



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

[GB/GB]; 33 Avenue Road, St Neots, Cambridgeshire
PE19 1LJ (GB).

(21) International Application Number:
PCT/GB201 1/052273

(74) Agent: **FROST, Alex**; Verulam Gardens, 70 Gray's Inn
Road, London, London WC1X 8BT (GB).

(22) International Filing Date:
21 November 2011 (21.11.2011)

(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.

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
1019688.9 19 November 2010 (19.11.2010) GB
1019685.5 19 November 2010 (19.11.2010) GB

(71) Applicant (for all designated States except US): **DOM-
INO PRINTING SCIENCES PLC** [GB/GB]; Trafalgar
Way, Bar Hill, Cambridge, Cambridgeshire CB23 8TU
(GB).

(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,

(72) Inventors; and

(75) Inventors/Applicants (for US only): **WALKINGTON,
Stuart Mark** [GB/GB]; 72 Westfields, St Albans, Hert-
fordshire AL3 4LZ (GB). **GUINEE, Brian Patrick**

[Continued on nextpage]

(54) Title: IMPROVEMENTS IN OR RELATING TO INKJET PRINTERS

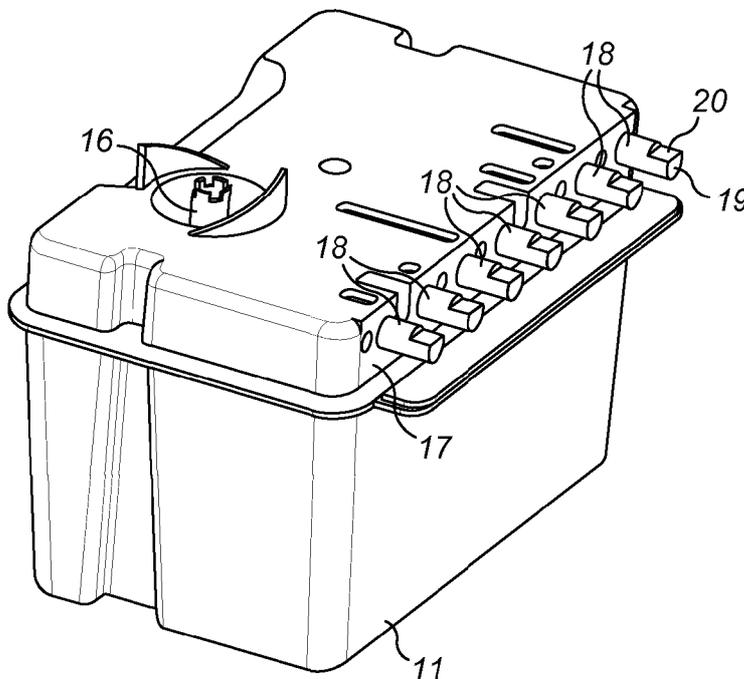


FIG. 1

(57) Abstract: The invention describes a con-
tinuous inkjet printer having an ink distribution
block and an ink module containing ink and fil-
ters which can be connected to the distribution
block with a substantially horizontal linear slid-
ing action. Spigots forming part of the connection
are preferably provided with upward facing fluid
transfer ports.

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))

IMPROVEMENTS IN OR RELATING TO INKJET PRINTERS*Field of the Invention*

This invention relates to inkjet printers and, more particularly, to a means of connecting an ink service module to an ink system of a continuous inkjet printer.

5 *Background*

Ink is typically supplied to a continuous inkjet printer from a disposable ink bottle. The ink bottle may be mounted on an ink reservoir that includes mating connection which allows ink to pass from the ink bottle into the ink reservoir. Each ink bottle contains a finite amount of ink, typically a pint or litre of ink. As the ink jet printing system is used, the ink within the
10 ink bottle is drained. When the ink bottle is fully depleted, the depleted ink bottle is replaced by a new, full bottle. Hence the level of ink in the reservoir is maintained at a particular level.

The properties of the printing ink may deteriorate over time. How long this may take depends upon a number of factors such as the rate at which new ink and/or make-up is
15 added, the environment in which the printer is operating and the ingredients from which the ink is made.

All manufacturers of continuous inkjet printers provide filtration within the ink system to limit the size of, and trap, particulate matter that may form in the ink. Such filters require replacement at a regular service interval. It is also typical to replace the bulk of the ink in
20 the printer with fresh ink at the same time as the filters are replaced. Usually this service action is undertaken by skilled personnel, e.g a service technician or maintenance staff, and requires the printer to be taken out of service and off line for approximately 30 to 60 minutes.

In a continuous inkjet print currently manufactured by the applicant, the ink reservoir is an
25 open-topped vessel on to which a manifold is fitted. The manifold is hydraulically

connected to an ink management (distribution) block by flexible tubing. The manifold has an ink pick up tube and level sensing electronics that are immersed in the ink. The ink system filter(s) are also connected by flexible tubing. When changing the reservoir and the filters a number of individual lines must be disconnected and, in turn, re-connected.

5 Accordingly there is potential for ink spillage and for the service technician to be exposed to solvent fumes. There is also potential for the replacement filter(s) to be fitted incorrectly.

It is an object of the invention to provide a continuous inkjet printer which will go at least some way in addressing the aforementioned problems; or which will at least offer a novel and useful alternative.

10 *Summary of the Invention*

Accordingly the invention provides a continuous inkjet printer having an ink distribution system and an ink module containing ink and one or more filters, said ink module being engageable with said ink distribution system, said printer being characterized in that the connections between said ink distribution system and said ink module comprises a plurality
15 of substantially horizontally aligned, inter-engaging, sockets and spigots provided on facing surfaces of said ink distribution system and said ink module which are arranged to allow said ink module to be engaged with said ink distribution system by way of a linear, substantially horizontal, displacement.

20 Preferably said spigots project from said ink module and said sockets are included in said ink distribution system.

Preferably each of said spigots has an upwardly facing fluid transfer port.

Preferably said printer further includes a make-up fluid module engageable with said ink distribution system, said make-up fluid module having one or more spigots thereon constructed and arranged to engage in corresponding sockets in said ink distribution system

wherein the arrangement of spigots on said make-up fluid module differs from the arrangement of spigots on said ink module.

Many variations in the way the present invention can be performed will present themselves to those skilled in the art. The description which follows is intended as an illustration only of one means of performing the invention and the lack of description of variants or
5 equivalents should not be regarded as limiting. Wherever possible, a description of a specific element should be deemed to include any and all equivalents thereof whether in existence now or in the future.

Brief Description of the Drawings

10 One embodiment of the invention will now be described with reference to the accompanying drawings in which:

Figure 1: an isometric view of an ink module for use in a printer according to the invention;

15 Figure 2: shows an isometric view of a make-up module for use in a printer according to the invention;

Figure 3: shows an isometric view of one side of an ink distribution facility incorporated in a printer according to the invention;

Figure 4: shows a schematic elevation of the engagement between a module and an ink distribution facility of a printer according to the invention; and

20 Figure 5: shows an isometric view of the ink module shown in Figure 1 and the make-up module shown in Figure 2 assembled on to the ink distribution facility shown in Figure 3.

Description of Working Embodiment

This invention provides a continuous inkjet printer having an ink distribution system 10 and an ink module 11 containing ink and one or more filters. As with known continuous inkjet printers the ink module 11 is, in use, engaged with the ink distribution system or block 10 to transfer ink into the ink distribution system and to filter ink circulated back into the module from the ink system. The characteristic feature of the invention is that the connection between the ink distribution block and the ink module is provided in the form of a plurality of horizontally aligned, inter-engaging, sockets and spigots provided on facing surfaces of the ink distribution block and the ink module. This arrangement allows the ink module to be directly engaged with the ink distribution block by way of a simple horizontal displacement. No intervening tubes or other connections are required. In this way, fresh volumes of ink and new filters can be easily and cleanly installed, in one simple action, by persons having no specialist skills.

As can be seen in Figure 3, the ink distribution system 10 includes a plurality of substantially valves or sockets 12 located in a row along that surface 13 of the ink distribution system which faces towards the front of the printer. As can be seen, the valves or sockets 12 are aligned horizontally and comprise a set of seven. A further set of two sockets, defined by valves or sockets 14, are provided for exchanging fluid with a make-up module 15.

Referring to Figure 1, it can be seen that the ink module 11 has a connection 16 for mounting a disposable ink bottle (not shown) and, on an upper outer surface 17 thereof, a plurality of spigots 18. As shown, seven spigots 18 are provided in a horizontal row. The spigots 18 are also horizontally aligned and are sized and positioned to engage the sockets 12 on the ink distribution block. It will thus be appreciated that the ink module can be engaged and inserted/extracted by sliding the service module into and out of the printer in a horizontal movement as indicated by the arrow in Figure 4. This means that the space required to fit, remove and retain the ink module is minimised.

A further feature of the invention is that ink is withdrawn from the module 11 into the ink distribution system 10 along an axis substantially perpendicular to the axis along which the module is engaged with the ink distribution system. To this end it will also be noted from Figures 1 & 4 that the distal end 19 of each of the spigots 18 is closed and a top-side opening or port 20 is provided adjacent to the end 19. Thus ink passing from the module 11 into the distribution system 10 must pass vertically through the port 20. The top-side port 20 has a dual function of allowing the non drip valve within the ink distribution block 10 to open and maintain a fluid flow path, whilst reducing the likelihood of fluid dripping from the spigot 18 when the ink module 12 is extracted.

In a similar manner to the ink module, the make-up service module 22 includes a connection 23 for a disposable make-up bottle (not shown) and two spigots, one of which is shown at 24, projecting horizontally from an upper side 25 thereof. The spigots 24 are positioned, sized and aligned to engage in the sockets 14 in the ink circulation block 10 and thus the make-up fluid module 22 can be engaged with the ink circulation block 10 with the same horizontal linear sliding action. It will be seen, however, that the geometry of the connections on the make-up fluid module differs from that of the connections on the ink module. As a consequence, the ink module cannot be connected into the make-up fluid sockets, and *vice versa* but the space requirement for the make-up module is also minimised because of the horizontal engagement feature.

It will thus be appreciated that the invention allows the filters and ink to be changed without the use of tools by lower skilled operators. Further, printer downtime is reduced significantly in that the printer is shut down under the normal shut down controls: the service module is undipped and removed; a new service module is fitted, primed with new ink, and the printer is restarted under normal start up controls. The procedure can be completed in less than about 5 minutes and the operator has minimal exposure to ink and solvent fumes. Still further, the module can only be fitted in one way and therefore the opportunity to fit incorrectly or to fit the filters the wrong way round or to the wrong connection is eliminated.

Thus the invention, at least in the case of the working embodiment described, provides a neat and effective arrangement for mounting the ink and make-up fluid modules. At least in the case of the embodiment described, tube connections and other manually connectable plumbing connections between the service module and ink system are eliminated. This
5 enables replacement of the modules without the need for specialist skill and knowledge whilst minimizing the risk of spillage.

Claims

1. A continuous inkjet printer having an ink circulation system and an ink module containing ink and one or more filters, said ink module being engageable with said ink circulation system, said printer being characterized in that the connection
5 between said ink circulation system and said ink module comprises a plurality of substantially horizontally aligned, inter-engaging, sockets and spigots provided on facing surfaces of said ink circulation system and said ink module which are arranged to allow said ink module to be engaged with said ink circulation system by way of a linear, substantially horizontal, displacement.
- 10 2. A continuous inkjet printer as claimed in claim 1 wherein said spigots project from said ink module and said sockets are included in said ink circulation system.
3. A continuous inkjet printer as claimed in claim 1 or claim 2 wherein each of said spigots includes an upwardly facing fluid transfer port.
- 15 4. A continuous inkjet printer as claimed in any one of claims 1 to 3 further including a make-up fluid module engageable with said ink circulation system, said make-up fluid module having one or more spigots thereon constructed and arranged to engage in corresponding sockets in said ink circulation system wherein the arrangement of spigots on said make-up fluid module differs from the arrangement of spigots on said ink module.

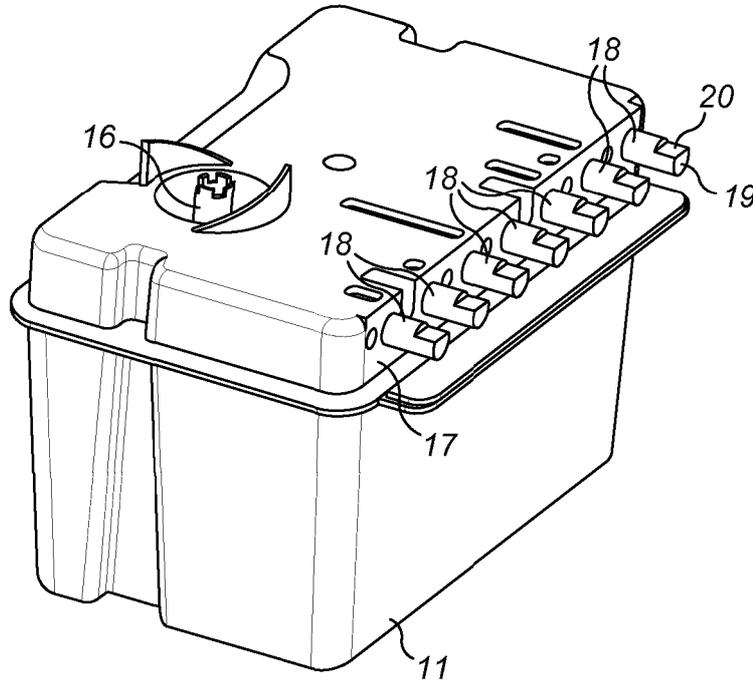


FIG. 1

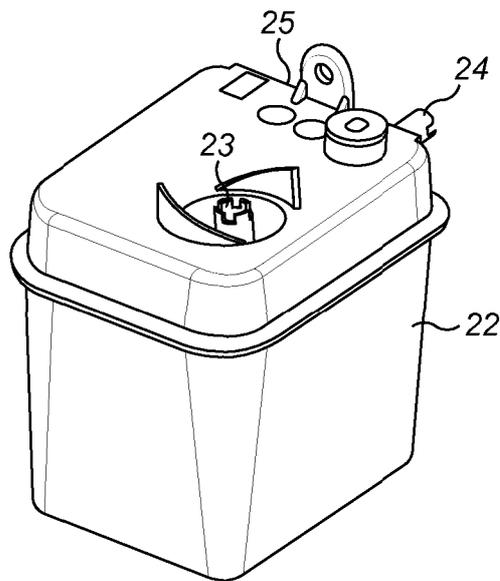


FIG. 2

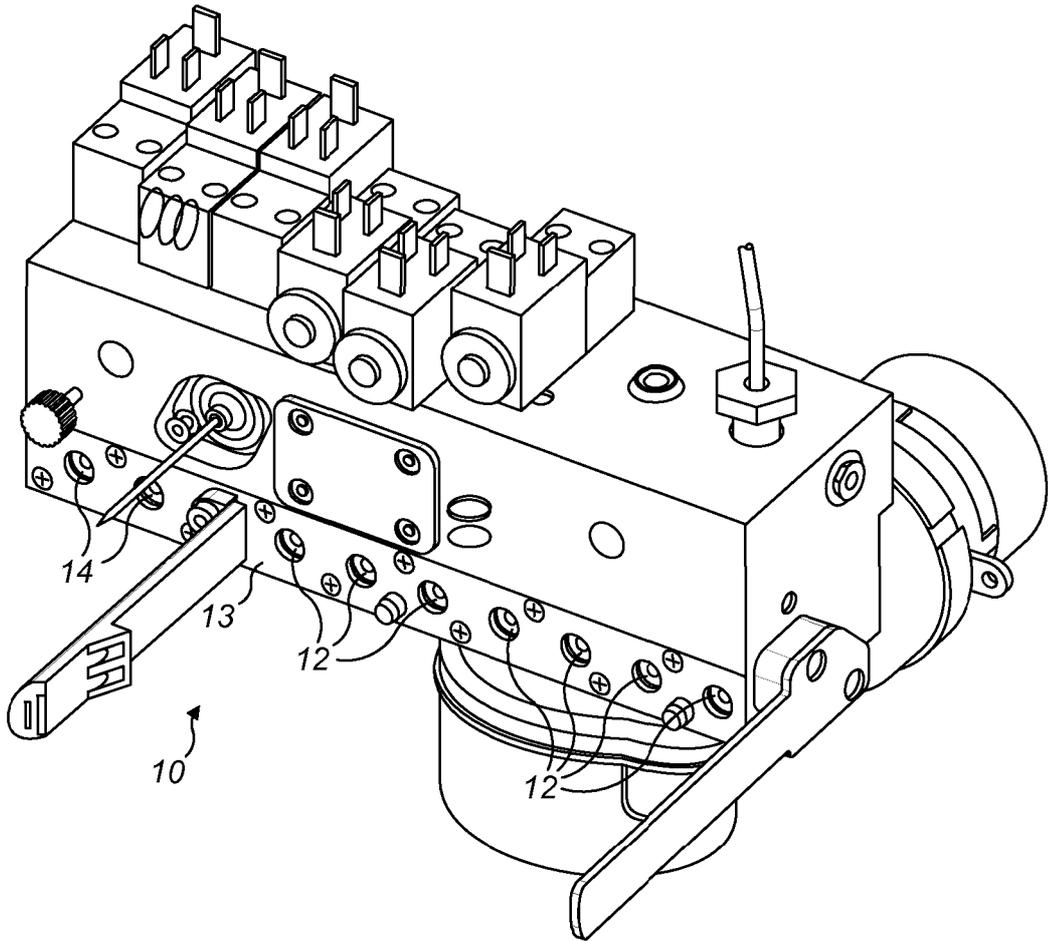


FIG. 3

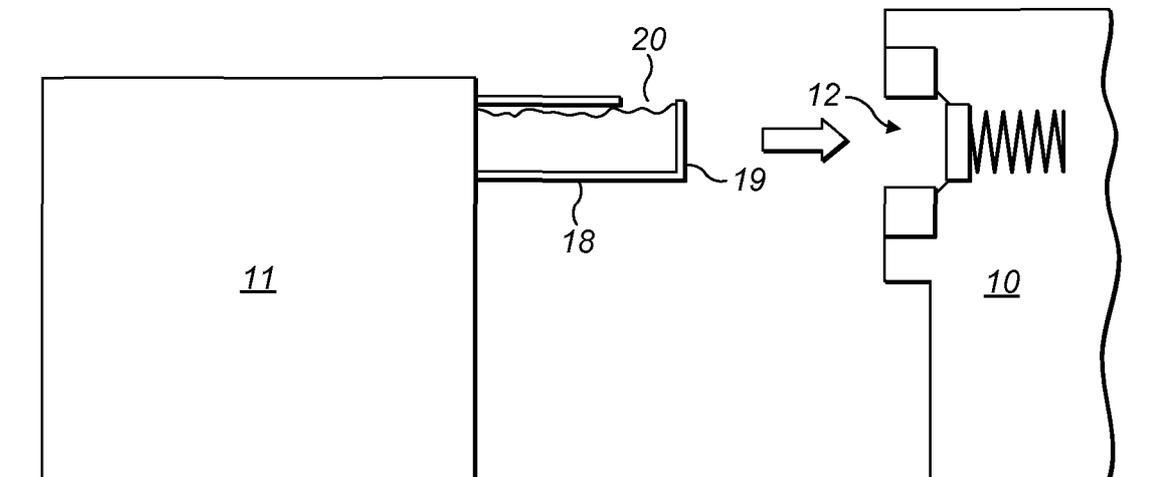


FIG. 4

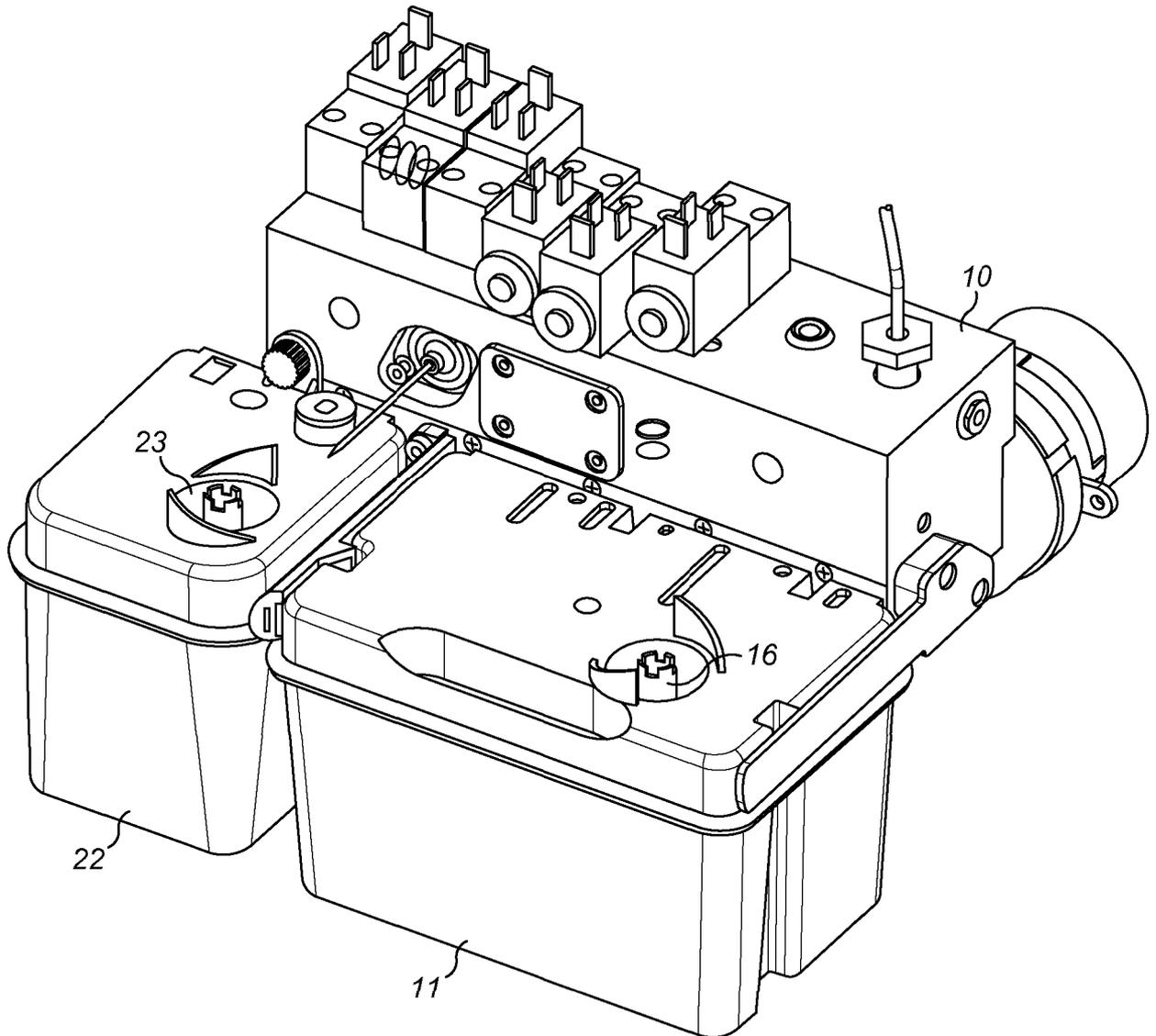


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No PCT/GB2011/052273
--

A. CLASSIFICATION OF SUBJECT MATTER
INV. B41J2/175
 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)
B41J

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 practical, search terms used)
EPO-Internal , WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	wo 2009/049146 AI (VIDEOJET TECHNOLOGIES INC [US]; TOMLIN MATTHEW [GB]; FOST IAN [GB]; PR) 16 April 2009 (2009-04-16) page 16, paragraphs 2, 3; figures 11- 13 -----	1-4
X	US 2002/024571 AI (CHILDERS WINTHROP D [US] ET AL) 28 February 2002 (2002-02-28) paragraphs [0053], [0055], [0097]; figures 2, 3, 9, 10a, 20 -----	1-4
X	EP 2 080 620 AI (SEIKO EPSON CORP [JP]) 22 July 2009 (2009-07-22) paragraph [0054]; figure 3 -----	1-4
X	US 2006/203045 AI (KOBAYASHI ATSUSHI [JP] ET AL) 14 September 2006 (2006-09-14) paragraphs [0109], [0116], [0187]; figures 9, 10 -----	1-4
-/--		

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

* Special categories of cited documents :

<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"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</p> <p>"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</p> <p>"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.</p> <p>"&" document member of the same patent family</p>
--	--

Date of the actual completion of the international search 25 January 2012	Date of mailing of the international search report 07/02/2012
---	---

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 Adam, Emmanuel
--	---

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2011/052273

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	wo 2009/089567 AI (SI LVERBROOK RES PTY LTD [AU]; HIBBARD CHRISTOPHER [AU]; DYER GEOFFREY) 23 July 2009 (2009-07-23) page 70, lines 10-15 ; figure 2b page 72, line 5 - page 73, line 17 ; figures 7, 8	1-4
X	----- us 2004/100539 AI (UJITA TOSHIHI KO [JP] ET AL) 27 May 2004 (2004-05-27) paragraph [0047] ; figure 1 -----	1,2

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2011/052273

Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
WO 2009049146	A1	16-04-2009	CN 101896357 A	24-11-2010
			EP 2200831 A1	30-06-2010
			US 2011085009 A1	14-04-2011
			WO 2009049146 A1	16-04-2009

US 2002024571	A1	28-02-2002	NONE	

EP 2080620	A1	22-07-2009	AT 511447 T	15-06-2011
			AU 2007318760 A1	15-05-2008
			CA 2669748 A1	15-05-2008
			CN 101177068 A	14-05-2008
			CN 101535053 A	16-09-2009
			CN 101535054 A	16-09-2009
			EP 2080620 A1	22-07-2009
			EP 2338685 A2	29-06-2011
			ES 2362022 T3	27-06-2011
			ES 2364291 T3	30-08-2011
			JP 2008137376 A	19-06-2008
			JP 2011235652 A	24-11-2011
			KR 20090091694 A	28-08-2009
			NZ 576676 A	29-04-2011
			RU 2009121533 A	20-12-2010
			TW 200821164 A	16-05-2008
			US 2008284810 A1	20-11-2008
			WO 2008056487 A1	15-05-2008
			ZA 200903099 A	31-03-2010

US 2006203045	A1	14-09-2006	CN 101052528 A	10-10-2007
			CN 101683789 A	31-03-2010
			CN 101774303 A	14-07-2010
			CN 102092195 A	15-06-2011
			CN 102092196 A	15-06-2011
			CN 102092197 A	15-06-2011
			CN 102092198 A	15-06-2011
			CN 102114732 A	06-07-2011
			EP 1844937 A1	17-10-2007
			EP 2383122 A2	02-11-2011
			KR 20070058629 A	08-06-2007
			KR 20090095650 A	09-09-2009
			KR 20090097195 A	15-09-2009
			SG 159513 A1	30-03-2010
			TW 1311951 B	11-07-2009
			TW 200817188 A	16-04-2008
			US 2006203045 A1	14-09-2006
			US 2009256893 A1	15-10-2009
			US 2010134574 A1	03-06-2010
			US 2011279587 A1	17-11-2011
			WO 2006082836 A1	10-08-2006

WO 2009089567	A1	23-07-2009	EP 2237960 A1	13-10-2010
			TW 200932535 A	01-08-2009
			TW 200932537 A	01-08-2009
			TW 200932538 A	01-08-2009
			TW 200932539 A	01-08-2009
			TW 200932540 A	01-08-2009
			TW 200932541 A	01-08-2009
			TW 200932542 A	01-08-2009
			TW 200932543 A	01-08-2009

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2011/052273

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		TW 200932544 A	01-08-2009
		TW 200932545 A	01-08-2009
		TW 200932546 A	01-08-2009
		TW 200932547 A	01-08-2009
		TW 200932548 A	01-08-2009
		TW 200932549 A	01-08-2009
		TW 200932550 A	01-08-2009
		TW 200932551 A	01-08-2009
		TW 200932552 A	01-08-2009
		TW 200932553 A	01-08-2009
		TW 200932554 A	01-08-2009
		TW 200932557 A	01-08-2009
		TW 200932561 A	01-08-2009
		TW 200932562 A	01-08-2009
		TW 200932563 A	01-08-2009
		TW 200932564 A	01-08-2009
		TW 200932565 A	01-08-2009
		wo 2009089567 A1	23-07-2009
US 2004100539	A1	27-05-2004	JP 2004174920 A
			US 2004100539 A1
			24-06-2004
			27-05-2004