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(54) **Top feed droplet generator**

Oberseitig gespeister Tröpfchengenerator

Générateur de gouttelettes à alimentaion par le haut

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(56) References cited:
EP-A- 0 624 469
US-A- 4 284 993
US-A- 4 746 929
US-A- 4 780 728
US-A- 4 827 287
US-A- 4 937 589

EP 0 805 036 B1

Description

Technical Field

[0001] The present invention relates to continuous ink jet printers and, more particularly, to a droplet generator for a continuous ink jet printer, the drop generator having an integral fluid cavity.

Background Art

[0002] Ink jet printing systems are known in which a print head defines one or more rows of orifices which receive an electrically conductive recording fluid, such as for instance a water base ink, from a pressurized fluid supply manifold and eject the fluid in rows of parallel streams. Printers using such print heads accomplish graphic reproduction by selectively charging and deflecting the drops in each of the streams and depositing at least some of the drops on a print receiving medium, while others of the drops strike a drop catcher device.

[0003] Droplet generators are one of the major components in a continuous ink jet printhead. Droplet generators often uses a nozzle plate attached to a resonant body to stimulate the jets. Several different methods are currently in practice to supply fluid to the nozzle plate. One known method includes fluid passages originating at the nodal line of the resonant body, with internal cavities leading to the nozzle plate. Another known method teaches that the fluid ingress can be achieved by feeding ink toward the same end of the nozzle plate, thus eliminating the longer internal cavities required with a nodal line feed droplet generator. This latter method is referred to as a bottom front feed droplet generator. As a variation of that concept, it is known that fluid can be fed from the side, as opposed to the front.

[0004] In all cases, additional space is required to provide a means to get the fluid to those inlet and outlet points. In the case of the side feed, this is especially undesirable because this increases the amount of space required perpendicular to the typical flow of the print media relative to a jet array printhead. A second drawback of current methods is that, in some cases, asymmetric modes of vibration may occur very near the desired mode. In particular, a shear type mode can exist across the narrow dimension of the body, parallel to the nozzle array. The damaging effect can be that each side of nozzle will experience out of phase excitation, thus destroying the desired uniform oscillations. These asymmetric modes generally will not occur unless the body is unsymmetrical or it is driven unsymmetrically. In particular, the front feed design could provide the means to excite the unwanted asymmetric mode.

[0005] It is seen then that there is a need for a droplet generator and the associated fluid cavity which reduces the space requirement while overcoming the problems associated with prior art drop generator designs.

[0006] This need is met by the droplet generator according to the present invention, wherein the droplet generator utilizes a resonant body configuration that minimizes space requirements for an ink jet printhead.

[0007] EP-A-0624469 discloses a droplet generator assembly for an ink jet printhead of a continuous ink jet printer, the droplet generator assembly having a resonator body, the assembly comprising a nozzle plate on a first side of the resonator body, the nozzle plate having associated nozzles to stimulate jets; a fluid ingress location and a fluid egress location; a fluid passage extending from the fluid ingress location to the fluid egress location; and a fluid trench to redirect flow from the fluid passage to a direction in-line with the nozzles.

[0008] The invention is characterised in that the fluid ingress location and the fluid egress location each comprise a location on a second side of the resonator body, opposite the first side of the resonator body, and the fluid passage from the ingress point to the fluid trench is not located directly above the fluid trench.

[0009] The droplet generator assembly according to the present invention provides a variety of advantages. First, the droplet generator utilizes a resonant body configuration. In addition, the droplet generator provides fluid ingress and egress on the side opposite the nozzle plate. This, in turn, provides the advantage of minimizing space requirements for an ink jet printhead.

[0010] Other objects and advantages of the invention will be apparent from the following description, the accompanying drawings and the appended claims. The invention will now be described in more detail and by way of example only, with reference to the accompanying drawings, in which:

Fig. 1A is an exploded view of the components of the droplet generator assembly of the present invention; and
Fig. 1B is a view along line B-B of Fig. 1A.

[0011] The present invention provides a droplet generator for an ink jet printhead. The droplet generator according to the present invention has an integral fluid cavity wherein fluid ingress and egress to and from the resonator body is on a second side of the resonator body opposite the nozzle plate which is on a first side of the resonator body, i.e., a top feed resonator. Of course, with ink jet printing systems, the goal is to get fluid into the resonator body and down to the nozzle plate. Existing top and front feed resonators do this very efficiently, but require external fluid tubing to the ingress and egress points. The external tubing is required by prior art systems because fluid tubing is typically routed to a point above the drop generator, as opposed to its sides, for space economy reasons. In accordance with the present invention, the top feed resonator has incorporated prior external fluid tubing into the fluid passages internal to the resonator body. This has the desirable effect of minimizing space requirements for an ink jet printhead.

[0012] Referring now to the drawings, in Figs. 1A and 1B there are illustrated the components of the droplet generator assembly according to the present invention. A droplet generator 1 comprises fluid ingress and egress on a surface 7 opposite nozzle plate 2. A counterbore 3 feature permits an effective means to secure fittings 6 to the droplet generator 1. A fluid passage 4 allows fluid to travel from an ingress point 8 down to the nozzle plate 2 and fluid trench 5. Narrow fluid trench 5 redirects fluid flow from the fluid passage 4 to an in-line direction with the nozzles associated with nozzle plate 2. The fluid passage 4 is located substantially along a centerline of the resonator body. Since the fluid passage 4 from the ingress point 8 to fluid trench 5 is not directly above fluid trench 5, this avoids fluid resonances directly between the nozzle plate 2 and the fluid passage 4.

[0013] The fluid passage 4 follows a 'U' shaped path through the resonator, as best illustrated in Fig. 1B. The narrow fluid trench 5 intersects the fluid passage 4 perpendicular to the flow. Fluid flow in passage 4 is in the direction of arrows 10; whereas fluid flow in the trench 5 is in the perpendicular direction, as indicated by arrows 11. Hence, trench 5 redirects fluid flow from the fluid passage 4 in the direction of arrows 10, to a direction 11 in-line with the nozzles, as indicated by arrows 12.

[0014] There are two modes of operation which can allow two different egress points. The first is what is referred to as crossflush mode, where fluid enters the resonator at the ingress point 8, follows the entire fluid passage 4, and exits at the egress point 9. In this mode, some fluid may flow into the narrow fluid trench 5 and weep out of the nozzles. The second mode is where a valve external to the resonator and downstream from the egress point may be selectively closed and substantially halt fluid flow from the egress point 9. In this mode, the nozzle plate is the only other passage for fluid to flow and have a much greater resistance to flow than the egress point. Also, greater fluid pressure is established within the resonator and jets are established through the nozzles.

Industrial Applicability and Advantages

[0015] The droplet generator assembly according to the present invention is useful in continuous ink jet printers. The droplet generator utilizes a resonant body configuration. In addition, the droplet generator provides fluid ingress and egress on the side opposite the nozzle plate. This, in turn, provides the advantage of minimizing space requirements for an ink jet printhead.

[0016] Having described the invention in detail and by reference to the preferred embodiment thereof, it will be apparent that other modifications and variations are possible without departing from the scope of the invention defined in the appended claims.

Claims

1. A droplet generator assembly for an ink jet printhead of a continuous ink jet printer, the droplet generator assembly having a resonator body, the assembly comprising:

   a nozzle plate (2) on a first side of the resonator body, the nozzle plate having associated nozzles to stimulate jets;
   a fluid ingress location (8) and a fluid egress location (9);
   a fluid passage (4) extending from the fluid ingress location (8) to the fluid egress location (9);
   a fluid trench (5) to redirect flow from the fluid passage (4) to a direction in-line with the nozzles;

   characterised in that the fluid ingress location (8) and the fluid egress location (9) each comprise a location on a second side of the resonator body, opposite the first side of the resonator body, and the fluid passage (4) from the ingress point to the fluid trench (5) is not located directly above the fluid trench (5).

2. A droplet generator assembly as claimed in claim 1 wherein the fluid passage (4) comprises a U-shaped fluid passage.

3. A droplet generator assembly as claimed in claim 1 or 2, wherein the fluid passage (4) is located substantially along a centre-line of the resonator body.

Patentansprüche

1. Ein Tröpfchen-Generatoraufbau für einen Tintenstrahldruckkopf eines kontinuierlichen Tintenstrahldruckers, bei dem der Tröpfchen-Generatoraufbau einen Resonanzkörper aufweist und der Aufbau umfasst:

   eine Düsenplatte (2) auf einer ersten Seite des Resonanzkörpers, wobei die Düsenplatte zugehörige Düsen zur Erzeugung von Strahlen aufweist;
   einen Flüssigkeitseintrittsort (8) und einen Flüssigkeitsaustrittsort (9);
   einen Flüssigkeitskanal (4), welcher sich vom Flüssigkeitseintrittsort (8) zum Flüssigkeitsaustrittsort (9) erstreckt;
   einen Flüssigkeitsgraben (5) um Fluss von dem Flüssigkeitskanal (4) in eine Richtung in Reihe mit den Düsen rückzuführen;

   dadurch gekennzeichnet, dass der Flüssig-

keitseintrittsort (8) und der Flüssigkeitsaustrittsort (9) jeweils einen Ort auf der zweiten Seite des Resonanzkörpers, der ersten Seite des Resonanzkörpers gegenüberliegend, umfassen, und der Flüssigkeitskanal (4) vom Eintrittspunkt zu dem Flüssigkeitsgraben (5) nicht direkt über dem Flüssigkeitsgraben (5) angeordnet ist.

2. Tröpfchen-Generatoraufbau nach Anspruch 1, worin der Flüssigkeitskanal (4) einen U-förmigen Flüssigkeitskanal enthält.

3. Tröpfchen-Generatoraufbau nach Anspruch 1 oder 2, worin der Flüssigkeitskanal (4) im Wesentlichen entlang einer Mittellinie des Resonanzkörpers angeordnet ist.

Revendications

1. Ensemble générateur de gouttelettes pour une tête d'impression à jet d'encre d'une imprimante à jet d'encre en continu, ensemble générateur de gouttelettes comprenant un corps de résonateur, l'ensemble comprenant :

- une plaque de buses (2) sur un premier côté du corps de résonateur, la plaque de buses possédant des buses associées pour activer des jets ;
- une position d'entrée de fluide (8) et une position de sortie de fluide (9) ;
- un passage de fluide (4) s'étendant de la position d'entrée de fluide (8) à la position de sortie de fluide (9) ;
- une tranchée de fluide (5) pour rediriger l'écoulement du passage de fluide (4) vers une direction en ligne avec les buses ;

caractérisé en ce que la position d'entrée de fluide (8) et la position de sortie de fluide (9) comprennent chacune un emplacement sur un second côté du corps de résonateur, opposé au premier côté du corps de résonateur, et le passage de fluide (4) du point d'entrée à la tranchée de fluide (5) n'est pas directement situé au-dessus de la tranchée de fluide (5).

2. Ensemble générateur de gouttelettes selon la revendication 1, dans lequel le passage de fluide (4) comprend un passage de fluide en forme de U.

3. Ensemble générateur de gouttelettes selon la revendication 1 ou 2, dans lequel le passage de fluide (4) est situé sensiblement le long d'un axe central du corps de résonateur.

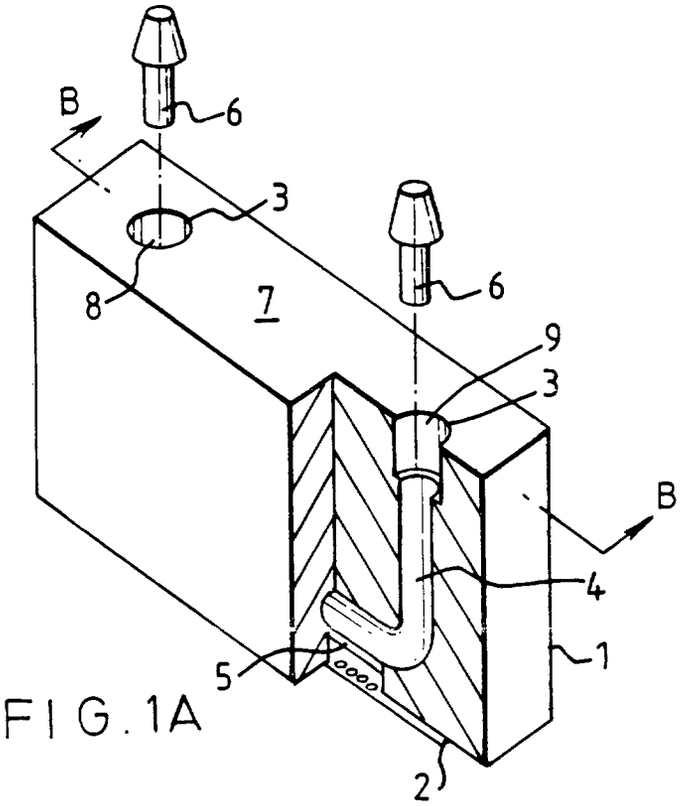

FIG. 1A

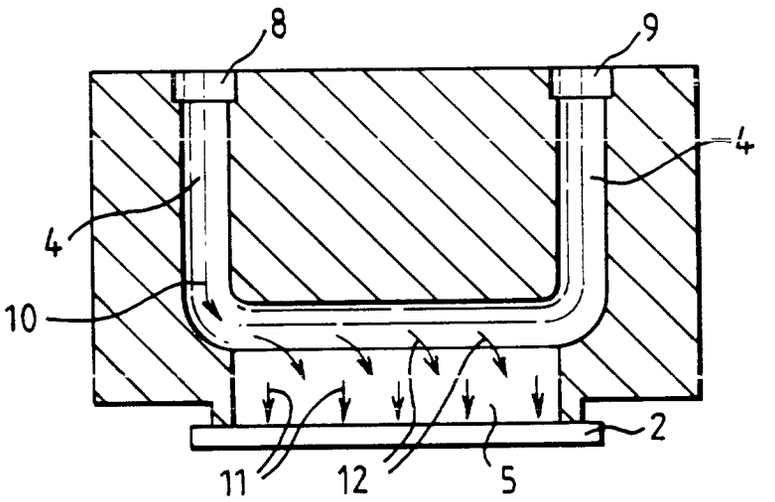

FIG. 1B