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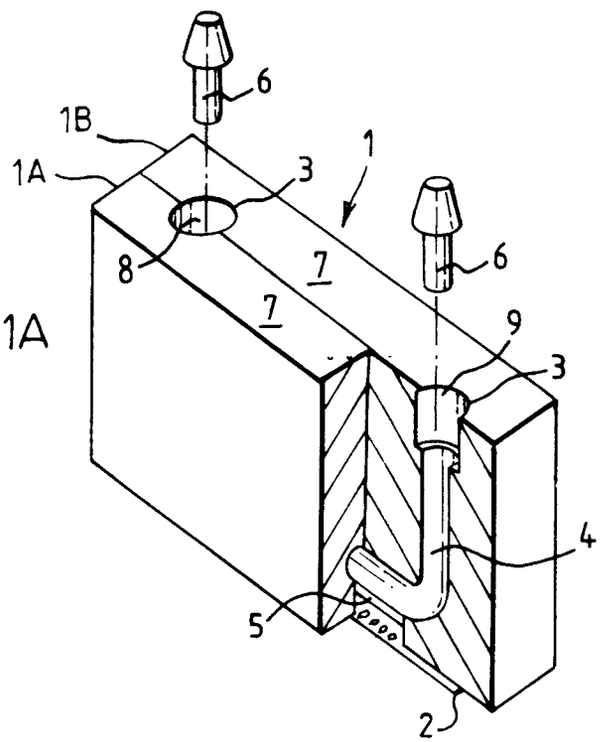
(54) Brazing process for a continuous ink jet printhead

(57) A brazing process is provided for joining machined resonator portions (1A,1B) to yield a single resonator body (1) for a continuous ink jet printhead. A first resonator body portion (1A) and a second resonator body portion (1B) are provided, each resonator portion having partial fluid ingress (8), fluid egress (9), and nozzle plate (2) channel fluid cavities. A braze preform is then insertable between the first and second resonator body portions to join the first and second resonator body portions. Alignment pins secure and align the first resonator body portion (1A) to the second resonator body portion (1B).

FIG.1A



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Description

Technical Field

The present invention relates to continuous ink jet printers and, more particularly, to a brazing process for joining machined resonator portions to yield a single resonator body for a continuous ink jet printhead.

Background Art

Ink jet printing systems are known in which a printhead defines one or more rows of orifices which receive an electrically conductive recording fluid from a pressurized fluid supply manifold and eject the fluid in rows of parallel streams. Printers using such printheads 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.

Droplet generators are one of the major components in a continuous ink jet printhead. Droplet generators often use a nozzle plate attached to a resonant body to stimulate the jets. In a resonator body design where the inlet and outlet ports are not directly in line with the nozzle plate channel, machining from a solid metal block is essentially impossible.

It is seen then that it would be desirable to eliminate the problems associated with the prior art resonator body design by providing a resonator body design which is particularly useful where the inlet and outlet ports are not directly in line with the nozzle plate channel.

Summary of the Invention

This need is met by the system according to the present invention, wherein the resonator body of a continuous ink jet printhead is fabricated from two precision machined halves which are brazed together in a process to yield an integral unit. The integral unit comprises the inlet and outlet fluid ports as well as the fluid channel which directs the fluid into the bonded nozzle plate.

In accordance with one aspect of the present invention, a brazing process is provided for joining machined resonator portions to yield a single resonator body for a continuous ink jet printhead. A first resonator body portion and a second resonator body portion are provided, each resonator portion having partial fluid ingress, fluid egress, and nozzle plate channel fluid cavities. A braze preform is then insertable between the first and second resonator body portions to join the first and second resonator body portions. Alignment pins secure and align the first resonator body portion to the second resonator body portion.

Accordingly, it is an object of the present invention to yield a single resonator body for a continuous ink jet printhead. It is a further object of the present invention to provide a resonator body design where the inlet and outlet ports are not directly in line with the nozzle plate channel. It is an advantage of the present invention that it provides a viable resonator body design which addresses the packaging constraints of some printheads.

Other objects and advantages of the invention will be apparent from the following description, the accompanying drawings and the appended claims.

Brief Description of the Drawings

Fig. 1A is a partially cutaway view illustrating two joined halves forming a resonator body in accordance with the present invention;

Fig. 1B is a view along section line B-B of Fig. 1A;

Fig. 2 illustrates a brazed foil-resonator preform used to braze the two resonator halves into the single resonator body of Fig. 1A; and

Fig. 3 is a side view of a brazing alignment pin used in the joining of the two resonator halves.

Detailed Description of the Preferred Embodiments

The present invention provides brazing process whereby two machined resonator halves are brazed together in a manner that yields a single resonator body for a continuous ink jet printhead. In co-pending, commonly assigned patent application Serial No. 08/640,180 (docket number SDP163PA), totally incorporated herein by reference, a top feed droplet generator assembly is disclosed, which has an integral fluid cavity wherein fluid ingress and egress to and from the resonator body is on the side of the resonator body opposite the nozzle plate. The brazing process according to the present invention is particularly useful when used to join two resonator halves into the top feed droplet generator described and claimed in co-pending, commonly assigned patent application Serial No. 08/640,180 (docket number SDP163PA).

Referring now to the drawings, in Fig. 1A there is illustrated a partially cutaway view of two resonator halves joined to form a resonator body in accordance with the present invention; and in Fig. 1B there is illustrated a front section view of one of the resonator halves. The resonator is a top feed resonator, wherein inlet and outlet ports are located at the top of the resonator body and communicate with a nozzle plate channel located at the bottom of the resonator body.

Resonator 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. A narrow fluid trench 5 redirects fluid flow from the fluid passage 4 to an in-line direction with the nozzles (not shown) associated with nozzle plate 2. Since fluid passage 4 is not directly in line with the nozzle plate channel, machining from a solid metal block is imprac-

tical and, essentially, impossible.

To provide such a design using machining, the present invention proposes a two piece resonator design, wherein two pieces 1A and 1B are brazed together to form a single resonator. Each symmetrically machined portion 1A and 1B preferably comprises half of inlet 8, outlet 9 and nozzle plate 2 channel fluid cavity. For a continuous ink jet printhead design, the resonator body 1 is fabricated from the two precision machined portions 1A and 1B which are brazed together to yield an integral unit. The integral unit comprises the inlet 8 and outlet 9 fluid ports and the fluid channel 4 which directs the fluid into the bonded nozzle plate 2. After brazing, a complete resonator body 1 with properly sized fluid channels is achieved.

In the prior art, such as a one inch, 120 drops per inch ink jet printer resonator body, the fluid channels can be machined in one portion of the resonator body, with the second resonator portion being a solid cover. A rectangular braze foil material without fluid channel cutouts was placed between the two halves, with the fluid cavity half being placed on top to avoid flow of the braze foil into the fluid channels.

In a one inch, 240 drops per inch printing system, each resonator portion 1A and 1B comprises part of the inlet 8, the outlet 9 and the nozzle plate 2 channel fluid cavity. With two fluid channel symmetrical halves, there is a greater chance for thin, rectangular braze foil to flow into the fluid channels, especially if a solid braze foil, i. e., one without fluid channel cutouts, is used.

Braze material in the fluid cavities is undesirable for several reasons. One, braze material that has melted and solidified presents a rough, almost grit blasted appearance, which can be a source of fluid flow disturbances and can create sites for air bubble attachment. Either of these problems can severely affect the resonator body performance. Also, the added nonsymmetrical mass due to the excess braze foil in one of the portions 1A or 1B may be another source of poor resonator body performance.

In an effort to greatly reduce the amount of braze material which can flow into the fluid channels, a braze foil preform 10, as shown in Fig. 2, is used. By the proper, standard mechanical use of brazing alignment pins 11, as illustrated in Fig. 3, insertable into apertures 12 of Fig. 2, the two portions 1A and 1B can be accurately aligned. In a preferred embodiment of the present invention, the pins 11 are machined from round stock and have break edges 14 at each end, to provide relief for ease of insertion into apertures 12. Preferably, one of the resonator sections 1A or 1B, has alignment apertures designed for a press fit; while the other resonator portion 1B or 1A, has alignment apertures designed for a slip fit.

The braze preform 10 of the present invention comprises fluid channel cutout 13. The preform shape allows for 5 to 15 mils of overhang into the fluid channels for tolerancing and to ensure adequate braze coverage at the melt temperature. With the insertion of the braze preform 10, the resulting resonator body 1 minimizes braze material in the fluid channels as the preform melts when the braze temperature is applied. This reduces poor resonator performance attributed to the existence of braze material. In a preferred embodiment of the present invention, the pins 11 are of the same material as the resonator portions 1A and 1B, to eliminate differences in thermal expansion at the braze temperature. If thermal expansion rates differ between the pin 11 and the resonator portions 1A and 1B, the upper resonator portions would "hang" up, when the upper resonator portion is actually required to float during the brazing process to obtain perfect braze integrity.

Industrial Applicability and Advantages

The present invention is useful in the field of ink jet printing, and has the advantage of addressing packaging constraints of certain printheads. The present invention provides the further advantage of providing an integral resonator body by brazing two separate resonator body portions. Finally, the present invention provides the advantage of minimizing braze material in the fluid channels.

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 resonator for an ink jet printhead of a continuous ink jet printer, the resonator comprising:

   a first resonator body portion and a second resonator body portion, the first and second resonator body portions each having partial fluid ingress, fluid egress, and nozzle plate channel fluid cavities;
   a braze preform insertable between the first and second resonator body portions to join the first and second resonator body portions; and
   at least one alignment pin for securably aligning the first resonator body portion to the second resonator body portion to form a single resonator body.

2. A resonator for an ink jet printhead as claimed in claim 1 wherein the first and second resonator body portions each comprise one half of the single resonator body.

3. A resonator for an ink jet printhead as claimed in claim 1 wherein the at least one alignment pin is machined from round stock.

4. A resonator for an ink jet printhead as claimed in claim 1 wherein the at least one alignment pin has break edges at each end.

5. A resonator for an ink jet printhead as claimed in claim 1 wherein the at least one alignment pin comprises a first alignment pin and a second alignment pin.

6. A resonator for an ink jet printhead as claimed in claim 1 wherein the at least one alignment pin is comprised of a material identical in thermal expansion to that of the first and second resonator body portions.

7. A resonator for an ink jet printhead as claimed in claim 1 wherein the braze preform comprises a fluid channel cutout section.

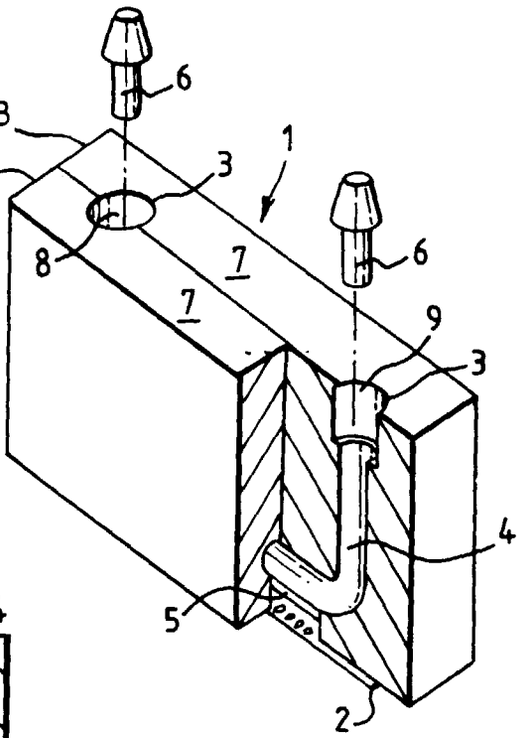

FIG.1A

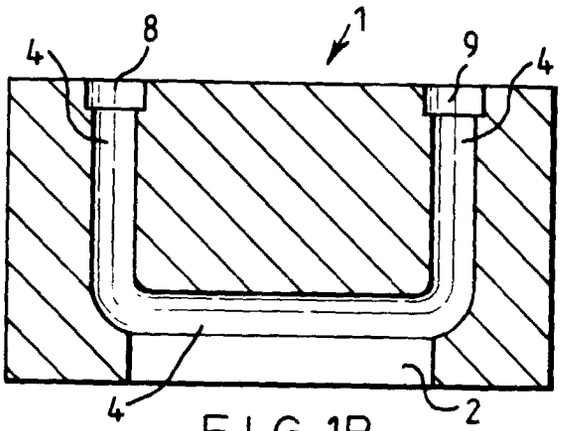

FIG.1B

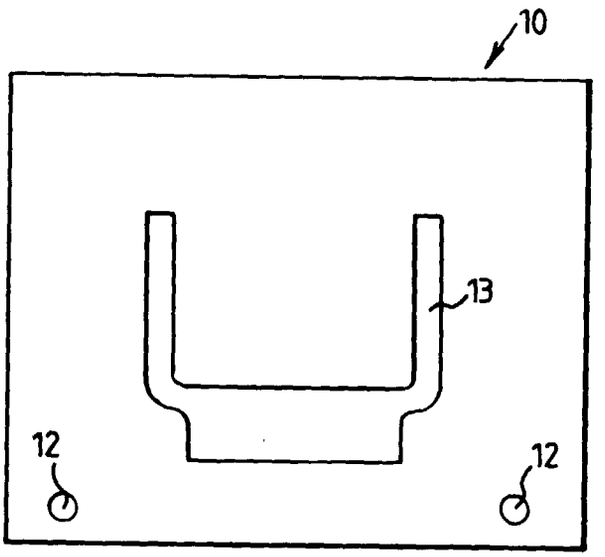

FIG.2

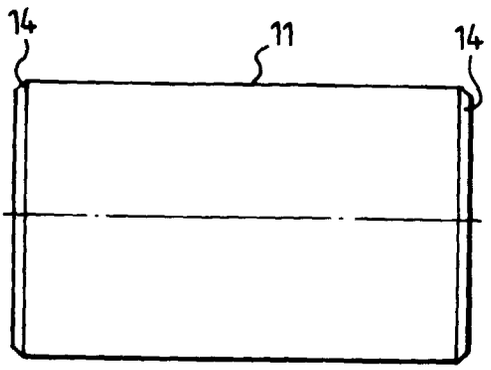

FIG.3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 30 2688

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	US 4 032 928 A (WHITE JOHN T ET AL) 28 June 1977 * the whole document *	1	B41J2/025 B41J2/16
A	US 4 135 197 A (STONEBURNER LEONARD G) 16 January 1979 * figures 1,2 *	1	
A	PATENT ABSTRACTS OF JAPAN vol. 008, no. 276 (M-346), 18 December 1984 & JP 59 146860 A (MATSUSHITA DENKI SANGYO KK), 22 August 1984, * abstract *	1	
A	EP 0 051 132 A (IBM) 12 May 1982 * abstract * * page 9, paragraph 2 - page 10, paragraph 2; figure 2 *	1	
A	EP 0 624 469 A (SCITEX DIGITAL PRINTING INC) 17 November 1994 * abstract * * column 2, line 53 - column 3, line 31; figure 1 *	1	TECHNICAL FIELDS SEARCHED (Int.Cl.6) B41J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	22 August 1997	Nielsen, M

CATEGORY OF CITED DOCUMENTS

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