AN INKJET PRINTER

This invention relates to an ink jet printer and more particularly, but not necessarily exclusively, to a multi-colour ink jet printer and/or to a wide format ink jet printer which can print items such as corrugated cardboard, wallpaper and textiles.

According to the present invention, there is provided an ink jet printer comprising a path along which a substrate to be printed can pass, an array of fixed ink jet heads each having a plurality of nozzles, the array comprising a plurality of rows of inkjet heads, each row extending transversely of the path and the rows being spaced apart from one another in the direction of the path, ~~and~~ control means for firing the ink jet heads and an encoder and friction wheel arrangement for producing a signal to trigger the control means in response to movement of the substrate.

All previously wide format ink jet printers have moving heads as opposed to fixed heads. The present design allows for any size of construction within the constraints of current software and enables the speed of printing to be increased dramatically.

Preferably, the encoder and friction wheel arrangement ~~sensing means are provided for sensing the movement of the substrate along the path and for~~ may produc~~ing~~ a signal to fire the inkjet heads each time the substrate moves a predetermined distance. This has the advantage that the speed of the substrate can vary

without affecting the resolution of print quality. It also allows the substrate to be mechanically fed or hand fed to the printer.

Advantageously, each inkjet head has its own electronic control board with dedicated memory for storing data for operating the nozzles of the head.

In this case, the printer, preferably, further comprises a plurality of distribution boards, each of which supplies information from a central processing unit to a group of head control boards.

Advantageously, the ink jet heads are arranged in a plurality of pairs of rows and each head has a heat sink attached thereto, the heat sinks of the two rows of heads of each pair of rows being arranged back to back and in contact with a common heat conductor. This minimises the space occupied by the ink jet heads.

Preferably, the ink jet printer further comprises means for moving the ink jet heads away from the said path in a direction perpendicular or substantially perpendicular thereto. In this case, the ink jet printer may further comprise means for detecting a tear in the substrate and for operating the moving means when a tear is detected to avoid damage to the inkjet heads. Additionally or alternatively, the ink jet printer may further comprise means for sensing the thickness of the substrate and for operating the moving means to adjust the position of the ink jet heads according to the thickness of the substrate.

Preferably, the said path of movement of the substrate is horizontal or substantially horizontal and the ink jet heads are arranged above the said path.

The ink jet printer may be provided in combination with a corrugating machine and/or a die cutting machine and may include means for synchronising the speed at which the substrate is fed or drawn through the inkjet printer with the speed at which the corrugating machine and/or the die cutting machine operates.

The invention will now be more particularly described with reference to the accompanying drawings, in which:-

Figure 1 is a side view of one embodiment of an ink jet printer according to the present invention,

Figure 2 is a fragmentary perspective view from above showing the arrangement of the ink jet heads,

Figure 3 is a fragmentary perspective view from below showing the ink jet heads and control circuitry therefore in more detail, and

Figure 4 is a schematic plan view of the ink jet heads.

Referring firstly to Figures 1 to 3 of the drawings, the printer shown therein is a multi-colour printer which typically has a printing image width of 1.3 metres and a

printing image length of about 2 metres and which can be used for printing on any large substrate, typically plastics material, cardboard, wooden panels, textiles or paper rolls. The printer could however be made larger for printing, for example, on carpet or much smaller for printing, for example, sheets of A3 paper.

The printer has a frame work structure 10 which supports a bed 11 defining a path A along which a substrate S to be printed can pass. The ink jet printer also comprises an array of fixed ink jet heads 12 each having a plurality of nozzles and typically 128 nozzles. The array comprises a plurality of rows of ink jet heads 12, each row extending transversely of the path A and the rows being spaced apart from one another in the direction of the path A, with a plurality of ink jet heads 12 in each row.

The ink jet heads 12 are supported by cross beams 13 extending transversely of the path. Each head 12 has a heat sink 14 attached thereto and the heat sinks 14 are secured to a respective cross beam 13 which serves as a heat conductor. As best shown in Figure 3, the ink jet heads 12 are arranged in pairs of rows, the heat sinks 14 of the two rows of heads 12 of each pair of rows being arranged back to back and in contact with a common cross beam 13.

Each ink jet head 12 has its own electronic control board 15 with dedicated random access memory for storing data for operating the nozzles of the head. Each control board 15 has its own address. This means that it is possible to pre-load any control board with any information at any time and, therefore, a particular image to be printed by each head can be stored by the dedicated memory of that head until no

longer needed thereby significantly reducing the amount of data which has to be handled in order to operate all of the heads.

In order to accept the back to back positioning of the heads 12, the printer is programmed to read the information in the reversed heads 12 (i.e. those heads on the downstream side of each beam 13) in the opposite direction. Therefore, for every line of code on a reversed head 12 the information is read backwards horizontally but still read forwards in the same vertical direction on the memory plane.

The ink jet printer further comprises a plurality of distribution boards 16, each of which supplies information from a central processing unit (not shown) to a group of head control boards 15. As shown in Figure 2, each distribution board 16 is associated with six head control boards 15.

As shown in Figure 3, the ink is supplied to the heads 12 through pipes 17 which run through the beams 13. The heads are connected to respective control boards 15 by respective printhead connectors 18 and the control boards 15 are connected to respective distribution boards 16 by printhead driver connectors 19.

As shown in Figure 2, the ink jet printer includes a sensor 20 for sensing the movement of the substrate S along the path A and for producing a signal to fire the ink jet heads 12 each time the substrate S moves a predetermined distance. The sensor 20 is in the form of a digital ~~decoder~~ encoder 21 driven by a friction wheel 22.

Also as shown in Figure 2, the cross beams 13 are secured to longitudinal support beams 23 and these are attached to the lower ends of hydraulic rams 24 supported from the top of the framework structure 10. The rams 24 can be operated in order to raise or lower the beams 13 and 23 so as to move the ink jet heads 12 towards or away from the path in a direction perpendicular or substantially perpendicular thereto.

The ink jet printer may also include one or more sensors (not shown) for detecting a tear in the substrate S and for operating the rams 24 to raise the ink jet heads 12 when a tear is detected.

The ink jet printer may also comprise one or more sensors (not shown) for sensing the thickness of the substrate S and for operating the rams 24 to adjust the position of the ink jet heads 12 according to the thickness of the substrate.

The printer is designed to operate with four different coloured inks, although it could be designed to operate with more or less coloured inks. As shown in Figure 4, there are twelve rows of inkjet heads 12, three rows being dedicated to each colour. The ink jet heads 12 of each row are spaced apart from one another and the ink jet heads 12 of adjacent rows are staggered with respect to one another so that each group of three rows covers the full width of the printer.

Each time a pulse is received from the digital ~~decoder~~ encoder 21, the heads 12 produce one line of print. The only limiting factor, therefore, on the speed at which the substrate S can be drawn through the printer is the speed of firing the heads 12.

CLAIMS

1. An ink jet printer comprising a path along which a substrate to be printed can pass, an array of fixed ink jet heads each having a plurality of nozzles, the array comprising a plurality of rows of ink jet heads, each row extending transversely of the path and the rows being spaced apart from one another in the direction of the path, ~~and~~ control means for firing the inkjet heads, and an encoder and friction wheel arrangement for producing a signal to trigger the control means in response to movement of the substrate.

2. An ink jet printer as claimed in claim 1, ~~wherein sensing means are provided for sensing the movement of the substrate along the path and for~~wherein the encoder and friction wheel arrangement ~~producing~~ produces a signal to fire the ink jet heads each time the substrate moves a predetermined distance.

3. An ink jet printer as claimed in claim 1 or claim 2, wherein each ink jet head has its own electronic control board with dedicated memory for storing data for operating the nozzles of the head.

4. An ink jet printer as claimed in claim 3, further comprising a plurality of distribution boards, each for supplying information from a central processing unit to a group of head control boards.

5. An ink jet printer as claimed in any one of the preceding claims, wherein the ink jet heads are arranged in a plurality of pairs of rows and each head has a heat sink attached thereto, the heat sinks of the two rows of heads of each pair of rows being arranged back to back and in contact with a common heat conductor.

6. An ink jet printer as claimed in claim 5, wherein the printer is programmed to read the information in the reversed heads backwards.

7. An ink jet printer as claimed in any one of the preceding claims, further comprising means for moving the ink jet heads away from the said path in a direction perpendicular or substantially perpendicular thereto.

8. An ink jet printer as claimed in claim 7, further comprising means for detecting a tear in the substrate and for operating the moving means when a tear is detected.

9. An ink jet printer as claimed in claim 7 or claim 8, further comprising means for sensing the thickness of the substrate and for operating the moving means to adjust the position of the ink jet heads according to the thickness of the substrate.

10. An ink jet printer as claimed in any one of the preceding claims, wherein the said path of movement of the substrate is horizontal or substantially horizontal and the ink jet heads are arranged above the said path.

11. A multi-colour ink jet printer as claimed in any one of the preceding claims.

12. An ink jet printer substantially as hereinbefore described with reference to the accompanying drawings.

13. An ink jet printer as claimed in any one of the preceding claims in combination with a corrugating machine, means being provided for synchronising the speed at which corrugated cardboard is fed or drawn through the ink jet printer with the speed at which the corrugating machine operates.

14. An ink jet printer as claimed in any one of the preceding claims in combination with a die cutting machine, means being provided for synchronising the speed at which a substrate is fed or drawn through the ink jet printer with the speed at which the die cutting machine operates.