

PAGE-WIDTH PRINthead

Field of the Invention

The present invention relates to a page-width printhead for an ink printer.

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Background of the Invention

Page width printheads for ink printers typically are formed from a plurality of individual printhead elements (sometimes referred to as "chips"), with each printhead element having a plurality of ink ejection nozzles formed therein.

10 Because a plurality of individual printhead elements is employed in any one printhead, achievement of a uniform print or print tone along the entire length of the printhead has so far been practically impossible. Non-uniformities or variations occur due to minor differences in the ink ejection nozzles in adjacent printhead elements and such variations may even occur when the elements originate from a single wafer due to
15 inherent variations in process parameters that arise during the production of elements on a single wafer.

It is known that even slight variations in the print determining characteristics of adjacent elements in a page-width printheads will diminish the quality of the resultant print significantly, as the differences between adjacent areas of a print will be
20 "amplified" in the visual perception of the print.

Summary of the Invention

In accordance with a first aspect of the present invention there is provided a page-width printhead for an ink printer. The printhead comprises a series of individual
25 printhead elements, each having an array of ink ejection nozzles formed therein. The series of printhead elements extends substantially across the width of the printhead, with respective end portions of adjacent elements being located side by side in overlapping relationship. A dithering unit is provided for controlling the ejection of ink from ink nozzles of the printhead elements and the dithering unit is arranged, in use, to provide
30 an interpolation between the characteristics of a pair of printhead elements across the length of the overlapping end portions of the pair of printhead elements.

In one embodiment of the invention, the elements are positioned obliquely with respect to one another to form a row of lapped elements.

In another embodiment, the elements are arranged in at least two parallel rows,
35 with the elements in each row being spaced apart from one another and with the end portions of each element in one row overlapping the end portions of adjacent elements in the adjacent row.

In accordance with a second aspect of the present invention there is provided a method of controlling the ejection of ink from a page-width printhead as above defined, the method comprising the step of effecting an interpolation between the characteristics of a pair of printhead elements across the length of the overlapping end portions of the pair of printhead elements.

Description of the Drawings

Notwithstanding any other forms which may fall within the scope of the present invention, preferred forms of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figs. 1a and b are schematic illustrations of arrangements for positioning a number of printhead elements in a single printhead row.

Fig. 2 illustrates a printhead embodying the present invention.

Fig. 3 illustrates a graph of dither probabilities for use with the printhead of Fig. 2.

Fig. 4 illustrates a second printhead embodying the present invention.

Fig. 5 illustrates a third printhead embodying the present invention.

Description of Preferred Embodiments

As shown in Fig. 1a, a CMOS processed wafer incorporating ink ejection nozzles 100 is initially diced into printhead elements 1 and tested for functionality of the ink-jet nozzles. The testing can take various forms from full ink ejection test to optical examination of device operation. Once a determination is made of the operational characteristics of each ink ejection nozzle, the elements are joined together into a longer inkjet printhead row 3 as illustrated in Fig. 1b. The printhead row 3 can include eight half-inch elements 1 and one quarter inch element 2 which are joined together. Each element 1 and 2 contains an array of a large number of the ink ejection nozzles 100.

Next, as shown in Fig. 2, parallel printhead rows 5 and 6 are positioned side-by-side so as to form a printhead 102. The two printhead rows 5 and 6 are located with respect to each other such that respective end portions 104 and 106 of adjacent elements of the two rows 5 and 6 are located side by side in overlapping relationship.

Further, the element boundaries 9 of the printhead row 5 are positioned so as not to coincide with the element boundaries 108 of the printhead row 6.

In each of the printhead rows 5 and 6 it is likely that neighbouring elements 110 and 112 will have slightly different characteristics which, if each printhead row was utilised as an individual printhead, would result in unacceptable variations in printing across the width of a page. If the element 110 were to be taken from a first wafer and

the element 112 taken from a second wafer, large variations across the element boundaries would be likely.

In the printhead 102 however, a dithering unit 114 is provided to control the ejection of ink from the nozzles 7 of the printhead 102. The dithering unit 114 is arranged to provide an overlap dithering matrix for the printhead rows 5 and 6.

Various dithering schemes may be adopted. One probability interpolation 12 for use in the provision of the overlap dithering matrix is as illustrated in Fig. 3.

In an alternative embodiment illustrated in Fig. 4, a printhead 200 comprises two rows 202 and 204 of spaced apart printhead elements 206 and 208, the elements each being provided with an array of ink ejection nozzles 210. The printhead further comprises a dithering unit 212 which is arranged to provide integral dithering matrices for pairs of respective end portions 214 and 216 of adjacent elements 206 and 208 of the rows 202 and 204. In regions 222 of the printhead 200 between the overlapping end portions, the dithering unit 210 is arranged to provide dithering matrices for centre portions 224 of the individual elements.

Fig. 5 shows an alternative embodiment for a printhead 300 which comprises a row of individual printhead elements 302 positioned obliquely with respect to one another. The printhead 300 further comprises a dithering unit 304 for controlling the ejection of ink from ink ejection nozzles 305 of the elements 302 of the printhead 300. The dithering unit 304 in this embodiment is arranged to provide integral dithering matrices for pairs of respective end portions 314 and 316 of adjacent elements 302 and 320. In regions 322 of the printhead 300 between the overlapping end portions, the dithering unit 304 is arranged to provide dithering matrices for centre portions 324 of the individual elements.

It will be appreciated by a person skilled in the art that numerous variations and/or modifications may be made to the present invention as shown in the specific embodiments and the attached appendices without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects to be illustrative and not restrictive.

The Claims:

1. A page-width printhead for an ink printer, the printhead comprising a series of individual printhead elements, each having an array of ink ejection nozzles
5 formed therein, the series of printhead elements extending substantially across the width of the printhead, with respective end portions of adjacent elements being located side by side in overlapping relationship, a dithering unit being provided for controlling the ejection of ink from the ink ejection nozzles of the printhead elements and the dithering unit being arranged, in use, to provide an
10 interpolation between the characteristics of a pair of printhead elements across the length of the overlapping end portions of the pair of printhead elements.
2. The page-width printhead as claimed in claim 1 wherein the elements are
15 positioned obliquely with respect to one another to form a row of lapped elements.
3. The page-width printhead as claimed in claim 1 wherein the elements are
20 arranged in at least two parallel rows, with the elements in each row being spaced apart from one another and with the end portions of each element in one row overlapping the end portions of adjacent elements in the adjacent row.
4. A method of controlling the ejection of ink from a page-width printhead having
25 a series of individual printhead elements each formed with an array of ink ejection nozzles, the series of printhead elements extending substantially across the width of the printhead with respective end portions of adjacent elements being located side by side in overlapping relationship, the method comprising
30 effecting an interpolation between the characteristics of a pair of printhead elements across the length of the overlapping end portions of the pair of printhead elements.

