(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
03 June 2021 (03.06.2021)

WIPO | PCT

(10) International Publication Number
WO 2021/107923 A1

(51) International Patent Classification:
B41J 2/175 (2006.01) *B41J 2/185* (2006.01)

(21) International Application Number:
PCT/US2019/063193

(22) International Filing Date:
26 November 2019 (26.11.2019)

(25) Filing Language: English

(26) Publication Language: English

(71) Applicant: **HEWLETT-PACKARD DEVELOPMENT COMPANY, L.P.** [US/US]; 10300 Energy Drive, Spring, Texas 77389 (US).

(72) Inventors: **WILLIAMS, Kenneth**; 1115 SE 164th Ave, Columbia Center, Suite 210, Vancouver, Washington 98683 (US). **MYERS, Vern Elliot**; 1115 SE 164th Avenue, Suite 210, Vancouver, Washington 98683 (US).

(74) Agent: **KOKOSKA, Christopher E.** et al.; HP Inc., 3390 E. Harmony Road, Mail Stop 35, Fort Collins, Colorado 80528-9544 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(54) Title: INK CHAMBERS WITH OPTIMIZED SUB-CHAMBER ARRANGEMENTS

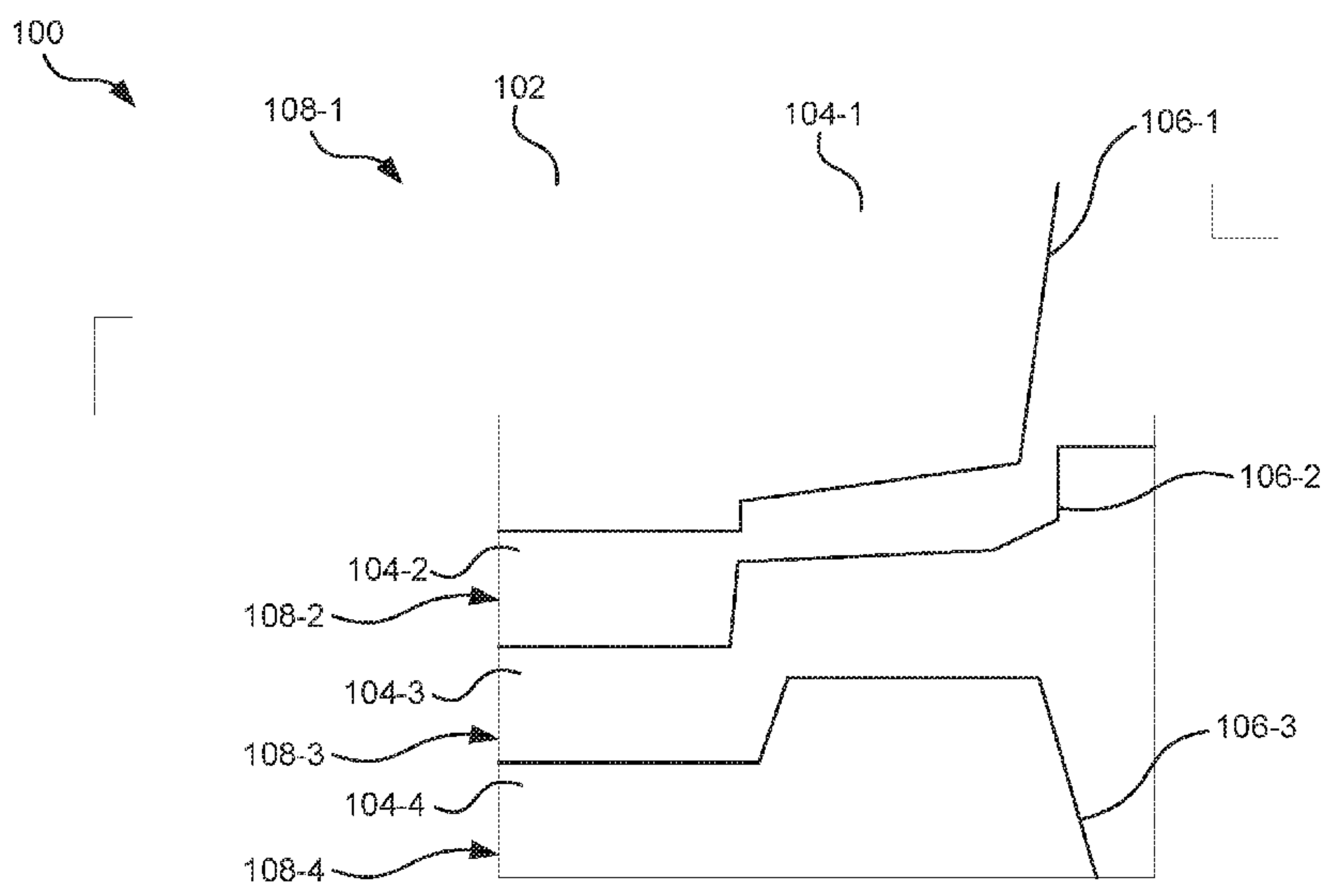

FIG. 1

(57) **Abstract:** An example ink chamber for a printer includes an external wall to enclose the ink chamber; and sub-chambers disposed in the ink chamber, the sub-chambers to contain inks of different colors, each sub-chamber having a vapor transmission rate of vapor lost through an external surface area defined by a portion of the external wall. The sub-chambers are arranged to equalize predicted vapor transmission rates for the sub-chambers.

WO 2021/107923 A1

[Continued on next page]

Declarations under Rule 4.17:
— *as to the identity of the inventor (Rule 4.17(i))*
— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

Published:
— *with international search report (Art. 21(3))*

INK CHAMBERS WITH OPTIMIZED SUB-CHAMBER ARRANGEMENTS

BACKGROUND

[0001] Printers use ink to print documents. Ink used by the printer may be stored in ink cartridges placed in the printer. The ink cartridges may be divided into different sub-chambers that store different colors of ink.

BRIEF DESCRIPTION OF THE DRAWINGS

[0002] FIG. 1 is a top view of an example ink chamber with an optimized sub-chamber arrangement.

[0003] FIG. 2 is an exploded perspective view of an example ink chamber and cover with an optimized sub-chamber arrangement.

[0004] FIG. 3 is a top view of the ink chamber of FIG. 2 including fasteners to fasten the cover.

[0005] FIG. 4 is a top view of the ink chamber of FIG. 2 in an ink chamber reception site.

[0006] FIG. 5 is a top view of another example ink chamber in an ink chamber reception site.

[0007] FIG. 6 is a schematic of a printer with an ink chamber with an optimized sub-chamber arrangement.

DETAILED DESCRIPTION

[0008] Printer ink may be water-based and may lose vapor and dry out over time. The rate at which the ink dehydrates depends on the volume of the ink and the surface area and material of the chamber containing the ink. In particular, each chamber may have a vapor transmission rate, which may be defined as a rate at which vapor is lost through an external surface area of the chamber. In some ink chambers, the volume-to-external surface area of the sub-chambers is imbalanced, and accordingly inks in the different sub-chambers may dehydrate at different rates. This may be inconvenient to users to replace the inks in the different sub-chambers at different times.

[0009] An example ink chamber for a printer includes an external wall to enclose the ink chamber, and internal walls to divide the ink chamber into sub-chambers. The plan of the internal walls may be selected to equalize predicted vapor transmission rates for the sub-chambers. The inks in each of the sub-chambers may therefore lose vapor and dehydrate at approximately equal rates.

[0010] FIG. 1 shows a top view of an example ink chamber 100 for a printer (not shown) having an optimized sub-chamber arrangement. The ink chamber 100 includes an external wall 102 to enclose the ink chamber 100 and sub-chambers 104-1, 104-2, 104-3, and 104-4 disposed in the ink chamber 100. In particular, the sub-chambers 104-1, 104-2, 104-3, and 104-4 (also referred to herein generically as a sub-chamber 104 and collectively as the sub-chambers 104) are arranged within the ink chamber 100 to equalize predicted vapor transmission rates for the sub-chambers 104.

[0011] The external wall 102 is to enclose the ink chamber 100 to contain ink therein and may be shaped to be received in an in an ink chamber reception site of the printer. In some examples, the external wall 102 may define an irregular shape for the ink chamber 100 to maximize a volume of ink to be contained within the ink chamber 100 while accommodating other fixed or non-variably shaped components of the printer. Thus, the ink chamber reception site may be defined by the other nearby components of the printer, and hence the external wall 102 may be shaped complementary to the ink chamber reception site to be received therein.

[0012] The sub-chambers 104 are disposed in the ink chamber 100 to contain ink for printing operations. For example, each sub-chamber 104 may contain a different color of ink (e.g., cyan, magenta, yellow, and black, or CMYK inks). The ink chamber may further include internal walls 106-1, 106-2, 106-3 to divide the ink chamber 100 into the sub-chambers 104. The internal walls 106 may comprise an impermeable material to prevent transmission of ink between the sub-chambers 104. Thus, each sub-chamber 104 may be defined by at least one of the internal walls 106 and a portion of the external wall 102. Thus, the sub-chambers 104 include respective external surface areas 108-1, 108-2, 108-3, 108-4 defined by the portion of the external wall 102 of the sub-chamber 104.

[0013] The sub-chambers 104 are arranged within the ink chamber 100 to optimize the dehydration rates for the inks contained in the sub-chambers 104. In particular, the sub-chambers 104 are arranged to approximately equalize the predicted vapor transmission rates for the sub-chambers 104 to enable the inks contained in each of the sub-chambers to dehydrate at approximately the same rate.

[0014] The inks in the sub-chamber 104 may dehydrate by losing vapor through the external surface area 108 of the sub-chamber. The respective absolute humidity is the same for each sub-chamber 104, and accordingly, there is no vapor transmission between sub-chambers 104. Further, the surface area of the floor and ceiling of each sub-chamber 104 is proportional to the volume of the sub-chamber, and accordingly the area of the floor and/or ceiling to the volume is constant across each sub-chamber. The rate at which the inks dehydrate may be computed as a ratio of the vapor loss of the ink to the volume of the ink. The vapor loss of the ink may, in turn, be computed as a function of the external surface area. Accordingly, a dehydration rate for the ink contained in each sub-chamber may also be computed based on the external surface area 108 and the volume of the sub-chamber 104.

[0015] The plan of the internal walls 106 is selected so that the predicted dehydration rates of the inks contained in the sub-chambers are approximately equal. For example, the plan of the internal walls 106 may be selected based on respective volume-to-external surface area ratios of the sub-chambers 104, and in particular, such that the volume-to-external surface area ratios of the sub-chambers 104 are approximately equal. The volume-to-external surface area ratios being approximately equal may therefore enable approximately equal vapor transmission rates for the sub-chambers. In turn, approximately equal vapor transmission rates for the sub-chambers may enable approximately equal dehydration rates of the inks contained in the sub-chambers. That is, the sub-chambers 104 may be arranged based on respective external surface areas 108 and volumes of the sub-chambers 104 to approximately equalize the dehydration rates of the inks contained in the sub-chambers 104.

[0016] In some examples, the sub-chambers 104 may further be arranged based on respective intrinsic dehydration rates of the inks contained in the sub-chambers 104. For example, the inks may have different chemical compositions and properties, and hence may have different intrinsic dehydration rates. A first ink having a higher intrinsic dehydration rate may lose vapor more readily than a second ink having a relatively lower intrinsic dehydration rate. Accordingly, the plan of the internal walls 106 may be selected to reduce the external surface area through which the first ink may lose vapor. Thus, the volume-to-external surface area ratio of the first ink may be relatively smaller than the volume-to-external surface area ratio of the second ink to approximately equalize the vapor transmission rates of the two inks, and accordingly dehydration rates of the two inks.

[0017] In further examples, the sub-chambers 104 may be further arranged to account for respective predicted usage rates of the inks contained in the sub-chambers 104. For example, printing operations may generally utilize more black ink than colored inks, and accordingly, the sub-chamber 104-1 containing the black ink may be relatively larger than the sub-chambers 104-2, 104-3, 104-4 containing the colored inks. The plan of the internal walls 106 may therefore be selected to increase the volume of the first sub-chamber 104-1 and its corresponding external surface area 108-1 to maintain an approximately equal volume-to-external surface area ratio of the first sub-chamber 104-1 relative to the volume-to-external surface area ratios of the sub-chambers 104-2, 104-3, and 104-4. Thus, the vapor transmission rates of the sub-chambers 104 may remain approximately equalized.

[0018] For example, in the plan depicted in FIG. 1, the volume-to-surface area ratios of the sub-chambers is given in Table 1.

Table 1: Volume-to-External Surface Area Ratios

Sub-Chamber	**Volume-to-External Surface Area Ratio**
104-1	41 mm^3/mm^2
104-2	36 mm^3/mm^2
104-3	39 mm^3/mm^2
104-4	37 mm^3/mm^2

[0019] Additionally, the dehydration rate of the inks depends on the volume of the ink and the vapor transmission rate of the sub-chamber 104. In particular, a smaller volume of ink loses the same amount of vapor through the external surface area 108 of the sub-chamber 104 as a larger volume of ink, and therefore, the smaller volume of ink dehydrates faster. Accordingly, an ink having a higher predicted usage rate may be in a sub-chamber having a higher vapor transmission rate than that of an ink having a lower predicted usage rate. Thus, over time, the two inks may have approximately equal dehydration rates. The sub-chambers 104, and in particular, the plan of the internal walls 106, may therefore be selected to allow the inks contained in the sub-chambers to have approximately equal dehydration rates based on their respective predicted usage rates.

[0020] Referring now to FIG. 2, an exploded, perspective view of another example ink chamber 200 is depicted. The ink chamber 200 is similar to the ink chamber 100.

[0021] In particular, the ink chamber 200 includes an external wall 202 to enclose the ink chamber 200. The external wall 202 may be shaped to be received in an ink chamber reception site of the printer. The ink chamber 200 further includes sub-chambers 204-1, 204-2, 204-3, and 204-4 to contain different colors of ink within the ink chamber 200. In particular, the ink chamber 200 includes internal walls 206-1, 206-2, and 206-3 to divide the ink chamber 200 into the sub-chambers 204. Each sub-chamber 204 further has a respective external surface area 208-1, 208-2, 208-3, and 208-4 defined by a portion of the external wall 202. Together, the external surface area 208 and the internal walls 206 define a volume for each sub-chamber 204. The plan of the internal walls 206 is selected such that respective volume-to-external surface area ratios of the sub-chambers 204 are approximately equal to enable approximately equal vapor transmission rates for the sub-chambers 204. The external wall 202 may define a main body 210 of the ink chamber 200.

[0022] The ink chamber 200 further includes a cover 212. The cover 212 is to cover the main body 210 and forms a top surface of the ink chamber 200 generally, and more specifically, of the sub-chambers 204. When the cover 212 covers the main body 210, seams are formed between top edges of the walls 202, 206 and the cover 212. Accordingly, the cover 212 may further include a gasket 214 formed of a resilient material, such as rubber, plastics, silicones, combinations of the above, and the like, to seal the ink chamber 200 at the seams between the walls 202, 206 and the cover 212. In particular, the gasket 214 may correspond to the plan of the internal walls 206 to enable the gasket 214 to seal the sub-chambers 204. In other examples, the gasket 214 may correspond to an entire surface area of the cover 212 to enable the gasket 214 to seal the sub-chambers 204.

[0023] Referring to FIG. 3, a top view of the ink chamber 200 is depicted. The ink chamber 200 further includes fasteners 300 to fasten the cover 212 to the ink chamber 200, and in particular, to the main body 210. In particular, the fasteners 300 may be disposed along the internal walls 206 to fasten the cover 212 to the main body 210 maintain the seal at the gasket 214. The fasteners

300 may be, for example, screws, nails, brackets, or other suitable fasteners to provide sufficient compression of the gasket 214 between the cover 212 and the main body 210 to maintain a seal at the seams of the ink chamber 200.

[0024] The fasteners 300 may be spaced apart along the internal walls 206 by approximately a predefined radial distance *2r*. The predefined radial distance may be selected according to the compressive force exerted by the fasteners 300 the compressive force to maintain a seal at the gasket 214, and the material of the cover 212. For example, the fasteners 300 may exert sufficient compressive force to maintain a seal at the gasket 214 within a circle 302 of radius *r* about the fastener 300. The radius *r* may increase for a cover 212 comprising a relatively stiffer material since a stiffer material may be less prone to bending and allowing a gap in between the fasteners 300. Accordingly, to maintain the seal along the length of a given internal wall 206, the entire length of the internal wall 206 is to be within a circle 302 of radius *r* about one of the fasteners 300. Thus, the radial pitch between adjacent fasteners 300 is approximately *2r*. The predefined radial distance may thus be defined as *2r* by this maximum radial pitch between adjacent fasteners 300. By maintaining the predefined radial distance *2r* between adjacent fasteners 300, the cover 212 may be secured to the main body 210 to seal the seams of the ink chamber 200. For example, the fasteners 300 may exert sufficient compressive force within a circle of radius 25 mm, and hence the predefined radial distance between adjacent fasteners may be about 50 mm.

[0025] The plan of the internal walls 206 may therefore also be selected based on the predefined radial distance. In particular, the length of each of the internal walls may be approximately an integer multiple of the predefined radial distance *2r*. For example, the internal wall 206-1 has a length **L** of approximately five times the predefined radial distance *2r*. The cover 212 may therefore be secured to the main body 210 with balanced compression on the gasket 214 to approximately evenly seal the seams of the ink chamber 200.

[0026] FIG. 4 is a top view of the ink chamber 200 in an ink chamber reception site 400 of a printer (not shown). The ink chamber reception site 400 includes fittings 402-1, 402-2, 402-3, 402-4 operatively coupled to the sub-chambers 204 to enable the sub-chambers 204 to interface with other components (not shown) of the printer. For example, the fittings 402 may include inlets, outlets, measuring devices, and the like. The fittings 402 may be to connect the sub-chambers 204 to components of the printer to enable printing operations. For example, the fittings 402 may be connected to a pump to draw ink from the sub-chambers 204 for printing operations at a printhead of the printer.

[0027] The fittings 402 may be fixed in predefined positions within the ink chamber reception site 400 of the printer. Accordingly, the plan of the internal walls 206 may further be selected based on the predefined positions of the fittings 402. For example, a region 404 of the ink chamber 200 may have a fixed plan of the internal walls 206 based on the predefined positions of the fittings 402. Thus, the ink chamber 200 with optimized sub-chamber arrangement may be utilized in existing printers without adjusting the fittings 402 and other components of the printer.

[0028] FIG. 5 is a top view of another example ink chamber 500 with an optimized sub-chamber arrangement according to a different plan. The ink chamber 500 is similar to the ink chambers 200 and 100.

[0029] In particular, the ink chamber 500 includes an external wall 502 to enclose the ink chamber 500. The external wall 502 is shaped to be received in an ink chamber reception site 510 of a printer (not shown). The ink chamber 500 further includes sub-chambers 504-1, 504-2, 504-3, and 504-4 to contain different colors of ink within the ink chamber 500. In particular, the ink chamber 500 includes internal walls 506-1, 506-2, and 506-3 to divide the ink chamber 500 into the sub-chambers 504.

[0030] The sub-chambers 504 are arranged within the ink chamber 500 to optimize the dehydration rates for inks contained the sub-chambers 504. In particular, the plan of the internal walls 506 is selected to enable approximately equal vapor transmission rates for the sub-chambers 504.

[0031] The plan of the internal walls 506 may further be selected based on predefined positions of fittings 512-1, 512-2, 512-3, 512-4. In particular the fittings 512 may be fixed in predefined positions within the ink chamber reception site 510 to connect the sub-chambers 504 to components of the printer to enable printing operations. Accordingly, the plan of the internal walls 506 may include a region 514 having a fixed plan of the internal walls 506 based on the predefined positions of the fittings 512.

[0032] FIG. 6 depicts a printer 600 including a housing 602, an ink chamber reception site 604 disposed in the housing, an ink chamber 606, and a printhead 614.

[0033] The ink chamber 606 includes an external wall 608 to enclose the ink chamber 606. The external wall 608 is shaped to be received in the ink chamber reception site 604. The ink chamber 606 further includes sub-chambers 610-1, 610-2, 610-3, and 610-4 to contain different colors of ink within the ink chamber 606. In particular, the ink chamber 606 includes internal walls 612-1, 612-2, and 612-3 to divide the ink chamber 606 into the sub-chambers 610. Each sub-chamber 610 has a respective external surface area defined by a portion of the external wall 608. Together, the external surface area and the internal walls 612 define a volume for each sub-chamber 610. The plan of the internal walls is selected to enable the predicted vapor transmission rates to be approximately equal. In particular, the plan is selected so that respective volume-to-external surface area ratios of the sub-chambers 610 are approximately equal.

[0034] The printhead 614 is coupled to the ink chamber 606 to receive ink from the ink chamber 606 during printing operations. In particular, the printer 600 may further include fittings to allow the ink chamber 606 to interface with other components of the printer, such as the printhead 614.

[0035] The plan of the internal walls 612 may thus further be selected based on predefined positions of the fittings. In other examples, the plan of the internal walls 612 may further be selected based on respective drying rates of the inks contend in the sub-chambers 610 to enable the predicted vapor transmission rates to be approximately equal. In further examples, the plan of the internal walls 612 may further be based on respective predicted usage rates of the inks contained in the sub-chambers 610 to enable the predicted vapor transmission rates to be approximately equal.

[0036] As described above, an example ink chamber for a printer are arranged to approximately equalize predicted vapor transmission rates for sub-chambers of the ink chamber. The plan for the internal walls dividing the ink chamber into the sub-chambers may be selected to approximately equalize the predicted vapor transmission rates. In particular, the plan may be selected such that respective external surface area-to-volume ratios of the sub-chambers are approximately equal to enable approximately equal vapor transmission rates. In other examples, the plan may be selected based on respective drying rates of the inks contained in the sub-chambers to equalize the predicted vapor transmission rates for the sub-chambers. In further examples, the plan may be selected based on respective predicted usage rates of the inks contained in the sub-chambers to equalize predicted vapor transmission rates for the sub-chambers. By optimizing the arrangement to approximately equalize the predicted vapor transmission rates, the inks in the different sub-chambers will dehydrate at approximately equal rates.

[0037] The scope of the claims should not be limited by the above examples, but should be given the broadest interpretation consistent with the description as a whole.

CLAIMS

1. An ink chamber for a printer, the ink chamber comprising:

an external wall to enclose the ink chamber; and

sub-chambers disposed in the ink chamber, the sub-chambers to contain inks of different colors, each sub-chamber having a vapor transmission rate of vapor lost through an external surface area defined by a portion of the external wall; and

wherein the sub-chambers are arranged to approximately equalize dehydration rates for the inks contained in the sub-chambers.

2. The ink chamber of claim 1, further comprising internal walls to divide the ink chamber into the sub-chambers.

3. The ink chamber of claim 1, wherein the sub-chambers are arranged based on respective external surface areas and volumes of the sub-chambers to approximately equalize the dehydration rates for the inks contained in the sub-chambers.

4. The ink chamber of claim 3, wherein the sub-chambers are further arranged based on respective drying rates of the inks contained in the sub-chambers to approximately equalize the dehydration rates for the inks contained in the sub-chambers.

5. The ink chamber of claim 3, wherein the sub-chambers are further arranged based on respective predicted usage rates of the inks contained in the sub-chambers to approximately equalize dehydration rates for the inks contained in the sub-chambers.

6. The ink chamber of claim 1, wherein the external wall is shaped to be received in an ink chamber reception site of the printer.

7. An ink chamber for a printer, the ink chamber comprising:

an external wall to enclose the ink chamber, the external wall shaped to be received in an ink chamber reception site of the printer; and

internal walls to divide the ink chamber into sub-chambers, each sub-chamber having an external surface area defined by a portion of the external wall and a volume; and

wherein a plan of the internal walls is selected such that respective volume-to-external surface area ratios of the sub-chambers are approximately equal to enable approximately equal vapor transmission rates for the sub-chambers.

8. The ink chamber of claim 7, further comprising:

a cover of the ink chamber, the cover including a gasket corresponding to the plan of the internal walls; and

fasteners to fasten the cover to the ink chamber to maintain a seal at the gasket.

9. The ink chamber of claim 8, wherein the fasteners are spaced apart along the internal walls by a predefined radial distance.

10. The ink chamber of claim 9, wherein a length of each of the internal walls is an integer multiple of the predefined radial distance.

11. The ink chamber of claim 7, wherein the plan of the internal walls is further selected based on predefined positions of fittings of the printer, wherein the fittings are to enable the sub-chambers to interface with components of the printer.

12. A printer comprising:

a housing;

an ink chamber reception site;

an ink chamber to be received in the ink chamber reception site, the ink chamber comprising:

an external wall to enclose the ink chamber, the external wall shaped complementary to the ink chamber reception site;

internal walls to divide the ink chamber into sub-chambers to contain inks of different colors, each sub-chamber including:

a vapor transmission rate of vapor lost through an external surface area defined by a portion of the external wall; and

a volume;

wherein a plan of the internal walls is selected based on respective volume-to-external surface area ratios to enable predicted vapor transmission rates to be approximately equal; and

a printhead coupled to the ink chamber to receive ink from the ink chamber during printing operations.

13. The printer of claim 12, further comprising fittings allow the ink chamber to interface with components of the printer; and wherein the plan of the internal walls is further selected based on predefined positions of the fittings.

14. The printer of claim 12, wherein the plan of the internal walls is further selected based on respective drying rates of the inks contained in the sub-chambers to enable the predicted vapor transmission rates to be approximately equal.

15. The printer of claim 12, wherein the plan of the internal walls is further selected based on respective predicted usage rates of the inks contained in the sub-chambers to enable the predicted vapor transmission rates to be approximately equal.

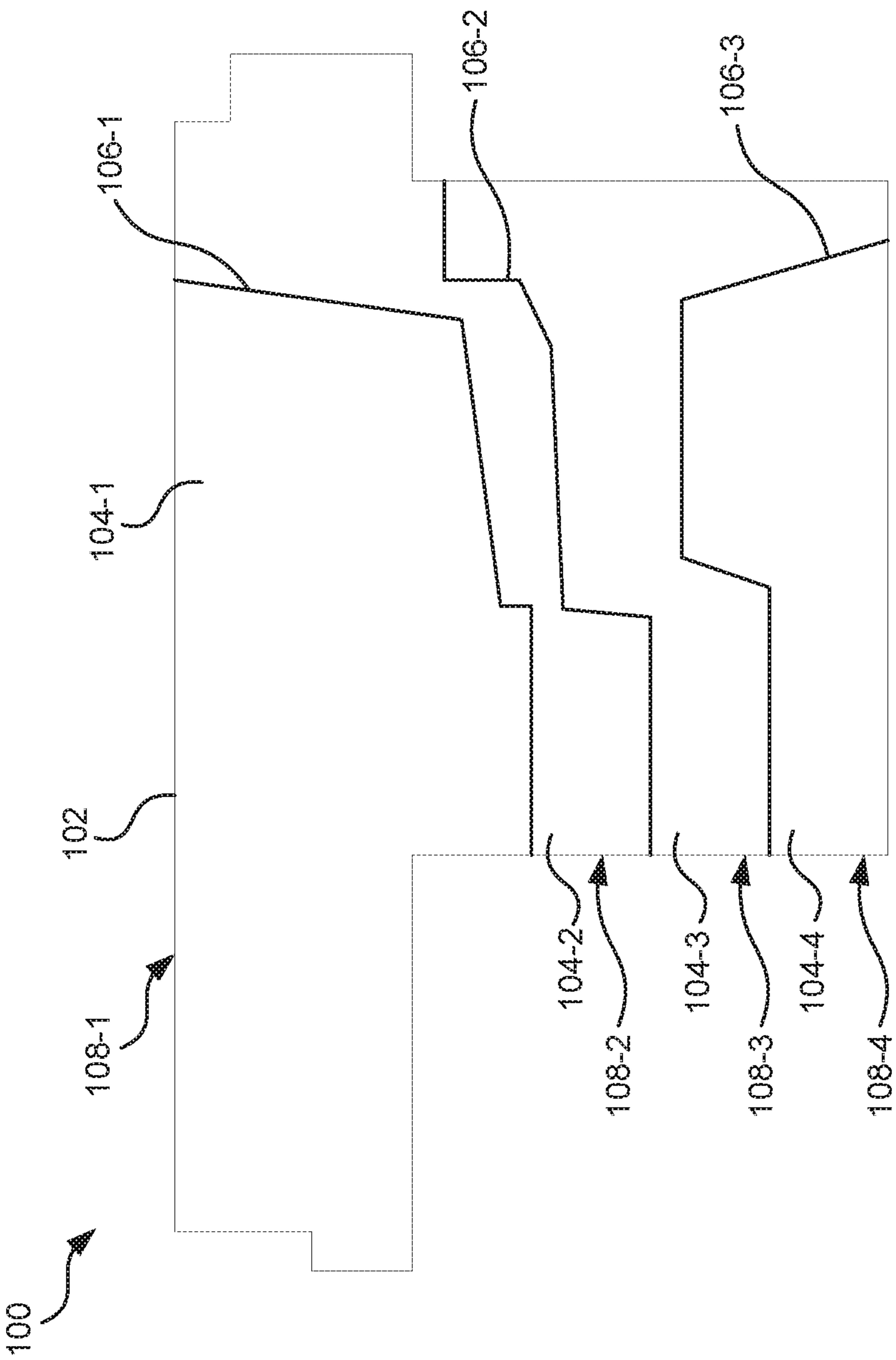
100
102
104-1
104-2
104-3
104-4
106-1
106-2
106-3
108-1
108-2
108-3
108-4

FIG. 1

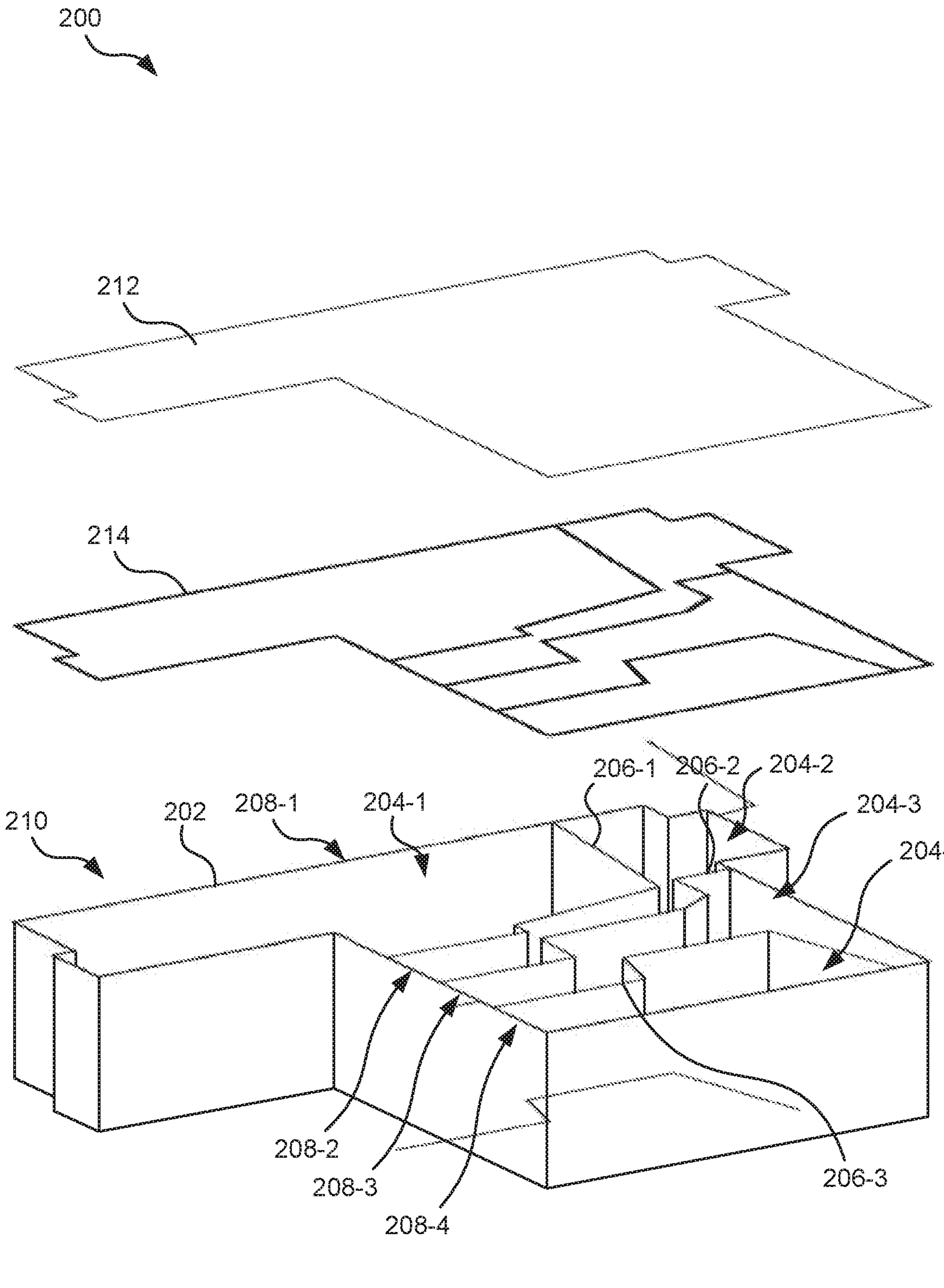
200
212
214
210
202
208-1
204-1
206-1
206-2
204-2
204-3
204-4
208-2
208-3
208-4
206-3

FIG. 2

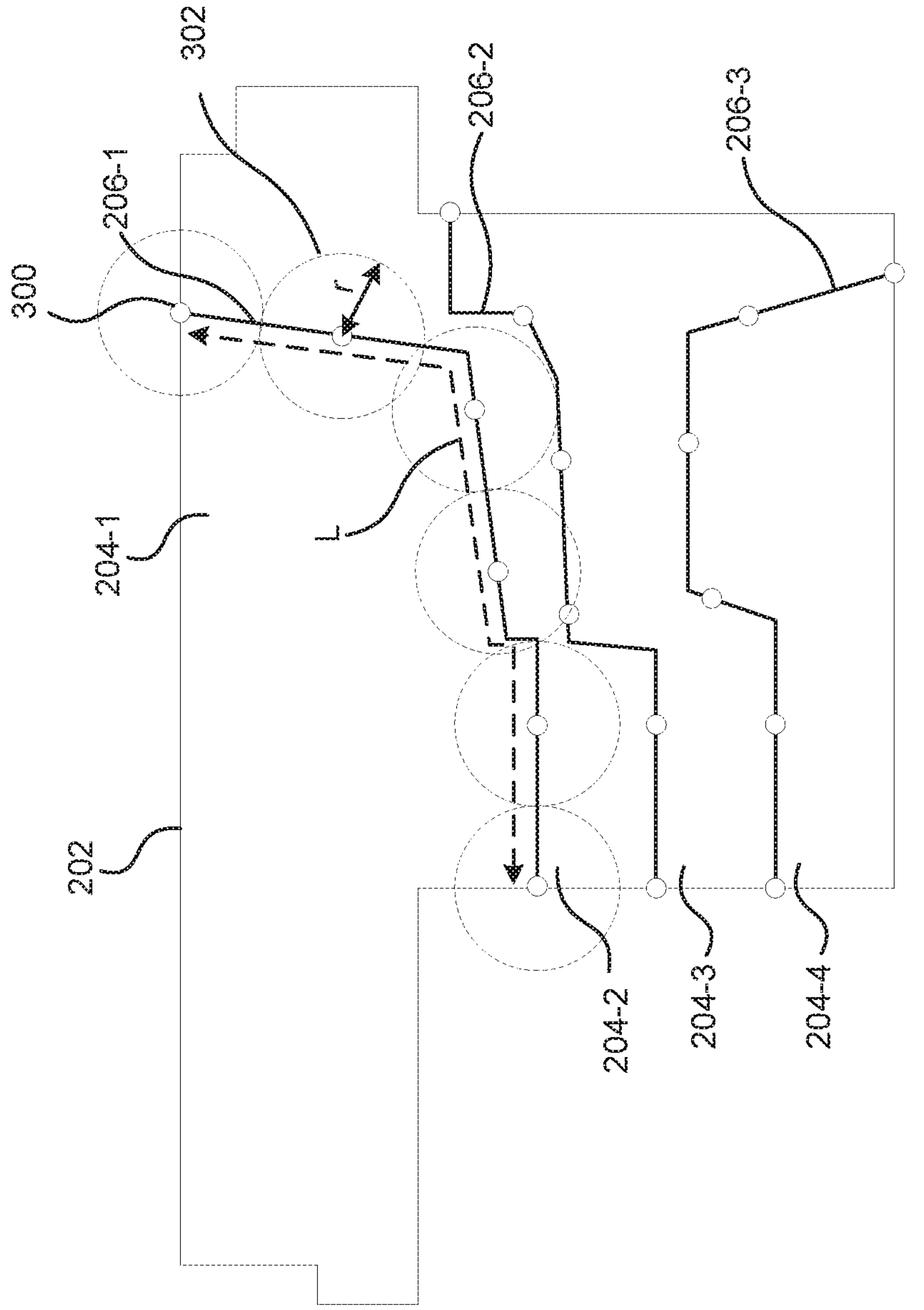

FIG. 3

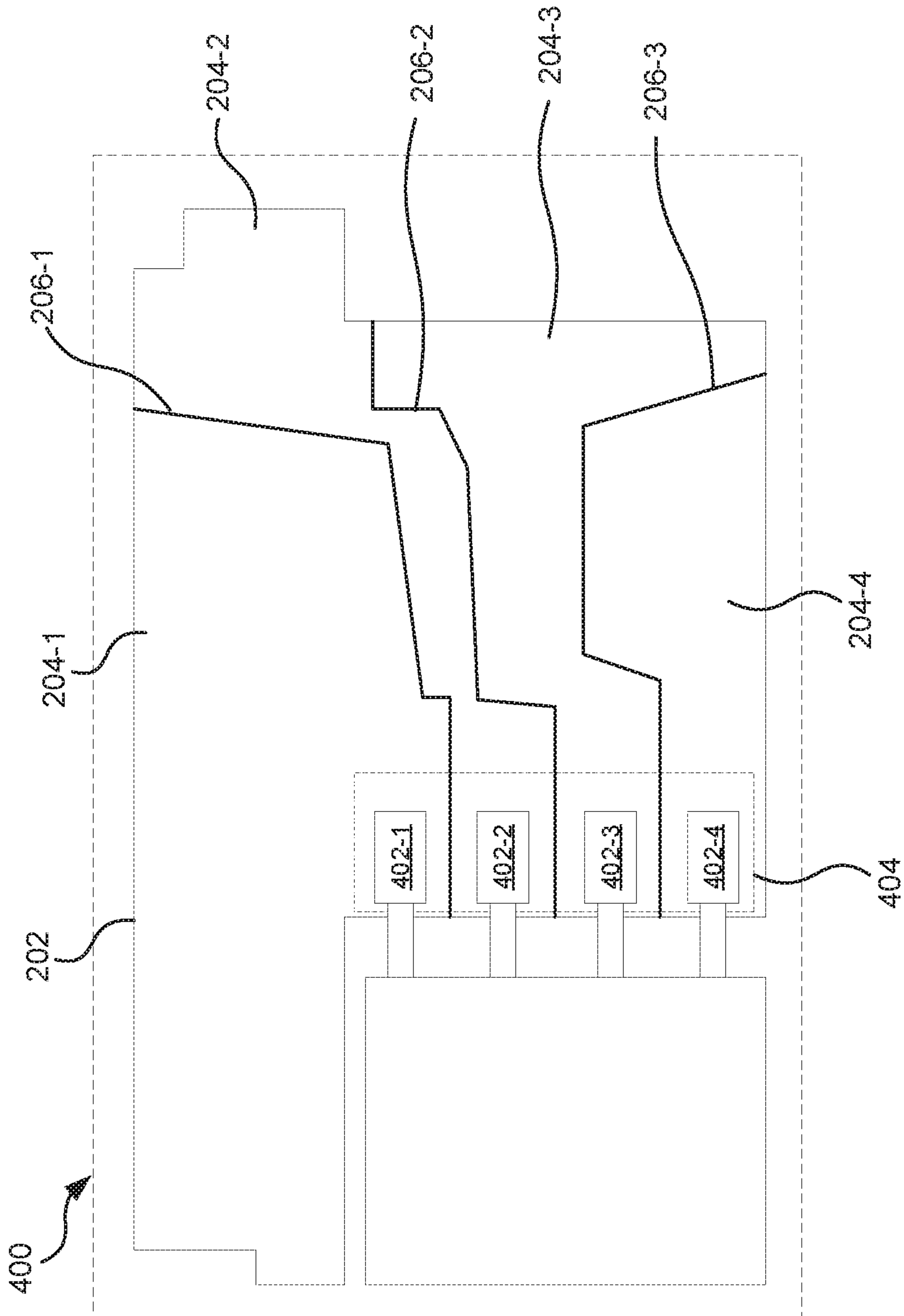
400
202
204-1
206-1
204-2
206-2
204-3
206-3
204-4
404
402-1
402-2
402-3
402-4

FIG. 4

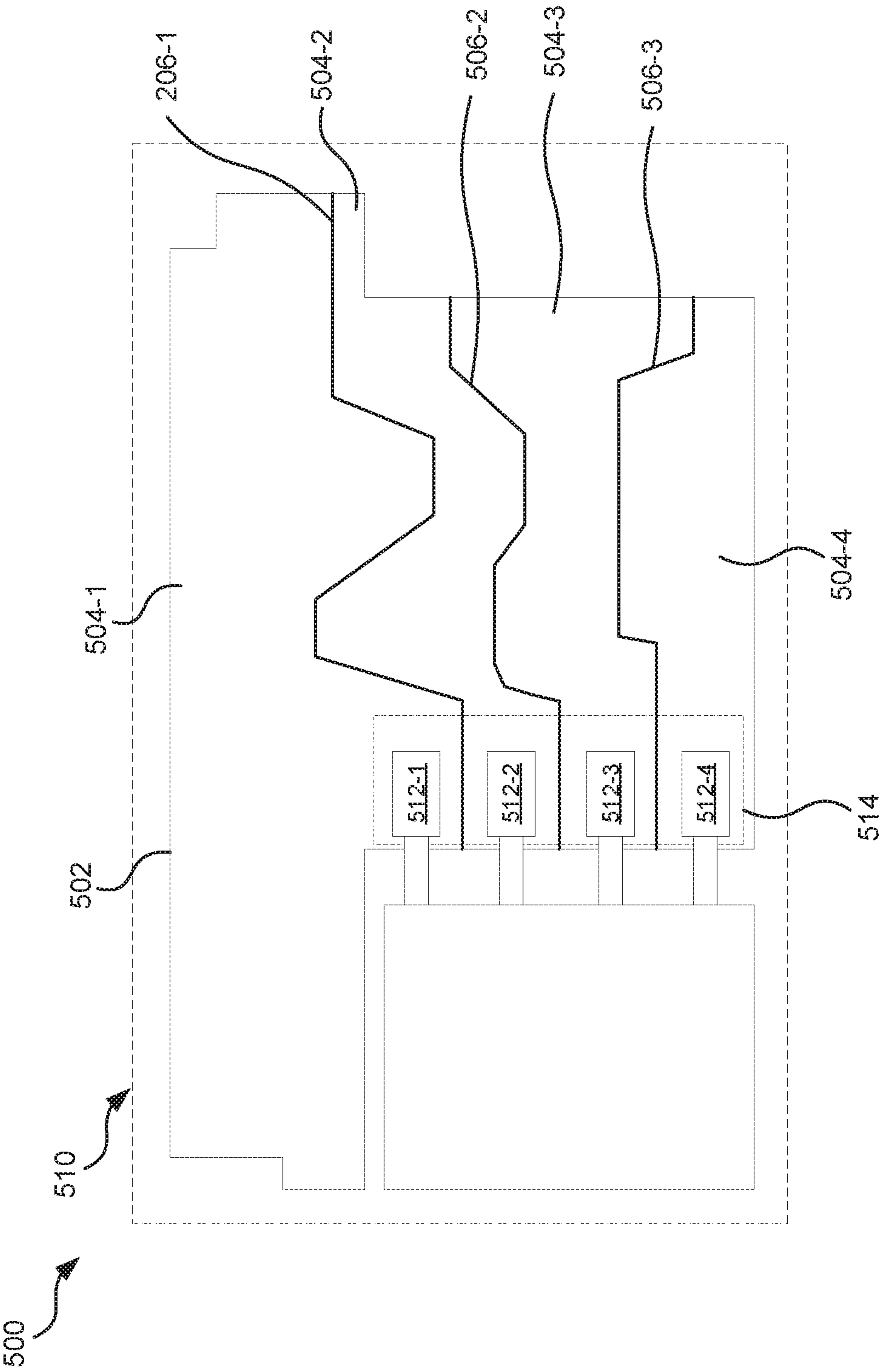
500
510
502
504-1
206-1
504-2
506-2
504-3
506-3
504-4
512-1
512-2
512-3
512-4
514

FIG. 5

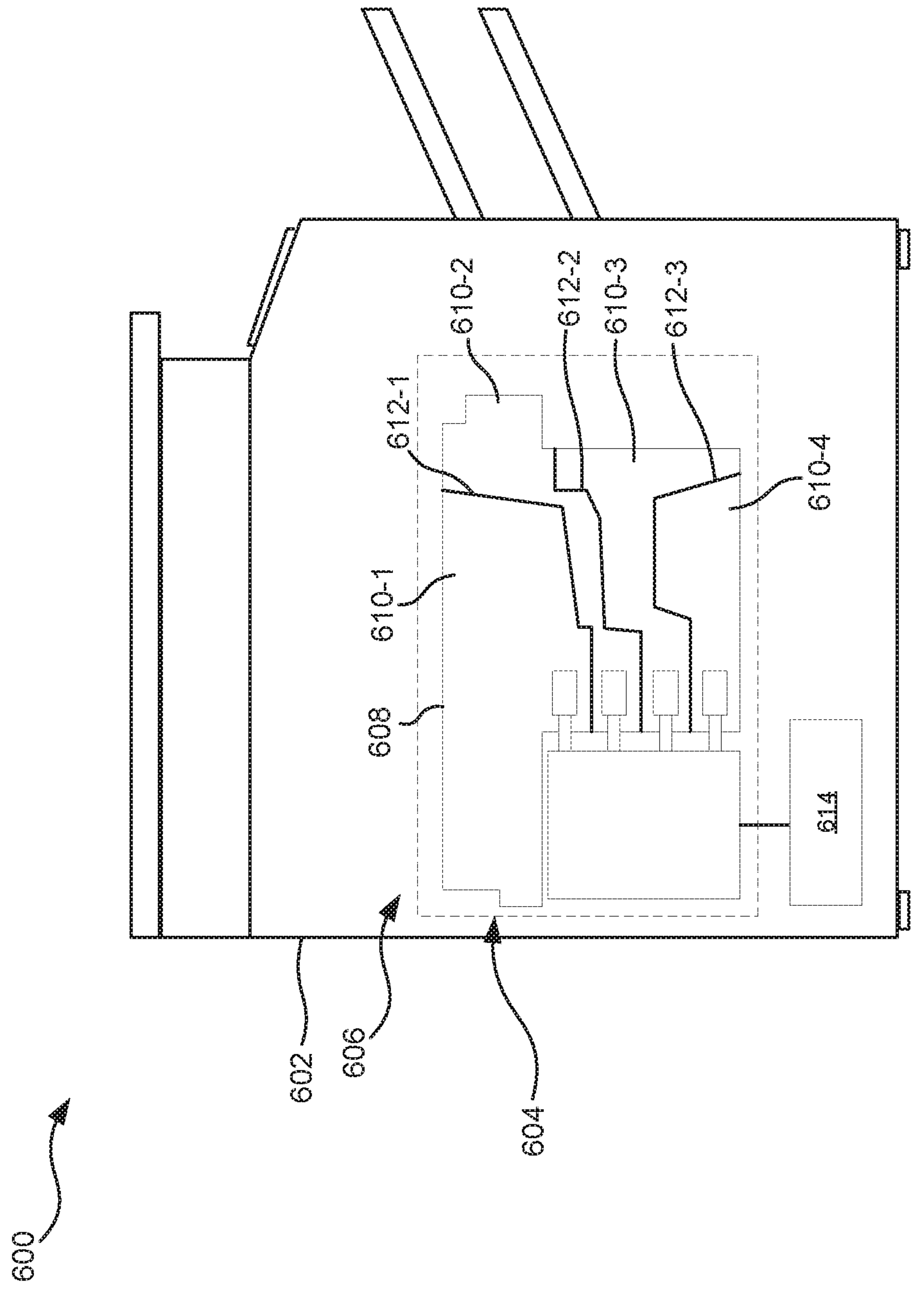

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2019/063193

A. CLASSIFICATION OF SUBJECT MATTER

B41J 2/175 *(2006.01)*
B41J 2/185 *(2006.01)*

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B41J 2 /40, 2/175, 2/185, G03G 13/10, 15/00, 15/02, 15/10, 15/11, 15/16, 15/20, 16/00, 21/00, 21/06

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PatSearch (RUPTO internal), USPTO, PAJ, Esp@cenet, DWPI, EAPATIS, PATENTSCOPE, Information Retrieval System of FIPS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2006/0119673 A1 (LEXMARK INTERNATIONAL, INC.) 08.06.2006	1-15
A	US 6390611 B1 (SEIKO EPSON CORPORATION) 21.05.2002	1-15
A	AU 2011256127 B2 (ZAMTEC LIMITED) 30.05.2013	1-15
A	US 2015/0029243 A1 (MEMJET TECHNOLOGY LIMITED) 29.01.2015	1-15

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"D" document cited by the applicant in the international application

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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

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

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

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

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 July 2020 (27.07.2020)	30 July 2020 (30.07.2020)

Name and mailing address of the ISA/RU:
Federal Institute of Industrial Property,
Berezhkovskaya nab., 30-1, Moscow, G-59,
GSP-3, Russia, 125993
Facsimile No: (8-495) 531-63-18, (8-499) 243-33-37

Authorized officer

E. Panferova

Telephone No. (499) 240-25-91