



(43) International Publication Date
20 September 2012 (20.09.2012)

- (51) International Patent Classification:
B41C 1/05 (2006.01) *B41M 1/10* (2006.01)
- (21) International Application Number:
PCT/US2012/027403
- (22) International Filing Date:
2 March 2012 (02.03.2012)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
13/049,951 17 March 2011 (17.03.2011) US
- (71) Applicant (for all designated States except US): EASTMAN KODAK COMPANY [US/US]; 343 State Street, Rochester, NY 14650-2201 (US).
- (72) Inventor; and
- (75) Inventor/Applicant (for US only): SOLOMON, Yehuda [IL/US]; 343 State Street, Rochester, NY 14650-2201 (US).

(74) Common Representative: EASTMAN KODAK COMPANY; 343 State Street, Rochester, NY 14650-2201 (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, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, 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, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, 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,

[Continued on next page]

(54) Title: REUSABLE PRINTING DEVICE

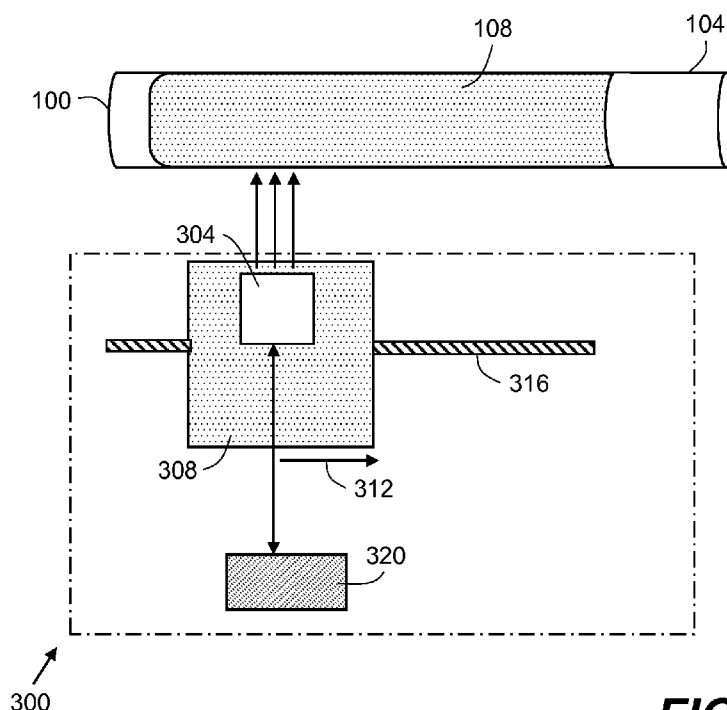


FIG. 3

[Continued on next page]



SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG). **Published:**

— with international search report (Art. 21(3))

(57) Abstract: An apparatus for preparing a printing cylinder includes providing an image bearing printing surface comprising a plurality of cells; applying a filling material into the cells; fixing the filling material in a first group of cells in a first pattern; and removing the filling material from a second group of cells.

REUSABLE PRINTING DEVICE**FIELD OF THE INVENTION**

This invention relates in general to printing, and in particular to a re-usable printing surface having a plurality of cells.

5

BACKGROUND OF THE INVENTION

In current printing technology the final image is conveyed to a substrate by transferring ink from an image bearing printing surface to the substrate. The image bearing surface generally picks up ink only on the 'image' areas, the areas that correspond on the substrate to be inked. The print on the
10 substrate is produced by transferring ink directly or indirectly from an inked-up image bearing surface to the substrate. An example of this technology is a printing plate wherein certain areas of the plate are hydrophobic or hydrophilic.

In conventional printing systems, the image bearing surface picks up liquid or paste ink, typically from an ink reservoir. The means by which the
15 surface transfers ink to the 'image' areas depends upon the particular technology. Printing plates will be used in flexography and offset lithography, whereas specially made cylinders are used in gravure printing. The ink is then transferred to another surface, be it the final product substrate, such as printed paper, or an intermediate medium such as a rubber blanket.

20 In digital printing systems, ink is transferred to the substrate in various ways for example, inkjet printing. Digital printing has an advantage over conventional print in its ability to handle variable information. This allows the printer to tailor each print differently. The main drawbacks of digital printing are that it is, in general, significantly more expensive and time consuming than
25 conventional printing processes.

SUMMARY OF THE INVENTION

Briefly, according to one aspect of the present invention an apparatus for preparing a printing cylinder includes providing an image bearing printing surface comprising a plurality of cells; applying a filling material into the
30 cells; fixing the filling material in a first group of cells in a first pattern; and removing the filling material from a second group of cells.

The invention and its objects and advantages will become more apparent in the detailed description of the preferred embodiment presented below.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic illustration of a printing block with plurality
5 of printing cells;

FIG. 2a is a schematic illustration of blocked and empty printing cells;

FIG. 2b is a cross-section of several empty printing cells on the printing block surface;

10 FIG. 2c is a cross-section of several printing cells on the printing block surface wherein some of them are empty, fully filled, or partially filled;

FIG. 3 is a schematic illustration of a printing block imaging device consisting of an imaging system and a cylinder made printing block the imaging system is adapted to adjust the printing cells content; and

15 FIG. 4 is a schematic illustration of an inkjet system adapted to fill the printing cells with blocking material.

DETAILED DESCRIPTION OF THE INVENTION

The present invention describes a direct printing device containing a surface of printing cells. The printing cells can be filled by selective control
20 thus allowing forming an image to be printed on a substrate. A previously formed image can be erased from printing cells surface and modified forming another image by suitable imaging means.

FIG. 1 shows a printing cylinder 100. The printing cylinder 100 contains a printing block 104. The printing block 104 is covered with an image bearing surface 108, containing plurality of printing cells. The printing cells are
25 in a form of micro-cavities of holes spread on surface 108, the printing cells are geometrically arranged for printing. The printing block 104 can be round as is depicted in FIG. 1 or flat (not shown). The printing block 104 can be made from flexible material. Additionally the round printing block 104 in FIG. 1 can rotated
30 during imaging or can be fixed into a single position during imaging.

FIG. 2a, depicts an illustration of printing cells 200 representing a segment of printing cells out of image bearing surface 108. The printing cells 200

are divided into two groups of cells, fully filled cells 204 and non-blocked or empty cells 208. The division of cells into two groups forms an image and transforms printing cells surface into an image bearing surface. The image bearing surface 108 when applied with ink and pressed on a substrate (not shown) will cause the image represented by printing cells 204 and 208 to be printed on the substrate.

In another arrangement, more than two groups (204, 208) can be formed, where each of the additional groups of cells represent filling of printing cells 200 in levels that may range from non empty to not fully filled printing cells.

FIG. 2b shows a cross-section of several empty printing cells on the printing block surface 212. FIG. 2c shows the filling level of the printing cells, for example printing cell 216 is fully filled, printing cell 220 is partially filled and printing cell 224 is not filled at all. Similar arrangements can be made by adding additional filling levels. The impact on the printing substrate of the printing cells with various filling will be different and distinct from each other.

In order to form an image on the image bearing surface 108, a filling material is applied one the entire surface 108. The filling material can be a photopolymer that will be cured by ultra violet (UV) light, or the filling material can be a liquid polymer to be solidified by cooling means. Another filling material can a polymer solution that solidifies by vaporization of the solvent, when laser means or other thermal sources area applied. All the printing cells (204 and 208) are filled with the printing material. The filling material can be applied for example by immersing the entire surface 108 in a filling material reservoir (not shown). The next step is to fix the filling material residing in a selected group of printing cells for example printing cells 204 and removing the filling material (which is not fixed) from printing cells 208, the removal of the filling material can be performed by an printing block imaging device 300 (shown in FIG. 3), described further in this document.

Fixing of the filling material can be achieved by applying UV (ultra violet) light in printing cells 204. Another alternative for fixing the filling material in cells 204 is by applying heat on the filling material in the first group in

printing cells 204. The fixing method depends on the characteristics of the chosen filling material.

At this stage the image bearing surface 108 represent an image which is ready to be mounted on a printing device (not shown) for printing. The imaging device 300 can integrated into a printing device as a pre-printing step or alternatively can be a standalone system detached from a printing device. The image is formed according to a previously prepared halftone image. The halftone image is typically prepared by a digital front end (DFE) (not shown) server such as Kodak Prinergy, the DFE is capable to process a printing job received in a page description language (PDL) format and rasterizing it into a halftone image or a plurality of halftone images that represent the entire print job, ready for imaging.

In order to perform printing, the printing block 104 is mounted on a printing device. Printing of the halftone image is initiated, the printing can be performed directly from the printing block 104 to a substrate, or alternatively via an intermediate blanket to the substrate. After printing is completed the printing block 104 is unloaded from the printing device. The printing block 104 is loaded on an imaging device 300 shown in FIG. 3, for removal of the filling material from cells 204. This process will enable reuse of printing block 104 for subsequent printing of new printing jobs. The cleaning of cells 204 or is performed by imaging device 300.

The imaging device 300 includes a laser imaging head 304 mounted on carriage 308 in direction 312, parallel to printing cylinder 100. The carriage movement is coordinated by screw 316. The laser imaging head 304 emits laser energy pointed on the cells 204 (filled with filling material). The information which cells are filled with a filling material is provided to imaging head 304 by micro-controller 320. Micro-controller 320 receives the information on cells 204 from the previously prepared halftone image that had been used to form an image on printing block 104. The applied laser energy from imaging head 304 is adapted to dissolve the filling material from cells 204.

Another embodiment that is used to fill cells 204 with filling material is described in FIG. 4. FIG. 4 shows an inkjet head 404 configured to apply filling material via inkjet means only on cells 204 of surface 108. In this

embodiment there is no need to fill the entire cells of surface 108, but only the selected cells 204 defined by the halftone image are injected by inkjet head 404 with filling material 408. The fixing of filling material is preformed selectively to cells 204.

- 5 In certain embodiments cells 204 will serve as printing cells and cells 208 as non printing cells, in other embodiments cells 208 will be printing cells whereas cells 204 will not print.

PARTS LIST

100	printing cylinder
104	printing block
108	image bearing surface
200	printing cells
204	fully filled cells
208	empty cells
212	printing block surface
216	fully filled printing cell
220	partially filled printing cell
224	empty printing cell
300	imaging device
304	imaging head
308	carriage
312	carriage direction
316	screw
320	micro-controller
404	inkjet head
408	injected filling material

CLAIMS:

1. A printing apparatus comprising:
an image printing surface;
a plurality of cells on the printing surface;
5 a device for filling the cells with a filling material;
a fixing element for fixing the filling material in a first
group of cells in at least a first pattern; and
an imaging element for removing the filling material from a
second group of cells.
10
2. A printing apparatus according to claim 1 wherein the
filling device is an inkjet element.
3. The printing apparatus according to claim 1 wherein the
15 printing surface comprises a cylinder.
4. The printing apparatus according to claim 1 wherein the
printing surface is a flexographic plate.
- 20 5. The printing apparatus according to claim 1 wherein the
plurality of cells is arranged in a geometric pattern.
6. The printing apparatus according to claim 1 wherein the
first pattern is a halftone image.
25
7. The printing apparatus according to claim 1 wherein the
fixing element applies ultra violet light to the filling material.
8. The printing apparatus according to claim 1 wherein the
30 fixing element applies heat to the filling material.

9. The printing apparatus according to claim 1 wherein the imaging device is a laser.

10. The printing apparatus according to claim 1 wherein the filling material is selected from a group consisting of a photopolymer, a liquid polymer, a polymer solution, or a combination thereof.

11. The printing apparatus according to claim 1 wherein the filling materials only partially fill the cells.

12. The printing apparatus according to claim 1 wherein the filling material in a portion of the first group of cells is partially fixed.

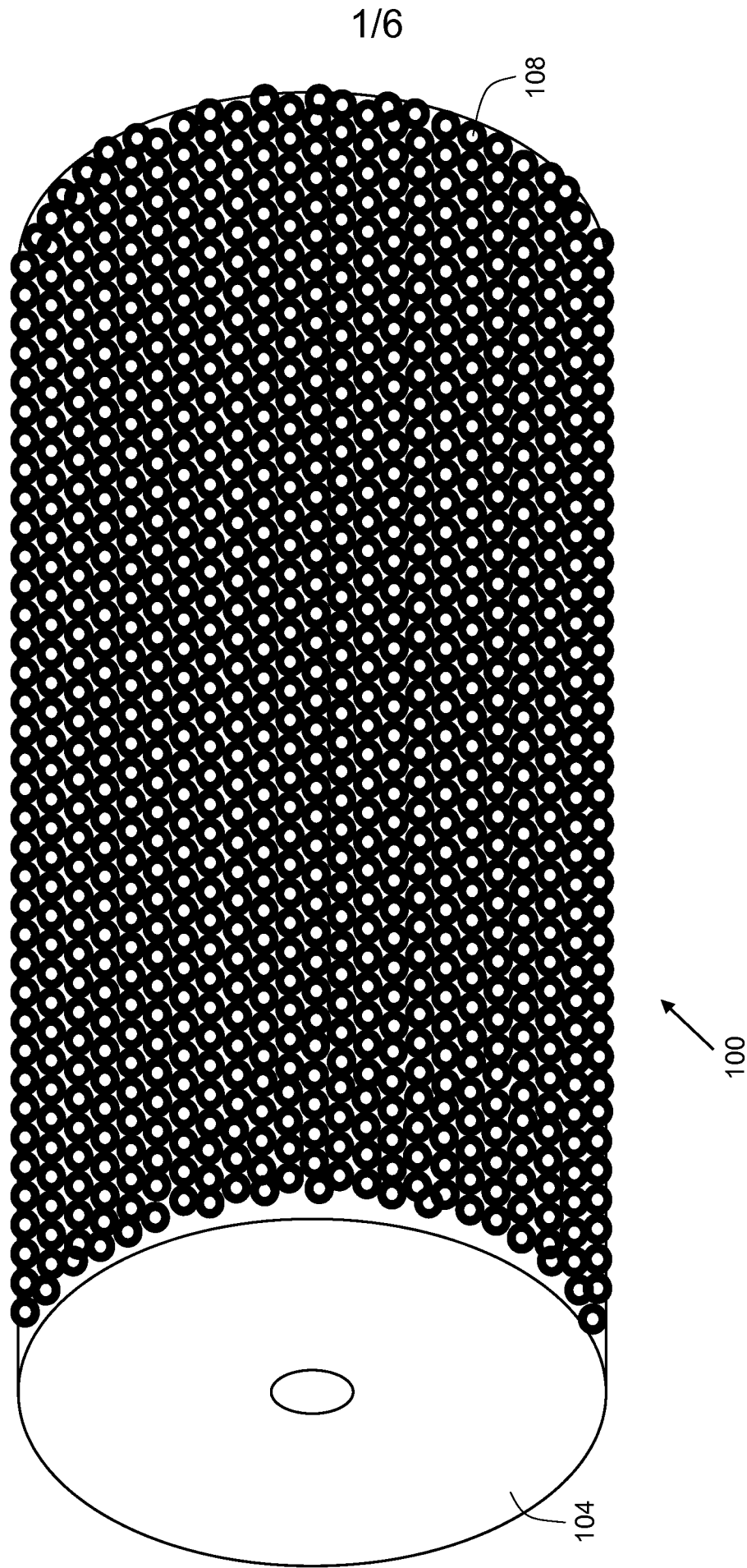
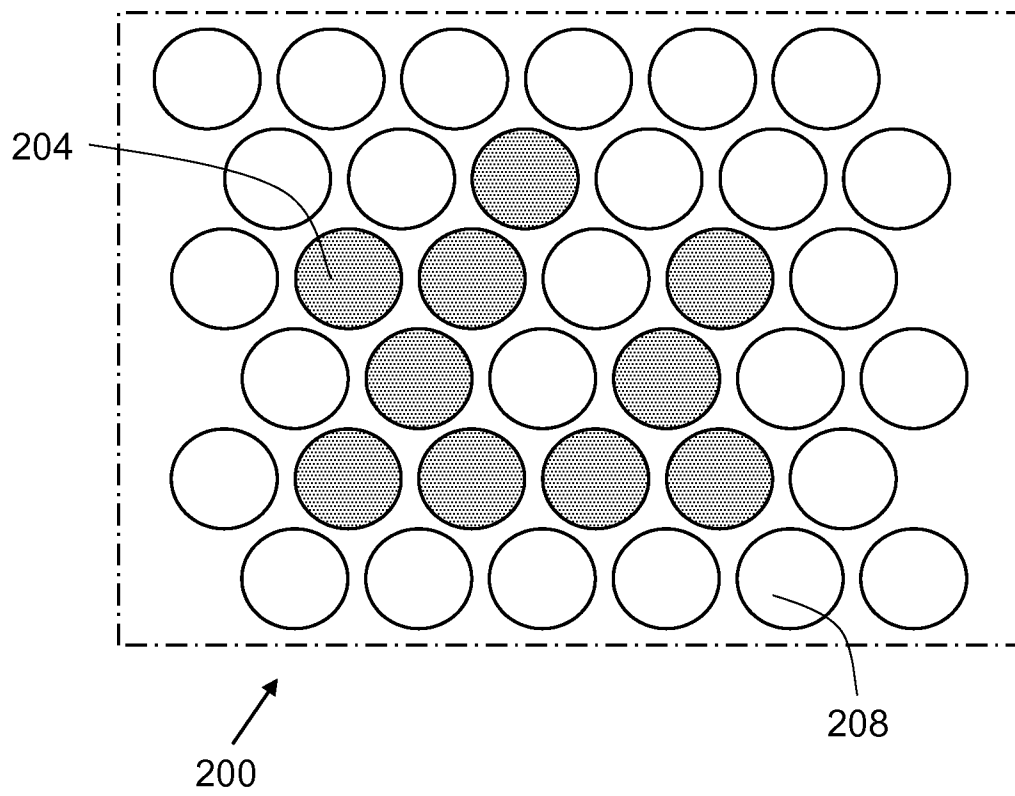


FIG. 1

2/6

**FIG. 2A**

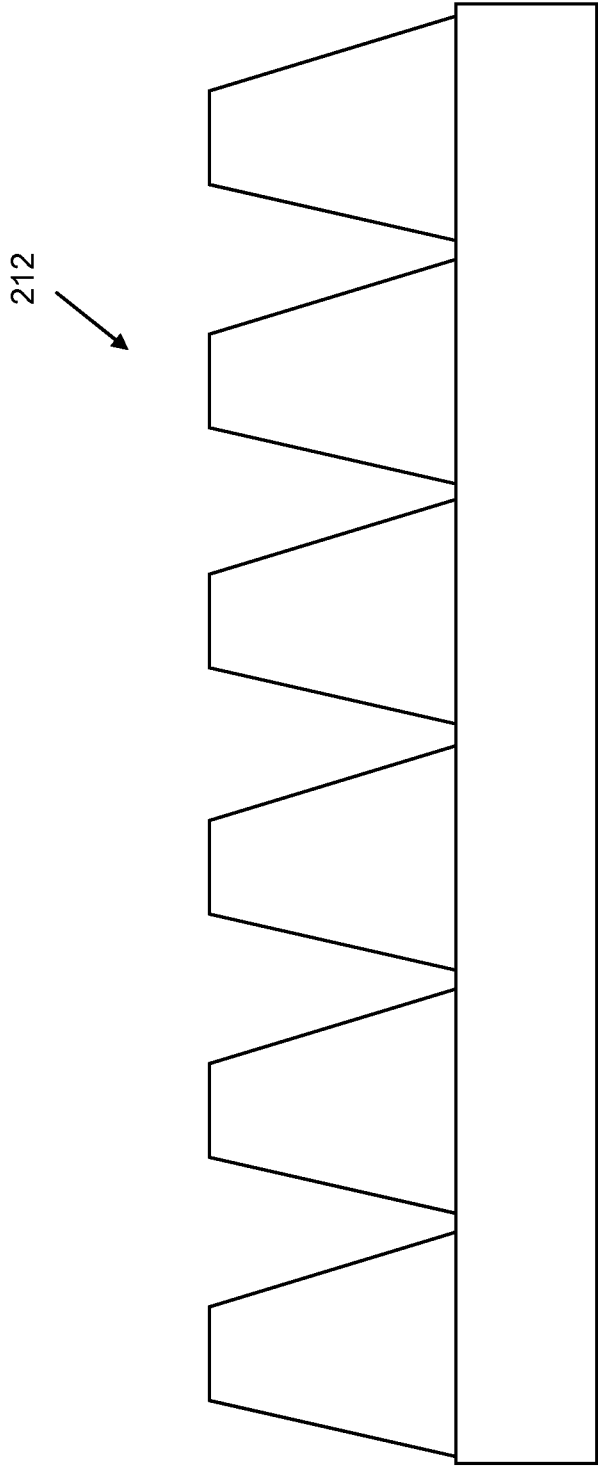


FIG. 2B

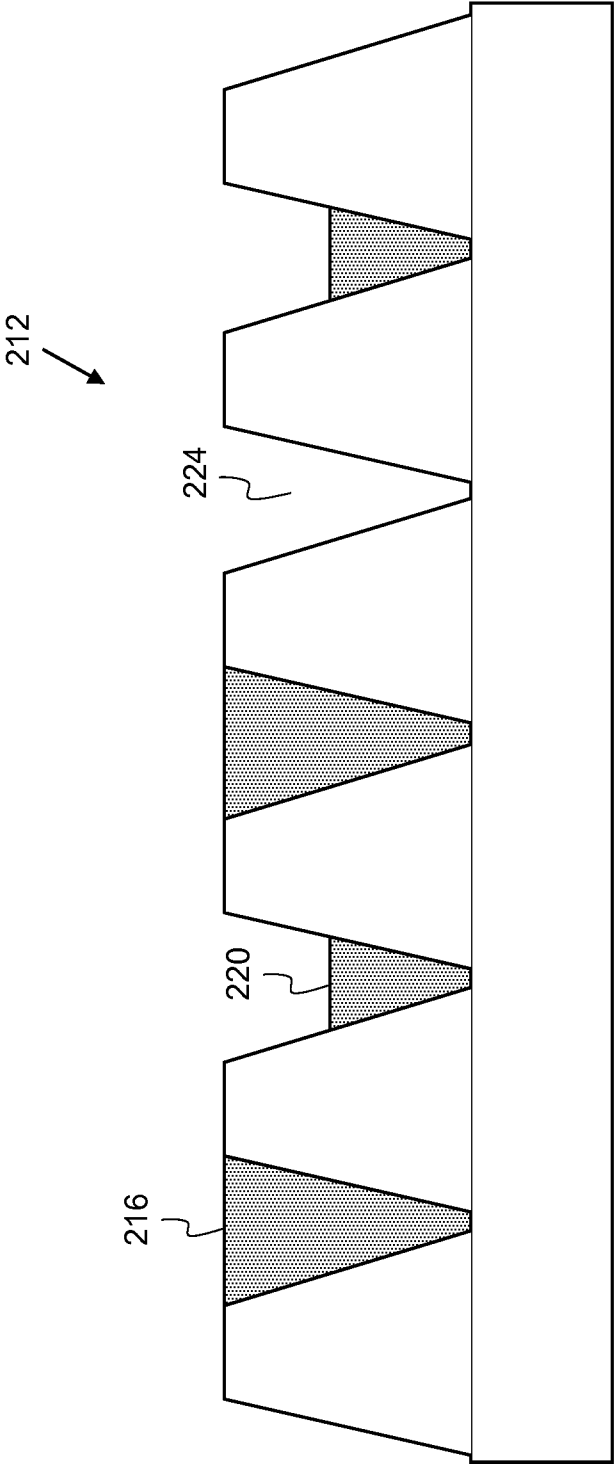


FIG. 2C

5/6

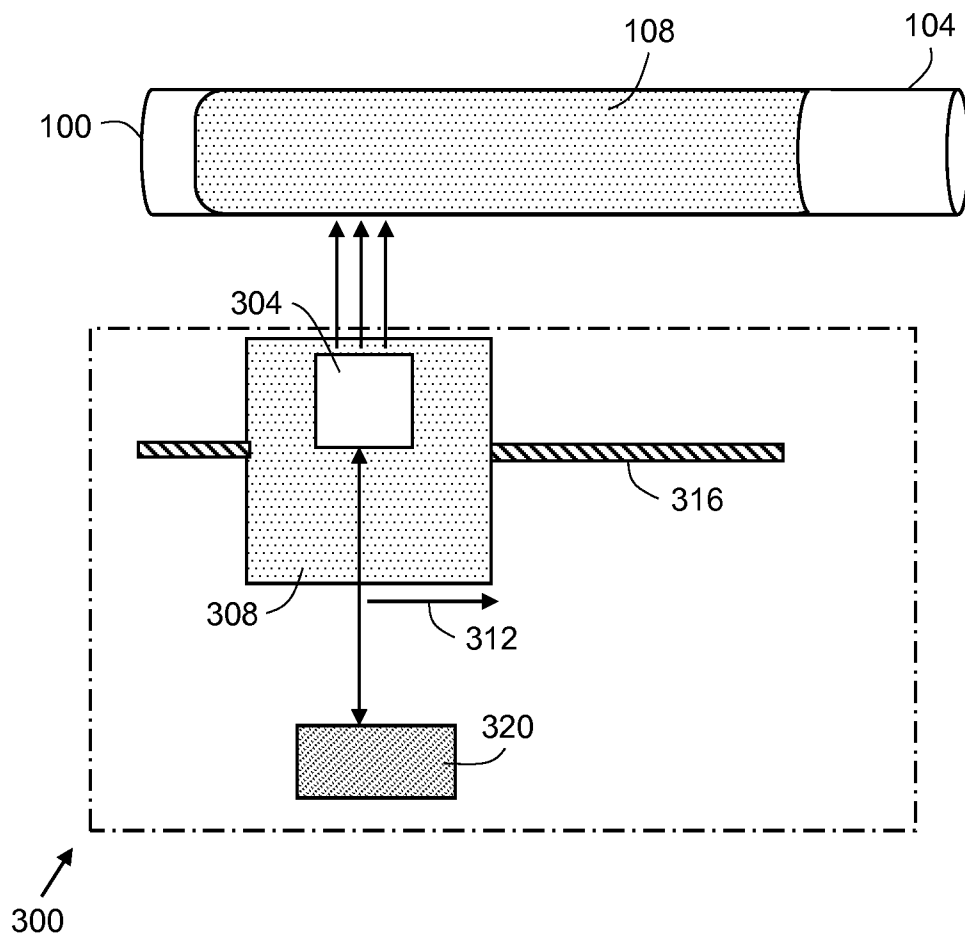


FIG. 3

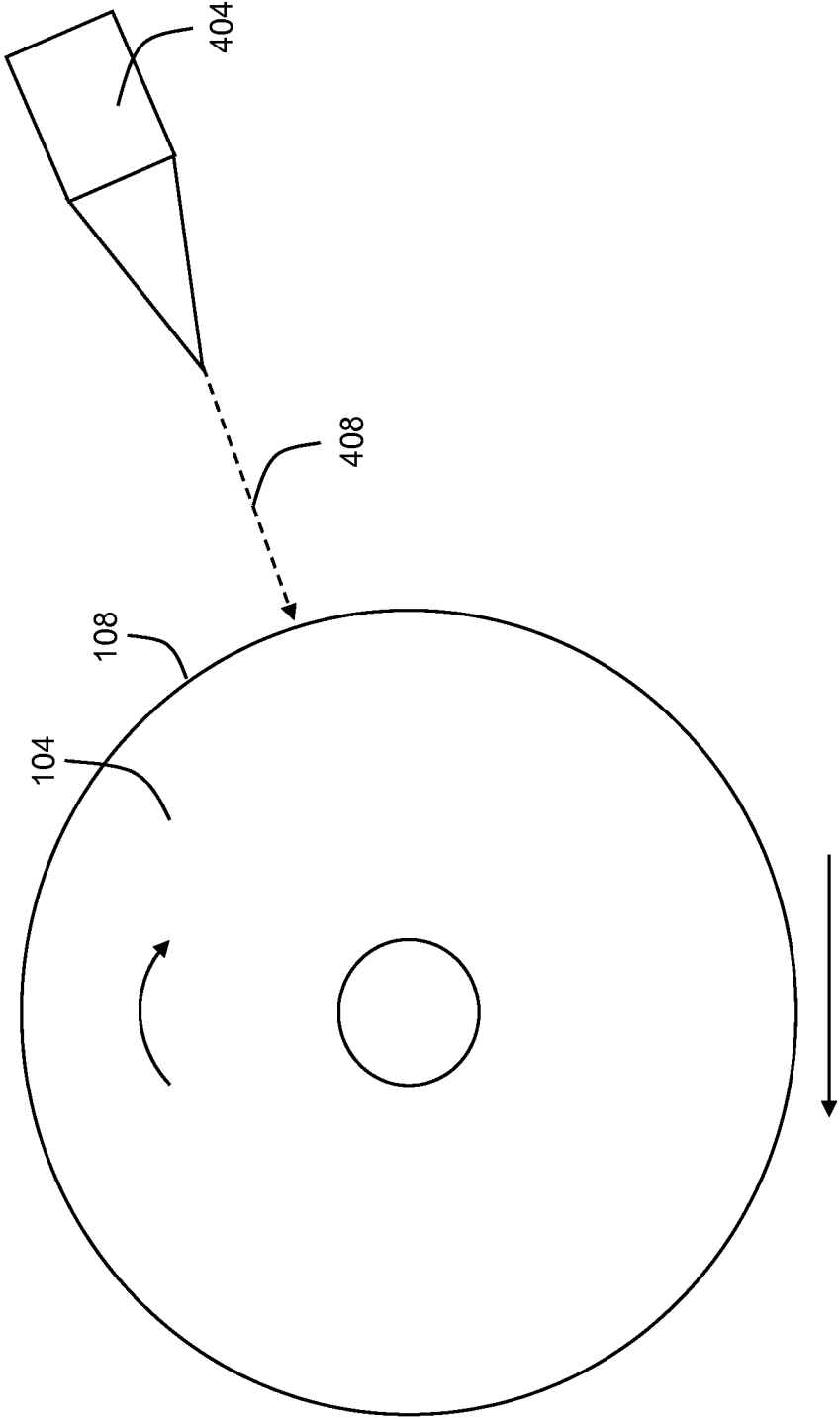


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/027403

A. CLASSIFICATION OF SUBJECT MATTER
INV. B41C1/05 B41M1/10
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B41C B41M

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

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

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 813 957 A2 (ROLAND MAN DRUCKMASCH [DE]) 29 December 1997 (1997-12-29) the whole document	1-12
X	JP 7 117207 A (HAMADA INSATSU KIKAI KK) 9 May 1995 (1995-05-09) the whole document	1-12
X	DE 27 48 062 A1 (BUGNONE ALDO) 18 May 1978 (1978-05-18) the whole document	1-12
X	GB 1 517 714 A (CROSFIELD ELECTRONICS LTD) 12 July 1978 (1978-07-12) the whole document	1-12
	----- -/-	

☒ 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

"E" earlier application or patent 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

21 May 2012

Date of mailing of the international search report

30/05/2012

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Vogel, Thomas

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2012/027403

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 730 953 A2 (ROLAND MAN DRUCKMASCH [DE]) 11 September 1996 (1996-09-11) the whole document	1-12
X	----- DONALD P J: "A PRE-CAVITATEDROTOGRAVURE PLATE AND METHOD OF PREPARING SAME FOR PRINTING", RCA TECHNICAL NOTES,, vol. 828, 10 April 1969 (1969-04-10), page 1/02, XP002028081, ISSN: 0483-7495 the whole document	1-12
X	----- DE 102 53 654 A1 (LORCH ERHARD [DE]) 17 July 2003 (2003-07-17) the whole document	1-12

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2012/027403

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0813957	A2	29-12-1997	CA 2207939 A1 19-12-1997
		DE 19624441 C1 04-12-1997	
		EP 0813957 A2 29-12-1997	
		JP 3238646 B2 17-12-2001	
		JP 10058814 A 03-03-1998	
		US 6070528 A 06-06-2000	

JP 7117207	A	09-05-1995	NONE

DE 2748062	A1	18-05-1978	BR 7707351 A 20-06-1978
		DE 2748062 A1 18-05-1978	
		FR 2370306 A1 02-06-1978	
		IT 1069122 B 25-03-1985	
		JP 53061407 A 01-06-1978	
		SU 706016 A3 25-12-1979	

GB 1517714	A	12-07-1978	DE 2550774 A1 20-05-1976
		GB 1517714 A 12-07-1978	
		JP 51072502 A 23-06-1976	

EP 0730953	A2	11-09-1996	CA 2168595 A1 08-08-1996
		DE 19503951 A1 08-08-1996	
		EP 0730953 A2 11-09-1996	
		JP 2918487 B2 12-07-1999	
		JP 8230344 A 10-09-1996	

DE 10253654	A1	17-07-2003	AT 388819 T 15-03-2008
		DE 10253654 A1 17-07-2003	
		EP 1456030 A1 15-09-2004	
		ES 2303567 T3 16-08-2008	
		WO 03041961 A1 22-05-2003	
