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(54) **Dot-matrix printer.**

(57) A dot-matrix printer having a print head (26) and a platen (27) allowing the head (26) to bring dot characters in normal printing mode and an extra-wide-margin printing mode. The printer has a microprocessor (20) which decides, in accordance with printing data from an external device, whether or not a wide dot character is to be printed at the left margin or right margin. When it decides that a wide dot character is to be printed at the left or right margin, the microprocessor controls a print head driver (25) so that the head (26) may print dot characters in the extra-wide-margin printing mode. The print head (26) can therefore print wide dot characters together with characters of ordinary width, neatly and clearly.

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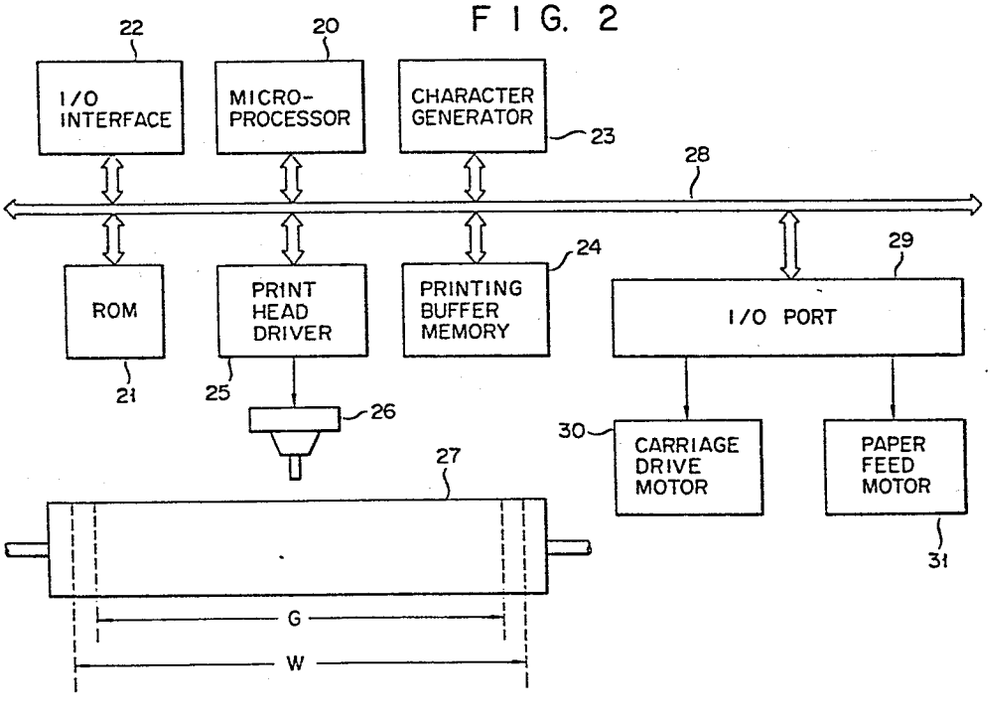
FIG. 2


22
I/O INTERFACE
20
MICRO-PROCESSOR
CHARACTER GENERATOR
23
28
ROM
21
PRINT HEAD DRIVER
25
24
PRINTING BUFFER MEMORY
29
I/O PORT
26
27
30
CARRIAGE DRIVE MOTOR
PAPER FEED MOTOR
31
G
W

Dot-matrix printer

The present invention relates to a dot-matrix printer of the serial type.

A dot-matrix printer of the serial type is designed to print dot characters of a specific font. Some of the dot characters printed by this printer are narrower than the same characters printed by a fully formed character printer such as a daisy-wheel printer.

The dot-matrix printer sometimes emulates the impact printer; it prints dot characters similar to the characters printed by the impact printer. That is, it may print a dot character that is wider than ordinary characters. A wide character 11 may be printed at the right margin as shown in Fig. 1A, or at the left margin as shown in Fig. 1B. In the first case, the wide character 11 inevitably extends over the right margin. In the second case, the last character 10 of the ordinary size also extends over the right margin. That is, the characters 10 and 11 cannot be printed within the normal printing margins (i.e., the distance G). When dot characters of different widths are printed in several lines, the characters of one line may not vertically aligned with those of the other lines. This deteriorates the quality of printing.

The object of this invention is to provide a dot-matrix printer which can neatly print documents even if a dot character, which is wider than those

of the ordinary width by a predetermined value, is printed at the left or right margin.

To achieve this object, a dot-matrix printer according to the invention comprises a print head for printing dot characters, a platen allowing said print head to print dot characters in a normal margin printing mode and also in an extra wide-margin printing mode, data-receiving means for receiving printing data, including data representing the normal printing mode or extra wide-margin printing mode and character codes representing dot characters to be printed, character dot pattern generating means for generating data representing the dot patterns determined by the printing data input to the data-receiving means, printing mode selecting means for selecting the extra wide-margin printing mode when at least one of the character codes input to said data-receiving means represents a dot character which is wider than characters of ordinary width and is to be printed at the left or right margin, print head moving means for moving said print head along a platen between the ordinary margins or between the extra wide margins in accordance with the data representing the mode selected by said printing mode selecting means, and print head drive means for driving the print head in accordance with the data output by the character dot pattern generating means.

To print a wide dot character at the right margin or left margin, together with other characters of ordinary width, the print head is operated in the extra-wide-margin printing mode. Hence, the last character of any printed line, whether wide or ordinary, is vertically aligned with the last dot character of the preceding printed line, and the characters of ordinary width, other than the last dot character, are also vertically aligned with those of the preceding printed line.

This invention can be more fully understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

Figs. 1A and 1B show the lines of dot characters printed by the conventional dot-matrix printer;

Fig. 2 is a block diagram of a dot-matrix printer according to the present invention;

Fig. 3 is a flow chart illustrating the operation of the printer shown in Fig. 2; and

Figs. 4A and 4B show two lines of dot characters printed by the printer shown in Fig. 2.

One embodiment of the invention, i.e., a dot-matrix printer, will be described with reference to Figs. 2, 3, 4A and 4B. As shown in Fig. 2, the printer comprises a microprocessor 20, a read-only memory (ROM) 21 and an input/output (IO) interface 22. The ROM 21 stores a program. In accordance with this program the microprocessor 20 controls the printing operation. The I/O interface 22 receives printing data from an external device, e.g., a host computer. This data contains data designating a normal printing mode or an extra-wide-margin printing mode and character codes representing the dot character to be printed.

The printer further comprises a character generator 23, a printing buffer memory 24, a print head driver 25, a print head 26, a platen 27, a bus 28, I/O PORT 29, carriage drive motor 30 and paper feed motor 31. The character generator 23 outputs character pattern data corresponding to the printing data received by the I/O interface 22, under the control of the microprocessor 20. The output data of the generator 23 is stored, line by line, in the printing buffer memory 24. The print head driver 25 operates under the control of the microprocessor 20, thereby driving the

print head 26. As a result, the head 26 prints dot characters on the paper (not shown) wrapped around the platen 27. The platen 27 is so long that the print head 26 prints dot characters over a long distance W as well as over the ordinary printing distance G. The carriage drive motor 30 is used to move a carriage (not shown) along the platen 27. The print head 26 is mounted on this carriage. The paper feed motor 31 is used to rotate the platen 27 to feed the paper. These motors 30 and 31 are controlled by signals supplied from the microprocessor 20 through the I/O port 29. The bus 28 transfers data between the elements 20-25 and the elements 29, 30.

Referring to the flow chart of Fig. 3, the operation of the printer of Fig. 2 will be explained.

Suppose printing data is supplied to the dot-matrix printer from the external device. In step S1, the I/O interface 22 receives this data and supplies it to the microprocessor 20 via the bus 28. The microprocessor 20 reads the character dot pattern from the character generator 23, in accordance with the printing data. In step S2, the generator 23 generates the dot pattern data of either an ordinary or wide character in accordance with the printing data, i.e., the normal or extra-wide-margin printing mode data and the character codes. The dot pattern data is stored in the printing buffer memory 24. This memory can store dot pattern data for several lines of characters.

When the dot patterns for one line are stored in the printing buffer memory 24, the dot characters of these patterns will be printed by the print head 26 under the control of the microprocessor 20. First, in step S3, the microprocessor 20 determines, in accordance with the printing mode data from the I/O interface 22, whether or not at least

one of the dot patterns for one line stored in the memory 24 is a wide dot pattern. When the answer to the question imposed in step S3 is no, the microprocessor 20 supplies a control signal designating normal printing to the carriage drive motor 30 through the I/O port 29. As a result, the microprocessor 20 controls the carriage drive motor 30, thereby moving the print head 26 to the left margin of ordinary printing. In step S7, the head 26 is driven by the print head driver 25. In step S8, the head 26 prints the dot characters in accordance with the dot patterns read from the character generator 23 to the printing buffer memory 24. The line thus printed has length G (Fig. 2).

On the other hand, when the answer to the question asked in step S3 is yes, the microprocessor 20 determines whether or not the wide character pattern is positioned at the left or right margin, in step S4. When the answer is no, the operation proceeds to step S5, S7 and S8, whereby the dot characters are printed.

When the answer to the question imposed in step S4 is yes, the microprocessor 20 supplies a control signal designating the extra-wide margin printing to the carriage drive motor 30 via the I/O port 29. In step S6, the microprocessor 20 controls the carriage drive motor 30, thus moving the print head 26 to the left margin of wide-margin printing. In step S8, the head 26 prints dot characters in accordance with the character dot patterns stored in the printing buffer memory 24. The line thus printed has length W (Fig. 2). In this case, the dot characters 10 of the ordinary width are printed and then the wide character 11 is printed at the right margin as shown in Fig. 4A. Alternatively, the wide character 11 is printed

at the left margin, and the characters 10 of the ordinary width are then printed as illustrated in Fig. 4B.

As described above, the dot-matrix printer of this invention prints a line of dot characters in the extra wide-margin printing mode when the first or last character of the line is wider than ordinary width. Hence, even if the last character of the line is a wide character as shown in Fig. 4A, it does not extend over the right margin. Further, even if the first character of the line is a wide character as illustrated in Fig. 4B, the last character of the ordinary width does not extend over the right margin and vertically aligned with the character of the preceding line at the corresponding position. When several lines of dot characters are printed in this manner, the characters of any line are vertically aligned with those of the adjacent lines. The printed document therefore is neat and clean.

Moreover, when a wide character is printed at the left or right margin, the number of characters of one line is the same as the number of characters of ordinary width which form one line. Hence, a neat and clean printing is achieved even if wide dot characters similar to those printed by the impact printer are printed together with dot characters of ordinary width.

Claims:

1. A dot-matrix printer of the type which determines the patterns of dot characters and prints the dot characters of these patterns, characterized by comprising: a print head (26) for printing dot characters; a platen (27) allowing said print head (26) to print dot characters in a normal margin printing mode and also in an extra wide-margin printing mode; data-receiving means (22) for receiving printing data including data representing the normal printing mode or extra wide-margin printing mode and character codes representing dot characters to be printed; character dot pattern generating means (23) for generating data representing the dot patterns determined by the printing data input to the data-receiving means (22); printing mode selecting means (20) for selecting the extra wide-margin printing mode when at least one of the character codes input to said data-receiving means (22) represents a dot character which is wider than characters of ordinary width and is to be printed at the left or right margin; print head moving means (30) for moving said print head along the platen between the ordinary margins or between the extra wide margins in accordance with the data representing the mode selected by said printing mode selecting means (20); and print head drive means (25) for driving the print head in accordance with the data output by the character dot pattern generating means (23).

2. A dot-matrix printer according to claim 1, characterized in that said character dot pattern generating means (23) is a read-only memory storing the patterns of dot characters of ordinary width and the patterns of wide dot characters.

3. A dot-matrix printer according to claim 1,

characterized in that said printing mode selecting means (20) is a microprocessor which operates in accordance with a specific program.

4. A dot-matrix printer according to claim 1, further comprising a character buffer memory (24) for storing at least character dot patterns for one line of characters which have been read from said character dot pattern generating means (23), and for supplying these patterns to said print head drive means (20, 25), to thereby print dot characters for one line.

5. A dot-matrix printer according to claim 4, characterized in that said printing mode selecting means (20) selects the extra-wide-margin printing mode when at least one of the character dot patterns stored in said character buffer memory (24) corresponds to a wide dot character to be printed at the left or right margin.

FIG. 1A

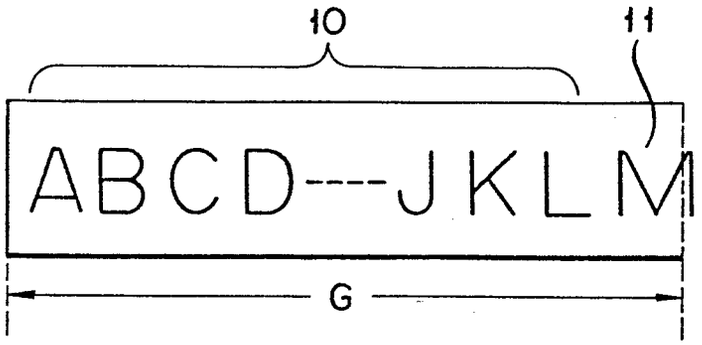


FIG. 1B

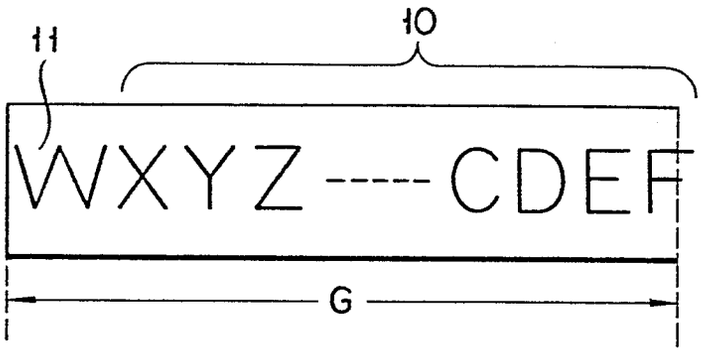


FIG. 4A

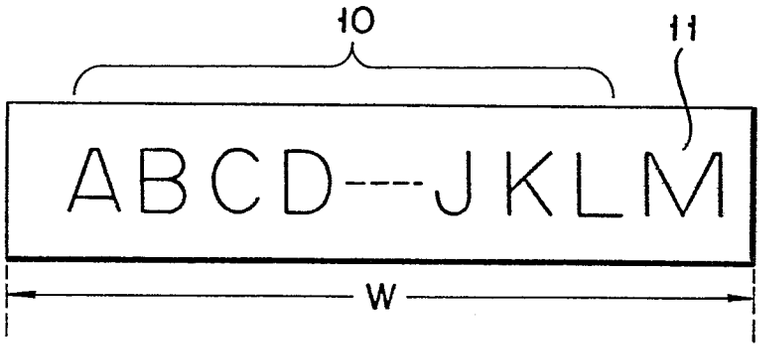


FIG. 4B

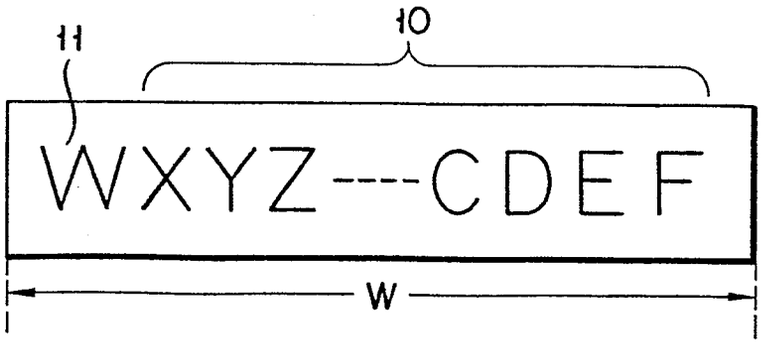


FIG. 2

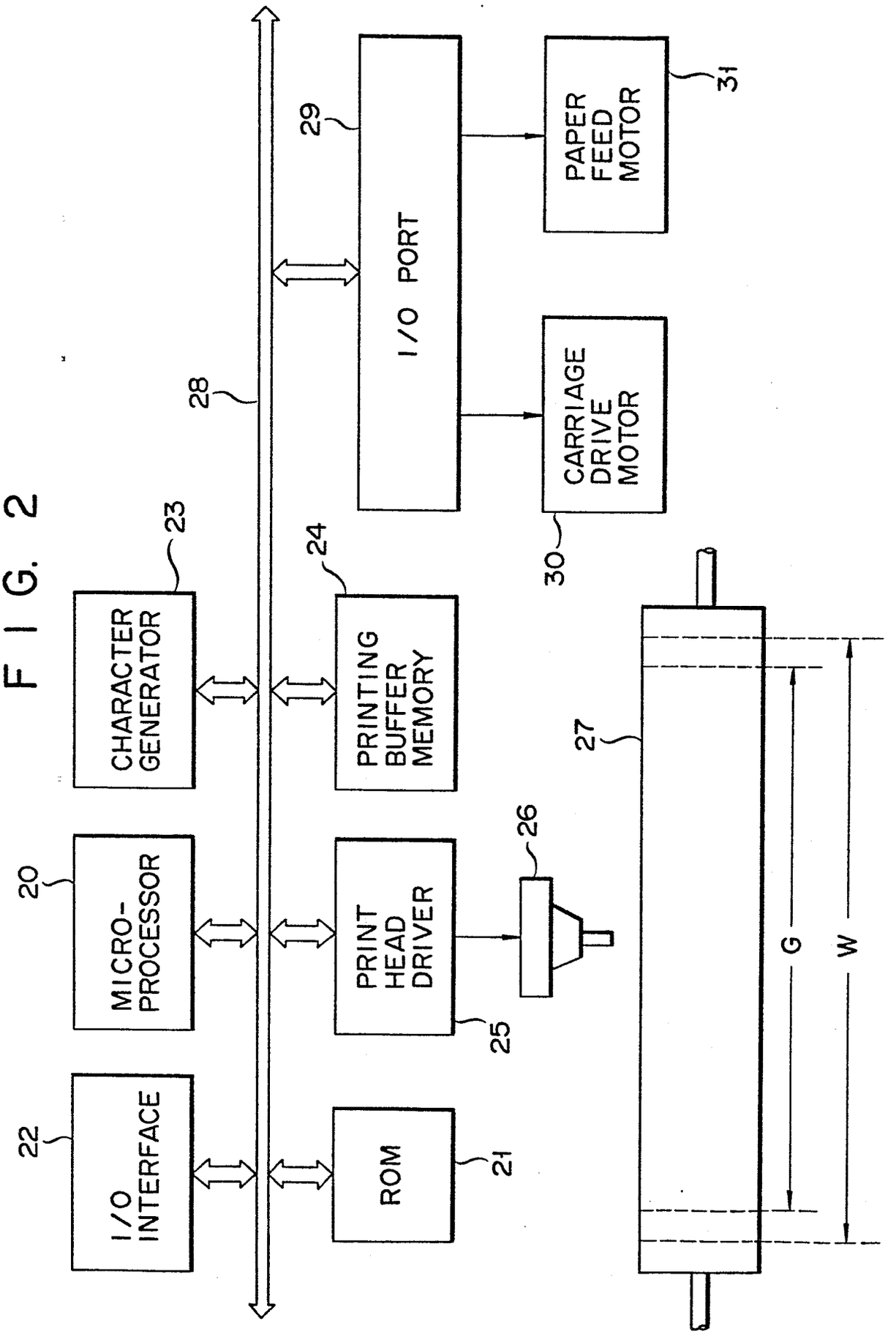

I/O INTERFACE
22
MICRO-PROCESSOR
20
CHARACTER GENERATOR
23
ROM
21
PRINTING BUFFER MEMORY
24
PRINT HEAD DRIVER
25
26
I/O PORT
29
PAPER FEED MOTOR
31
CARRIAGE DRIVE MOTOR
30
28
27
G
W

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FIG. 3