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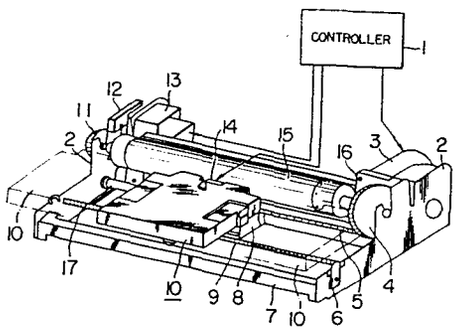
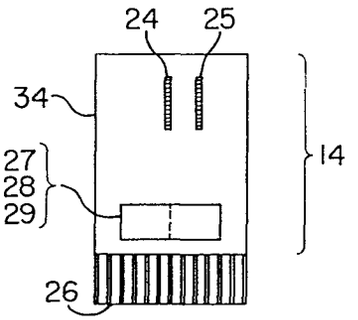
(54) Thermal printer.

(57) A thermal printer having a reciprocating carriage (8), a thermal print head (14) provided on the carriage, a controller (1) for controlling the movement of the carriage and the printing operation of the print head, a ribbon cassette (10) mounted on the carriage, an inked ribbon (21) coiled within the ribbon cassette, a carriage drive motor (3) and drive belt (5) for reciprocating the carriage, and an inked ribbon take-up mechanism for taking up the inked ribbon in one direction by the reciprocative movement of the carriage, wherein the thermal print head is provided with a plurality of thermal element arrays (24, 25) having different pitches of thermal elements or different sizes of thermal elements.





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THERMAL PRINTER

The present invention relates to a thermal printer capable of printing characters in various sizes.

Conventional thermal printers have the provision of several print heads of different character sizes, and characters in different sizes are printed by changing the print head. Therefore, such a printer including several types of print heads is costly, and printing is less efficient due to the replacement of the print head.

It is an object of the present invention to provide a thermal printer capable of printing characters in different sizes using a single print head.

The present invention resides in a thermal printer having a plurality of arrays of thermal elements constituting a print head, each array of thermal elements being provided with a different pitch or size of thermal elements, so that the size of printed characters can readily be changed by selectively activating an array of thermal elements.

The present invention will be apparent from the following detailed description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a perspective view of the thermal transfer printer embodying the present invention;

Fig. 2 is an illustration used to explain the carriage drive system of the inventive printer;

Fig. 3 is a perspective view of the ribbon cassette used in the inventive printer;

Fig. 4 is an internal view of the ribbon cassette;

Fig. 5 is an external view of the thermal print head of the inventive printer;

Fig. 6 is a magnified view showing two arrays of thermal resistor elements provided in the thermal print head;

Fig. 7 is a schematic diagram showing the print mode switching control circuit; and

Fig. 8 is a timing chart showing major signals observed in the circuit shown in Fig. 7.

An embodiment of the present invention which is applied to the thermal transfer printer will now be described with reference to the drawings. The arrangement of Fig. 1 includes a controller 1, side boards 2, a carriage drive motor 3, a paper feed knob 4, a carriage drive belt 5, a clamp 6, a frame 7, a carriage 8, a ribbon take-up belt 9, a ribbon cassette 10, a line feed gear 11, a paper release lever 12, a line feed motor 13, a dual print head 14, a platen 15, a motor frame 16, and a shaft 17. The ribbon cassette shown in Fig. 4 contains a ribbon sensor 18, a ribbon drive pulley 19, guide pins 20, an inked ribbon 21, a ribbon take-up rubber 22, and ribbon take-up pulleys 23. In Fig. 1, the side boards 2 are secured by screws to the motor frame 16 constituting the

main frame of the printer, and the frame 7 and shaft 17 are fixed by screws between the side boards 2. The line feed motor 13 is secured by screws to the side board 2, and the carriage drive motor 3 is secured by screws to the motor frame 16. The platen 15 provided with the line feed gear 11 and paper feed knob 4 is fixed rotatably between the side boards 2. The carriage 8 is mounted slidably on the shaft 17, and the thermal head 14 and ribbon cassette 10 are mounted on the carriage 8. The inked ribbon 21 is taken up by the gear mechanism provided on the carriage 8 and the ribbon drive belt 9. These gear mechanism and ribbon drive belt, in conjunction with the ribbon drive pulley 19, guide pins 20, ribbon take-up rubber 22 and ribbon take-up pulley 23, as will be described later, constitute the ribbon take-up mechanism. For the explanatory convenience, the printer is assumed to be of unidirectional printing (printing takes place only when the carriage 8 moves from left to right), and the inked ribbon 21 is taken up only when the carriage 8 moves from left to right.

The drive belt 9 is fixed on the side board 2 by the clamp 6. The carriage drive motor 3, line feed motor 13 and thermal print head 14 are operated by the controller 1 as shown by the arrows in Fig. 1. When the carriage 8 fixed on the carriage drive belt 5 is moved from left to right by the rotation of the carriage drive motor 3, the inked ribbon 21 in the ribbon cassette 10 is taken up, while it is stationary when the carriage is

moved reversely.

In Figs. 3 and 4, the ribbon take-up force is produced by the inked ribbon drive mechanism on the carriage 8 and transmitted to the ribbon drive pulley 19. The transmitted force is used to take up the inked ribbon 21 through the ribbon take-up rubber 22 which is pressed to both coiled ribbons 21 as shown in Fig. 4. The ribbon take-up rubber 22 runs between the ribbon take-up pulley 23 and the ribbon drive pulley 19, and the inked ribbon 21 is led by the guide pins 20. Accordingly, when the ribbon drive pulley 19 rotates, the inked ribbon 21 is taken up, while during the movement of the inked ribbon 21, the ribbon sensor 18 checks the presence of the ribbon 21.

Fig. 5 shows the external view of the thermal print head 14 used in the thermal transfer printer arranged as described above. On a head substrate 34, there are provided arrays of thermal resistor elements 24 and 25, head drivers 28 and 29, shift register 27, and connectors 26.

Fig. 6 shows the magnified view of the thermal resistor elements. Each thermal resistor element has a longitudinal dimension of ℓ and a lateral dimension of W, and they are aligned at a pitch of P. By changing one or more of the dimensions ℓ, W and P of the thermal resistor arrays 24 and 25, the size of characters printed by these thermal resistor arrays can be changed. For example, by making the thermal resistor array 24 to have

a pitch P1 for Point-12 characters and the thermal resistor array 25 to have a pitch P2 for Point-10 characters, characters of Point-12 and Point-10 can be printed using these thermal resistor arrays selectively.

In this embodiment, the controller 1 is provided with a character size switching controller arranged as shown in Fig. 7. In the figure, reference numbers 24 and 25 denote the above-mentioned thermal resistor arrays, 32 is a switch, 30 is a memory, 31 is a processor, 27 is a shift register, 28 and 29 are head drivers A and B for energizing the print head, 33 is an inverter, A_{11}-A_{1n} and A_{21}-A_{2n} are AND gates, Q_{11}-Q_{1n} and Q_{21}-Q_{2n} are transistors, and R denotes resistors.

The print operation by the thermal resistor array 24 will first be described. When the switch 32 is turned off, i.e., the contacts open, one of three inputs of the AND gates A_{11}-A_{1n} becomes high. The AND gates A_{21}-A_{2n} receive the low output of the inverter 33, providing low outputs irrespective of the remaining two inputs, and the driving transistors Q_{21}-Q_{2n} for the thermal resistor array (B) 25 are kept cut off. Namely, the thermal resistor array 24 is selected.

The processor 31 sends print data (DATA) in the memory 30 over the data lines (DATA) to the shift register (SR) 27 in synchronism with the clock (CLK), and the data is latched in stages Q_1-Q_n of the shift register (SR) 27 by the latch signal (LATCH). When the processor 31 issues the print command signal (STRB), the

transistors Q_{11}-Q_{1n} operate to drive respective thermal resistor elements R_{11}-R_{1n} in accordance with the print data (DATA) supplied to one input of the AND gates A_{11}-A_{1n}. These operations are repeated, and after one line has been printed, the paper is fed by one line, and the print operation for the next line will proceed.

For the print operation using the thermal resistor array 25, the switch 32 is closed. The signal SELO goes low, causing the transistors Q_{11}-Q_{1n} for the thermal resistor array 24 to be cut off by the same reason as mentioned above, and the AND gates A_{21}-A_{2n} are given the high input so that the thermal resistor array 25 is selected. These operations are identical to those in selecting the thermal resistor array 24 as described previously, and the explanation will be omitted.

Accordingly, the relatively simple arrangement as described above allows printing of characters in two sizes. This arrangement fairly meets the needs of extensive applications, and the use of a thermal print head with the capability of two character sizes allows a considerable cost reduction when compared with printers which need several thermal print heads for this purpose.

CLAIMS:

1. A thermal printer having a reciprocating carriage (8), a thermal print head (14) provided on said carriage, and a controller (1) for controlling the movement of the carriage and the printing operation of said thermal print head, wherein said thermal print head is provided with a plurality of arrays of thermal elements (24, 25), said arrays having different pitches of thermal elements or different sizes of thermal elements.

2. A thermal printer according to claim 1 comprising switching control means for selecting one of said thermal element arrays.

3. A thermal printer having a reciprocating carriage (8), a thermal print head (14) provided on said carriage, a controller (1) for controlling the movement of said carriage and the printing operation of said thermal print head, a ribbon cassette (10) mounted on said carriage, an inked ribbon (21) coiled in said ribbon cassette, a carriage drive motor (3) for moving said carriage, and an inked ribbon take-up mechanism (9, 19, 20, 22, 23) for taking up said inked ribbon by the movement of said carriage, wherein said thermal print head is provided with a plurality of thermal element arrays (24, 25) having different pitches of thermal elements or different sizes of thermal elements, and wherein said printer is provided with switching control means for selecting one of said thermal element arrays.

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FIG. 1

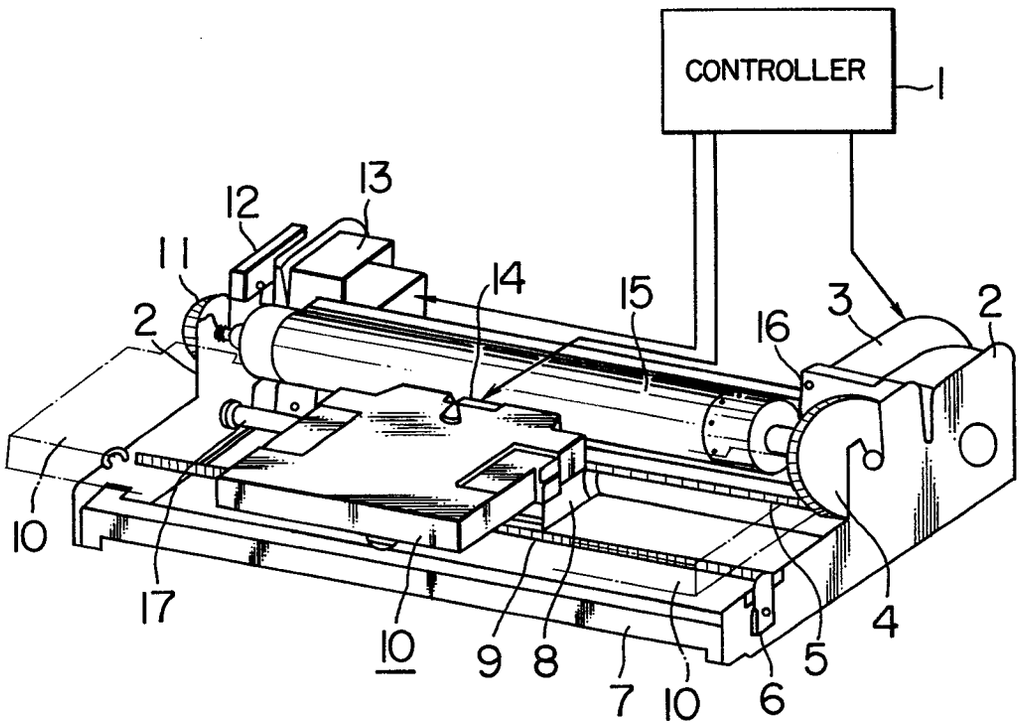

FIG. 2

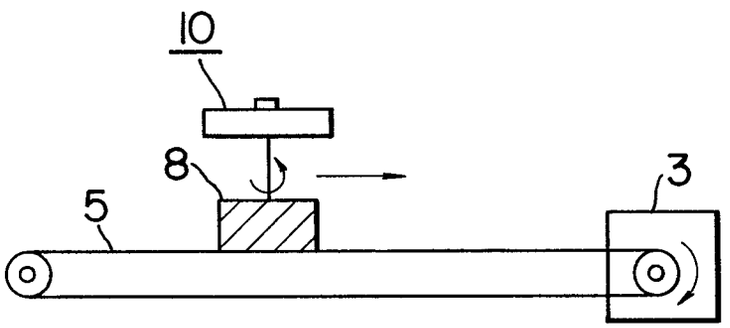

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FIG. 3

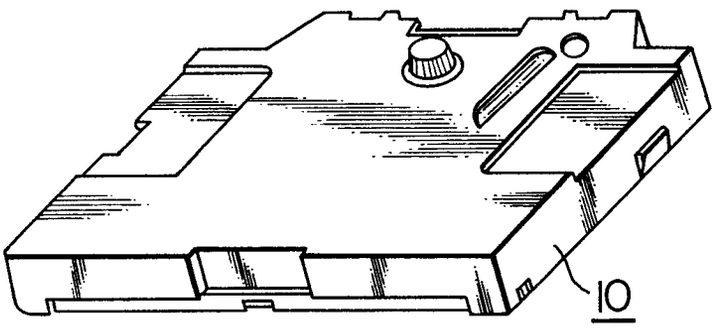

FIG. 4

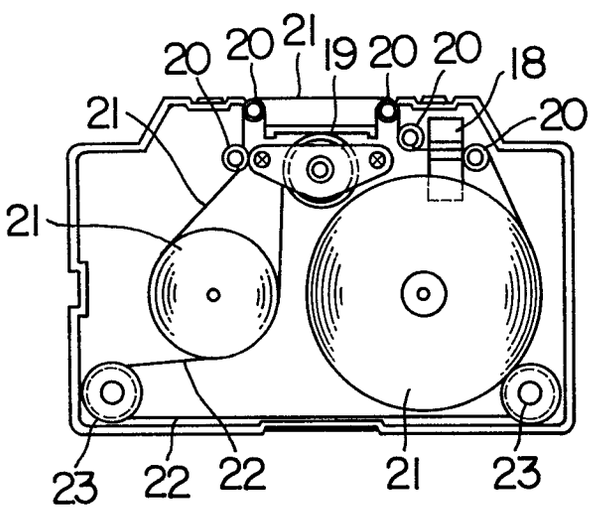

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FIG. 5

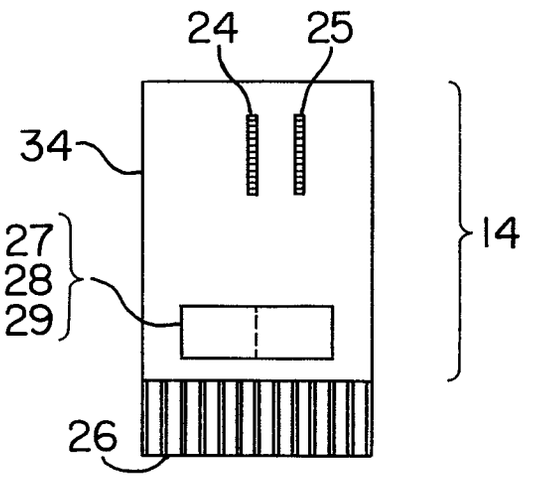

FIG. 6

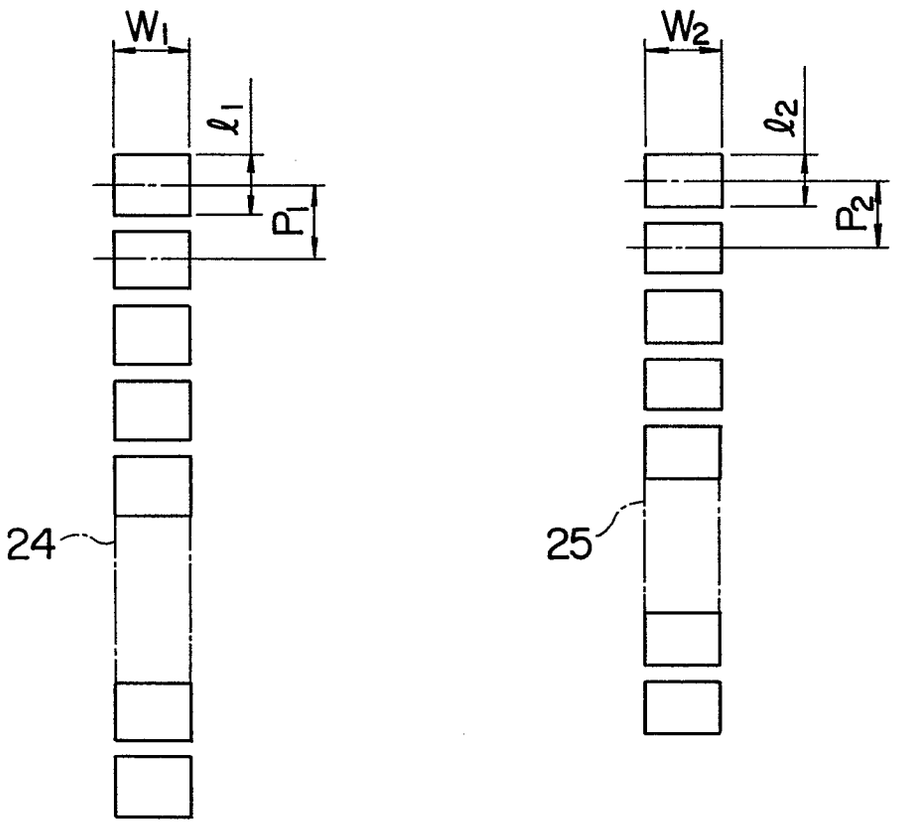

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FIG. 7

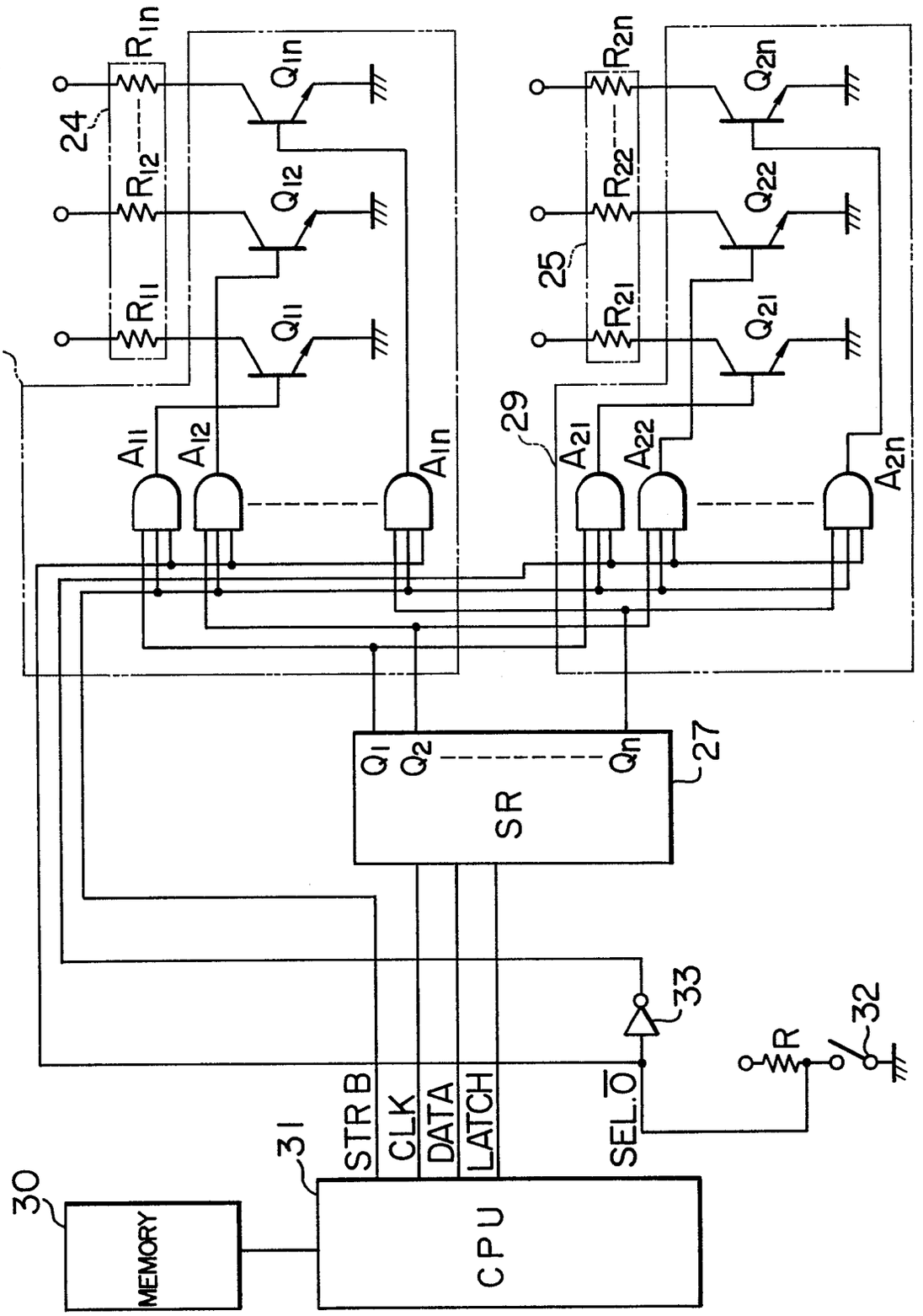

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FIG. 8