

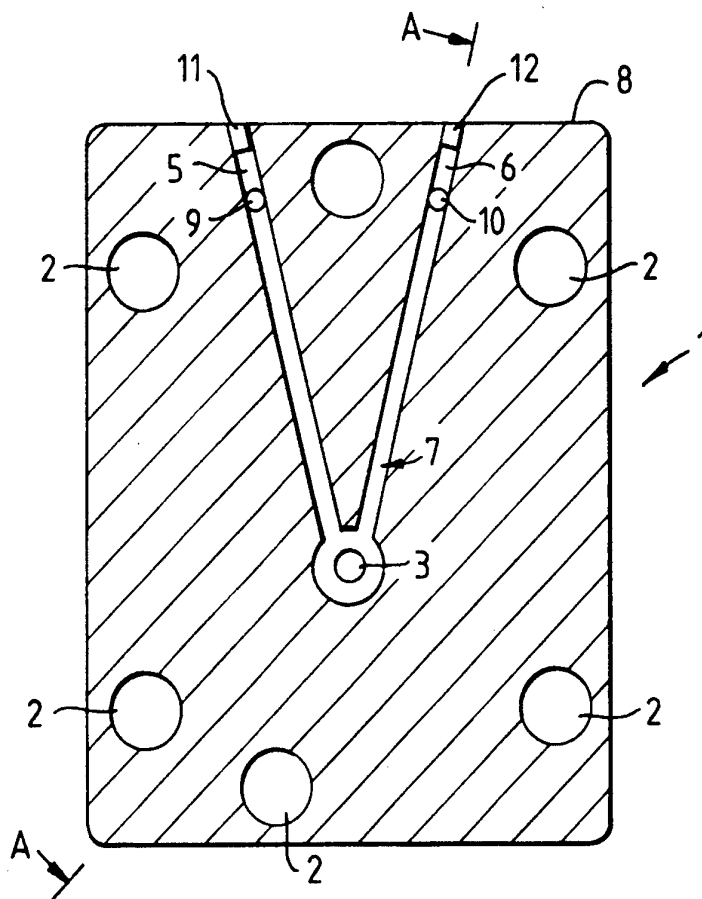


INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁵ : B41J 2/165	A1	(11) International Publication Number: WO 94/16900 (43) International Publication Date: 4 August 1994 (04.08.94)
(21) International Application Number: PCT/GB94/00143 (22) International Filing Date: 26 January 1994 (26.01.94) (30) Priority Data: 9301602.0 27 January 1993 (27.01.93) GB (71) Applicant (for all designated States except US): DOMINO PRINTING SCIENCES PLC [GB/GB]; Bar Hill, Cambridge CB3 8TU (GB). (72) Inventors; and (75) Inventors/Applicants (for US only): CHAMBERLAIN, Colin, Edward [GB/GB]; 130 Hine Way, Hitchin, Herts HT5 2SN (GB). LECHHEB, Ammar [GB/GB]; 13 Wragg Drive, Newmarket, Suffolk CB8 7SD (GB). PALMER, Danny, Charles [GB/GB]; 30 Kennedy Road, Isleham, Cambridge CB7 5SU (GB). ZABA, Jerzy [GB/GB]; 26 Bishop Way, Impington, Cambridge CB4 4LA (GB). (74) Agent: GILL JENNINGS & EVERY; Broadgate House, 7 Eldon Street, London EC2M 7LH (GB).		(81) Designated States: JP, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

(54) Title: NOZZLE PLATE FOR INK JET PRINTER**(57) Abstract**

An ink jet printer has a nozzle plate (1) which includes an orifice (3) for emitting a stream of ink. A counterbore (4) surrounds the orifice. A passage (5, 6) is provided which lies substantially in the plane of the plate and intersects the counterbore, and through which a flow of cleaning agent may be supplied to the counterbore, in order to flush ink from the surrounds of the orifice.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	GB	United Kingdom	MR	Mauritania
AU	Australia	GE	Georgia	MW	Malawi
BB	Barbados	GN	Guinea	NE	Niger
BE	Belgium	GR	Greece	NL	Netherlands
BF	Burkina Faso	HU	Hungary	NO	Norway
BG	Bulgaria	IE	Ireland	NZ	New Zealand
BJ	Benin	IT	Italy	PL	Poland
BR	Brazil	JP	Japan	PT	Portugal
BY	Belarus	KE	Kenya	RO	Romania
CA	Canada	KG	Kyrgyzstan	RU	Russian Federation
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo	KR	Republic of Korea	SE	Sweden
CH	Switzerland	KZ	Kazakhstan	SI	Slovenia
CI	Côte d'Ivoire	LI	Liechtenstein	SK	Slovakia
CM	Cameroon	LK	Sri Lanka	SN	Senegal
CN	China	LU	Luxembourg	TD	Chad
CS	Czechoslovakia	LV	Latvia	TG	Togo
CZ	Czech Republic	MC	Monaco	TJ	Tajikistan
DE	Germany	MD	Republic of Moldova	TT	Trinidad and Tobago
DK	Denmark	MG	Madagascar	UA	Ukraine
ES	Spain	ML	Mali	US	United States of America
FI	Finland	MN	Mongolia	UZ	Uzbekistan
FR	France			VN	Viet Nam
GA	Gabon				

NOZZLE PLATE FOR INK JET PRINTER

5 The present invention relates to an ink jet printer and, more particularly, a nozzle plate for an ink jet printer.

10 Ink jet printers are well known and different types (both continuous and drop-on-demand) each include a nozzle plate through or in which single or plural nozzles are formed or mounted for emission of ink. The nozzles may be formed as separate nozzle members, for example in the form of a jewel with an orifice formed therein and mounted at an aperture in the plate, or else may be formed simply as a orifice(s) in the plate. The plate forms a front or closure member on a printhead, behind which lies an ink reservoir or an ink feed channel.

15 One particular problem which occurs on shutdown of an ink jet printer is in connection with ink residues which may be left around the nozzle. These may agglomerate to cause a build-up of dried ink which may distort the jet emitted from the nozzle. It is known to wash the area of the nozzle by means of a flow of cleaning fluid, which, in the case of a solvent based ink, may be neat solvent fluid. However, this generally involves considerable wastage of solvent and is often environmentally unacceptable.

25 Accordingly, it is an object of this invention to provide a nozzle plate inherently adapted to allow nozzle washing without such difficulties and, moreover, one in which a cleaning fluid can be accurately directed to the area in which agglomerations might otherwise be built up.

30 According to the present invention there is provided a nozzle plate for an ink jet printer, the nozzle plate including an orifice for emitting a stream of ink; a counterbore surrounding the orifice; and a passage substantially in the plane of the plate and intersecting the counterbore, through which passage a flow of cleaning agent may be supplied to the counterbore, in order to flush ink from the surrounds of the orifice.

Preferably, the passage comprises a supply duct and a return duct through which solvent can be withdrawn from the counterbore area by means of a vacuum pump attached thereto. By providing a vacuum pump or the like solvent
5 wastage can be avoided whilst ensuring satisfactory cleaning of the area around the orifice when printing is stopped.

The ducts may be formed by pairs of channels (preferably V-shaped) formed in opposed halves of a
10 composite, two-layer, plate, but, preferably, are formed by wire electro-discharge machining.

Two examples of nozzle plates according to the invention, will now be described with reference to the accompanying drawings, in which:-

15 Figure 1 is a planar sectional view (on B-B of figure 2) through a first plate;

Figure 2 is a cross-sectional view (on A-A of figure 1) of the same plate;

Figure 3 is a planar sectional view of a second plate;
20 and,

Figure 4 is a planar sectional view of a third plate.

The nozzle plate 1 of figures 1 & 2 comprises a thin stainless steel plate having a number of fixing holes 2 and a central, circular, single ink jet nozzle formed by an
25 orifice 3. Bolts (not shown) are used to bolt the plate to the front of a printhead (not shown).

Around the ink jet nozzle orifice 3, on the outer surface of the plate, a counterbore 4 is formed of larger diameter than the orifice 3.

30 In the central plane of the plate 1 there are formed (by electro-discharge forming in this example) a pair of passageways 5,6 which form a substantially V-shaped passage 7 for ink solvent or other suitable cleaning agent fluid. Each of the passages 5,6 extends from an edge 8 of the
35 nozzle plate to the counterbore 4 and intersects with it. A cleaning fluid inlet 9 and outlet 10 are formed to and from the respective passages 5,6, through the plate 1 as

shown. The inlet and outlet extend from the opposite side of the plate to that from which the nozzle emits the stream of ink in use, so that they can be connected to suitable supply and return passages (not shown) in the printhead.

5 To complete the formation of the plate a closure plug 11,12 is inserted as a sealing fit into the open end of each passage 5,6.

In use solvent or other fluid cleaning agent can be supplied through one passage (say 5) to the counterbore 4,
10 at which point it swirls around the counterbore adjacent to the edge of the nozzle orifice 3, in order to clean the orifice after printing is halted, before being removed through the other passage (say 6). Fluid tension may serve to retain the cleaning fluid in the counterbore before it
15 leaves through the passage 6 carrying with it dried ink particles removed from the surfaces around the orifice.

Figures 3 and 4 illustrate respective nozzle plates 100,110 having multiple orifices 30 and cleaning fluid passages 50,60, 51,61 which are arranged as in figure 1
20 (figure 2 example) or in alignment across the counterbore (figure 3 example).

Cleaning fluid may be supplied from beneath the nozzle through suitable passages formed in the printhead onto which the the plate is attached for use. Suitable seals
25 are provided around the edge of the nozzle plate and individual O-ring type seals may be provided around the inlet and outlet passages 9,10.

CLAIMS

1. A nozzle plate (1) for an ink jet printer, the nozzle plate including an orifice (3) for emitting a stream of ink; a counterbore (4) surrounding the orifice; and a passage (5,6) substantially in the plane of the plate and intersecting the counterbore, through which passage a flow of cleaning agent may be supplied to the counterbore, in order to flush ink from the surrounds of the orifice.
2. A nozzle plate (1) according to claim 1, wherein the passage (5,6) comprises a supply duct (5) and a return duct (6) through which solvent can be withdrawn from the counterbore area by means of a vacuum pump attached thereto.
3. A nozzle plate (1) according to claim 2, wherein the ducts (5,6) are formed by pairs of channels formed in opposed halves of a composite, two layer, plate.
4. A nozzle plate (1) according to claim 2, wherein the ducts (5,6) are formed by wire electro-discharge machining.
5. A nozzle plate (1) according to claim 2, claim 3 or claim 4, wherein the ducts (5,6) are pairs of V-shaped channels.

1/2

Fig.1.

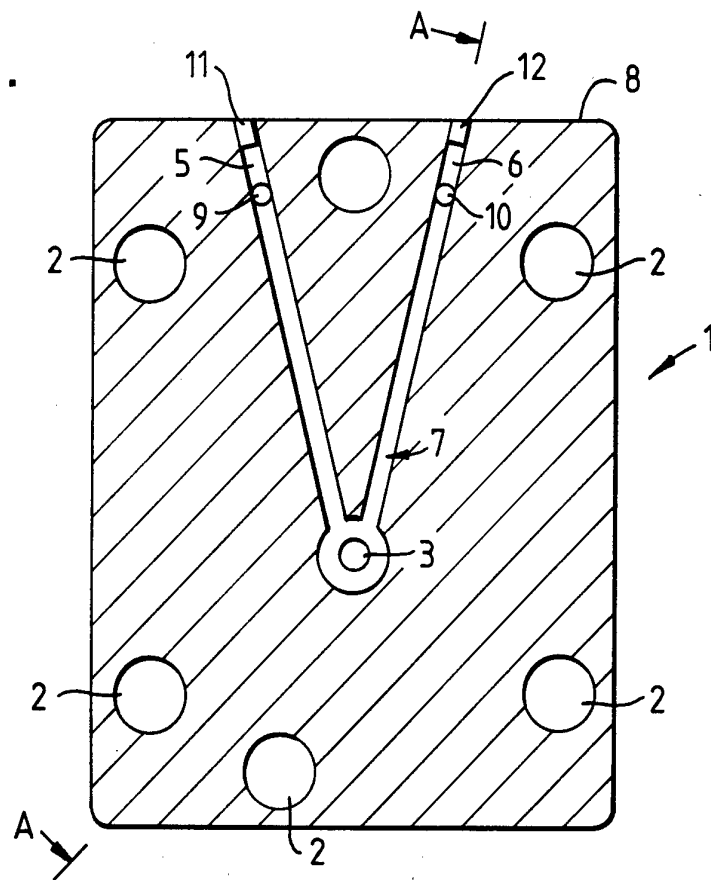


Fig.2.

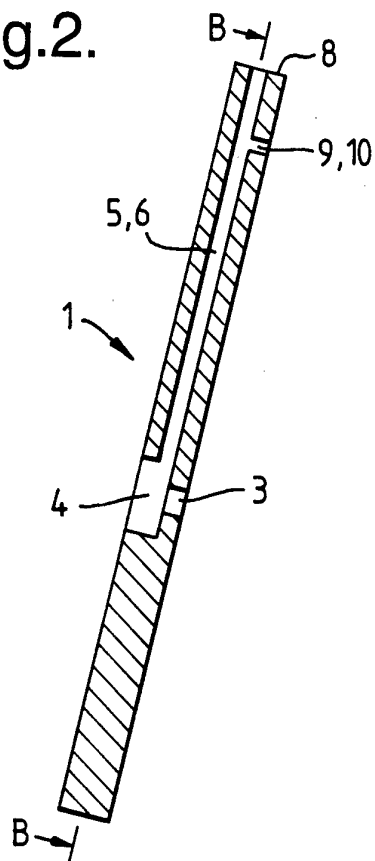
**SUBSTITUTE SHEET**

Fig.3.

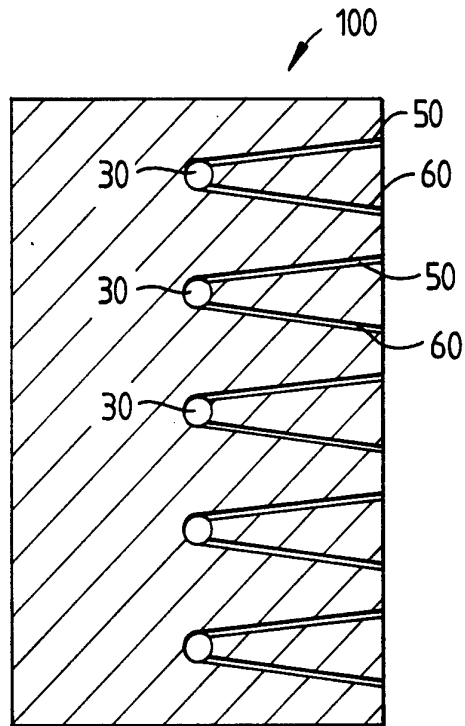
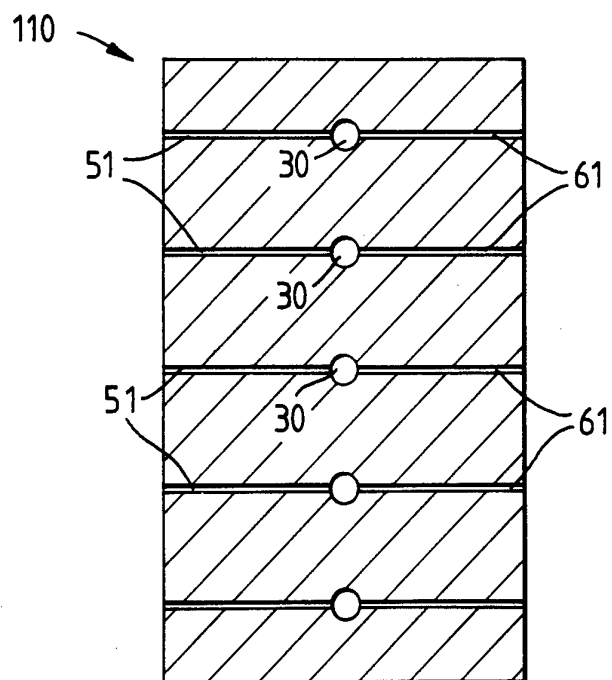


Fig.4.



A. CLASSIFICATION OF SUBJECT MATTER
IPC 5 B41J2/165

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 5 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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 11, no. 296 (M-627) (2743) 25 September 1987 & JP,A,62 090 252 (SANYO ELECTRIC CO LTD) 24 April 1987 see abstract	1
X	PATENT ABSTRACTS OF JAPAN vol. 5, no. 101 (M-76) (773) 30 June 1981 & JP,A,56 044 667 (SUWA SEIKOSHA K.K.) 23 April 1981 see abstract	1

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in 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 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

30 March 1994

Date of mailing of the international search report

30. 05. 94

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl,
Fax (+ 31-70) 340-3016

Authorized officer

Joosting, T

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 94/00143

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 12, no. 374 (M-749) (3221) 6 October 1988 & JP,A,63 125 342 (MATSUSHITA ELECTRIC IND CO LTD) 28 May 1988 see abstract	1
A	----- US,A,4 007 465 (CHAUDHARY) 8 February 1977 see the whole document -----	2,3

INTERNATIONAL SEARCH REPORT

information on patent family members

International Application No

PCT/GB 94/00143

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A-4007465	08-02-77	AU-B- 501713	28-06-79
		AU-A- 1968976	25-05-78
		BE-A- 847364	31-01-77
		CA-A- 1087674	14-10-80
		CH-A- 596992	31-03-78
		DE-A, B, C 2648079	18-05-77
		FR-A, B 2331383	10-06-77
		GB-A- 1551990	05-09-79
		JP-C- 1037438	24-03-81
		JP-A- 52062024	23-05-77
		JP-B- 55028868	30-07-80
		NL-A- 7612221	20-05-77
		SE-B- 418911	29-06-81
		SE-A- 7612588	18-05-77
