

[54] **WIRE MATRIX PRINTER HEADS** 3,400,798 9/1968 Smith..... 197/1 R
 [75] Inventor: **Dieter Stellmach, Niederstotzingen, Germany** 3,426,880 2/1969 Blodgett..... 197/1 R
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[22] Filed: **Feb. 1, 1972**

[21] Appl. No.: **222,469**

[57] **ABSTRACT**

A wire matrix printer head has the recording ends of wires positioned to form a matrix of five vertical columns of seven points each. The head is pivotally mounted on a carriage moveable in the direction of printing and an electromagnet on the carriage attracts an armature plate on the printer head to tilt the printer head downwardly to print certain characters so that the vertical range of printing of the recording ends is extended beyond the seven points of the vertical columns of the matrix.

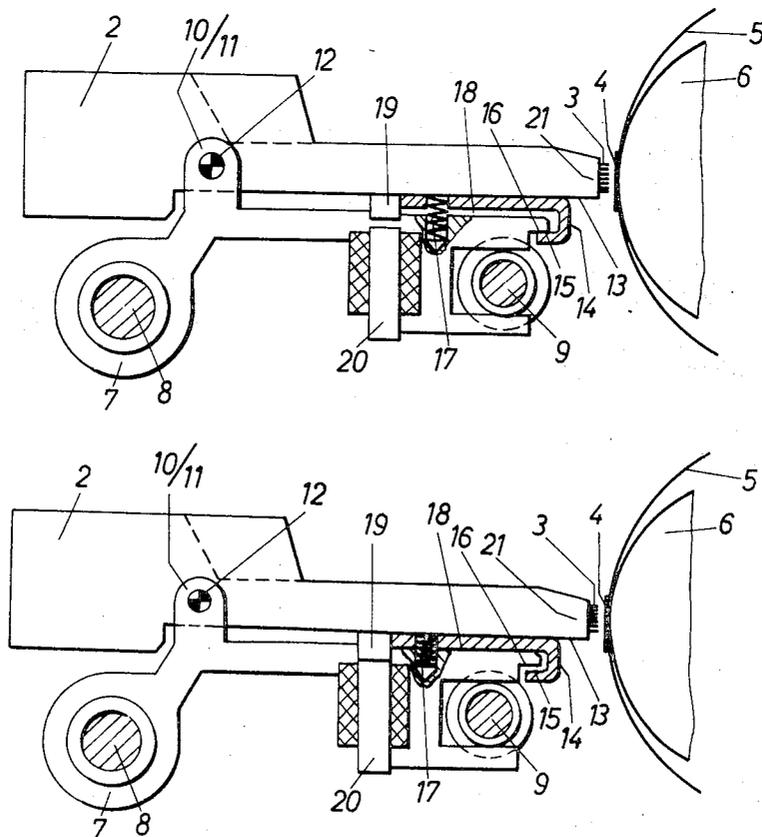
[30] **Foreign Application Priority Data**
 Feb. 19, 1971 Germany..... P 21 08 006.8

[52] U.S. Cl. 197/1 R, 101/93 C
 [51] Int. Cl. B41j 3/02
 [58] Field of Search..... 197/1; 101/93

[56] **References Cited**
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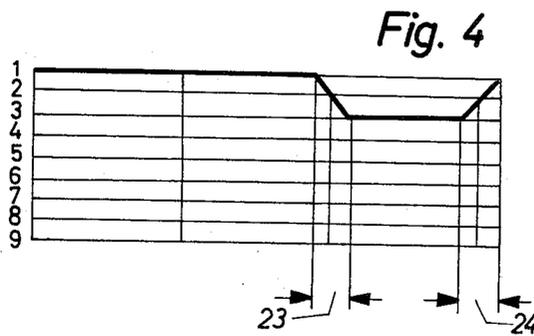
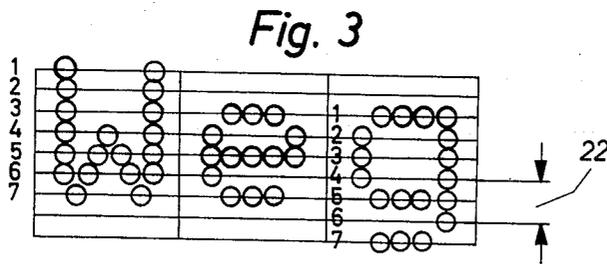
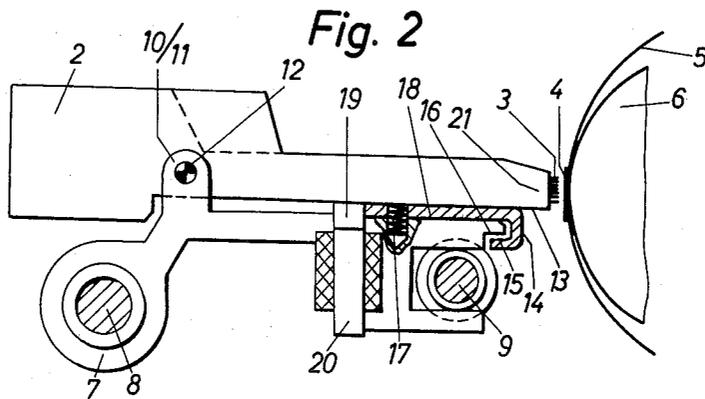
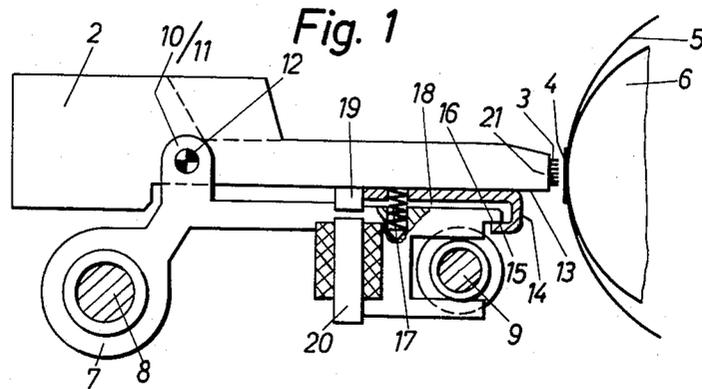
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4 Claims, 4 Drawing Figures



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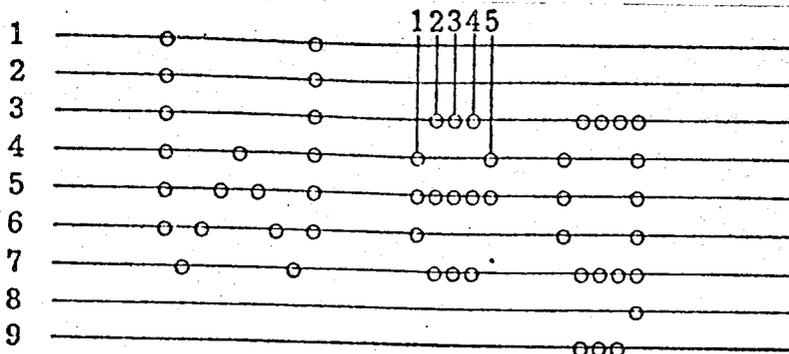


WIRE MATRIX PRINTER HEADS

The present invention relates to a wire matrix printer head, more particularly, to the mounting of the head on a moveable carriage so as to extend the vertical range of printing beyond the vertical points of the matrix defined by the ends of the wires.

A wire matrix printer head has a plurality of character forming individually operable dot print elements which are simultaneously projected in combination against a recording medium, such as an ink ribbon, to print an entire character at one time. The print elements generally comprise a number of wires having their outer ends arranged in mosaic fashion to define a matrix of 5 x 7, ie, five vertical columns of seven dots each. The wires are selectively actuated in each matrix so as to form a pattern or print a character. The wires are each individually connected to power driven actuating members, which may be logic circuits, and are operated selectively in accordance with the character or data to be printed. Upon proper selection of the wires the letters of the alphabet and the 10 decimal numerical digits as well as most commonly used symbols can be printed. Generally, individual electromagnets are employed to actuate the printing wires or needles.

It has not been possible to print both capital and lower case letters of the alphabet with known wire matrix printers having a matrix of 5 x 7 points. Where it has been desired to print both capital and lower case letters such printer heads have generally been provided with a larger matrix consisting of at least 5 x 9 points in which the printing ends of the wires are arranged in five vertical columns of nine points each. A 5 x 9 matrix would thus be sufficient to print the letters forming the word "Weg" as shown in the following diagram:



Based upon actual experience, the use of a 5 x 9 matrix wire printer head has certain disadvantages. One disadvantage is that a greater number of structural elements are required which significantly increases the manufacturing cost. Further, such a printer head has a significantly greater weight and size because of the additional electronic controls required to actuate the increased number of printing wire and to move the printer head in the direction of the printing. All these additional elements contribute significantly to greater production costs and increase the complexity of construction of the printer head which in turn increases maintenance problems. The combination of these disadvantages have tended to rule against any significant adoption of the use of a 5 x 9 matrix printer head.

It is therefore the principal object of the present invention to provide a novel and improved wire matrix printer.

It is another object of the present invention to provide a wire matrix printer head which would print a much greater variety of symbols than heretofore possible with a 5 x 7 matrix.

It is a further object of the present invention to provide a 5 x 7 matrix wire printer which is simple in construction and operation but which incorporates the advantages of a printer head having a larger matrix with a greater number of printing points.

The objects of the present invention are achieved and the disadvantages as pointed out above are eliminated by the wire matrix printer of the present invention which essentially comprises elongated guide means parallel to a line of printing. A carriage is slideably mounted on the guide means for movement in the direction of printing. A printer head is pivotally mounted on the carriage so as to be tiltable in a vertical plane. Mounted in the printer head is a plurality of elongated character-forming recording elements adapted to be operated selectively for moving their recorded ends into and out of engagement with a record medium, such as an ink ribbon. Means are provided for selectively pivoting the printer head from its normal printing position to a position to lower momentarily the recording ends of the recording elements to print a character so as to extend the vertical range of printing of the recording ends beyond the number of vertically positioned points of the wire matrix. The pivoting means may comprise an electromagnet mounted on the carriage which cooperates with an armature plate mounted on the underside of the printer head. The electromagnet is selectively actuated in response to signals corresponding to characters requiring a lowering of the ends of the recording element.

Other objects and advantages of the present invention will be apparent upon reference to the accompanying description when taken in conjunction with the following drawings, which are exemplary, wherein;

FIG. 1 is a vertical cross-sectional view of a carriage and printer head incorporating the present invention with the head being shown in its normal printing position;

FIG. 2 is a view similar to that of FIG. 1 but showing the printer head in its lower position;

FIG. 3 is an enlarged plan view of a word printed with the printer head of the present invention wherein one of the letters has a downwardly extending portion; and

FIG. 4 is a space-time functional diagram showing the movements of the matrix printer head during the printing process shown in FIG. 3.

Proceeding next to the drawings wherein like reference symbols indicate the same parts throughout the

various views a specific embodiment of the present invention will be described in detail.

As may be seen in FIG. 1, the wire matrix printer of the present invention comprises a print head assembly indicated generally at 1 which comprises a printer head 2 in which are mounted a number of wires having their outer or recording ends 3 arranged in a mosaic pattern to form a 5×7 matrix. As known in the art, the recording wires may comprise music wires and at least a portion of the length of each wire is enclosed by a guide sheath in which are provided suitable means for lubricating the wires to enable the wires to move freely within the sheaths in response to the individual electromagnets for actuating each wire.

The recording ends 3 of the printing wires or needles are brought into contact with a color or ink ribbon 4 in a preselected pattern in accordance with the character or data to be printed. The ribbon is then pressed against a paper or other recording medium 5 upon which the characters are to be recorded. The other face of the paper is in contact upon a supporting surface 6 which may comprise a roll as also known in the art.

The print head assembly is mounted on a carriage 7 which in turn is slideably mounted upon a pair of guide rods 8 and 9 positioned parallel to the line of printing so that the printing head is displaced in the direction of the line of print.

In order to permit a tilting or pivoting of the print head assembly in a vertical plane the printer head 2 is pivotally mounted at bearings 10 and 11 on a shaft or axle 12 which is also positioned parallel to the direction of printing and to the guide rods 8 and 9. The pivot points 10 and 11 are positioned in the vicinity of the rear guide shaft 8 which is further away from the line of print.

On the underside 13 of the printer head there is attached a guide rail 14 which is U-shaped and which has an inner end 15 which contacts the lateral surface or underside of a substantially horizontal lip 16 on the carriage 7. The printer head 2 is maintained in its normal printing position, as shown in FIG. 1 by means of a pressure spring 17 disposed between the printer head and the carriage. Maintaining of the printer head in this normal position thus creates an air gap 18 between the printer head and the carriage 7.

An armature plate 19 is also fastened to the underside 13 of the printer head and is opposite an electromagnet 20 mounted on the carriage 7. It is apparent that energization of the electromagnet 20 by means of an electrical signal will attract the armature plate and accordingly the printer head downwardly into the position as shown in FIG. 2.

If it is desired to print the word "Weg" as shown in FIG. 3, the letters "W" and "e" are formed by utilizing the 5×7 printing points in their normal working position. Therefore, no lowering of the printer head is necessary for the printing of these letters. However, in order to print "g", including its lower end, the same 5×7 matrix of printing points is lowered in the amount defined by the distance 22 as shown in FIG. 3. This is accomplished by lowering the recording end 21 of the printer head 2 to the extent defined by the air gap 18 downwardly into the position where the full letter "g" can be printed in response to a signal generated from a corresponding logic circuit. This signal also energizes the electromagnet 20 which attracts the armature plate 19 to tilt momentarily the printer head to the position as shown in FIG. 2. Upon termination of the signal, the matrix printer head will return to its normal printing position under the action of the spring 17.

In FIG. 4, the diagram illustrates the relative duration of the movements of the matrix printer head with respect to its printing positions. The time of the downward movement 23, as well as the time 24 of the return movement to the normal position is indicated.

Thus it can be seen that the present invention discloses a wire matrix printer having a 5×7 matrix with which symbols and characters can be printed which previously required much larger matrices, such as a 5×9 or even greater. Further, the wire matrix printer according to the present invention is simple in construction and operation and requires a minimum of maintenance. The invention has been disclosed with respect to the writing of capital and lower case letters in high speed printers commonly employed in connection with computers and the like, but 17 can also be used with a minimum of modification in thermal printing apparatus, ink recorders, RMP recorders and other forms of recording apparatus. With a minimum of modification, the wire matrix printer according to the present invention can also be used with a vertically downward movement during the printing operation. The pivoting of the printer head would be accomplished in the same manner as described above in order to obtain the advantages of a larger matrix.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions, and accordingly, it is described to comprehend such modifications within this invention as may fall within the scope of the appended claims.

What is claimed is:

1. In a wire matrix printer, the combination of elongated guide means parallel to a line of printing, a carriage slideably mounted on said guide means for movement in the direction of printing, a printer head pivotally mounted on said carriage and tiltable in a vertical plane, a plurality of elongated character-forming recording elements on said printer head to define a matrix having a predetermined number of horizontal and vertical ends and adapted to be operated selectively for moving their recording ends into and out of engagement with a record medium, means for selectively extending the vertical range of printing of said recording ends beyond said predetermined number of vertically positioned recording ends consisting of means selectively pivoting said printer head to momentarily lower the recording ends of said recording elements to print a character, said pivoting means comprising an armature plate on said printer head and an electromagnet on said carriage opposed from said armature plate and energized in response to predetermined signals corresponding to the characters to be printed.

2. In a wire matrix printer as claimed in claim 1 wherein said guide means comprise a pair of parallel guide rods, said printer head pivotally mounted in the vicinity of the guide rod further away from the line of printing.

3. In a wire matrix printer as claimed in claim 1 and comprising a U-shaped guide rail on the underside of said printer head, means on said carriage defining a horizontal lip, said guide rail contacting the underside of said lip when the printer head is in its normal printing position.

4. In a wire matrix printer as claimed in claim 3 and comprising spring means between said carriage and said printer head to maintain said printer head in its normal position so that an air gap is formed therebetween.