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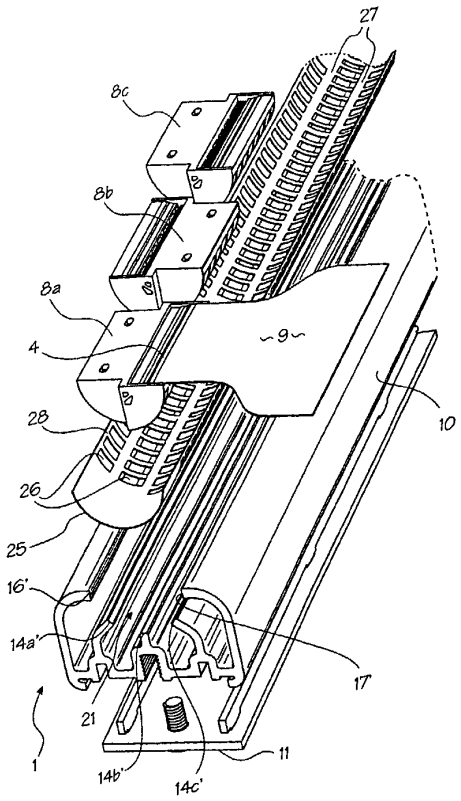
(54) Title: PRINTHEAD SUPPORT STRUCTURE AND ASSEMBLY



(57) Abstract: An inkjet printhead assembly (1) includes a hollow elongate member (10) having at least one ink supply channel (14) formed therein, the or each ink supply channel (14) being in fluid communication with an elongate slot (21) in and extending at least partly along the elongate member (10). A plurality of printhead segment carriers (8) is received and secured in neighbouring arrangement within the slot (21), and at least one printhead segment (4) is mounted to each printhead segment carrier (8). Each printhead segment carrier (8) includes at least one ink gallery (92) arranged so as to connect the or an associated one of said ink supply channels (14) with an ink inlet (41) of the at least one printhead segment (4) mounted to that printhead segment carrier (8). The inkjet printhead segments (4) are both conveniently supported in the elongate member (10) and supplied with ink, and their printing ranges may overlap longitudinally.

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PRINTHEAD SUPPORT STRUCTURE AND ASSEMBLY

Field of the Invention

This invention relates to the field of ink jet printing systems, and more specifically to a support structure and ink supply arrangement for a printhead assembly and such printhead assemblies for ink jet printing systems.

Description of the Prior Art

Micro-electromechanical systems ("MEMS"), fabricated using standard VLSI semi-conductor chip fabrication techniques, are becoming increasingly popular as new applications are developed. Such devices are becoming widely used for sensing (for example accelerometers for automotive airbags), inkjet printing, micro-fluidics, and other applications. The use of semi-conductor fabrication techniques allows MEMS to be interfaced very readily with microelectronics. A broad survey of the field and of prior art in relation thereto is provided in an article entitled "The Broad Sweep of Integrated Micro-Systems", by S. Tom Picraux and Paul McWhorter, in IEEE Spectrum, December 1998, pp24-33.

In PCT Application No. PCT/AU98/00550, the entire contents of which is incorporated herein by reference, an inkjet printing device has been described which utilizes MEMS processing techniques in the construction of a thermal-bend-actuator-type device for the ejection of a fluid, such as an ink, from a nozzle chamber. Such ink ejector devices will be referred to hereinafter as MEMJETs. The technology there described is intended as an alternative to existing technologies for inkjet printing, such as Thermal Ink Jet (TIJ) or "Bubble Jet" technology developed mainly by the manufacturers Canon and Hewlett Packard, and Piezoelectric Ink Jet (PIJ) devices, as used for example by the manufacturers Epson and Tektronix.

While TIJ and PIJ technologies have been developed to very high levels of performance since their introduction, MEMJET technology is able to offer significant advantages over these technologies. Potential advantages include higher speeds of operation and the ability to provide higher resolution than obtainable with other technologies. Similarly, MEMJET Technology provides the ability to manufacture monolithic printhead devices incorporating a large number of nozzles and of such size as to span all or a large part of a page (or other print surface), so that pagewidth printing can be achieved without any need to mechanically traverse a small printhead across the width of a page, as in typical existing inkjet printers.

It has been found difficult to manufacture a long TIJ printhead for full-pagewidth printing. This is mainly because of the high power consumption of TIJ devices and the problem associated therewith of providing an adequate power supply for the printhead. Similarly, waste heat removal from the printhead to prevent boiling of the ink provides a challenge to the layout of such printhead. Also, differential thermal expansion over the length of a long TIJ-printhead my lead to severe nozzle alignment difficulties.

Different problems have been found to attend the manufacture of long PIJ printheads for large- or full-page-width printing. These include acoustic crosstalk between nozzles due to similar time scales of drop ejection and reflection of acoustic pulses within the printhead. Further, silicon is not a piezoelectric material, and is very difficult to integrate with CMOS chips, so that separate external connections are required for every nozzle.

Accordingly, manufacturing costs are very high compared to technologies such as MEMJET in which a monolithic device may be fabricated using established techniques, yet incorporate very large numbers of individual nozzles. Reference should be made to the aforementioned PCT application for detailed information on the

manufacture of MEMJET inkjet printhead chips; individual MEMJET printhead chips will here be referred to simply as printhead segments. A printhead assembly will usually incorporate a number of such printhead segments.

While MEMJET technology has the advantage of allowing the cost effective manufacture of long monolithic printheads, it has nevertheless been found desirable to use a number of individual printhead segments (CMOS chips) placed substantially end-to-end where large widths of printing are to be provided. This is because chip production yields decrease substantially as chip lengths increase, so that costs increase. Of course, some printing applications, such as plan printing and other commercial printing, require printing widths which are beyond the maximum length that is practical for successful printhead chip manufacture.

Summary of the Invention

The present invention is broadly directed to the provision of a suitable printhead segment support structure and ink supply arrangement for an inkjet printhead assembly capable of single-pass, full-page-width printing as well as to such printhead assemblies. While the invention was conceived in the context of MEMJET printhead segments (chips), and thus the following summary and description of the invention is provided with particular reference to printhead assemblies incorporating MEMJET printhead segments, it is believed that the invention also has the potential to be employed with other ink jet printhead technologies.

Accordingly, it is one object of the present invention to provide a printhead segment support structure that is capable of accommodating a series of printhead segments as described in PCT/AU98/00550 in an array that permits single-pass pagewidth printing across the width of a surface passing under the printhead assembly.

The term "single-pass pagewidth printing" should here be understood as referring to a printing operation during which the printhead assembly is moved in only one direction along or across the entire width or length of any print surface, as compared to a superimposed, generally orthogonal printhead carriage movement as employed in conventional ink jet printers. (Of course, printhead assembly movement may be relative, with the surface moving past a stationary printhead assembly.) It will be also understood that there are many possible page widths and the inkjet printhead segment support structure of the invention would be suitable for adaptation to a range of widths. A printhead assembly in accordance with the invention should in particular be useful where a plurality of generally elongate, but relatively small printhead segments are to be used to print across substantially the entire width of a sizable surface without the need for mechanically moving the printhead assembly or any printhead segment across as well as along the print surface.

The invention has also been conceived in light of potential problems related to the relatively small size of individual printhead segments, their fragility and the required highly accurate alignment or registration of individual printhead segments with each other on the support structure and with external components in order to provide a printhead assembly capable of single-pass, full pagewidth printing. Multiple ink supply channels are required to supply ink in reliable manner to all printhead segments. Because of the small size of the segments, this in general would require high quality micro-machined parts. An ink supply conduit, on the other hand, is most economically made if it can be formed at a much coarser scale.

Accordingly, another object of the invention is to provide a printhead segment support structure with a print fluid supply arrangement that ensures adequate print fluid (eg ink) supply to individual printhead segments mounted to the support structure, at an affordable manufacturing cost.

Typical MEMJET printhead segments have a dimension of 2cm length by 0.5mm width, and will include (in a layout for 4-color printing) four lengthwise-oriented rows of ink ejection nozzles, the segment being of

monolithic fabrication. Longer segments could be made and used, but the size mentioned gives very satisfactory fabrication yields. Each printhead segment has ink inlet holes arrayed on one surface and corresponding nozzle outlets arrayed on an opposite surface. Each of the four rows will then require connection to an appropriate ink supply, such that an inkjet printhead assembly can be provided for operation with (for example) cyan, magenta, yellow and black inks for color printing.

Accordingly, a yet further object is to provide an ink supply arrangement thereby to enable supply of a number of differently colored inks (or other printing fluids) to selected ink inlets of individual printhead segments carried on a support structure for full pagewidth color printing.

Another herewith related object of the invention is to provide a print fluid supply arrangement that is simple in layout and thus easy to incorporate in a printhead support structure. It should ensure even and reliable distribution of print fluids in a pagewidth inkjet printhead assembly.

In a first aspect, the invention provides a support for a plurality of inkjet printhead segments, said support including:

a hollow elongate member having at least one ink supply channel formed therein, the or each ink supply channel being in fluid communication with an elongate slot in and extending at least partly along the elongate member; and

a plurality of printhead segment carriers received and secured in neighbouring arrangement within the slot, each printhead segment carrier being adapted for mounting thereto of at least one printhead segment,

wherein each printhead segment carrier includes at least one ink gallery arranged so as to connect the or an associated one of said ink supply channels with an ink inlet of said at least one printhead segment when mounted to that printhead segment carrier.

In a second aspect, the invention provides an inkjet printhead assembly including:

a hollow elongate member having at least one ink supply channel formed therein, the or each ink supply channel being in fluid communication with an elongate slot in and extending at least partly along the elongate member; and

a plurality of printhead segment carriers received and secured in neighbouring arrangement within the slot; and

at least one printhead segment mounted to each printhead segment carrier,

wherein each printhead segment carrier includes at least one ink gallery arranged so as to connect the or an associated one of said ink supply channels with an ink inlet of the at least one printhead segment mounted to that printhead segment carrier.

It is preferred that the at least one printhead segment on each printhead segment carrier has a defined printing range in a direction lengthwise along the elongate member, and that the printing ranges of the printhead segments mounted to a plurality of adjoining printhead segment carriers overlap, so that the printhead segments mounted to said plurality of adjoining printhead segment carriers have a combined printing range of greater lengthwise extent than any of the printing ranges comprised therein. This is a suitable way in which printing may be accomplished on a surface without the presence of gaps corresponding to lengthwise gaps between individual printhead segments.

In a further aspect, the invention provides a method for assembling the inkjet printhead assembly wherein the step of mounting to each printhead segment carrier its respective at least one printhead segment precedes the step of securing that printhead segment carrier within the slot. It is then preferred that the printhead segment

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