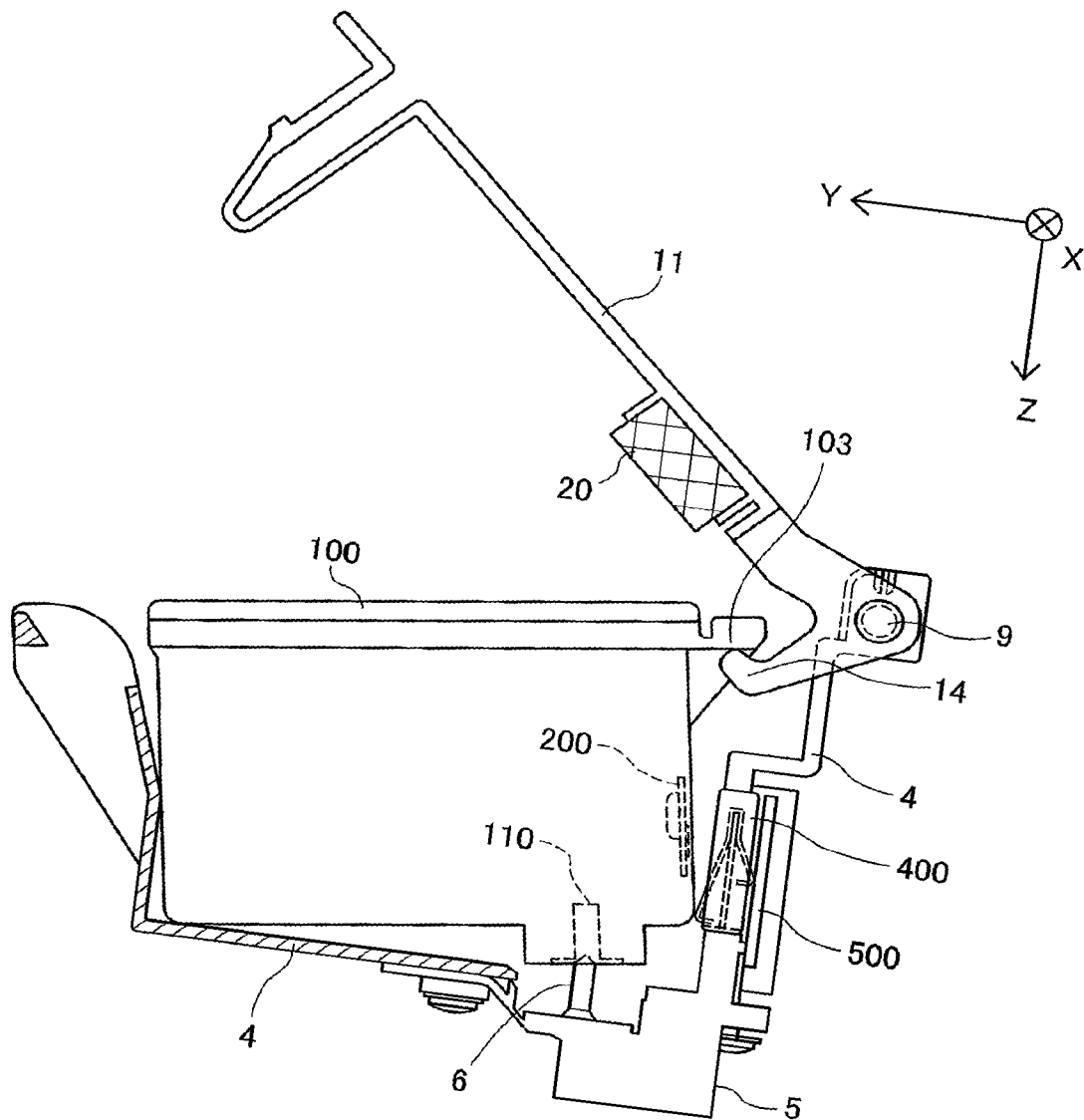


Fig.4



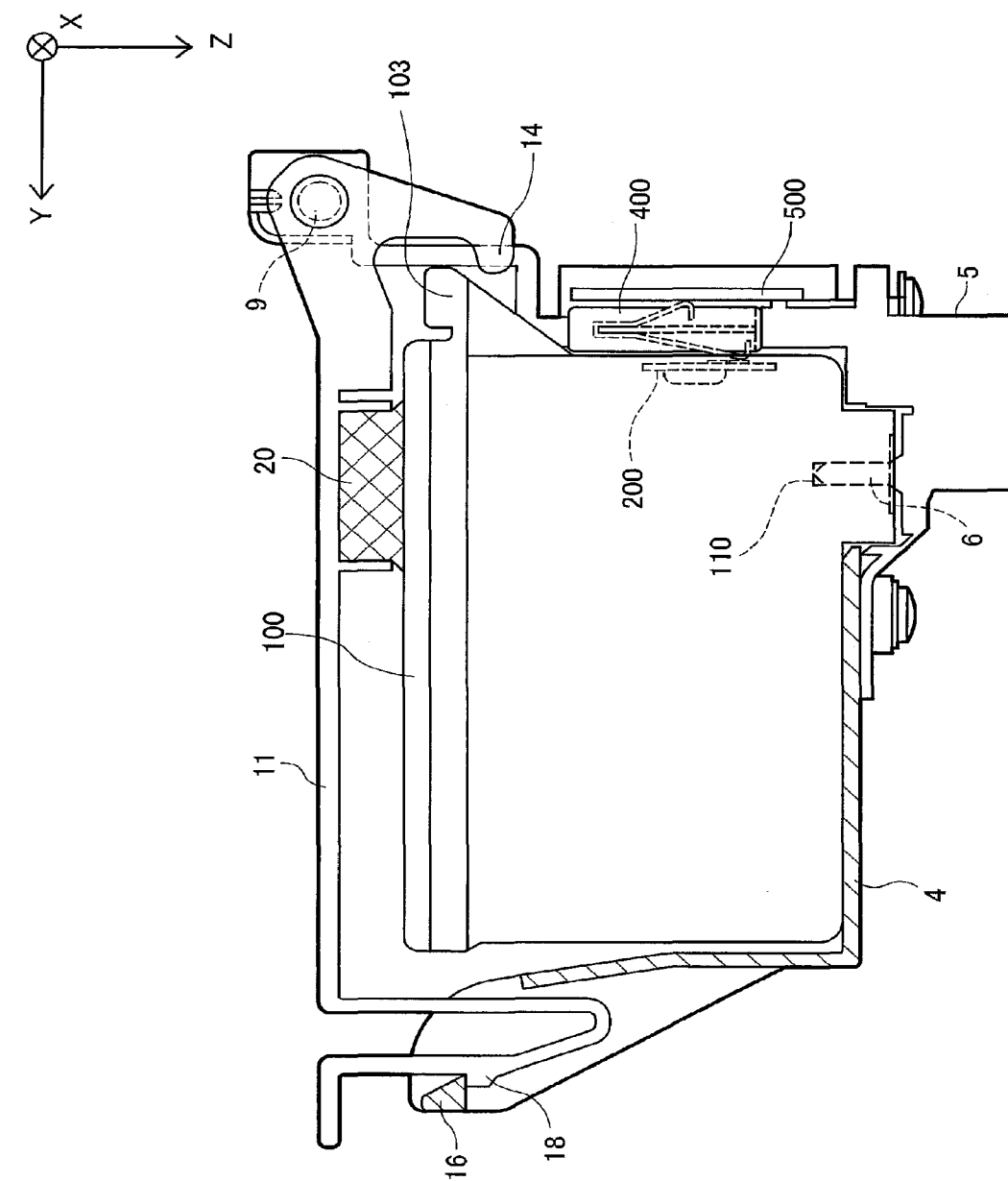


Fig. 5

Fig.6A

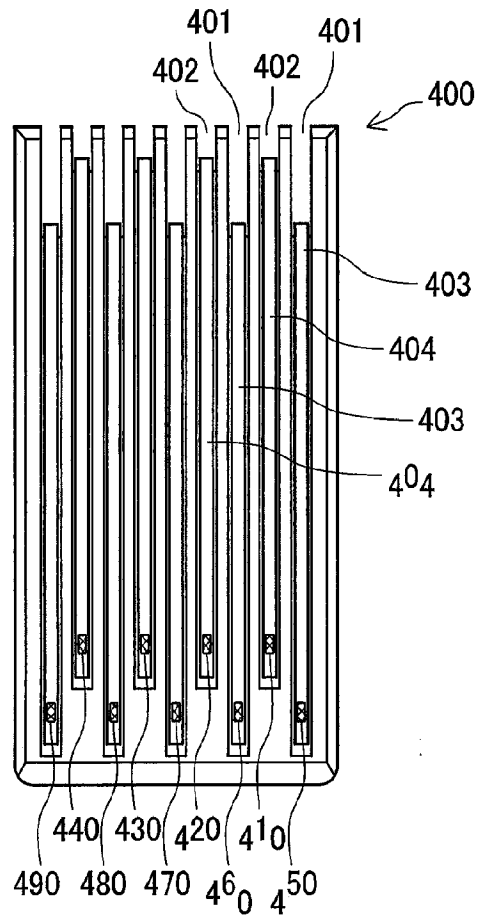


Fig.6B

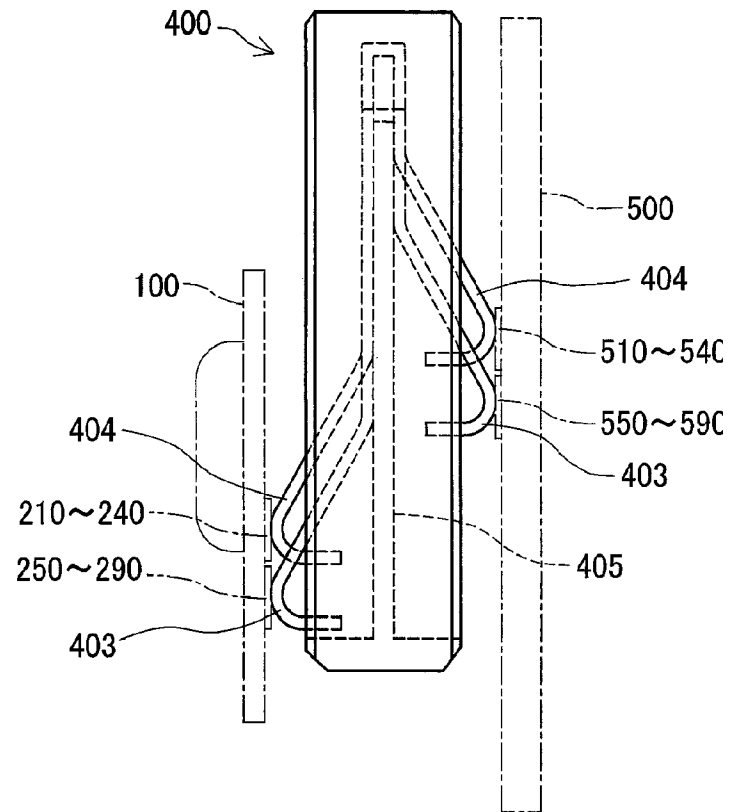


Fig.7

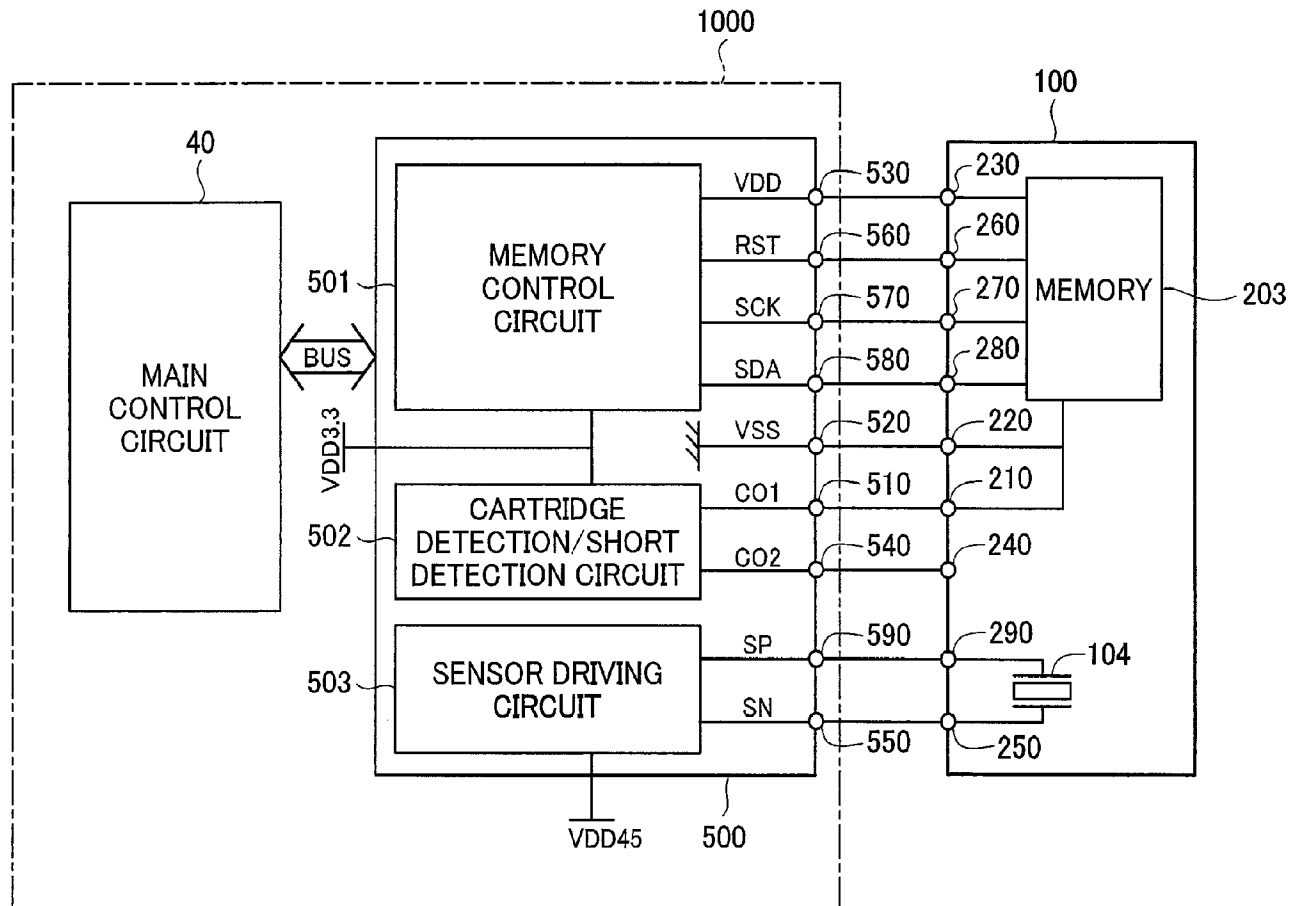


Fig.8

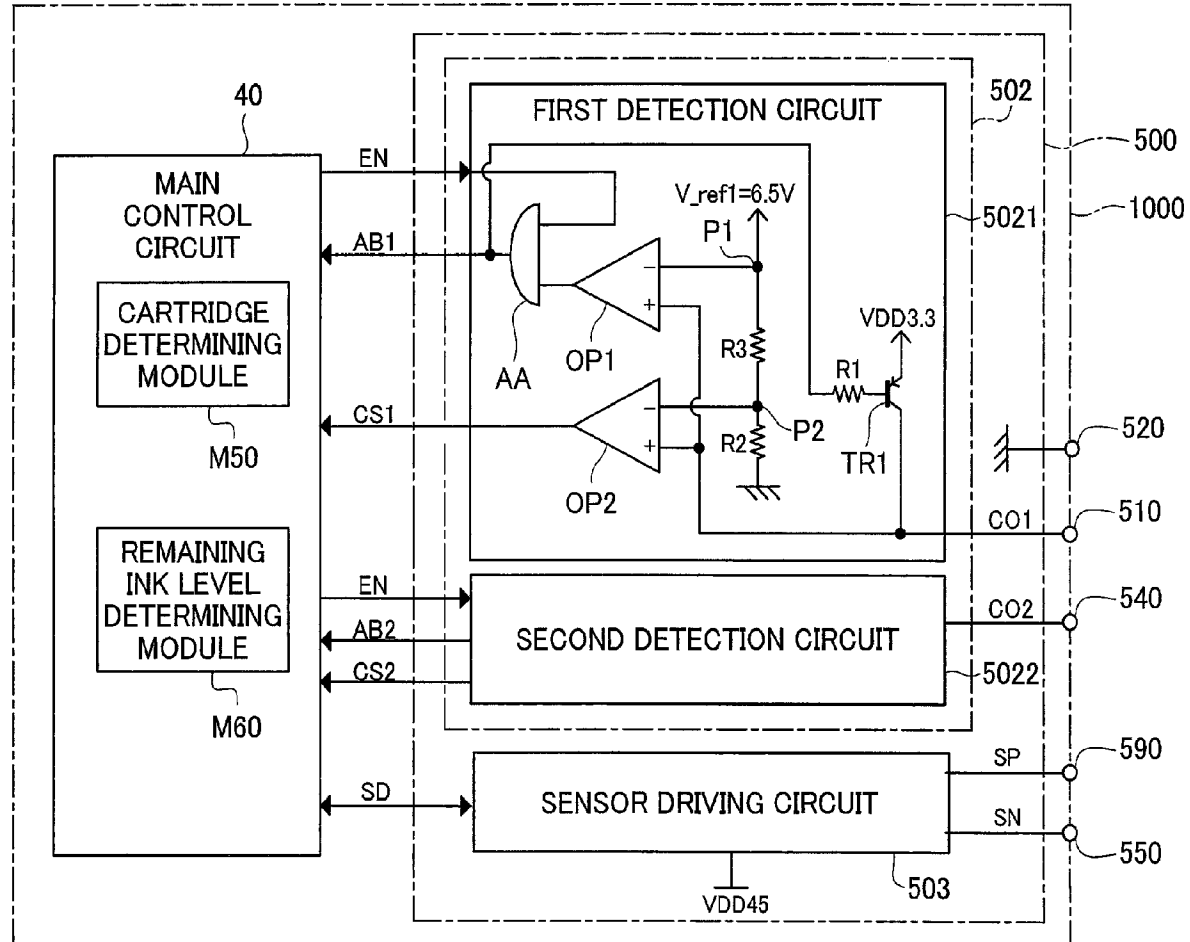


Fig.9

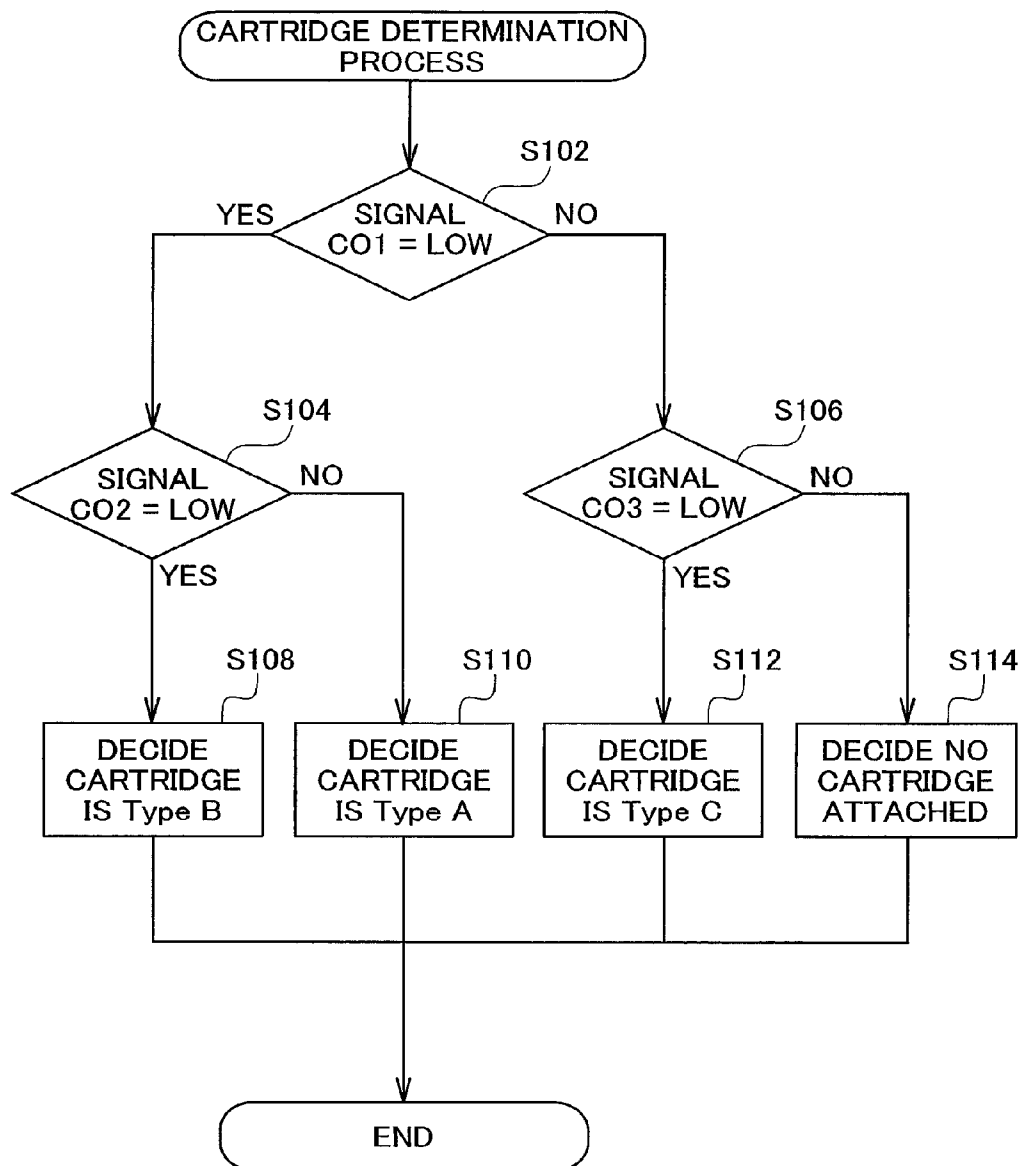
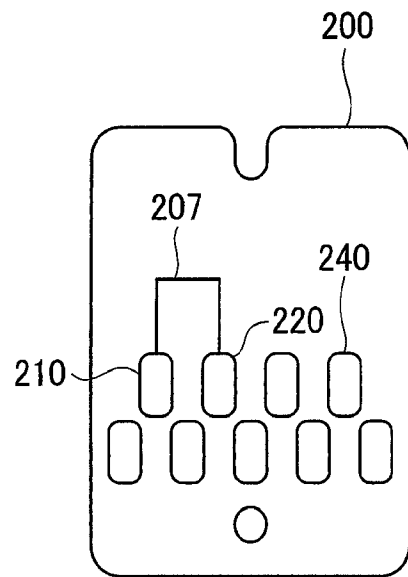
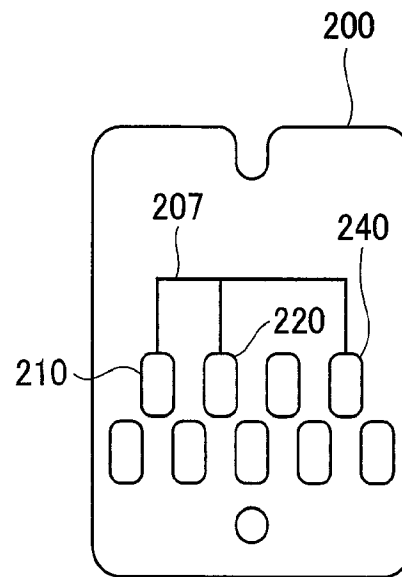


Fig.10A



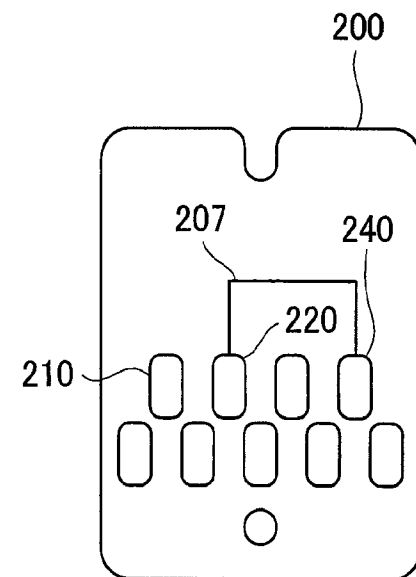
typeA

Fig.10B



typeB

Fig.10C



typeC

Fig.11

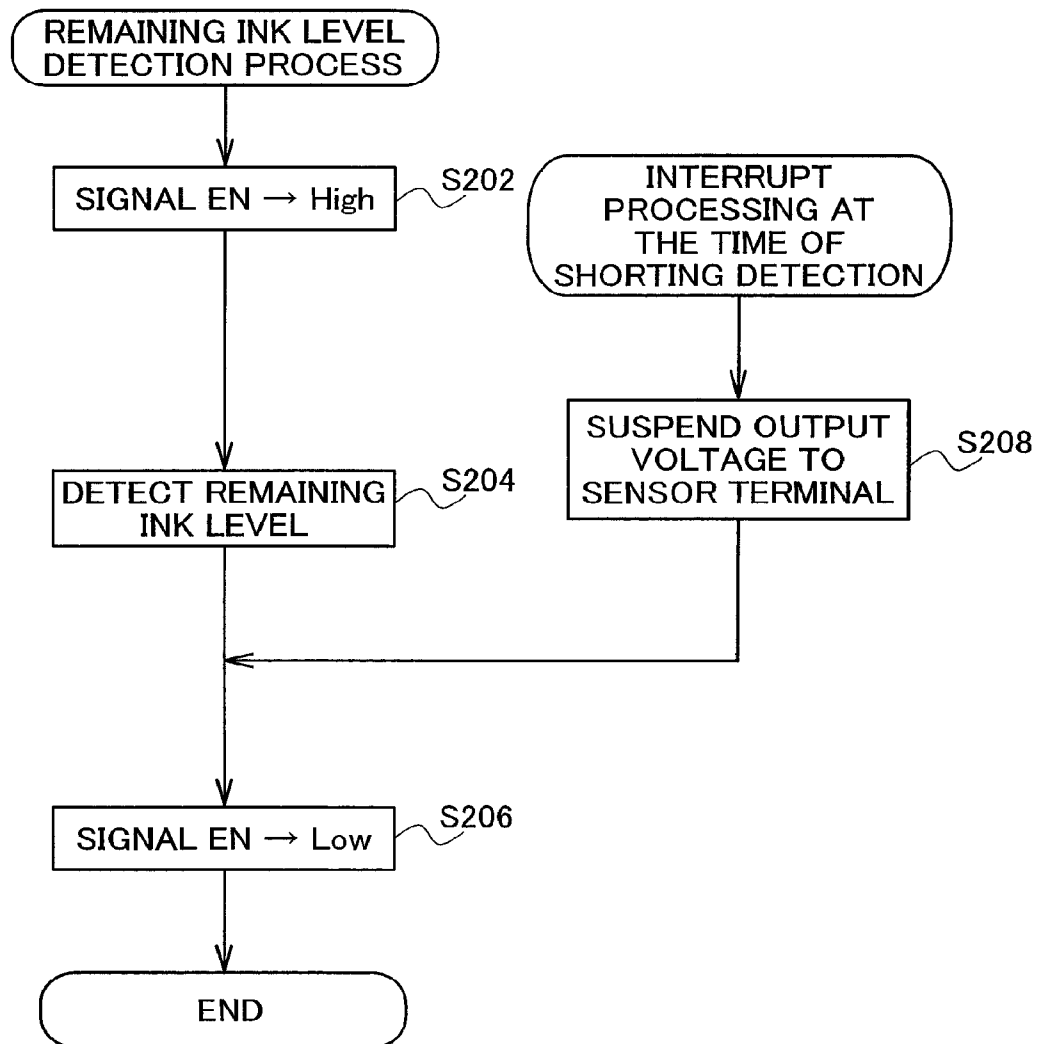


Fig.12A

SIGNAL EN

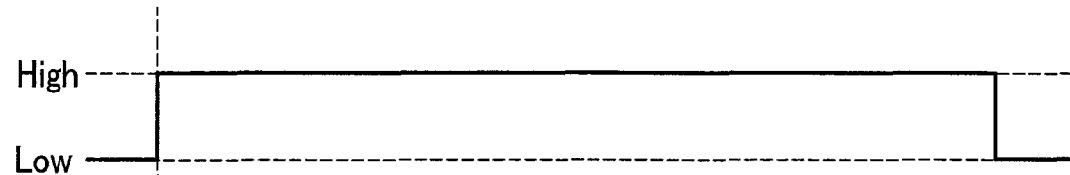


Fig.12B

SENSOR VOLTAGE
(NORMAL)

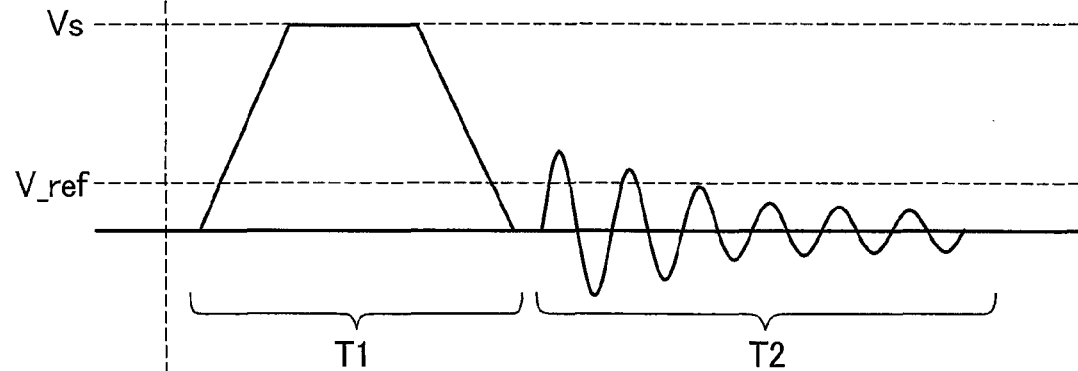


Fig.12C

SENSOR VOLTAGE
(SHORTING)

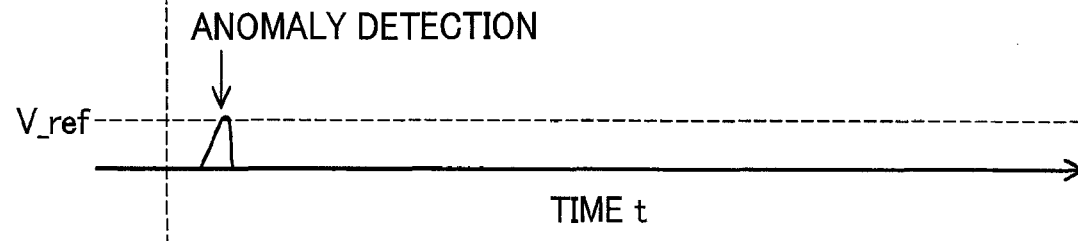


Fig.13

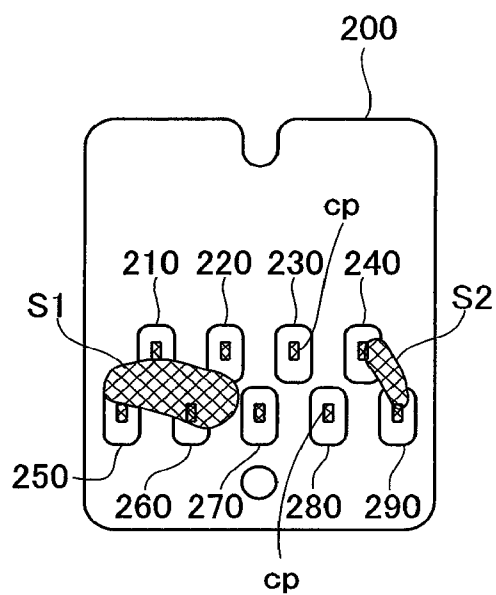


Fig.14A

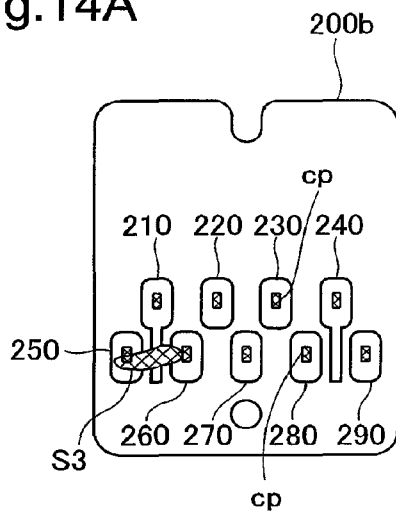


Fig.14B

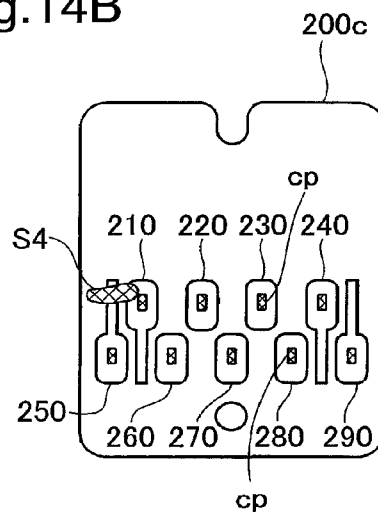


Fig.14C

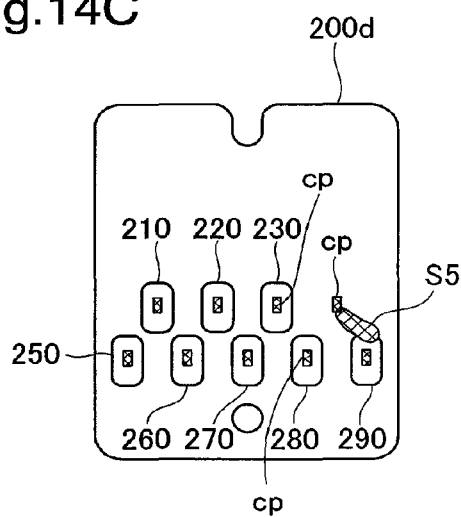


Fig.14D

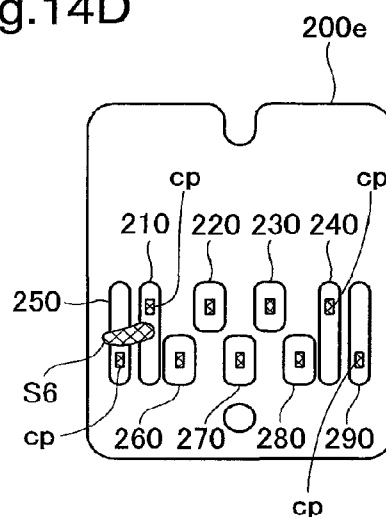


Fig.15A

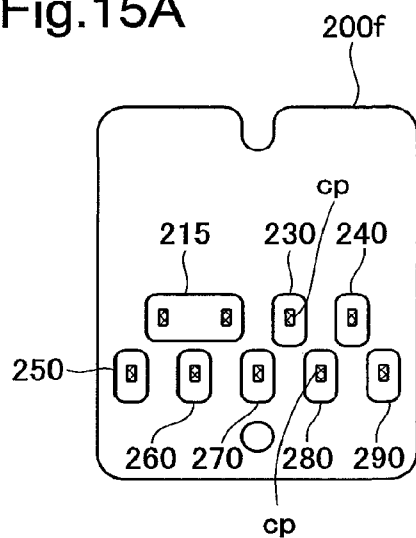


Fig.15B

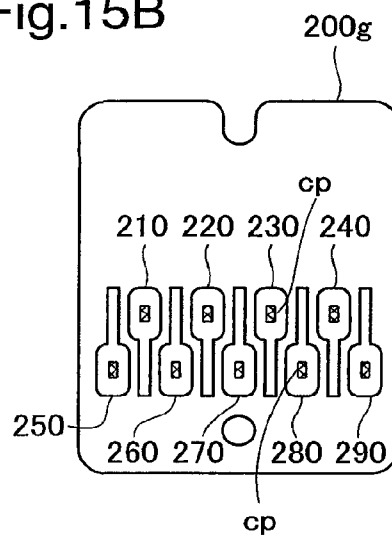


Fig.15C

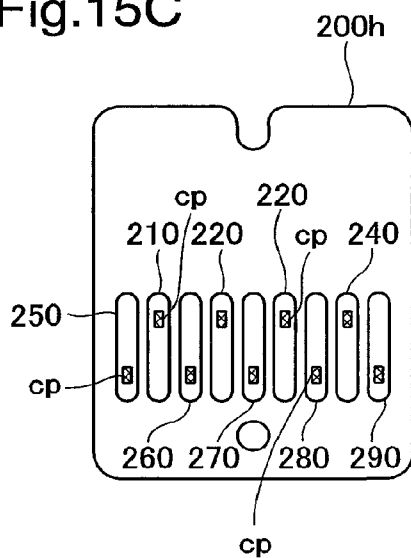


Fig.16A

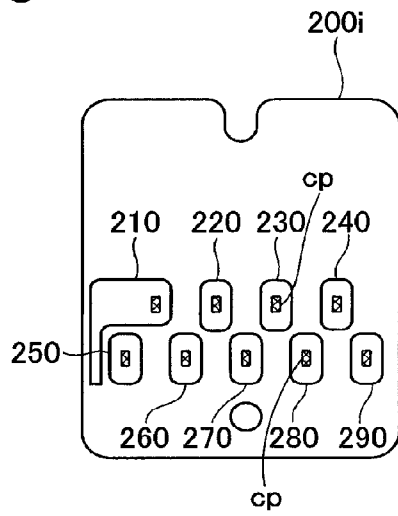


Fig.16B

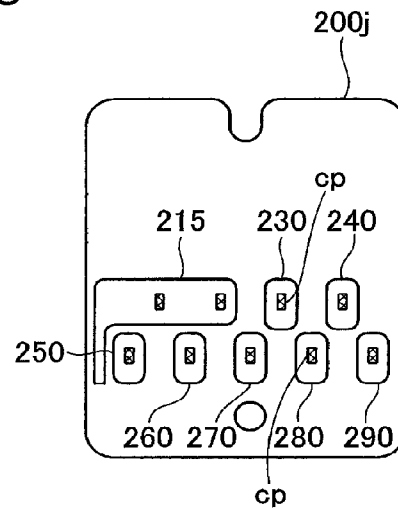


Fig.16C

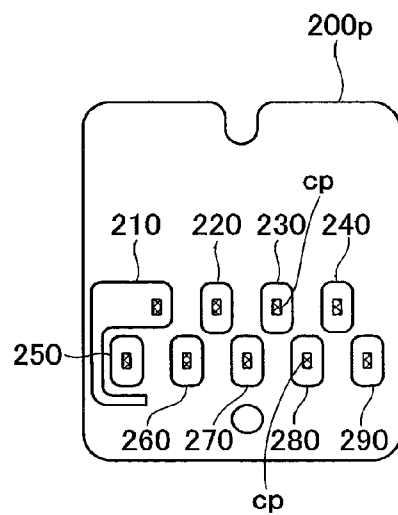


Fig.16D

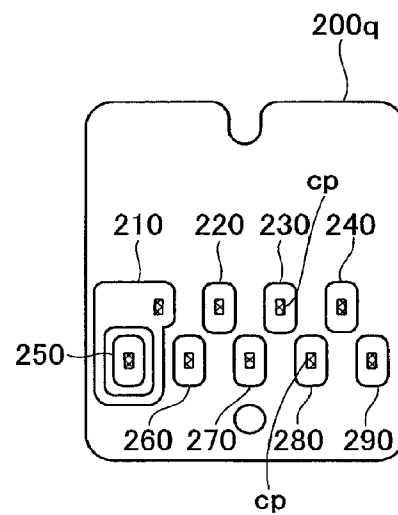


Fig.17A

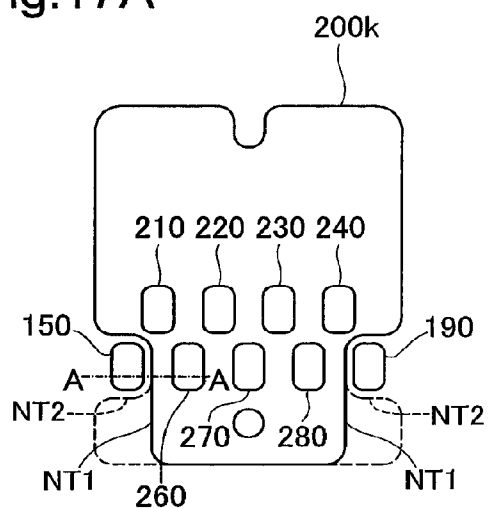


Fig.17B

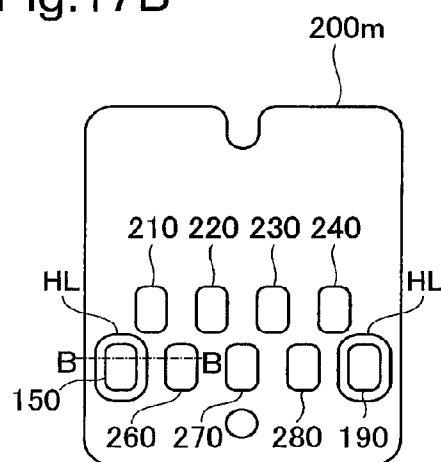


Fig.17C

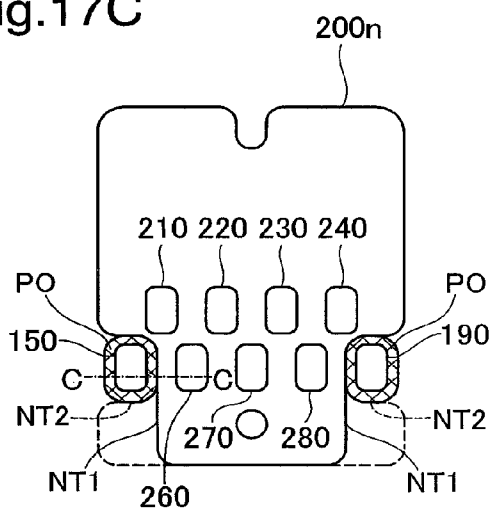


Fig.17D

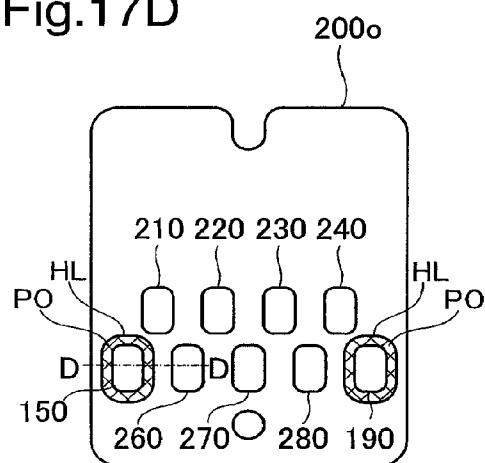


Fig.18A

A-A CROSS SECTION

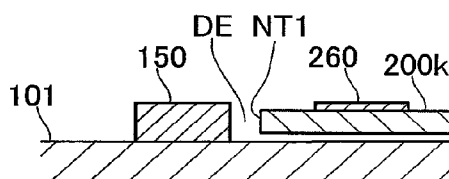


Fig.18B

B-B CROSS SECTION

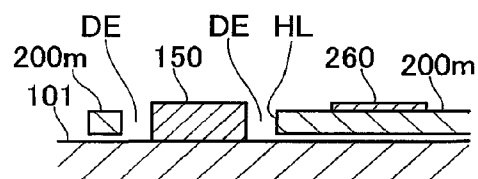


Fig.18C

C-C CROSS SECTION

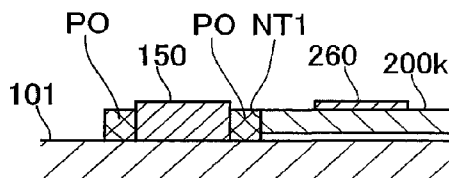


Fig.18D

D-D CROSS SECTION

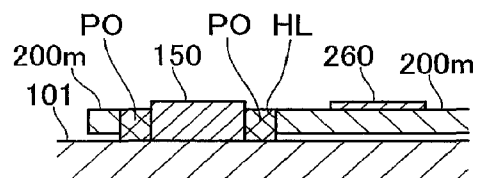


Fig.19A

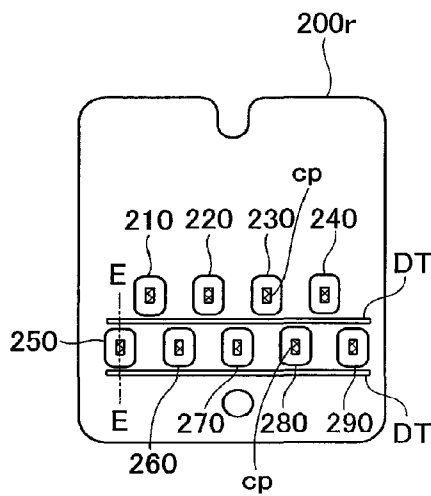


Fig.19B

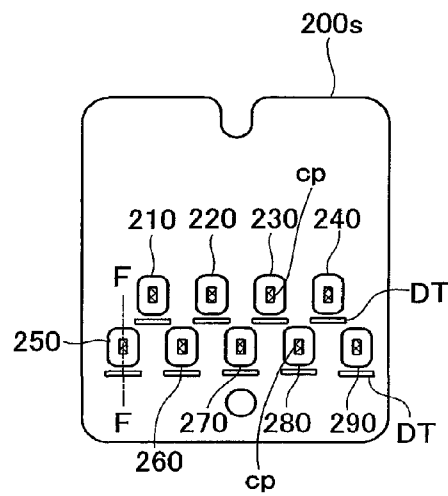


Fig.19C

E-E CROSS SECTION

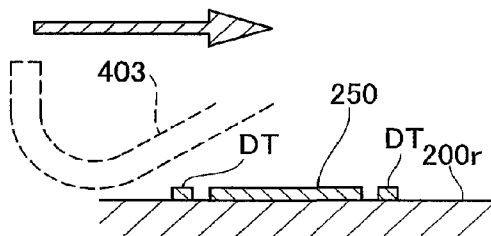


Fig.19D

F-F CROSS SECTION

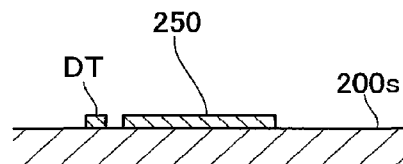
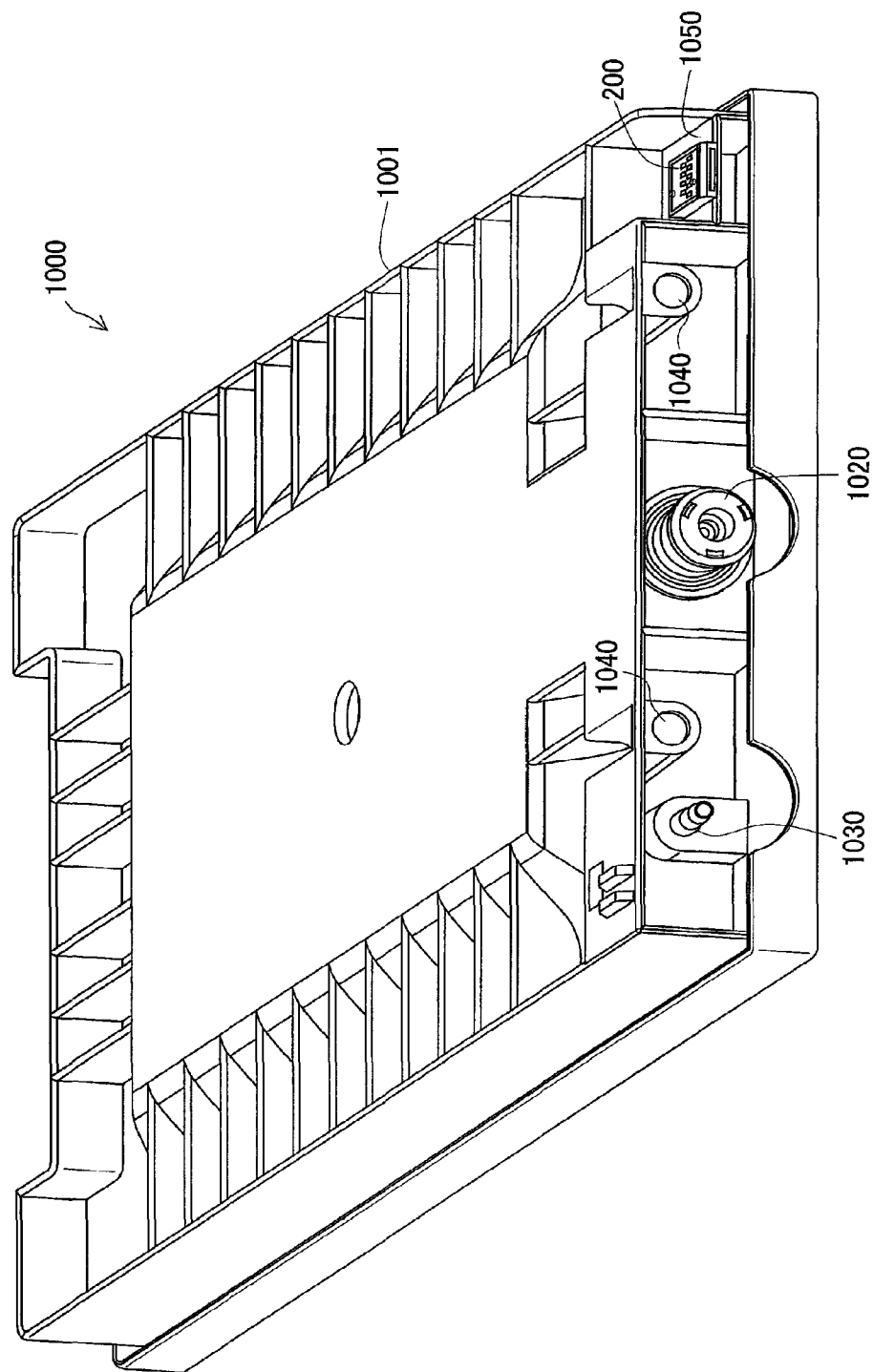


Fig. 20



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Fig.21

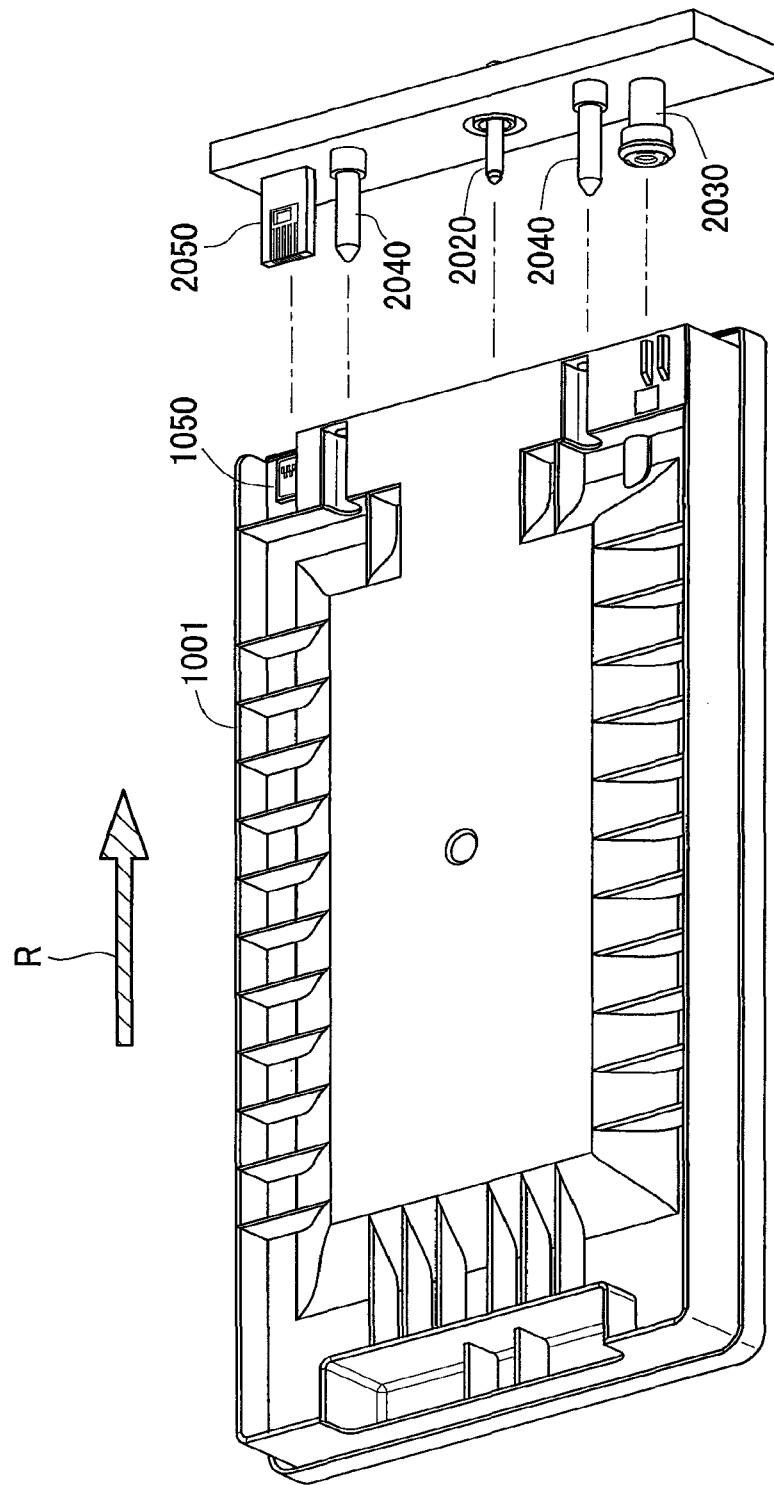


Fig.22

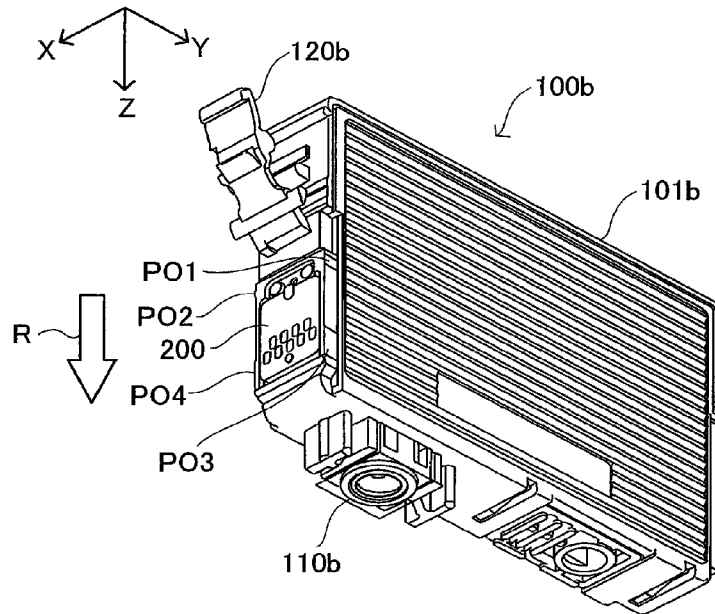


Fig.23

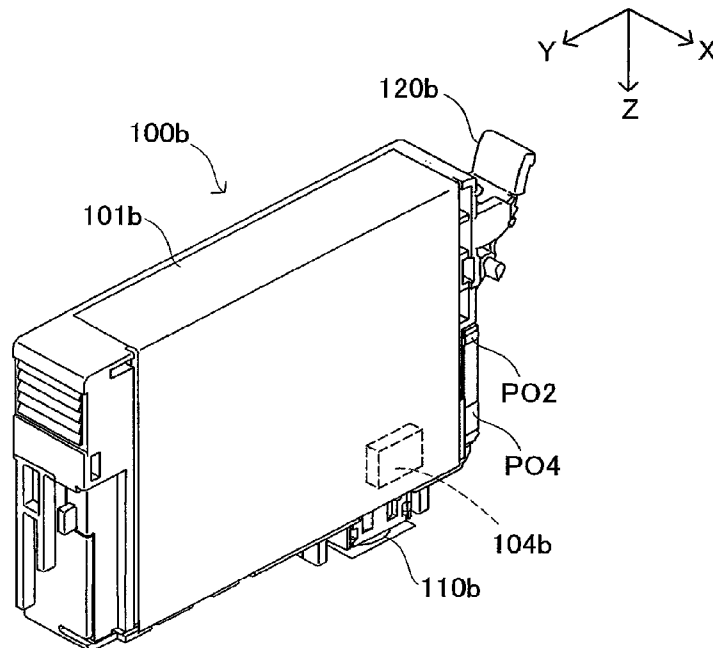
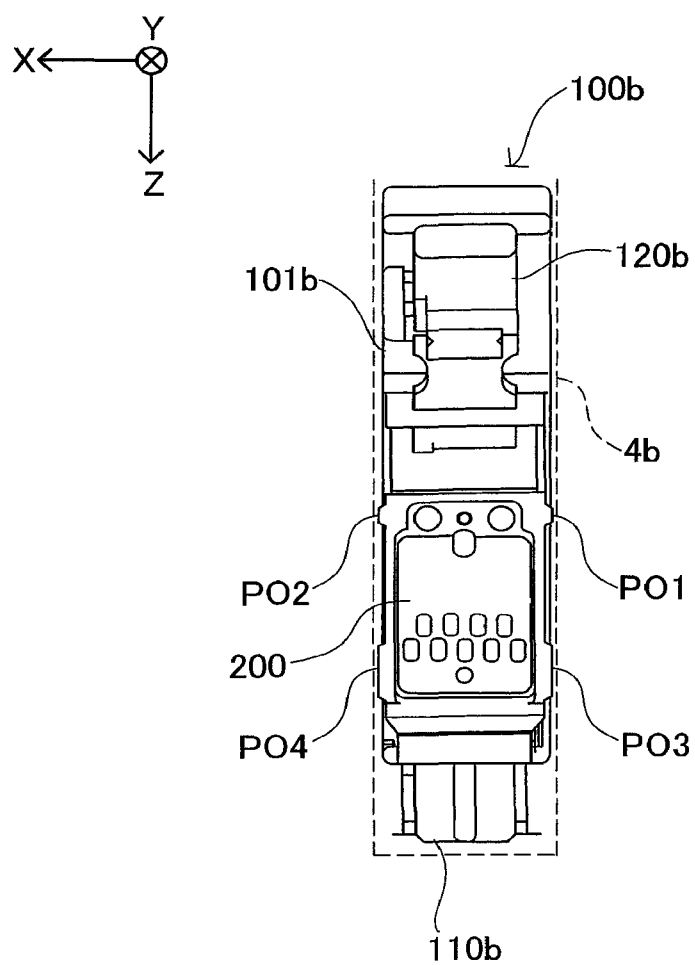


Fig.24



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PRINTING MATERIAL CONTAINER, AND BOARD MOUNTED ON PRINTING MATERIAL CONTAINER

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of application Ser. No. 13/608,658, filed on Sep. 10, 2012, which is a continuation of application Ser. No. 12/257,914, filed Oct. 24, 2008, now U.S. Pat. No. 8,366,233, which is a continuation of application Ser. No. 12/040,308, filed on Feb. 29, 2008, now U.S. Pat. No. 7,484,825, which is a continuation of application Ser. No. 11/611,641, filed on Dec. 15, 2006, now U.S. Pat. No. 7,562,958.

This application relates to and claims priority from Japanese Patent Applications No. 2005-372028, filed on Dec. 26, 2005 and No. 2006-220751, filed on Aug. 11, 2006, the entire disclosures of which are incorporated by reference herein.

BACKGROUND

1. Technical Field

The present invention relates in general to a printing material container containing a printing material and a board mounted on the printing material container, and relates in particular to an arrangement for a plurality of terminals disposed on these components.

2. Description of the Related Art

In recent years, it has become common practice to equip ink cartridges used in ink jet printers or other printing apparatus, with a device, for example, a memory for storing information relating to the ink. Also disposed on such ink cartridges is another device, for example, a high voltage circuit (e.g. a remaining ink level sensor using a piezoelectric element) applied to higher voltage than the driving voltage of the memory. In such cases, there are instances in which the ink cartridge and the printing apparatus are electrically connected through terminals. There is proposed a structure for preventing the information storage medium from shorting and becoming damaged due to a drop of liquid being deposited on the terminals connecting the printing apparatus with the storage medium furnished to the ink cartridge.

However, the technologies mentioned above do not contemplate an ink cartridge having equipped with a plurality of devices, for example, a memory and a high voltage circuit, with terminals for one device and the terminals for another device. With this kind of cartridge, there was a risk that shorting could occur between a terminal for the one device and the terminal for the another device. Such shorting caused the problem of possible damage to the ink cartridge or to the printing apparatus in which the ink cartridge is attached. This problem is not limited to ink cartridges, but is a problem common to receptacles containing other printing materials, for example, toner.

SUMMARY

An advantage of some aspects of the present invention is to provide a printing material container having a plurality of devices, wherein damage to the printing material container and the printing apparatus caused by shorting between terminals can be prevented or reduced.

A first aspect of the invention provides a printing material container detachably attachable to a printing apparatus having a plurality of apparatus-side terminals. The printing material container pertaining to the first aspect of the invention

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comprises a first device, a second device and a terminal group that includes a plurality of first terminals, at least one second terminal and at least one third terminal. The plurality of first terminals are connected to the first device and respectively include a first contact portion for contacting a corresponding terminal among the plurality of apparatus-side terminals. The at least one second terminal is connected to the second device and includes a second contact portion for contacting a corresponding terminal among the plurality of apparatus-side terminals. The at least one third terminal is for the detection of shorting between the at least one second terminal and the at least one third terminal and includes a third contact portion for contacting a corresponding terminal among the plurality of apparatus-side terminals. The at least one second contact portion, the plurality of the first contact portions, and the at least one third contact portion are arranged so as to form one or multiple rows. The at least one second contact portion is arranged at an end of one row among the one or multiple rows.

According to the printing material container pertaining to the first aspect of the invention, the second contact portions of the second terminals connected to the second device are arranged at the ends, whereby other contact portions adjacent to the second contact portions are fewer in number, and consequently the second terminals have less likelihood of shorting to terminals include other contact portions. Accordingly, damage to the printing material container or printing apparatus caused by such shorting can be prevented or reduced.

A second aspect of the invention provides printing material container detachably mountable to a printing apparatus having a plurality of apparatus-side terminals. The printing material container pertaining to the second aspect of the invention comprises a first device, a second device, a group of terminals for connection to the apparatus-side terminals and comprising a plurality of first terminals, at least one second terminal, and at least one third terminal. The plurality of first terminals are connected to the first device. The at least one second terminal is connected to the second device. At least a portion of the at least one third terminal is arranged relative to at least a portion of the at least one second terminal, without a said first terminal therebetween in at least one direction, for the detection of shorting between the at least one second terminal and the at least one third terminal.

According to the printing material container pertaining to the second aspect of the invention, at least a portion of the at least one third terminal is arranged relative to at least a portion of the at least one second terminal, without a said first terminal therebetween in at least one direction. As a result, shorting between the portion of the at least one third terminal and the portion of the at least one second terminal have a greater tendency to occur than shorting between the first terminal and the second terminal. Accordingly, in the event that the shorting between the first terminal and the second terminal occurs by a drop of ink or foreign matter, it is highly likely that the shorting between the portion of the at least one third terminal and the portion of the at least one second terminal also occurs, and is detected as anomaly. As a result, damage to the printing material container or printing apparatus caused by a shorting between the first terminal and the second terminal can be prevented or reduced.

A third aspect of the invention provides a printing material container detachably mountable to a printing apparatus having a plurality of apparatus-side terminals. The printing material container pertaining to the third aspect of the invention comprises a first device, a second device, a group of terminals for connection to the apparatus-side terminals and comprising a plurality of first terminals, at least one second terminal, and at least one third terminal. The plurality of first terminals

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are connected to the first device. The at least one second terminal is connected to the second device. The at least one third terminal is for the detection of shorting between the at least one second terminal and the at least one third terminal. At least a portion of the at least one third terminal is located adjacently to at least a portion of the at least one second terminal in at least one direction.

According to the printing material container pertaining to the third aspect of the invention, at least a portion of the at least one third terminal is located adjacently to at least a portion of the at least one second terminal. As a result, shorting between the portion of the at least one third terminal and the portion of the at least one second terminal have a greater tendency to occur than shorting between the first terminal and the second terminal. Accordingly, in the event that the shorting between the first terminal and the second terminal occurs by a drop of ink or foreign matter, it is highly likely that the shorting between the portion of the at least one third terminal and the portion of the at least one second terminal also occurs, and is detected as anomaly. As a result, damage to the printing material container or printing apparatus caused by a shorting between the first terminal and the second terminal can be prevented or reduced.

A fourth aspect of the invention provides printing material container detachably mountable to a printing apparatus having a apparatus-side terminal group. The apparatus-side terminal group includes a plurality of first apparatus-side terminals, a plurality of second apparatus-side terminals, and a plurality of third apparatus-side terminals. Terminals within the apparatus-side terminal group are arranged so as to form a first row and second row. The plurality of second apparatus-side terminals are respectively arranged at each end of the first row and the third apparatus-side terminals are respectively arranged at each end of the second row. Each of the second apparatus-side terminals is adjacent to any of the third apparatus-side terminals. The printing material container pertaining to the fourth aspect of the invention comprises a first device, a second device, a group of terminals comprising a plurality of first terminals, at least one second terminal, and at least one third terminal. The plurality of first terminals are connected to the first device and are respectively contactable to a corresponding terminal among the first apparatus-side terminals. The at least one second terminal is connected to the second device and is respectively contactable to a corresponding terminal among the second apparatus-side terminals. The at least one third terminal is for the detection of shorting between the at least one second terminal and the at least one third terminal and is respectively contactable to a corresponding terminal among the third apparatus-side terminals.

The printing material container pertaining to the fourth aspect of the invention can afford working effects analogous to those of the printing material container pertaining to the first aspect. The printing material container pertaining to the fourth aspect of the invention may be reduced to practice in various forms, in the same manner as the printing material container which pertaining to the first aspect.

A fifth aspect of the invention provides a printing material container detachably attachable to a printing apparatus having a plurality of apparatus-side terminals. The printing material container pertaining to the fifth aspect of the invention comprises a first device, a second device, and a terminal group that includes a plurality of first terminals, at least one second terminal and at least one third terminal. The plurality of first terminals are connected to the first device. The at least one second terminal is connected to the second device. The at least one third terminal is for the detection of shorting

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between the at least one second terminal and the at least one third terminal. Each of the terminals has an circumferential edge, a portion of the circumferential edge of the third terminal facing a portion of the circumferential edge of the second terminal and a portion of the circumferential edge of the one first terminal facing another portion of the circumferential edge of the second terminal. The length of the portion of circumferential edge of the third terminal is longer than that of the portion of the circumferential edge of the one first terminal.

According to the printing material container pertaining to the fifth aspect of the invention, the length of the portion of circumferential edge of the third terminal is longer than that of the portion of the circumferential edge of the one first terminal. As a result, shorting between the third terminal and the second terminal have a greater tendency to occur than shorting between the first terminal and the second terminal. Accordingly, in the event that the shorting between the first terminal and the second terminal occurs by a drop of ink or foreign matter, it is highly likely that the shorting between the portion of the at least one third terminal and the portion of the at least one second terminal also occurs, and is detected as anomaly. As a result, damage to the printing material container or printing apparatus caused by a shorting between the first terminal and the second terminal can be prevented or reduced.

A sixth aspect of the invention provides a board mountable on a printing material container detachably attachable to a printing apparatus that has a plurality of apparatus-side terminals. The printing material container has second device. The board pertaining to the sixth aspect of the invention comprises a first device and a terminal group that includes a plurality of first terminals, at least one second terminal and at least one third terminal. The plurality of first terminals are connected to the first device and respectively include a first contact portion for contacting a corresponding terminal among the plurality of apparatus-side terminals. The at least one second terminal is connectable to the second device and includes a second contact portion for contacting a corresponding terminal among the plurality of apparatus-side terminals. The at least one third terminal is for the detection of shorting between the at least one second terminal and the at least one third terminal and includes a third contact portion for contacting a corresponding terminal among the plurality of apparatus-side terminals. The at least one second contact portion, the plurality of the first contact portions, and the at least one third contact portion are arranged so as to form one or multiple rows. The at least one second contact portion is arranged at an end of one row among the one or multiple rows.

A seventh aspect of the invention provides a board mountable on a printing material container detachably attachable to a printing apparatus that has a plurality of apparatus-side terminals. The printing material container has second device. The board pertaining to the seventh aspect of the invention comprises a first device and a group of terminals for connection to the apparatus-side terminals and comprising a plurality of first terminals, at least one second terminal, and at least one third terminal. The plurality of first terminals are connected to the first device. The at least one second terminal is connected to the second device. At least a portion of the at least one third terminal is arranged relative to at least a portion of the at least one second terminal, without a said first terminal therebetween in at least one direction, for the detection of shorting between the at least one second terminal and the at least one third terminal.

An eighth aspect of the invention provides a board mountable on a printing material container detachably attachable to

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a printing apparatus that has a plurality of apparatus-side terminals. The printing material container has second device. The board pertaining to the eighth aspect of the invention comprises a first device and a group of terminals for connection to the apparatus-side terminals and comprising a plurality of first terminals, at least one second terminal, and at least one third terminal. The plurality of first terminals are connected to the first device. The at least one second terminal is connected to the second device. The at least one third terminal is for the detection of shorting between the at least one second terminal and the at least one third terminal. At least a portion of the at least one third terminal is located adjacently to at least a portion of the at least one second terminal in at least one direction.

A ninth aspect of the invention provides a board mountable on a printing material container detachably attachable to a printing apparatus having a apparatus-side terminal group that includes a plurality of first apparatus-side terminals, a plurality of second apparatus-side terminals, and a plurality of third apparatus-side terminals. Terminals within the apparatus-side terminal group are arranged so as to form a first row and second row. The plurality of second apparatus-side terminals are respectively arranged at each end of the first row and the third apparatus-side terminals are respectively arranged at each end of the second row. Each of the second apparatus-side terminals is adjacent to any of the third apparatus-side terminals. The printing material container has second device. The board pertaining to the ninth aspect of the invention comprises a first device and a group of terminals comprising a plurality of first terminals, at least one second terminal, and at least one third terminal. The plurality of first terminals are connected to the first device and are respectively contactable to a corresponding terminal among the first apparatus-side terminals. The at least one second terminal is connected to the second device and is respectively contactable to a corresponding terminal among the second apparatus-side terminals. The at least one third terminal is for the detection of shorting between the at least one second terminal and the at least one third terminal and is respectively contactable to a corresponding terminal among the third apparatus-side terminals.

A tenth aspect of the invention provides a board mountable on a printing material container detachably attachable to a printing apparatus that has a plurality of apparatus-side terminals. The printing material container has second device. The board pertaining to the tenth aspect of the invention comprises a first device and a terminal group that includes a plurality of first terminals, at least one second terminal and at least one third terminal. The plurality of first terminals are connected to the first device. The at least one second terminal is connected to the second device. The at least one third terminal is for the detection of shorting between the at least one second terminal and the at least one third terminal. Each of the terminals has an circumferential edge, a portion of the circumferential edge of the third terminal facing a portion of the circumferential edge of the second terminal and a portion of the circumferential edge of the one first terminal facing another portion of the circumferential edge of the second terminal. The length of the portion of circumferential edge of the third terminal is longer than that of the portion of the circumferential edge of the one first terminal.

An eleventh aspect of the invention provides a board mountable on a printing material container detachably attachable to a printing apparatus that has a plurality of apparatus-side terminals. The printing material container has a second device. The board pertaining to the eleventh aspect of the invention comprises a first device and a terminal group that

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includes at least a plurality of first terminals, at least one cut-out portions into which a respective second terminal mounted on the printing material container can be inserted and at least one third terminal. The plurality of first terminals are connectable to the first device and respectively include a first contact portion for contacting a corresponding terminal among the plurality of apparatus-side terminals. The at least one second terminal is connectable to the second device and includes a second contact portion for contacting a corresponding terminal among the plurality of apparatus-side terminals. The at least one third terminal is for the detection of shorting between the at least one second terminal and the at least one third terminal and includes a third contact portion for contacting a corresponding terminal among the plurality of apparatus-side terminals. When mounted on the printing material container, the at least one third contact portion is located adjacently to the at least one second contact portion. When mounted on the printing material container, the at least one second contact portion, the plurality of the first contact portions, and the at least one third contact portion are arranged so as to form one or multiple rows. When mounted on the printing material container, the at least one second contact portion is arranged at an end of one row among the one or multiple rows.

A twelfth aspect of the invention provides a board connectable to a printing apparatus that has a plurality of apparatus-side terminals. The board pertaining to the twelfth aspect of the invention comprises a terminal group that includes a plurality of first terminals, at least one second terminal and at least one third terminal. The plurality of first terminals are connected to a first device and respectively include a first contact portion for contacting a corresponding terminal among the plurality of apparatus-side terminals. The at least one second terminal is connectable to a second device and includes a second contact portion for contacting a corresponding terminal among the plurality of apparatus-side terminals. The at least one third terminal is for the detection of shorting between the at least one second terminal and the at least one third terminal and includes a third contact portion for contacting a corresponding terminal among the plurality of apparatus-side terminals. The at least one second contact portion, the plurality of the first contact portions, and the at least one third contact portion are arranged so as to form one or multiple rows. The at least one second contact portion is arranged at an end of one row among the one or multiple rows.

The boards pertaining to the sixth to the twelfth aspects of the invention can afford working effects analogous to those of the printing material container pertaining to the first to the fifth aspects respectively. The boards pertaining to the sixth to eleventh aspects may be reduced to practice in various forms, in the same manner as the printing material container pertaining to the first to the fifth aspects respectively.

The above and other objects, characterizing features, aspects and advantages of the present invention will be clear from the description of preferred embodiments presented below along with the attached figures.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a perspective view of the construction of the printing apparatus pertaining to an embodiment of the invention;

FIG. 2 shows a perspective view of the construction of the ink cartridge pertaining to the embodiment;

FIGS. 3A-B show diagrams of the construction of the board pertaining to the embodiment;

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FIG. 4 shows an illustration showing attachment of the ink cartridge in the holder;

FIG. 5 shows an illustration showing the ink cartridge attached to the holder;

FIGS. 6A-B show schematics of the construction of the contact mechanism;

FIG. 7 shows a brief diagram of the electrical arrangement of the ink cartridge and the printing apparatus;

FIG. 8 shows a brief diagram of the electrical arrangement, focusing on the cartridge detection/short detection circuit;

FIG. 9 shows a flowchart depicting the processing routine of the cartridge determination process;

FIGS. 10A-C show illustrations depicting three types of terminal lines on the board;

FIG. 11 shows a flowchart depicting the processing routine of the remaining ink level detection process;

FIGS. 12A-C show timing charts depicting temporal change in the shorting-detection enable signal and sensor voltage during execution of the remaining ink level detection process;

FIG. 13 shows an illustration of a scenario of shorting;

FIGS. 14A-D show first diagrams depicting boards pertaining to variations;

FIGS. 15A-C show second diagrams depicting boards pertaining to variations;

FIGS. 16A-D show third diagrams depicting boards pertaining to variations;

FIGS. 17A-D show diagrams depicting the construction around boards of ink cartridges pertaining to variations;

FIGS. 18A-D show cross sections A-A to D-D in FIG. 17;

FIGS. 19A-D show fourth diagrams depicting boards pertaining to variations;

FIG. 20 shows a perspective view of the construction of the ink cartridge pertaining to a variation;

FIG. 21 shows a picture of the ink cartridge pertaining to a variation being attached to the printer;

FIG. 22 shows a first diagram of the construction of the ink cartridge pertaining to a variation;

FIG. 23 shows a second diagram of the construction of the ink cartridge pertaining to a variation;

FIG. 24 shows a third diagram of the construction of the ink cartridge pertaining to a variation.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiments of the present invention will be described below with reference to the drawings.

A. Embodiment

Arrangement of Printing apparatus and Ink Cartridge:

FIG. 1 shows a perspective view of the construction of the printing apparatus pertaining to an embodiment of the invention. The printing apparatus 1000 has a sub-scan feed mechanism, a main scan feed mechanism, and a head drive mechanism. The sub-scan feed mechanism carries the printing paper P in the sub-scanning direction using a paper feed roller 10 powered by a paper feed motor, not shown. The main scan feed mechanism uses the power of a carriage motor 2 to reciprocate in the main scanning direction a carriage 3 connected to a drive belt. The head drive mechanism drives a print head 5 mounted on the carriage 3, to eject ink and form dots. The printing apparatus 1000 additionally comprises a main control circuit 40 for controlling the various mechanisms mentioned above. The main control circuit 40 is connected to the carriage 3 via a flexible cable 37.

The carriage 3 comprises a holder 4, the print head 5 mentioned above, and a carriage circuit, described later. The

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holder 4 is designed for attachment of a number of ink cartridges, described later, and is situated on the upper face of the print head 5. In the example depicted in FIG. 1, the holder 4 is designed for attachment of four ink cartridges, e.g. individual attachment of four types of ink cartridge containing black, yellow, magenta, and cyan ink. Four openable and closable covers 11 are attached to the holder 4 for each attached ink cartridge. Also disposed on the upper face of the print head 5 are ink supply needles 6 for supplying ink from the ink cartridges to the print head 5.

The construction of the ink cartridge pertaining to the embodiment will now be described with reference of FIGS. 2-5. FIG. 2 shows a perspective view of the construction of the ink cartridge pertaining to the embodiment. FIGS. 3A-B show diagrams of the construction of the board pertaining to the embodiment. FIG. 4 shows an illustration showing attachment of the ink cartridge in the holder. FIG. 5 shows an illustration showing the ink cartridge attached to the holder. The ink cartridge 100 attached to the holder 4 comprises a housing 101 containing ink, a lid 102 providing closure to the opening of the housing 101, a board 200, and a sensor 104. On the bottom face of the housing 101 there is formed an ink supply orifice 110 into which the aforementioned ink supply needle 6 inserts when ink cartridge 100 is attached to the holder 4. At the upper edge of the front face FR of the housing 101 there is formed a flared section 103. On the lower side of the center of the front face FR of the housing 101 there is formed a recess 105 bounded by upper and lower ribs 107, 106. The aforementioned board 200 fits into this recess 105. The sensor 104 is located in the region posterior to the board 200. The sensor 104 is used to detect remaining ink level, as will be described later.

FIG. 3A depicts the arrangement on the surface of the board 200. This surface is the face that is exposed to the outside when the board 200 is mounted on the ink cartridge 100. FIG. 3B depicts the board 200 viewed from the side. A boss slot 201 is formed at the upper edge of the board 200, and a boss hole 202 is formed at the lower edge of the board 200. As shown in FIG. 1, with the board 200 attached to the recess 105 of the housing 101, bosses 108 and 109 formed on the lower face of the recess 105 mate with the boss slot 201 and the boss hole 202 respectively. The distal ends of the bosses 108 and 109 are crushed to effect caulking. The board 200 is secured within the recess 105 thereby.

The following description of attachment of the ink cartridge 100 makes reference to FIG. 4 and FIG. 5. As depicted in FIG. 4, the cover 11 is designed to be rotatable about a rotating shaft 9. With the cover 11 rotated upward to the open position, when the ink cartridge 100 is being attached to the holder, the flared section 103 of the ink cartridge is received by a projection 14 of the cover 11. When the cover 11 is closed from this position, the projection 14 rotates downward, and the ink cartridge 100 descends downward (in the Z direction in FIG. 4). When the cover 11 is completely closed, a hook 18 of the cover 11 interlocks with a hook 16 of the holder 4. With the cover 11 completely closed, the ink cartridge 100 is secured pressed against the holder 4 by an elastic member 20. Also, with the cover 11 completely closed, the ink supply needle 6 inserts into the ink supply orifice 110 of the ink cartridge 100, and the ink contained in the ink cartridge 100 is supplied to the printing apparatus 1000 via the ink supply needle 6. As will be apparent from the preceding description, the ink cartridge 100 is attached to the holder 4 by means of inserting it so as to move in the forward direction of the Z axis in FIG. 4 and FIG. 5. The forward direction of the Z axis in FIG. 4 and FIG. 5 shall also be referred to as insertion direction of the ink cartridge 100.

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Returning to FIG. 3, the board 200 shall be described further. The arrow R in FIG. 3(a) indicates the insertion direction of the ink cartridge 100 discussed above. As depicted in FIG. 3, the board 200 comprises a memory 203 disposed on its back face, and a terminal group composed of nine terminals 210-290 disposed on its front face. The memory 203 stores information relating to the ink contained in the ink cartridge 100. The terminals 210-290 are generally rectangular in shape, and are arranged in two rows generally orthogonal to the insertion direction R. Of the two rows, the row on the insertion direction R side, i.e. the row situated on the lower side in FIG. 3(a), shall be termed the lower row, and the row on the opposite side from the insertion direction R, i.e. the row situated on the upper side in FIG. 3(a), shall be termed the upper row. The terminals arranged so as to form the upper row consist, in order from left in FIG. 3(a), of a first short detection terminal 210, a ground terminal 220, a power supply terminal 230, and a second short detection terminal 240. The terminals arranged so as to form the lower row consist, in order from left in FIG. 3(a), of a first sensor drive terminal 250, a reset terminal 260, a clock terminal 270, a data terminal 280, and a second sensor drive terminal 290. As depicted in FIG. 3, each of the terminals 210-290 contains in its center portion a contact portion CP for contacting a corresponding terminal among the plurality of apparatus-side terminals, described later.

The terminals 210-240 forming the upper row and the terminals 250-290 forming the lower row are arranged differently from one another, constituting a so-called staggered arrangement, so that the terminal centers do not line up with one another in the insertion direction R. As a result, the contact portions CP of the terminals 210-240 forming the upper row and the contact portions CP of the terminals 250-290 forming the lower row are similarly arranged differently from one another, constituting a so-called staggered arrangement.

As will be appreciated from FIG. 3A, the first sensor drive terminal 250 is situated adjacently to two other terminals (the reset terminal 260 and the first short detection terminal 210), and of these, the first short detection terminal 210 for detecting shorting is positioned closest to the first sensor drive terminal 250. Similarly, the second sensor drive terminal 290 is situated adjacently to two other terminals (the second short detection terminal 240 and the data terminal 280), and of these, the second short detection terminal 240 for detecting shorting is positioned closest to the second sensor drive terminal 290.

With regard to relationships among the contact portions CP, the contact portion CP of the first sensor drive terminal 250 is situated adjacently to the contact portions CP of two other terminals (the reset terminal 260 and the first short detection terminal 210). Similarly, the contact portion CP of the second sensor drive terminal 290 is situated adjacently to the contact portions CP of two other terminals (the second short detection terminal 240 and the data terminal 280).

As will be appreciated from FIG. 3A, the first sensor drive terminal 250 and the second sensor drive terminal 290 are situated at the ends of the lower row, i.e. at the outermost positions in the lower row. The lower row is composed of a greater number of terminals than the upper row, and the length of the lower row in the direction orthogonal to the insertion direction R is greater than the length of the upper row, and consequently of all the terminals 210-290 contained in the upper and lower rows, the first sensor drive terminal 250 and the second sensor drive terminal 290 are situated at the outermost positions viewed in the direction orthogonal to the insertion direction R.

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With regard to relationships among the contact portions CP, the contact portion CP of the first sensor drive terminal 250 and the contact portion CP of the second sensor drive terminal 290 are respectively situated at the ends of the lower row formed by the contact portions CP of the terminals, i.e., at the outermost positions in the lower row. Among the contact portions of all the terminals 210-290 contained in the upper and lower rows, the contact portion CP of the first sensor drive terminal 250 and the contact portion CP of the second sensor drive terminal 290 are situated at the outermost positions viewed in the direction orthogonal to the insertion direction R.

As will be appreciated from FIG. 3A, the first short detection terminal 210 and the second short detection terminal 240 are respectively situated at the ends of the upper row, i.e., at the outermost positions in the upper row. As a result, the contact portion CP of the first short detection terminal 210 and the contact portion CP of the second short detection terminal 240 are similarly located at the ends of the upper row formed by the contact portions CP of the terminals, i.e. at the outermost positions in the upper row. Consequently, as will be discussed later, the terminals 220, 230, 260, 270 and 280 connected to the memory 203 are situated between the first short detection terminal 210 and the first sensor drive terminal 250, and the second short detection terminal 240 and the second sensor drive terminal 290, located to either side.

In the embodiment, the board 200 has width of approximately 12.8 mm in the insertion direction R, width of the approximately 10.1 mm in the direction orthogonal to the insertion direction R, and thickness of approximately 0.71 mm. The terminals 210-290 each have width of approximately 1.8 mm in the insertion direction R and width of approximately 1.05 mm in the direction orthogonal to the insertion direction R. The dimension values given here are merely exemplary, with differences on the order of ± 0.5 mm being acceptable, for example. The spacing between adjacent terminals in a given row (the lower row or the upper row), for example the interval K between the first short detection terminal 210 and the ground terminal 220, is 1 mm for example. With regard to spacing among terminals, differences on the order of ± 0.5 mm are acceptable, for example. The interval J between the upper row and the lower row is about 0.2 mm. With regard to spacing among rows, differences on the order of ± 0.3 mm are acceptable, for example.

As depicted in FIG. 5, with the ink cartridge 100 attached completely within the holder 4, the terminals 210-290 of the board 200 are electrically connected to a carriage circuit 500 via a contact mechanism 400 disposed on the holder 4. The contact mechanism 400 shall be described briefly making reference to FIGS. 6A-B.

FIGS. 6A-B show schematics of the construction of the contact mechanism 400. The contact mechanism 400 has multiple slits 401, 402 of two types that differ in depth, formed in alternating fashion at substantially constant pitch in correspondence with the terminals 210-290 on the board 200. Within each slit 401, 402 there fits a contact forming member 403, 404 endowed with electrical conductivity and resistance. Of the two ends of each contact forming member 403 and 404, the end exposed to the inside of the holder is placed in resilient contact with a corresponding terminal among the terminals 210-290 on the board 200. In FIG. 6A, portions 410-490 which are the portions of the contact forming members 403 and 404 that contact the terminals 210-290 are shown. Specifically, the portions 410-490 that contact the terminals 210-290 function as apparatus-side terminals for electrically connecting the printing apparatus 1000 with the terminals 210-290. The portions 410-490 that contact the terminals 210-290

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shall hereinafter be termed apparatus-side terminals **410-490**. With the ink cartridge **100** attached to the holder **4**, the apparatus-side terminals **410-490** respectively contact the contact portions CP of the terminals **210-290** described above (FIG. 3A).

On the other hand, of the two ends of each contact forming member **403** and **404**, the end lying exposed on the exterior of the holder **4** is placed in resilient contact with a corresponding terminal among the terminals **510-590** furnished to the carriage circuit **500**.

The electrical arrangements of the ink cartridge **100** and the printing apparatus will now be described, focusing on the part relating to the ink cartridge **100**, with reference to FIG. 7 and FIG. 8. FIG. 7 shows a brief diagram of the electrical arrangement of the ink cartridge and the printing apparatus. FIG. 8 shows a brief diagram of the electrical arrangement, focusing on the cartridge detection/short detection circuit.

First, the electrical arrangement of the ink cartridge **100** shall be described. Of the terminals of the board **200** described with reference to FIG. 3, the ground terminal **220**, the power supply terminal **230**, the reset terminal **260**, the clock terminal **270** and the data terminal **280** are electrically connected to the memory **203**. The memory **203** is, for example, EEPROM comprising serially accessed memory cells, and performing data read/write operations in sync with a clock signal. The ground terminal **220** is grounded via a terminal **520** on the printing apparatus **1000** side. The reset terminal **260** is electrically connected to a terminal **560** of the carriage circuit **500**, and is used to supply a reset signal RST to the memory **203** from the carriage circuit **500**. The clock terminal **270** is electrically connected to a terminal **570** of the carriage circuit **500**, and is used to supply the clock signal CLK to the memory **203** from the carriage circuit **500**. The data terminal **280** is electrically connected to a terminal **580** of the carriage circuit **500**, and is used for exchange of data signals SDA between the carriage circuit **500** and the memory **203**.

Of the terminals of the board **200** described with reference to FIG. 3, either the first short detection terminal **210**, the second short detection terminal **240**, or both are electrically connected with the ground terminal **220**. In the example depicted in FIG. 7, it will be apparent that the first short detection terminal **220** is electrically connected to the ground terminal **220**. The first short detection terminal **210** and the second short detection terminal **240** are electrically connected respectively to the terminals **510**, **540** of the carriage circuit **500**, and used for cartridge detection and short detection, described later.

In the embodiment, a piezoelectric element is used as the sensor **104**. The remaining ink level can be detected by applying driving voltage to the piezoelectric element to induce the piezoelectric element to vibrate through the inverse piezoelectric effect, and measuring the vibration frequency of the voltage produced by the piezoelectric effect of the residual vibration. Specifically, this vibration frequency represents the characteristic frequency of the surrounding structures (e.g. the housing **101** and ink) that vibrate together with the piezoelectric element. The characteristic frequency changes depending on the amount of ink remaining within the ink cartridge, so the remaining ink level can be detected by measuring this vibration frequency. Of the terminals of the board **200** described with reference to FIG. 3, the second sensor drive terminal **290** is electrically connected to one electrode of the piezoelectric element used as the sensor **104**, and the first sensor drive terminal **250** is electrically connected to the other electrode. These terminals **250**, **290** are used for

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exchange of sensor driving voltage and output signals from the sensor **104**, between the carriage circuit **500** and the sensor **104**.

The carriage circuit **500** comprises a memory control circuit **501**, a cartridge detection/short detection circuit **502**, and a sensor driving circuit **503**. The memory control circuit **501** is a circuit connected to the terminals **530**, **560**, **570**, **580** of the carriage circuit **500** mentioned above, and used to control the memory **203** of the ink cartridge **100** to perform data read/write operations. The memory control circuit **501** and the memory **203** are low-voltage circuits driven at relatively low voltage (in the embodiment, a maximum of about 3.3 V). The memory control circuit **501** can employ a known design, and as such need not be described in detail here.

The sensor driving circuit **503** is a circuit connected to the terminals **590** and **550** of the carriage circuit **500**, and used to control the driving voltage output from these terminals **590** and **550** to drive the sensor **104**, causing the sensor **104** to detect the remaining ink level. As will be described later, the driving voltage has a generally trapezoidal shape, and contains relatively high voltage (in the embodiment, about 3.6 V). Specifically, the sensor driving circuit **503** and the sensor **104** are high-voltage circuits using relatively high voltage via the terminals **590** and **550**. The sensor driving circuit **503** is composed of a logic circuit for example, but need not be described in detail herein.

The cartridge detection/short detection circuit **502**, like the memory control circuit **501**, is a low-voltage circuit driven using relatively low voltage (in the embodiment, a maximum of about 3.3V). As depicted in FIG. 8, the cartridge detection/short detection circuit **502** comprises a first detection circuit **5021** and a second detection circuit **5022**. The first detection circuit **5021** is connected to the terminal **510** of the carriage circuit **500**. The first detection circuit **5021** has a cartridge detection function for detecting whether there is contact between the terminal **510** and the first short detection terminal **210** of the board **200**, and a short detection function for detecting shorting of the terminal **510** to the terminals **550** and **590** which output high voltage.

To describe in more specific terms, the first detection circuit **5021** has a reference voltage V_{ref1} applied to one end of two series-connected resistors $R2$, $R3$, with the other end being grounded, thereby maintaining the potential at point P1 and P2 in FIG. 4 at V_{ref1} and V_{ref2} , respectively. Herein V_{ref1} shall be termed the short detection voltage, and V_{ref2} shall be termed the cartridge detection voltage. In the embodiment, the short detection voltage V_{ref1} is set to 6.5 V, and the cartridge detection voltage V_{ref2} is set to 2.5 V. These values are established by means of the circuits, and are not limited to the values given herein.

As depicted in FIG. 8, the short detection voltage V_{ref1} (6.5 V) is input to the negative input pin of a first Op-Amp OP1, while the cartridge detection voltage V_{ref2} (2.5 V) is input to the negative input pin of a second Op-Amp OP2. The potential of the terminal **510** is input to the positive input pins of the first Op-Amp OP1 and the second Op-Amp OP2. These two Op-Amps function as a comparator, outputting a High signal when the potential input to the negative input pin is higher than the potential input to the positive input pin, and conversely outputting a Low signal when the potential input to the negative input pin is lower than the potential input to the positive input pin.

As depicted in FIG. 8, the terminal **510** is connected to a 3.3 V power supply VDD 3.3 via a transistor TR1. By means of this arrangement, if terminal **510** is free e.g. there is no contact with terminal **510**, the potential of the terminal **510** will be set at about 3 V. As noted, when the ink cartridge **100** is attached,

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the terminal **510** comes into contact with the first short detection terminal **210** of the board **200** described previously. Here, as depicted in FIG. 7, with the first short detection terminal **210** and the ground terminal **220** electrically connected (shorted) in the board **200**, when the terminal **510** comes into contact with the first short detection terminal **210** (herein referred to as being in contact), the terminal **510** is electrically continuous with the grounded terminal **520**, and the potential of the terminal **510** drops to 0 V.

Consequently, with the terminal **510** free, a High signal from the second Op-Amp OP2 is output as the cartridge detection signal CS1. With the terminal **510** in contact, a Low signal from the second Op-Amp OP2 is output as the cartridge detection signal CS1.

On the other hand, if the terminal **510** is shorted to the adjacent terminal **550**, there are instances in which the sensor driving voltage (45 V max) will be applied to the terminal **510**. As shown in FIG. 8, when voltage greater than the short detection voltage V_{ref1} (6.5 V) is applied to the terminal **510** due to shorting, a High signal from the Op-Amp OP1 will be output to an AND circuit AA.

As shown in FIG. 8, a short detection enable signal EN is input from the main control circuit **40** to the other input pin of the AND circuit AA. As a result, only during the time interval that a High signal is input as the short detection enable signal EN, the first detection circuit **5021** outputs the High signal from the Op-Amp OP1 as a short detection signal AB1. That is, execution of the short detection function of the first detection circuit **5021** is controlled by means of the short detection enable signal EN of the main control circuit **40**. The short detection signal AB1 from the AND circuit AA is output to the main control circuit **40**, as well as being output to the base pin of the transistor TR1 via resistance R1. As a result, by means of the transistor TR1 it is possible to prevent high voltage from being applied to the power supply VDD 3.3 via the terminal **510** when a short is detected (when the short detection signal AB1 is HI).

The second detection circuit **5022** has a cartridge detection function for detecting whether there is contact between the terminal **540** and the second short detection terminal **240** of the board **200**, and a short detection function for detecting shorting of the terminal **540** to the terminals **550** and **590** which output high voltage. Since the second detection circuit **5022** has the same arrangement as the first detection circuit **5021**, a detailed illustration and description need not be provided here. Hereinafter, the cartridge detection signal output by the second detection circuit **5022** shall be denoted as CS2, and the short detection signal as AB2.

An arrangement of the carriage circuit **500** corresponding to a single ink cartridge **100** has been described above. In the embodiment, since four ink cartridges **100** are attached, four of the cartridge detection/short detection circuits **502** described above will be provided, at each of the attachment locations for the four ink cartridges **100**. While only a single sensor driving circuit **503** is provided, and a single sensor driving circuit **503** is connectable to each of the sensors **104** of the ink cartridges **100** attached at the four attachment locations by means of a switch(not shown). The memory control circuit **501** is a single circuit responsible for processes relating to the four ink cartridges.

The main control circuit **40** is a computer of known design comprising a central processing unit (CPU), a read-only memory (ROM), and a random access memory (RAM). As noted, the main control circuit **40** controls the entire printer; in FIG. 8, however, only those elements necessary for description of the embodiment are selectively illustrated, and the following description refers to the illustrated arrange-

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ment. The main control circuit **40** comprises a cartridge determining module M50 and a remaining ink level determining module M60. On the basis of the received cartridge detection signals CS1, CS2, the cartridge determining module M50 executes a cartridge determination process, described later. The remaining ink level determining module M60 controls the sensor driving circuit **503**, and executes a remaining ink level detection process, described later.

Cartridge Determination Process:

The cartridge determination process executed by the cartridge determining module M50 of the main control circuit **40** will be described with reference to FIG. 9 and FIG. 10. FIG. 9 shows a flowchart depicting the processing routine of the cartridge determination process. FIGS. 10A-C show illustrations depicting three types of terminal lines on the board **200**.

Before turning to the cartridge determination process, the board **200** will be described further with reference to FIG. 10. The board **200** mentioned previously comes in three types, depending on the wiring pattern of the first short detection terminal **210**, the second short detection terminal **240**, and the ground terminal **220**. These three types are designated respectively as Type A, Type B, and Type C. As depicted in FIG. 10A, the Type A board **200** is arranged with the first short detection terminal **210** and the ground terminal **220** electrically connected by a conducting line **207**, while the second short detection terminal **240** and the ground terminal **220** are not electrically connected. As depicted in FIG. 10B, the Type B board **200** is arranged with both the first short detection terminal **210** and the second short detection terminal **240** electrically connected with the ground terminal **220** by a conducting line **207**. As depicted in FIG. 10C, the Type C board **200** is arranged with the second short detection terminal **240** and the ground terminal **220** electrically connected by a conducting line **207**, while the first short detection terminal **210** and the ground terminal **220** are not electrically connected. A board **200** of predetermined type, selected with reference to ink type or ink quantity for example, is disposed on the ink cartridge **100**. Specifically, depending on the quantity of ink contained in the ink cartridge **100**, a Type A board **200** could be disposed on an L size cartridge containing a large quantity of ink; a Type B board **200** could be disposed on an M size cartridge containing a standard quantity of ink; and a Type C board **200** could be disposed on an S size cartridge containing a small quantity of ink.

The cartridge determining module M50 of the main control circuit **40** constantly receives from the cartridge detection/short detection circuit **502** the cartridge detection signals CS1, CS2 for each of the four attachment locations of the holder **4**, and using these signals executes the cartridge determination process for each of the attachment locations.

When the cartridge determining module M50 initiates the cartridge determination process for a selected attachment location, the cartridge determining module M50 first ascertains whether the cartridge detection signal CS1 from the cartridge detection/short detection circuit **502** in the selected attachment location is a Low signal (Step S102). Next, the cartridge determining module M50 ascertains whether the cartridge detection signal CS2 in the selected attachment location is a Low signal (Step S104 or S106). If as a result the cartridge detection signals CS1 and CS2 are both Low signals (Step S102: YES and Step S104: YES), the cartridge determining module M50 decides that the ink cartridge **100** attached to the selected attachment location is furnished with the Type B board **200** (Step S108).

Similarly, the cartridge determining module M50, in the event that the cartridge detection signal CS1 is a Low signal and the cartridge detection signal CS2 is a High signal (Step

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S102: YES and **Step S104: NO**), decides that the ink cartridge is furnished with the Type A board **200** (Step **S110**); or in the event that the cartridge detection signal **CS1** is a High signal and the cartridge detection signal **CS2** is a Low signal (Step **S102: NO** and **Step S104: YES**), decides that the ink cartridge is furnished with the Type C board **200** described above (Step **S112**).

In the event that both the cartridge detection signals **CS1** and **CS2** are High signals **Step S102: NO** and **Step S104: NO**), the cartridge determining module **M50** decides that no cartridge is attached to the selected attachment location (Step **S114**). In this way, the cartridge determining module **M50** determines whether an ink cartridge **100** is attached, and if so what type, for each of the four attachment locations.

Remaining Ink Level Detection Process:

The remaining ink level detection process executed by the remaining ink level determining module **M60** of the main control circuit **40** will now be described with reference to FIG. 11 and FIGS. 12A-C. FIG. 11 shows a flowchart depicting the processing routine of the remaining ink level detection process. FIGS. 12A-C show timing charts depicting temporal change in the shorting-detection enable signal and sensor voltage during execution of the remaining ink level detection process;

The remaining ink level determining module **M60** of the main control circuit **40**, in the event that the remaining ink level in the ink cartridge **100** attached at any of the attachment locations of the holder **4** is to be detected, first sets to High the short detection enable signal **EN** to all of the cartridge detection/short detection circuits **502** (Step **S202**). As a result, the short detection function is enabled in all of the cartridge detection/short detection circuits **502**, and if voltage above the reference voltage **V_ref1** (6.5 V) is applied to the aforementioned terminal **520** and terminal **540**, are able to output High signals as the short detection signals **AB1**, **AB2**. In other words, a state in which the short detection enable signal **EN** are High signals is a state in which shorting of the terminal **510** or terminal **540** to the terminal **550** or terminal **590** is monitored.

Next, the remaining ink level determining module **M60** instructs the sensor driving circuit **503** to output driving voltage from the terminal **550** or terminal **590** to the sensor **104**, and detect the remaining ink level output (Step **S204**). To describe in more specific terms, when the sensor driving circuit **503** receives an instruction signal from the remaining ink level determining module **M60**, the sensor driving circuit **503** outputs driving voltage from either the terminal **550** or the terminal **590**, the voltage being applied to the piezoelectric element which constitutes the sensor **104** of the ink cartridge **100**, charging the piezoelectric element and causing it to distort by means of the inverse piezoelectric effect. The sensor driving circuit **503** subsequently drops the applied voltage, whereupon the charge built up in the piezoelectric element is discharged, causing the piezoelectric element to vibrate. In FIG. 12, the driving voltage is the voltage shown during time interval **T1**. As depicted in FIG. 12, the driving voltage fluctuates between the reference voltage and the maximum voltage **Vs** in such a way as to describe a trapezoidal shape. The maximum voltage **Vs** is set to relatively high voltage (e.g. about 36 V). Via the terminal **550** of the terminal **590**, the sensor driving circuit **503** detects the voltage produced by the piezoelectric effect as a result of vibration of the piezoelectric element (in FIG. 12 depicted as the voltage during time interval **T2**), and by measuring the vibration frequency thereof detects the remaining ink level. Specifically, this vibration frequency represents the characteristic frequency of the surrounding structures (the housing **101** and

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ink) that vibrate together with the piezoelectric element, and changes depending on the amount of ink remaining within the ink cartridge **100**, so the remaining ink level can be detected by measuring this vibration frequency. The sensor driving circuit **503** outputs the detected result to the remaining ink level determining module **M60** of the main control circuit **40**.

When the remaining ink level determining module **M60** receives the detected result from the sensor driving circuit **503**, the remaining ink level determining module **M60** brings the short detection enable signal **EN**, which was previously set to a High signal in Step **S202**, back to a Low signal (Step **S206**), and terminates the process. In this process, the interval that the remaining ink level is being detected is a state in which the short detection enable signal **EN** is set to a High signal to enable short detection. In other words, remaining ink level is detected while the occurrence of shorting is being monitored by the cartridge detection/short detection circuit **502**.

Process When Shorting is Detected

The process carried out in the event that, during execution of detection of the remaining ink level (Step **S204**), the remaining ink level determining module **M60** receives a High signal as the short detection signal **AB1** or **AB2**, e.g. shorting is detected shall be described here. In FIG. 11, a flowchart of the interrupt processing routine when shorting is detected is shown as well. When the terminal **510** or the terminal **540** shorts to the terminal that is outputting the sensor driving voltage of the terminals **550** and **590**, the sensor driving voltage will be applied to the shorting terminal **510** or terminal **540**. Thereupon, since the short detection enable signal **EN** is currently set to High, at the instant that the sensor driving voltage goes above the short detection voltage **V_ref1** (6.5 V), a High signal will be output as the short detection signals **AB1**, **AB2** from the cartridge detection/short detection circuit **502**. When the remaining ink level determining module **M60** receives either of these short detection signals **AB1**, **AB2**, the remaining ink level determining module **M60** suspends detection of remaining ink level, and executes the interrupt processing when shorting is detected.

When the interrupt processing is initiated, the remaining ink level determining module **M60** immediately instructs the sensor driving circuit **503** to suspend the output of sensor driving voltage (Step **S208**).

Next, the remaining ink level determining module **M60**, without carrying out remaining ink level detection process to its conclusion, brings the short detection enable signal **EN** back to a Low signal (Step **S206**) to terminate the process. For example, the main control circuit **40** may take some countermeasure, such as notifying the user of the shorting.

FIG. 12A depicts change of the detection enable signal **EN** through time. FIG. 12B depicts sensor voltage in the event that neither the terminal **510** nor the terminal **540** is shorting to the terminal that outputs the sensor driving voltage of the terminals **550** and **590**, so that the remaining ink level detection process is being executed normally. FIG. 12C depicts sensor voltage in the event that the terminal **510** or the terminal **540** is shorting to the terminal that, of the terminals **550** and **590**, outputs the sensor driving voltage.

As depicted in FIG. 12A, during execution of the remaining ink level detection process, the detection enable signal **EN** is a High signal. As shown in FIG. 12B, in the normal state (no shorting), after high voltage **Vs** has been applied to the sensor **104**, the applied voltage drops, and subsequently vibration voltage is produced through the piezoelectric effect. In the embodiment, **Vs** is set at 36 V.

As depicted in FIG. 12C, on the other hand, in the abnormal state (shorting), the sensor voltage drops at the instant that it

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goes above the short detection voltage V_{ref1} (6.5 V). This is due to the fact that, at the instant that the sensor voltage goes above the short detection voltage V_{ref1} (6.5 V), a High signal is output as the short detection signal AB1 or AB2 from the cartridge detection/short detection circuit 502 to the remaining ink level determining module M60, and the remaining ink level determining module M60 receiving this signal immediately drops the sensor driving voltage.

FIG. 13 shows an illustration of a scenario of shorting. Here, the likely scenario for shorting to other terminals by the terminals 550 and 590 which output the sensor driving voltage is, for example, the case depicted in FIG. 13, in which an electrically conductive ink drop S1 or a water drop S2 formed by condensation has become deposited on the board 200 of the ink cartridge 100, bridging the gap between the first sensor drive terminal 250 or the second sensor drive terminal 290 and another terminal or terminals on the board 200, producing shorting. For example, ink drop S1 that has adhered to the surface of the carriage 3 or ink supply needle 6 disperses and adheres as shown in FIG. 13 by the motion of attaching or detaching of ink cartridge 100. In this instance, when the ink cartridge 100 is attached, the terminal 550 that outputs the sensor driving voltage, for example, will short to another terminal 510, 520, or 560 of the carriage circuit 500 via the first sensor drive terminal 250 and the terminals (FIG. 13: terminals 210, 220, 260) bridged by the ink drop S1 to the sensor drive terminal 250. Or, the terminal 590 that outputs the sensor driving voltage will short to another terminal 540 of the carriage circuit 500 via the second sensor drive terminal 290 and the second short detection terminal 240 (FIG. 13) bridged by the water drop S2 to the second sensor drive terminal 290, for example. Such a shorting is caused by various factor as well as the adhesion of the ink drop. For example, the shorting may be caused by trapping electrically conducting object, for example, paper clip on carriage 3. The shorting also may be caused by adhesion to terminals of the electrically conducting material, for example, skin oil of user.

As mentioned previously with reference to FIG. 3, in the ink cartridge 100 pertaining to the embodiment the first sensor drive terminal 250 and the second sensor drive terminal 290 which apply the driving voltage to the sensor are arranged at the two ends of the terminal group, so the number of adjacent terminals is small. As a result, the likelihood of the first sensor drive terminal 250 and the second sensor drive terminal 290 shorting to other terminals is low.

On the board 200, if the first sensor drive terminal 250 should short to the adjacent first short detection terminal 210, the shorting will be detected by the aforementioned cartridge detection/short detection circuit 502. For example, shorting of the first sensor drive terminal 250 to another terminal caused by the ink drop S1 infiltrating from the first sensor drive terminal 250 side will be detected instantly and the output of sensor driving voltage will be suspend, preventing or reducing damage to the memory 203 and the printing apparatus 1000 circuits (the memory control circuit 501 and the cartridge detection/short detection circuit 502) caused by the shorting.

Also, the first short detection terminal 210 is adjacent to the first sensor drive terminal 250 and situated closest to the first sensor drive terminal 250. Consequently, in the event that the first sensor drive terminal 250 should short to another terminal or terminals due to the ink drop S1 or the water drop S2, there is a high likelihood that the first sensor drive terminal 250 will short to the first short detection terminal 210 as well. Consequently, shorting of the first sensor drive terminal 250 to another terminal can be detected more reliably.

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In addition to detecting shorting, the first short detection terminal 210 is also used by the cartridge detection/short detection circuit 502 to determine whether an ink cartridge 100 is attached, as well as to determine the type of attached ink cartridge 100. As a result, the number of terminals on the board 200 can be kept down, and it becomes possible to reduce the number of board 200 manufacturing steps and the number of parts for the board 200.

Similarly, if the second sensor drive terminal 290 should short to the second short detection terminal 240, the short will be detected by the cartridge detection/short detection circuit 502. Consequently, shorting of the second sensor drive terminal 290 to another terminal caused by the ink drop S1 or the water drop S2 infiltrating from the second sensor drive terminal 290 side can be detected instantly. As a result, damage to the circuits of the memory 203 and the printing apparatus 1000 caused by shorting can be prevented or reduced. Similarly, the second short detection terminal 240 is the terminal situated closest to the second sensor drive terminal 290. Consequently, in the event that the second sensor drive terminal 290 should short to another terminal or terminals due to the ink drop S1 or the water drop S2, there is a high likelihood that the second sensor drive terminal 290 will short to the second short detection terminal 240 as well. Consequently, shorting of the second sensor drive terminal 290 to another terminal can be detected more reliably.

The first sensor drive terminal 250 and the first short detection terminal 210 on the one hand, and the second sensor drive terminal 290 and the second short detection terminal 240 on the other, are situated at the ends of the terminal group so that the other terminals (220, 230, 260-270) lie between them. Consequently, if foreign matter (the ink drop S1, water drop S2 etc.) should infiltrate from either side as indicated by the arrows in FIG. 13, this infiltration can be detected before it infiltrates as far as the other terminals (220, 230, 260-270). Consequently, damage to the circuits of the memory 203 and the printing apparatus 1000 due to infiltration of foreign matter can be prevented or reduced.

The first sensor drive terminal 250 and the second sensor drive terminal 290 are arranged in the row on the insertion direction R side (lower row). As a result, since the terminals 250, 290 to which sensor driving voltage including high voltage is applied are situated to the back in the insertion direction, there is less likelihood that ink drops or foreign matter (e.g. a paperclip) will infiltrate to the location of these terminals 250, 290. As a result, damage to the circuits of the memory 203 and the printing apparatus 1000 caused by infiltration of foreign matter can be prevented or reduced.

The terminal group of the board 200 is arranged in a staggered pattern. As a result, unwanted contact of the terminals of the ink cartridge 100 with the terminals of the printing apparatus 1000 (the contact forming members 403, 404 mentioned previously) during the attachment operation can be prevented or reduced.

B. Variations

Variations of the board 200 mounted to the ink cartridge 100 shall be described with reference to FIGS. 14A-16B. FIGS. 14A-D show first diagrams depicting boards pertaining to variations. FIGS. 15A-C show second diagrams depicting boards pertaining to variations. FIGS. 16A-B show third diagrams depicting boards pertaining to variations.

Variation 1:

On the board 200b depicted in FIG. 14A, the first short detection terminal 210 is similar to the first short detection terminal 210 of the board 200 of the embodiment, but has at its lower end an extended portion that reaches into proximity with the lower edge of the lower row. The extended portion is

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positioned between the first sensor drive terminal **250** and the reset terminal **260** of the lower row. As a result, for example, even in the event of adhesion of an ink drop **S3** as depicted in FIG. **14** (a), shorting of the extended portion of the short detection terminal **210** to the first sensor drive terminal **250** will be detected. Like this, when the first sensor drive terminal **250** and terminal other than the first short detection terminal **210** are shorting, there is a high possibility that the first sensor drive terminal **250** and the first short detection terminal **210** are shorting and the sensor driving voltage is suspended. Accordingly, problems caused by shorting of the first sensor drive terminal **250** to another terminal (in the example of FIG. **14A**, the reset terminal **260**) can be prevented or reduced.

As shown in FIG. **14A**, the second short detection terminal **240** of the board **200b** is also similar in shape to the first short detection terminal **210** mentioned above, and shorting of the second sensor drive terminal **290** to another terminal will also be detected more reliably.

Variation 2:

The board **200c** depicted in FIG. **14B** has, in addition to the arrangement of the board **200b** described above, also has an extended portion located at the upper side of the first sensor drive terminal **250**, and reaching into proximity with the upper edge of the upper row. As a result, even in the event of adhesion of an ink drop **S4** as depicted in FIG. **14(b)**, shorting of the short detection terminal **210** to the extended portion of the first sensor drive terminal **250** will be detected. Like this, when the first sensor drive terminal **250** and terminal other than the first short detection terminal **210** are shorting, there is a high possibility that the first sensor drive terminal **250** and the first short detection terminal **210** are shorting and the sensor driving voltage is suspended. Accordingly, problems caused by shorting of the first sensor drive terminal **250** to another terminal can be prevented or reduced.

As shown in FIG. **14B**, the second sensor drive terminal **290** of the board **200c** is also similar in shape to the first sensor drive terminal **250** mentioned above, and infiltration of an ink drop from the end, at the end at which the second sensor drive terminal **290** is situated, can be detected instantly.

Variation 3:

The board **200d** depicted in FIG. **14C** differs from the board **200** of the embodiment in that there is no second short detection terminal **240**. In the case of the Type A board **200** depicted in FIG. **10A**, the second short detection terminal **240** does not carry out detection of contact by means of the cartridge detection/short detection circuit **502** (since there is no shorting to the ground terminal **220**). Consequently, in the case of the Type A board **200**, the second short detection terminal **240** is used for short detection only and accordingly can be dispensed with. In this case as well, since the first short detection terminal **210** is at the location closest to the first sensor drive terminal **250**, when the first sensor drive terminal **250** and terminal other than the first short detection terminal **210** are shorting, there is a high possibility that the first sensor drive terminal **250** and the first short detection terminal **210** are shorting and the sensor driving voltage is suspended. Infiltration of an ink drop to second sensor drive terminal **290** side will also be detected to a certain extent. In FIG. **14C**, the symbol CP represents the location of contact with the contact forming member **403** that would contact the second short detection terminal **240** if the second short detection terminal **240** were present (i.e. the contact forming member **403** corresponding to the terminal **540** of the carriage circuit **500**). Even in the case that the second short detection terminal **240** is absent, if a shorting should occur between the second sensor drive terminal **290** and the contact forming member **403** corresponding to the terminal **540** of the carriage circuit

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500 due to an ink drop **S5**, infiltration of the ink drop **S5** will be detected. Similarly, in the case of a Type C board **200**, the first short detection terminal **210** may be dispensed with.

Variation 4:

On the board **200e** depicted in FIG. **14D**, the first sensor drive terminal **250** and the first short detection terminal **210** have elongated shape reaching from the vicinity of the upper edge of the upper row to the vicinity of the lower edge of the lower row. The terminals of this shape, as the contact locations are indicated by the symbol CP in FIG. **14D**, can contact the corresponding contact forming portions **403** arranged in a staggered pattern. In the case of the board **200e**, like the board **200c** described previously, even if an ink drop **S6** should become deposited for example, shorting between the extended portions of the first short detection terminal **210** and the first sensor drive terminal **250** will be detected. Like this, first short detection terminal **210** is located between first sensor drive terminal **250** and terminal other than the first short detection terminal **210**. Accordingly, when the first sensor drive terminal **250** and terminal other than the first short detection terminal **210** are shorting, there is a high possibility that the first sensor drive terminal **250** and the first short detection terminal **210** are shorting and the sensor driving voltage is suspended.

The second sensor drive terminal **290** and the second short detection terminal **240** of the board **200e** have shape similar to the first sensor drive terminal **250** and the first short detection terminal **210** described above. Accordingly, when the second sensor drive terminal **290** and terminal other than the second short detection terminal **240** are shorting, there is a high possibility that the second sensor drive terminal **290** and the second short detection terminal **240** are shorting. As a result, the possibility preventing or reducing the problems caused by shorting of the sensor drive terminal **250**, **290** to another terminal becomes higher.

Variation 5:

On the board **200f** depicted in FIG. **15A**, the terminal which corresponds to the first short detection terminal **210** and the ground terminal **220** in the board **200** pertaining to the embodiment is an integral terminal **215** wherein these two terminals are integrally formed as a single member. This board **200f** can be used in place of the Type A or Type B board **200** (FIG. **10**) whose first short detection terminal **210** and ground terminal **220** are shorted. With the board **200f**, the need is obviated for a line between the first short detection terminal **210** and the ground terminal **220**, which was required in the case of in the board **200** pertaining to the embodiment, so the board **200** requires fewer process steps and fewer parts.

Variation 6:

On the board **200g** depicted in FIG. **15B**, the terminals **210-240** of the upper row each have shape similar to the first short detection terminal **210** of the board **200b** described previously. Specifically, each of the terminals **210-240** has an extended portion situated at the lower edge of the corresponding terminal of the board **200** pertaining to the embodiment and reaching into proximity with the lower edge of the lower row. The terminals **250-290** of the lower row of the board **200g** are similar in shape to the first sensor drive terminal **250** of the board **200c** described earlier. Specifically, each of the terminals **250-290** has an extended portion situated at the upper edge of the corresponding terminal of the board **200** pertaining to the embodiment and reaching into proximity with the upper edge of the upper row.

As a result, the terminals **210-290** of the board **200g** are arranged so as to form a terminal group composed of a single row of terminals of generally oar shape of in mutually differ-

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ent arrangement, rather than being arranged in two rows. The first sensor drive terminal **250** and the second sensor drive terminal **290** to which the high-voltage sensor driving voltage is applied are positioned at the two ends of the single row of the terminal group, with the first short detection terminal **210** and the second short detection terminal **240** respectively arranged adjacently inward from the first sensor drive terminal **250** and the second sensor drive terminal **290**.

With the board **200g**, an ink drop or foreign matter infiltrating from either end can be detected immediately at the point in time that shorting occurs between the first sensor drive terminal **250** and the short detection terminal **210**, or between the second sensor drive terminal **290** and the second short detection terminal **240**. In the event that the first sensor drive terminal **250** or the second sensor drive terminal **290** should short to another terminal, in the case where the shorting is due to an ink drop or the like, the likelihood is extremely high that shorting between the first sensor drive terminal **250** and the short detection terminal **210**, or between the second sensor drive terminal **290** and the second short detection terminal **240**, will occur at the same time. Consequently, shorting of the first sensor drive terminal **250** or the second sensor drive terminal **290** to another terminal can be detected reliably. As a result, damage to the memory **203** and the printing apparatus **1000** circuits (the memory control circuit **501** and the cartridge detection/short detection circuit **502**) caused by the shorting can be prevented or minimized.

Variation 7:

On the board **200h** depicted in FIG. **15C**, the terminals **210-290** have elongated shape extending over a distance equivalent to two rows of the board **200** pertaining to the embodiment, in a manner similar to the first sensor drive terminal **250** and the first short detection terminal **210** of the board **200e** described previously. The terminals of this shape, as the contact locations are indicated by the symbol *cp* in FIG. **15C**, can contact the corresponding contact forming portions **403** arranged in a staggered pattern.

In the board **200h**, the terminals **210-290** are arranged so as to form a single row in the orthogonal direction to the insertion direction *R*, in a manner similar to the board **200g** described above. Also, like the board **200g**, the first sensor drive terminal **250** and the second sensor drive terminal **290** to which the high-voltage sensor driving voltage is applied are positioned at the two ends of the single row of terminals, with the first short detection terminal **210** and the second short detection terminal **240** respectively arranged adjacently inward from the first sensor drive terminal **250** and the second sensor drive terminal **290**. As a result, the board **200h** affords advantages analogous to those of the board **200g** described above.

Variation 8:

The first short detection terminal **210** of the board **200i** depicted in FIG. **16A** has a shape that is longer on the left side in the drawing, as compared to the first short detection terminal **210** of the board **200** pertaining to the embodiment. Additionally, the first short detection terminal **210** of the board **200i** has an extended portion reaching from the left edge portion to the vicinity of the lower edge of the lower row. The extended portion is situated to the left of the first sensor drive terminal **250** in the lower row. In other words, the extended portion is disposed to further from the middle of the terminal group in a direction substantially orthogonal to the insertion direction *R* than the first sensor drive terminal **250**. In this case, whereas viewed in terms of the terminal as a whole, the first short detection terminal **210** is situated outwardly (to the left side) of the first sensor drive terminal **250**, when viewed in terms of the contact portion *CP* of the terminal, of the

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contact portions *CP* of all of the terminals **210-290** the contact portion *CP* of the first sensor drive terminal **250** is the one situated at the outermost position (left side), in the same manner as in the embodiment. Also, shorting between the first sensor drive terminal **250** and the first short detection terminal **210** that includes the contact portion *CP* adjacent to the contact portion *CP* of the first sensor drive terminal **250** is detected. Accordingly, the board **200i** pertaining to this variation affords advantages similar to the board **200** pertaining to the embodiment. Specifically, infiltration of an ink drop from the edge can be detected instantly, and damage to the circuits of the memory **203** and the printing apparatus **1000** can be prevented or minimized. Additionally, since the first short detection terminal **210** has the extended portion, the length of a first portion that is a portion adjacent to the circumferential edge of the first short detection terminal **210** among the circumferential edge of the first sensor drive terminal **250** becomes long. As shown in FIG. **16B**, the length of the first portion is longer than that of a second portion that is a portion adjacent to the circumferential edge of the reset terminal **260** among the among the circumferential edge of the first sensor drive terminal **250**. As a result, when the first sensor drive terminal **250** and terminal other than the first short detection terminal **210**, for example, the reset terminal **260** are shorting, there is a high possibility that the first sensor drive terminal **250** and the first short detection terminal **210** are shorting. Accordingly, the sensor driving voltage is suspended and problems caused by shorting of the first sensor drive terminal **250** to another terminal can be prevented or reduced with higher probability.

The first short detection terminal **210** of the board **200p** in FIG. **16C** has the longer extended portion than the first short detection terminal **210** of the board **200i**. As shown in FIG. **16C**, the extended portion of the first short detection terminal **210** of the board **200p** extends from upper left to lower right of the first sensor drive terminal **250** along the circumferential edge of the first sensor drive terminal **250**. As a result, the length of the first portion in the board **200p** is longer than that in the board **200i**. Accordingly, when the first sensor drive terminal **250** and terminal other than the first short detection terminal **210** are shorting, there is a higher possibility the sensor driving voltage is suspended and problems caused by shorting of the first sensor drive terminal **250** to another terminal can be prevented or reduced.

The first short detection terminal **210** of the board **200q** in FIG. **16D** has the longer extended portion than the first short detection terminal **210** of the board **200i** and **200p**. As shown in FIG. **16D**, the extended portion of the first short detection terminal **210** of the board **200q** extends from upper left through lower to upper right of the first sensor drive terminal **250** along the circumferential edge of the first sensor drive terminal **250**. In other words, the first short detection terminal **210** is formed so as to surround the first sensor drive terminal **250** completely. As a result, the length of the first portion in the board **200q** is longer than that in the board **200i** and **200p**. Accordingly, when the first sensor drive terminal **250** and terminal other than the first short detection terminal **210** are shorting, there is a higher possibility the sensor driving voltage is suspended and problems caused by shorting of the first sensor drive terminal **250** to another terminal can be prevented or reduced.

As shown in FIGS. **16A-C**, board **200i**, **200p**, **200q** are added the direction in which the portion of the first short detection terminal **210** is located adjacently to a portion of the sensor drive terminal **250** by providing the extended portion of the first short detection terminal **210**. About board **200i**, the extended portion of the first short detection terminal **210**

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located adjacently to left border of the first sensor drive terminal **250** in a lateral direction towards an edge of the ink cartridge **100**, and the first short detection terminal **210** itself is located adjacently to upper border of the first sensor drive terminal **250** in opposite direction of the insertion direction R. Meanwhile, about board **200p**, in addition to above-mentioned two directions, the extended portion of the first short detection terminal **210** is located adjacently to lower border of the first sensor drive terminal **250** in the insertion direction R. Furthermore, about board **200q**, the extended portion of the first short detection terminal **210** is located adjacently to right border of the first sensor drive terminal **250** in lateral direction away from an edge of the ink cartridge **100**. In other words, about board **200q**, at least a portion of the first short detection terminal **210** is located adjacently to the first sensor drive terminal **250** in all direction.

When the first sensor drive terminal **250** and terminal other than the first short detection terminal **210** are shorting by ink drop or other object infiltrating from the direction in which the portion of the first short detection terminal **210** is located adjacently to the portion of the first sensor drive terminal **250**, there is a much high possibility that the first sensor drive terminal **250** and the first short detection terminal **210** are shorting. Accordingly, problems caused by shorting of the first sensor drive terminal **250** to another terminal by ink drop or other object infiltrating from such direction can be prevented or reduced with much high probability. In the present variations, the extended portion of the first short detection terminal **210** adds the direction in which the first short detection terminal **210** and the first sensor drive terminal **250** are adjacent each other, and prevents or reduces problems caused by shorting of the first sensor drive terminal **250** to another terminal with much high probability.

In the boards **200i**, **200p**, **200q** pertaining to this variation, only the first short detection terminal **210** on the left side is furnished with a structure having the extended portion described above, but it would be possible to furnish the second short detection terminal **240** on the right side with a structure having an extended portion, in addition to the first short detection terminal **210** or instead of the first short detection terminal **210**. In this case as well, there are afforded advantages analogous to those of the boards **200i**, **200p**, **200q** pertaining to this variation.

Variation 9:

The board **200j** depicted in FIG. 16B, like the board **200f** described previously in Variation 5, has an integral terminal **215** wherein the first short detection terminal **210** and the ground terminal **220** in the board **200** pertaining to the embodiment are integrally formed as a single member. The integral terminal **215** of the board **200j** differs in shape from the integral terminal **215** of the board **200f** described previously. Specifically, the integral terminal **215** of the board **200j**, like the first short detection terminal **210** of the board **200i** described in Variation 8, has a shape elongated on the left side, and has an extended portion reaching from the left edge portion to the vicinity of the lower edge of the lower row. In this case, advantages analogous to those of the board **200i** pertaining to Variation 8 are attained, while reducing the number of production steps and parts needed for the board.

In the embodiment and variations described hereinabove, all of the terminals are situated on the board **200**, but it is not necessary that all terminals be situated on the board **200**. For example, it would be acceptable for some of the terminals to be situated on the housing **101** of the ink cartridge **100**. By way of specific examples, Variation 10 and Variation 11 shall be described below with reference to FIGS. 17A-18D. FIGS. 17A-D show diagrams depicting the construction around

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boards of ink cartridges pertaining to variations. FIGS. 18A-D show cross sections A-A to D-D in FIG. 17.

Variation 10:

The board **200k** depicted in FIG. 17A is furnished with seven terminals **210-240** and **260-280**, out of the nine terminals **210-290** furnished to the board **200** of the embodiment. Out of the nine terminals **210-290** furnished to the board **200** of the embodiment, the board **200k** lacks the first sensor drive terminal **250** and the second sensor drive terminal **290**. The board **200k** pertaining to this variation is furnished with notches NT1 or NT2 situated in zones that include the locations where the first sensor drive terminal **250** and the second sensor drive terminal **290** were disposed on the board **200** pertaining to the embodiment. The notches may have the shape indicated by the solid lines NT1, or the shape indicated by the broken lines NT2, in FIG. 17A. Terminals **150** and **190** having function similar to the first sensor drive terminal **250** and the second sensor drive terminal **290** of the board **200** in the embodiment are arranged on the housing **101** situated to the rear of the board **200k**. Naturally, with the ink cartridge **100** attached to the holder **4**, these terminals **150** and **190** are situated at locations contacting the corresponding apparatus-side terminals **450** and **490**.

A-A cross section viewed in FIG. 17A is depicted in FIG. 18A. As shown in FIG. 18A, a depressed portion DE, formed by a gap between the notch NT1 of the board **200k** and the terminal **150**, is situated between the terminal **150** and the adjacent terminals **260**, **210** (in FIG. 18A, the reset terminal **260** is shown). While omitted from the drawing, a similar depressed portion DE is situated between the terminal **190** and the adjacent terminals **280**, **240**.

According to this variation, the following advantages are afforded in addition to those analogous to the board **200** pertaining to the embodiment. If an ink drop or foreign matter should infiltrate from the end of the ink cartridge **100** pertaining to this variation, it will become trapped in the depressed portion DE arranged surrounding the terminal **150** or the terminal **190**, whereby shorting of the terminal **150** or the terminal **190** to another terminal due to an infiltrating ink drop or foreign matter can be further prevented or minimized.

Variation 11

The board **200m** depicted in FIG. 17B, rather than having the notches NT1 or NT2 pertaining to Variation 10, is instead furnished with through-holes HL situated at locations corresponding to the locations where the first sensor drive terminal **250** and the second sensor drive terminal **290** are situated on the board **200** pertaining to the embodiment. B-B cross section viewed in FIG. 17B is depicted in FIG. 18B. Other arrangements of the ink cartridge **100** pertaining to Variation 11 are the same as those of the ink cartridge **100** pertaining to Variation 10. In this variation as well, depressed portions DE are situated between the terminals **150**, **190** and the adjacent terminals. Accordingly, the ink cartridge **100** pertaining to this variation affords advantages analogous to those of the ink cartridge **100** pertaining to Variation 10.

Variation 12:

In the boards pertaining to the embodiment and variations, all terminals are connected to one of memory **203** and sensor **104**. However, the board may include dummy terminal that is not connected to any device. An example of such type of the board will be described as Variation 12 with reference to FIGS. 19A-D. FIGS. 19A-D show fourth diagrams depicting boards pertaining to variations.

The board **200r** includes the upper row formed by four terminals and the lower row formed by five terminals, as with the board **200** pertaining to the embodiment. Arrangement and function of the terminals **210-290** forming the upper row

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and the lower row of board **200r** is the same as those of the terminals of board **200** in the embodiment, so the detailed description thereof is omitted.

The board **200r** shown in FIG. 19A has the dummy terminals DT between the upper row and the lower row and on the underside (the insertion direction side) of the lower row. The dummy terminals DT, for example, are made of the same material as other terminal **210-290**. FIG. 19C shows E-E cross-section including dummy terminals DT. The dummy terminals DT has about the same thickness as other terminal **210-290**.

The dummy terminals DT are for scraping away foreign object adherent on the contact forming members **403**, for example, dust when ink cartridge **100** is attached or detached. This enables to prevent foreign object from being brought to the terminal to be contacted by contact forming member **403** (for example, the first sensor drive terminal **250** in FIG. 19C) when ink cartridge **100** is attached or detached, and to prevent contact failure between the terminal and the contact forming member **403**.

The board **200r** shown in FIG. 19A has the dummy terminal DT between the first sensor drive terminal **250** and the short detection terminal **210**, so you can't say first sensor drive terminal **250** is located adjacent to first short detection terminal **210**. However, the dummy terminals DT is not connected to memory **203** and not connected to the apparatus-side terminals **510-590** on printing apparatus **1000**. Therefore, the shorting between the first sensor drive terminal **250** and the dummy terminals DT never cause any problem. Accordingly, the board **200r** can afford working effects analogous to the board **200** pertaining to the embodiment. That is to say, about the board **200r**, even if first sensor drive terminal **250** is not located adjacent to first short detection terminal **210** in a precise sense, at least a portion of the first short detection terminal **210** is arranged relative to at least a portion of the first sensor drive terminal **250**, without a terminal connected to memory **203** (terminal **220**, **230**, **260-280**) therebetween in at least one direction, for the detection of shorting between the first sensor drive terminal **250** and the first short detection terminal **210**. In such a case, the first sensor drive terminal **250** is substantially located adjacent to first short detection terminal **210**. Consequently, in the event that the first sensor drive terminal **250** should short to another terminal or terminals due to the ink drop or the water drop, there is a high likelihood that the first sensor drive terminal **250** will short to the short detection terminal **210** as well. As a result, the output of sensor driving voltage is suspend and damage to the circuits of the memory **203** and the printing apparatus **1000** caused by shorting can be prevented or reduced.

Variation 13:

The boards pertaining to the embodiment and variations, as shown in FIG. 2, are described as the board mounted on an ink cartridge **100** used for "on carriage" type printer. However, the boards pertaining to the embodiment and variations may be mounted on an ink cartridge used for "off carriage" type printer. The ink cartridge used for "off carriage" type printer will be described below with reference to FIG. 20 and FIG. 21. FIG. 20 shows a perspective view of the construction of the ink cartridge pertaining to the variation 13. FIG. 21 shows a picture of the ink cartridge pertaining to the variation 13 being attached to the printer.

Ink cartridge **100b** pertaining to Variation 13 is configured for installation in an "off carriage" type printer, i.e., one in which the ink cartridge is not installed on a carriage. Off carriage type printers are typically large-scale printers; the

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ink cartridges employed in such large-scale printers are typically larger in size than the ink cartridges employed in on-carriage type printers.

Ink cartridge **100b** comprises a housing **1001** containing ink, a board mounting portion **1050** for mounting board **200**, an ink feed orifice **1020** for supplying ink from a housing **1001** to the printer; an air feed orifice **1030** allowing intake of air into ink cartridge **100b** to allow smooth flow of ink; and guide portions **1040** for installation in the printer. The exterior dimensions of ink cartridge **100b** are such that the side thereof (i.e. the depth direction) extending perpendicular to the side on which the guide portions **1040**, etc. are formed (i.e. the width direction) is longer than the width direction. The relationship of the depth-wise dimension to the width-wise dimension of board **200**, expressed as a ratio of the two, is 15:1 or greater, for example.

As in the case of the above-mentioned embodiment, board **200** is positioned by means of boss hole **202** and boss slot **201**, and secured on the board mounting portion **1050** of ink cartridge **100b**.

As shown in FIG. 21, when installing the ink cartridge **100b** in the printer, the guide portions **1040** of ink cartridge **100b** guide the guide pins **2040** on the printer so that the board mounting portion **1050**, ink feed orifice **1020**, and air feed orifice **1030** are appropriately contacted/coupled with a contact pin **2050**, ink feed orifice **2020**, and air feed orifice **2030** on the printer. The insertion direction of ink cartridge **100b** is indicated by arrow R in FIG. 21. The insertion direction R on board **200** in this variation is the same as that in the above-mentioned embodiment.

Ink cartridge **100b** used for off carriage type printer pertaining to this variation can prevent or reduce problems caused by shorting of the first sensor drive terminal **250** to another terminal as in the case of the embodiment and variations described above.

Variation 14:

Configuration of the ink cartridge for "on carriage" type printer shown in FIG. 2 is one example among many. Configuration of the ink cartridge for "on carriage" type printer is not limited to this. Other configuration of the ink cartridge for "on carriage" type printer shall be described as Variation 14 with reference to FIGS. 22-24. FIG. 22 shows a first diagram of the construction of the ink cartridge pertaining to Variation 14. FIG. 23 shows a second diagram of the construction of the ink cartridge pertaining to variation 14. FIG. 24 shows a third diagram of the construction of the ink cartridge pertaining to Variation 14.

As shown in FIGS. 22 and 23, the ink cartridge **100b** pertaining to Variation 14 includes housing **101b**, board **200** and sensor **104b**. On the bottom face of the housing **101b**, as with ink cartridge **100** in the embodiment, there is formed an ink supply orifice **110b** into which the ink supply needle inserts when ink cartridge **100b** is attached to the holder **4b**. The board **200** is mounted on the lower side (Z-axis plus direction side) of the front face (Y-axis plus direction side face) of the housing **101** as with ink cartridge **100** in the embodiment. Configuration of the board **200** is identical with the board **200** in the embodiment. The sensor **104b** is embedded in the side wall of the housing **101b** and used for detection of remaining ink level. Hook **120b** that engages with catching part of the holder **4b** when the ink cartridge **100b** is attached to the holder **4b** is mounted on the upper side of the front face of the housing **101b**. Hook **120b** fixates the ink cartridge **100b** to the holder **4b**. The insertion direction when the ink cartridge **100b** is attached to the holder **4b** is a direction of arrow R in FIG. 22 (Z-axis plus direction) as with the ink cartridge **100** in the embodiment.

The housing **101b** has displacement preventers PO1-PO4 on the side portion (x-axis direction side) of housing **101b** close to the board **200**. The displacement preventers PO1-PO4 comes into contact with or close to a corresponding portion of the side wall of the holder **4b** when the ink cartridge **100b** is attached to the holder **4b**. This prevents the ink cartridge **100b** from moving in X-axial direction from its ideal position on the holder **4b**. Specifically, the displacement preventers PO1 and PO2 are located on the upper side of the board **200** and prevent the upper side of the **100b** from swinging in X-axial direction taking the ink supply orifice **110b** as an axis of rotation. The displacement preventers PO3 and PO4 are lateral to the terminals **210-290** on the board **200** (FIG. 3) and keep the terminals **210-290** in the correct position so as to contact the corresponding apparatus-side terminal **410-490** correctly.

The electrical arrangements of the ink cartridge **100b** pertaining to Variation **14** is identical with those of the ink cartridge **100** pertaining to above-embodiment described with reference to FIG. 7. So, the description thereof is omitted.

The ink cartridge **100b** pertaining to Variation **14** affords the following working effects in addition to the same working effects as the ink cartridge **100** pertaining to the embodiment. Since the ink cartridge **100b** has the displacement preventers PO1-PO4, it can prevent or reduce the position displacement when the ink cartridge **100b** is attached to the holder **4b**. Especially, since the displacement preventers PO3 and PO4 are lateral to the terminals **210-290** on the board **200**, accuracy of positioning of the terminals **210-290** relative to the corresponding apparatus-side terminals can be improved. Further, as described with reference to FIG. 3, in the board **200**, the sensor drive terminal **250** and the second sensor drive terminal **290** are arranged at each end of the terminals **210-290**, that is, the sensor drive terminal **250** and the second sensor drive terminal **290** are closest to the displacement preventers PO4 and PO4 respectively. This lead to improvement of accuracy of positioning of the sensor drive terminal **250** and the second sensor drive terminal **290**. Therefore, the false contact between the terminals **250, 290** to which high voltage is applied and one of the non-corresponding apparatus-side terminals can be prevented or reduced.

As substitute for the board **200** in the embodiment, one of the boards **200b-200c** shown in FIGS. 14-19 can be mounted on the ink cartridge **100b** shown in FIG. 22-24.

Other Variations:

As depicted in FIGS. 17C-D and in FIGS. 18C-D, porous elements PO may be disposed within the depressed portions DE in Variation **10** and Variation **11** described above, i.e. between the terminals **150, 190** and the board. By so doing, ink drops or condensed water, which can easily cause shorting of the terminals **150, 190** to other terminals, can be effectively absorbed by the porous elements PO. Accordingly, this design also affords advantages analogous to those of Variation **10** and Variation **11** discussed above.

In the embodiment herein, the ink cartridge **100** is furnished with a sensor **104** (piezoelectric element) and memory **203** as the plurality of the devices; however, the plurality of the devices are not limited to a sensor **104** and memory **203**. For example, the sensor **104** may be a sensor of a type that detects the properties or level of ink by means of applying voltage to the ink within an ink cartridge **100**, and measuring its resistance. In the embodiment, among the plurality of the devices, the sensor **104** is mounted on the housing **101** and the memory **203** is mounted on the board **200**. However, the arrangements of the plurality of the devices are not limited to those in the embodiment. For example, the memory **203** and the board **200** may be separate, and the memory **203** and the

board **200** may be installed on the housing **101** individually. The plurality of the devices may be integrated into a circuit board or a single module. The circuit board or the single module may be mounted on the housing **101** or the board **200**. It's preferred that terminals connected to a device to which relatively high voltage among the plurality of the devices are arranged in positions of the first sensor drive terminal **250** and the second sensor drive terminal **290** described above, and terminals connected to a device to which relatively low voltage among the plurality of the devices are arranged in positions of the terminals **220, 230, 260-280**. In this case, damage to the ink cartridge **100** and the printing apparatus **1000** caused by shorting between the terminal connected to the device to which relatively high voltage and the terminal connected to the device to which relatively low voltage can be prevented or reduced.

In above-mentioned embodiment, five terminals for memory **203** (**220, 230, 260-280**) and two terminals for sensor **104** (**250, 290**) are employed, however, other number of terminals may be employed due to the specification of the device. For example, the terminal connected to the device to which relatively high voltage may be one. In this case, such terminal may be arranged in a position of any of the terminals **250, 290** described above.

Whereas in the embodiment herein the invention is implemented in an ink cartridge **100**, implementation thereof is not limited to ink cartridges, with implementation in a similar manner to receptacles containing other types of printing material, such as toner, being possible as well.

With regard to the arrangements of the main control circuit **40** and the carriage circuit **500** in the printing apparatus, portions of these arrangements implemented through hardware could instead be implemented through software, and conversely portions implemented through software could instead be implemented through hardware.

While the printing material container and board pertaining to the invention have been shown and described on the basis of the embodiment and variation, the embodiments of the invention described herein are merely intended to facilitate understanding of the invention, and implies no limitation thereof. Various modifications and improvements of the invention are possible without departing from the spirit and scope thereof as recited in the appended claims, and these will naturally be included as equivalents in the invention.

What is claimed is:

1. A printing material container adapted to be attached to a printing apparatus by being inserted into the printing apparatus in an insertion direction, the printing apparatus having a print head and a plurality of apparatus-side electrical contact members, the printing material container comprising:

- an ink supply opening, having an exit, adapted to supply ink from the ink cartridge to the printing apparatus;
- a low voltage electronic device adapted to receive and function with a low voltage, the low voltage electronic device comprising a memory device;
- a high voltage electronic device adapted to receive and function with a high voltage, which is a higher voltage than the low voltage of the low voltage electronic device; and

a plurality of container-side terminals having contact portions adapted and positioned to contact corresponding apparatus-side contact forming members so that electrical communication is enabled between the container and the printing apparatus, the contact portions of the terminals including a plurality of low voltage electronic device contact portions electrically coupled to the low voltage electronic device, and a first high voltage elec-

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tronic device contact portion and a second high voltage electronic device contact portion, each electrically coupled to the high voltage electronic device, wherein: the contact portions are arranged in a first row of contact portions and in a second row of contact portions, the first row of contact portions and the second row of contact portions extending in a row direction which is generally orthogonal to the insertion direction, the first row of contact portions is disposed at a location that is further in the insertion direction than the second row of contact portions, and,

the first row of contact portions has a first end position and a second end position at opposite ends thereof, the first high voltage electronic device contact portion is disposed at the first end position of the first row of contact portions and the second high voltage electronic device contact portion is disposed at the second end position of the first row of contact portions.

2. The printing material container according to claim 1, wherein the low voltage electronic device contact portions, are located between the first and second high voltage electronic device contact portions, with respect to the row direction.

3. The printing material container according to claim 1, wherein the high voltage electronic device is adapted to output an oscillating signal, in response to receiving the high voltage.

4. The printing material container according to claim 1, wherein the high voltage electronic device is an ink level sensor.

5. The printing material container according to claim 1, wherein the first row of contact portions is longer than the second row of contact portions, in the row direction.

6. The printing material container according to claim 1, wherein the number of contact portions in the first row is larger than the number of contact portions in the second row.

7. The printing material container according to claim 1, wherein the plurality of terminals includes a first short detection terminal provided at a location and adapted to detect shorting between at least the terminal in which the first high voltage electronic device contact portion is located and the first short detection terminal.

8. The printing material container according to claim 7, wherein there are fewer low voltage electronic device contact portions adjacent to the first high voltage electronic device contact portion than are adjacent to the contact portion of the first short detection terminal.

9. The printing material container according to claim 7, wherein the first short detection terminal is the closest terminal to the terminal in which the first high voltage electronic device contact portion is located.

10. The printing material container according to claim 7, wherein the contact portion of the first short detection terminal is located between one of the low voltage electronic device contact portions and the first high voltage electronic device contact portion with respect to the row direction.

11. The printing material container according to claim 7, wherein the plurality of terminals, include a second short detection terminal, which is provided at a location and adapted to detect shorting between at least the terminal in which the second high voltage electronic device contact portion is located and the second short detection terminal.

12. The printing material container according to claim 11, wherein the low voltage electronic device contact portions are disposed in between the contact portion of the first short detection terminal and the contact portion of the second short detection terminal, with respect to the row direction.

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13. The printing material container according to claim 12, wherein the contact portions of the first short detection terminal and the second short detection terminal are disposed in between the first and second high voltage electronic device contact portions, with respect to the row direction.

14. The printing material container according to claim 11, wherein the contact portions of the first short detection terminal and the second short detection terminal are disposed in between the first and second high voltage electronic device contact portions, with respect to the row direction.

15. The printing material container according to claim 11, wherein the first high voltage electronic device contact portion and contact portion of the first short detection terminal are disposed on one side of the low voltage electronic device contact portions, with respect to the row direction, and the second high voltage electronic device contact portion and the contact portion of the second short detection terminal are disposed on the other side of the low voltage electronic device contact portions, with respect to the row direction.

16. The printing material container according to claim 11, wherein the first short detection terminal and the terminal in which the first high voltage electronic device contact portion is located are disposed on one side of the terminals in which the low voltage electronic device contact portions are located, with respect to the row direction, and the second short detection terminal and the terminal in which the second high voltage electronic device contact portion is located are disposed on the other side of terminals in which the low voltage electronic device contact portions are located with respect to the row direction.

17. The printing material container according to claim 11, wherein the number of low voltage electronic device contact portions adjacent to the second high voltage electronic device contact portion is smaller than the number of low voltage electronic device contact portions adjacent to the contact portion of the second short detection terminal.

18. A printing material container for mounting in a printing apparatus having a print head and a plurality of apparatus-side contact forming members, the printing material container comprising:

an ink supply opening, having an exit, adapted to supply ink from the ink cartridge to the printing apparatus;

a low voltage electronic device constructed to receive and function with a low voltage;

a high voltage electronic device constructed to receive and function with a high voltage, which is a higher voltage than the low voltage; and

a plurality of terminals having contact portions adapted to contact corresponding apparatus-side contact forming members so that electrical communication is enabled with the printing apparatus when the printing material container is mounted on the printing apparatus, the contact portions of the terminals including a plurality of low voltage electronic device contact portions electrically coupled to the low voltage electronic device, a first high voltage electronic device contact portion electrically coupled to the high voltage electronic device, and a second high voltage electronic device contact portion electrically coupled to the high voltage electronic device and arranged to have applied thereto a higher voltage than the low voltage electronic device contact portions, wherein:

the contact portions are arranged in a first row of contact portions and in a second row of contact portions, such that when the plurality of terminals is viewed from the vantage of the apparatus-side contact forming members, with the plurality of terminals oriented as if in

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contact with the apparatus-side contact forming members so that electrical communication is enabled with the ink jet printing apparatus, and with the exit of the ink supply opening facing downward, the first row of contact portions and the second row of contact portions extend in a row direction which is generally horizontal and the first row of contact portions is disposed at a location below the second row of contact portions, and

the first high voltage electronic device contact portion is disposed at one end of the first row of contact portions and the second high voltage electronic device contact portion is disposed at the opposite end of the first row of contact portions.

19. The printing material container according to claim 18, wherein the low voltage electronic device contact portions are located between the first and second high voltage electronic device contact portions, with respect to the row direction.

20. The printing material container according to claim 18, wherein the high voltage electronic device is adapted to output an oscillating signal, in response to receiving the high voltage.

21. The printing material container according to claim 18, wherein the high voltage electronic device is an ink level sensor.

22. The printing material container according to claim 18, wherein the first row of contact portions is longer than the second row of contact portions.

23. The printing material container according to claim 18, wherein the number of contact portions in the first row is larger than the number of contact portions in the second row.

24. The printing material container according to claim 18, wherein the plurality of terminals include a first short detection terminal provided at a location and adapted to detect shorting between at least the terminal in which the first high voltage electronic device contact portion is located and the first short detection terminal.

25. The printing material container according to claim 24, wherein fewer low voltage electronic device contact portions are adjacent to the first high voltage electronic device contact portion than are adjacent to the first short detection terminal.

26. The printing material container according to claim 24, wherein the first short detection terminal is the closest terminal to the terminal in which the first high voltage electronic device contact portion is located.

27. The printing material container according to claim 24, wherein the contact portion of the first short detection terminal is located between a low voltage electronic device contact portion and the first high voltage electronic device contact portion, with respect to the row direction.

28. The printing material container according to claim 24, wherein the plurality of terminals include a second short detection terminal provided at a location and adapted to detect shorting between at least the terminal in which the second high voltage electronic device contact portion is located and the second short detection terminal.

29. The printing material container according to claim 28, wherein the low voltage electronic device contact portions are disposed in between the first short detection terminal and the second short detection terminal, with respect to the row direction.

30. The printing material container according to claim 29, wherein the contact portions of the first short detection terminal and the second short detection terminal are disposed in between the first and second high voltage electronic device contact portions, with respect to the row direction.

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31. The printing material container according to claim 28, wherein the contact portions of the first short detection terminal and the second short detection terminal are disposed in between the first and second high voltage electronic device contact portion with respect to the row direction.

32. The printing material container according to claim 28, wherein the first high voltage electronic device contact portion and the contact portion of the first short detection terminal are disposed on one side of the low voltage electronic device contact portions, with respect to the row direction, and the second high voltage electronic device contact portion and the contact portion of the second short detection terminal are disposed on the other side of the low voltage electronic device contact portions, with respect to the row direction.

33. The printing material container according to claim 28, wherein the first short detection terminal and the terminal in which the first high voltage electronic device contact portion is located are disposed on one side of the terminals in which the low voltage electronic device contact portions are located, with respect to the row direction, and the second short detection terminal and the terminal in which the second high voltage electronic device contact portion is located are disposed on the other side of the terminals in which the low voltage electronic device contact portions are located, with respect to the row direction.

34. The printing material container according to claim 28, wherein the number of low voltage electronic device contact portions adjacent to the second high voltage electronic device contact portion is smaller than the number of low voltage electronic device contact portions adjacent to the contact portion of the second short detection terminal.

35. The printing material container according to claim 1, wherein the first row of contact portions includes at least one of the plurality of low voltage electronic device contact portions.

36. The printing material container according to claim 35, wherein the low voltage electronic device contact portions in the first row of contact portions are arranged in between the first and second high voltage electronic device contact portions.

37. The printing material container according to claim 35, wherein the first row of contact portions is the leading row of contact portions in the insertion direction.

38. The printing material container according to claim 35, wherein the first row of contact portions is the row of contact portions furthest in the insertion direction.

39. The printing material container according to claim 7, wherein the first row of contact portions includes at least one of the plurality of low voltage electronic device contact portions.

40. The printing material container according to claim 7, wherein the contact portion of the first short detection terminal and a portion of the low voltage electronic device contact portions are located in the second row of contact portions.

41. The printing material container according to claim 40, wherein the plurality of terminals include a second short detection terminal, which is provided at a location and adapted to detect shorting between at least the terminal in which the second high voltage electronic device contact portion is located and the second short detection terminal, the contact portion of the second short detection terminal being located in the second row of contact portions, the portion of the low voltage electronic device contact portions being located in between the contact portions of the first and second short detection terminal in the second row of contact portions.

42. The printing material container according to claim 41, wherein the remainder of the low voltage electronic device

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contact portions are located in the first row of contact portions, the remainder of the low voltage electronic device contact portions being located in between the contact portions of the first and second short detection terminals, with respect to the row direction.

43. The printing material container according to claim 40, wherein the remainder of the low voltage electronic device contact portions are located in the first row of contact portions.

44. The printing material container according to claim 43, wherein the low voltage electronic device contact portions in the first row of contact portions are arranged in between the first and second high voltage electronic device contact portions.

45. The printing material container according to claim 43, wherein the first row of contact portions is the leading row of contact portions in the insertion direction.

46. The printing material container according to claim 43, wherein the first row of contact portions is the row of contact portions that is furthest in the insertion direction.

47. The printing material container according to claim 18, wherein the first row of contact portions includes at least one of the plurality of low voltage electronic device contact portions.

48. The printing material container according to claim 47, wherein the low voltage electronic device contact portions in the first row of contact portions are arranged in between the first and second high voltage electronic device contact portions.

49. The printing material container according to claim 47, wherein the contact portions in the first row of contact portions are the lowest row of contact portions when the plurality of terminals is viewed from the vantage of the apparatus-side contact forming members, with the plurality of terminals oriented as if in contact with the apparatus-side contact forming members so that electrical communication is enabled with the ink jet printing apparatus, and with the exit of the ink supply opening facing downward.

50. The printing material container according to claim 47, wherein the first row of contact portions is longer than the second row of contact portions.

51. The printing material container according to claim 24, wherein the first row of contact portions includes at least one of the plurality of low voltage electronic device contact portions.

52. The printing material container according to claim 24, wherein the contact portion of the first short detection terminal and at least one of the low voltage electronic device contact portions are located in the second row of contact portions.

53. The printing material container according to claim 52, wherein the plurality of terminals include a second short detection terminal, which is provided at a location and adapted to detect shorting between at least the terminal in

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which the second high voltage electronic device contact portion is located and the second short detection terminal, the contact portion of the second short detection terminal being located in the second row of contact portions.

54. The printing material container according to claim 53, wherein the remainder of the low voltage electronic device contact portions are located in the first row of contact portions, the remainder of the low voltage electronic device contact portions being located in between the contact portions of the first and second short detection terminals, at least one of the low voltage electronic device contact portions being located in between the contact portions of the first and second short detection terminals in the second row of contact portions.

55. The printing material container according to claim 52 wherein the remainder of the low voltage electronic device contact portions are located in the first row of contact portions.

56. The printing material container according to claim 55, wherein the low voltage electronic device contact portions in the first row of contact portions are arranged in between the first and second high voltage electronic device contact portions.

57. The printing material container according to claim 55, wherein the contact portions in the first row of contact portions is the lowest row of contact portions when the plurality of terminals is viewed from the vantage of the apparatus-side contact forming members, with the plurality of terminals oriented as if in contact with the apparatus-side contact forming members so that electrical communication is enabled with the ink jet printing apparatus, and with the exit of the ink supply opening facing downward.

58. The printing material container according to claim 57, wherein the first row of contact portions is longer than the second row of contact portions.

59. The printing material container according to claim 42, wherein the first row of contact portions is the leading row of contact portions in the insertion direction.

60. The printing material container according to claim 42, wherein the first row of contact portions is the furthest row of contact portions in the insertion direction.

61. The printing material container according to claim 54, wherein the contact portions in the first row of contact portions is the lowest row of contact portions when the plurality of terminals is viewed from the vantage of the apparatus-side contact forming members, with the plurality of terminals oriented as if in contact with the apparatus-side contact forming members so that electrical communication is enabled with the ink jet printing apparatus, and the exit of the ink supply opening facing downward.

62. The printing material container according to claim 61, wherein the first row of contact portions is longer than the second row of contact portions.

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