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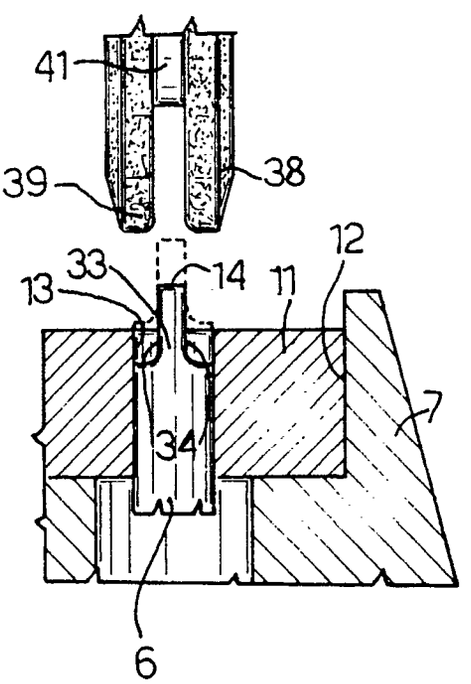
(54) **Dot matrix print head.**

(57) A print head wherein the pins (6) present a circular section and an end portion (33) tapered to form a rectangular printing surface (14). On a serial print head, the printing surfaces (14) are oriented with the longer side (34) arranged vertically. Each pin (6) is welded to a respective anchor (23) for preventing it from rotating. After assembling the pins (6) on to a support (5), the end portion (33) may be formed by flattening the two lateral surfaces in one grinding operation, using two diamond wheels (38, 39) spaced according to the required thickness of the end portion (33). The print head is particularly suitable for printing cMC7 magnetic font characters.

Fig.3



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The present invention relates to a dot matrix print head comprising a series of pins guided in sliding manner into the print position, said pins being arranged in at least one row and being selectively operated by a corresponding series of electromagnets.

Dot matrix print heads are widely used on modern printers on account of the higher printing speed afforded as compared with nonmatrix printers, and the enormous range of fonts generable by means of straightforward permanent memories.

For special applications, such as the printing of characters readable both visually and automatically by means of optical or magnetic readers, for the character to be recognized by the reader, it is essential that the contour, particularly the vertical portions, be clearly and accurately defined. On print heads of the aforementioned type, the pins usually present a round printing surface resulting in characters consisting of round dots with an uneven contour.

For quality character printing, with a contour comparable to that of nonmatrix printers, printers have been proposed whereby each line is printed twice, or featuring a large number of pins arranged in one or more rows for printing a single vertical column of character dots. In addition to being highly complex and expensive, printers of the aforementioned types all fail to provide for printing thin straightline segments with a well defined contour. For this reason, standard optical or magnetic recognition characters continue to be printed on dedicated printers, e.g. with printwheels or interchangeable members such as daisywheels.

It is an object of the present invention to provide a dot matrix print head designed to print straightline segments with a highly well defined contour, which is extremely straightforward in design, and provides for overcoming the aforementioned drawbacks typically associated with known print heads.

According to the present invention, there is provided a print head comprising a series of pins guided in sliding manner into the print position, said pins being arranged in at least one row and being selectively activated by a corresponding series of electromagnets; characterised by the fact that each said pin presents a printing surface substantially in the form of a rectangle having one side parallel to said row, for enabling straightline segments to be printed by simultaneously operating a group of adjacent said pins.

A preferred non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Fig.1 shows a partial horizontal section of the print head according to the present invention;

Fig.2 shows a partial larger-scale front view of the Fig.1 print head;

Fig.3 shows a section along line III-III in Fig.2 together with a manufacturing fixture;

Fig.4 shows a magnetic character printed using the Fig.1 and 2 head.

The print head according to the present invention is particularly suitable for printing so-called CMC7 magnetic characters, an enlarged view of the character "2" of which is shown in Fig.4. These characters are printed using ink containing ferrite powder, and consist of thin vertical segments 3 of different lengths within the height of the character, and separated horizontally by gaps 4 of different widths. The overall appearance of the character printed as described above is such as to perfectly readable visually, while the combination of segments 3 and gaps 4 provides a code recognizable by a magnetic reader, and the data read by which may be transferred easily from a document, such as a cheque or similar, to a computer memory.

Number 5 in Fig.1 indicates a hollow support housing a series of nine print pins 6, each having a body made of extremely hard, round-section wire, such as steel, tungsten, tungsten carbide or similar. Support 5 comprises a substantially conical front portion 7 having a seat 8 in which is fitted a first perforated plate 9 for guiding pins 6. A second guide plate 11 is fitted in a seat 12 on the front end of support 5.

Plate 11 presents a series of nine holes 13 (Fig.s 2 and 3) arranged in a vertical row and the diameter of each of which is such as to accurately guide the portion of pin 6 adjacent to the printing surface 14 of the same. Holes 13 are generally arranged as close together as technologically possible.

Close to plate 11, each pin 6 is engaged by a leaf spring 15 (Fig.1) for taking up any slack inside hole 13 and in a constant direction for all of pins 6. Printing surface 14 engages a standard print support through a magnetic ink ribbon (not shown).

Support 5 also comprises a circular flange 16 secured to a cylindrical body 17 closed at the rear by a cover 18. Cylindrical body 17 houses a series of nine electromagnets 19 arranged circumferentially and energized selectively in known manner. Both body 17 and cover 18 are provided with flanges 20 for dissipating the heat produced by electromagnets 19.

Each electromagnet 19 comprises a core 21 of magnetic material and a coil 22, and provides for activating a respective anchor 23 normally detached from the pole shoes of core 21 by a compression spring 24 housed in a seat 25.

In particular, anchor 23 is guided by a frame 26 and is maintained by spring 24 with one end 29 resting on an inner retaining ring 27 acting as a

damper. The other end of anchor 23 is maintained contacting an outer retaining ring 28 for positioning it against a fulcrum consisting of the outer edge of the pole shoe of core 21.

End 29 of each anchor 23 is secured to the rear end 31 of a respective pin 6 for controlling the printing of one dot. Pins 6 secured by ends 29 and guide plates 9 and 11 flex slightly and, at any rate, converge, so that, when pins 6 are activated, the distance between adjacent printing surfaces 14 is further reduced as compared with that of holes 13. Body 17 houses a printed circuit 32 connected to the control circuit of electromagnets 19 and having a series of laybys to which the electric terminals of coils 22 are connected in known manner.

According to the present invention, the printing surface 14 of each pin 6 is supported on a tapered end portion 33 of pin 6 (Fig.s 2 and 3) and is substantially rectangular with its longer side 34 parallel to the row of pins 6. In particular, the two faces of portion 33 relative to sides 34 of printing surface 14 are formed by flattening two parallel opposite surfaces on the end of the body of pin 6, so that the shorter sides 36 of the rectangle of surface 14 actually consist of two small arcs.

Portion 33 is preferably 1 to 2 mm long, with a thickness ranging from 1/2 to 1/4 of the diameter of pin 6. With a pin diameter of 0.35 mm, the thickness of portion 33 may advantageously range from 0.12 to 0.13 mm. To ensure permanent vertical alignment of sides 34 of portion 33, pin 6 must be prevented from rotating in guide 11. Advantageously, rear portion 31 of pin 6 is rigidly connected to end 29 of anchor 23 by means of a weld 37 (Fig.1) between the edge of end 29 and the two sides of portion 31.

When printing, an anchor 23 activates a respective pin 6 to expel portion 33 from plate 11, and respective printing surface 14 engages the printing support through the magnetic ink ribbon, so as to print a thin vertical line. By simultaneously activating a number of adjacent pins 6, the various print lines combine to form a thin vertical segment with a highly defined, perfectly straight contour. Using a character generator to control the print head, it is therefore possible to print optical or magnetic font characters and, in particular, CMC7 magnetic font characters as shown in Fig.4.

The print head according to the present invention can be manufactured using most of the components used for conventional heads featuring pins with circular printing surfaces. After welding portion 31 of each pin 6 to the edge of end 29 of respective anchor 23, at least some of the print head components are assembled inside support 5 and body 17.

The print head is then fitted on to a grinder on which a fixture (not shown) rigidly secures pins 6 with portions 33 outside guide 11, as shown by the dotted line in Fig.3. The grinder is fitted with two parallel diamond wheels 38 and 39 separated by a spacer 41 of the same thickness as that required of portion 33. Sides 34 of portions 33 of pins 6 may thus all be machined in one grinding operation for enabling extremely low-cost manufacture of the print head.

As compared with both known dot matrix and nonmatrix print heads, the advantages of the print head according to the present invention will be clear from the foregoing description. In particular, it provides for printing both character recognition, e.g. optical, fonts, and conventional fonts produced by one or more passes of the print head. Moreover, as compared with known types featuring a large number of pins, the print head according to the present invention provides for obtaining thinner segments with a more highly defined contour, and is much cheaper to produce.

To those skilled in the art it will be clear that changes may be made to the print head as described and illustrated herein without, however, departing from the scope of the present invention. For example, each pin may be welded to an actuating member separate from anchor 23; pins 6 may be spring-activated (stored energy), in which case, electromagnet 19 is energized for reloading the spring, and is de-energized for printing; tapered portion 33 may be designed differently, e.g. be wedge-shaped, and produced using means other than those described; the print head may be designed for parallel printers, in which case, the smaller side 36 of the rectangle will be parallel to the horizontal row of pins; finally, the print head may be designed for printing straight horizontal and/or vertical segments by appropriately orienting the rectangle of the printing surface of each pin.

Claims

1. A print head comprising a series of pins (6) guided in sliding manner into the print position, said pins (6) being arranged in at least one row and being selectively activated by a corresponding series of electromagnets (19); characterised by the fact that each said pin (6) presents a printing surface (14) substantially in the form of a rectangle having one side (36, 34) parallel to said row, for enabling straightline segments to be printed by simultaneously operating a group of adjacent said pins (6).

2. A print head as claimed in Claim 1, characterised by the fact that said pins (6) are arranged in a vertical row with the longer side (34) of said printing surface (14) parallel to the

same; said electromagnets (19) being activated in such a manner as to print characters having at least one vertical edge and readable both visually and by an automatic character reader.

3. A print head as claimed in Claim 1 or 2, characterised by the fact that said printing surface (14) is located on a tapered portion (33) of each said pin (6).

4. A print head as claimed in Claim 3, characterised by the fact that each said pin (6) presents a circular-section body guided by a respective hole (13) in a common guide member (11), so that the shorter side (36) of said rectangle is in the form of an arc.

5. A print head as claimed in Claim 4, characterised by the fact that a portion (31) of said pin (6) is welded to an actuating member (23) of a respective said electromagnet (19) so as to maintain said longer side (34) parallel to said row.

6. A print head as claimed in Claim 5, characterised by the fact that said actuating member consists of the anchor (23) of said respective electromagnet (19); said portion (31) of said pin (6) being welded to the edge of one end (29) of said anchor (23).

7. A print head as claimed in Claim 5 or 6, characterised by the fact that said tapered portion (33) is formed by flattening two parallel surfaces of an end portion of said pin (6) by means of two side by side diamond wheels (38, 39) separated by a distance equal to the length of said shorter side (36).

8. A print head as claimed in one of the foregoing Claims, characterised by the fact that said shorter side (36) is 1/4 to 1/2 of said longer side (34).

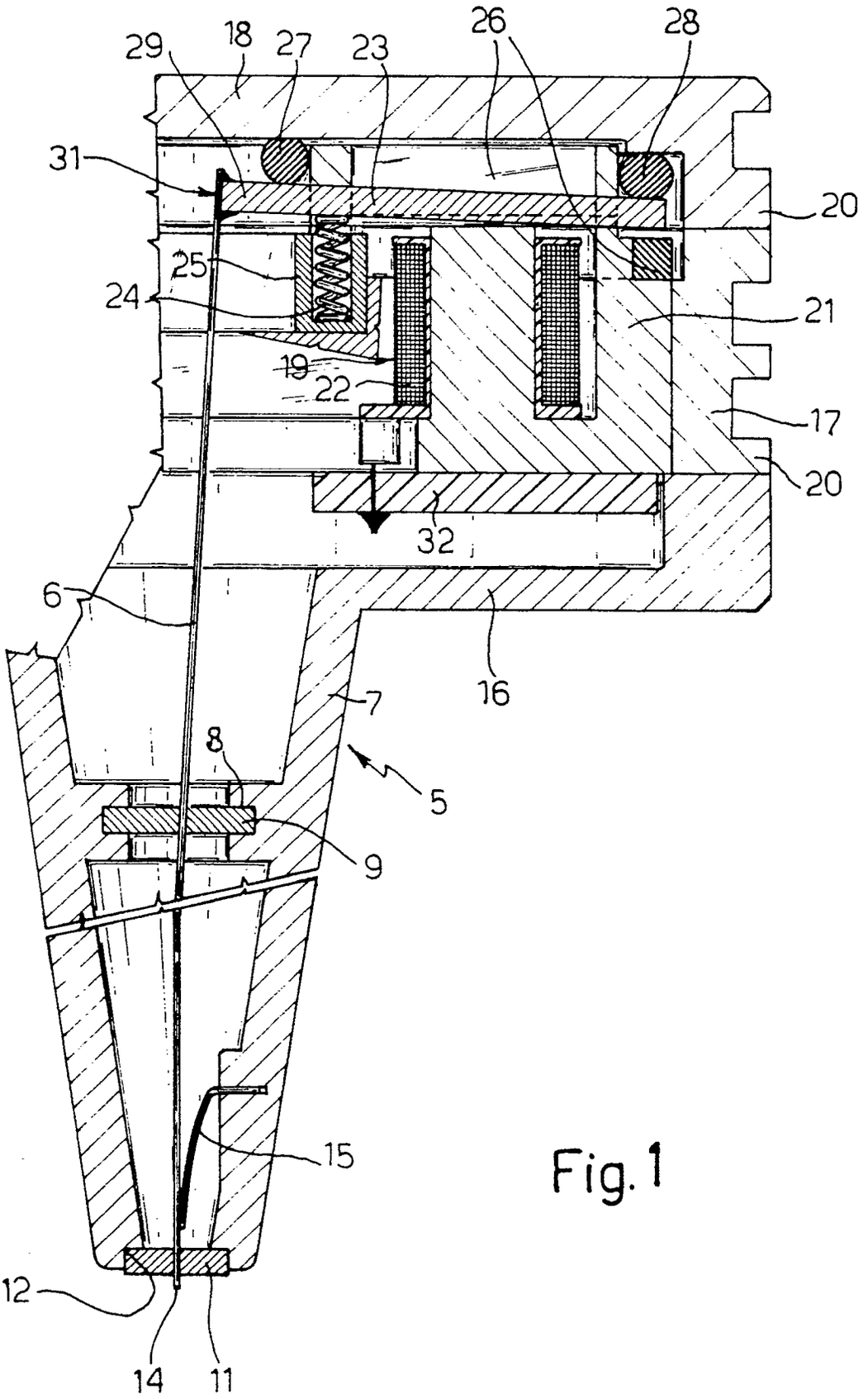

Fig. 1

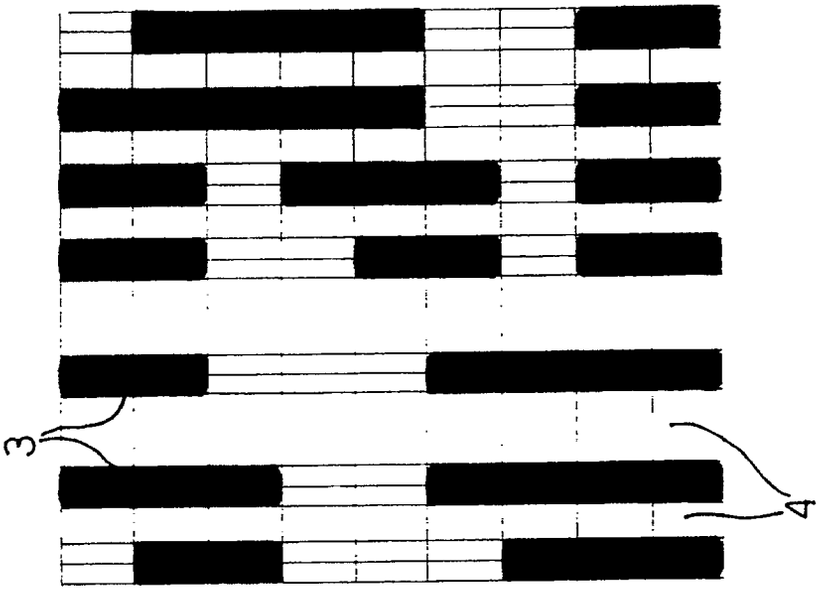

Fig. 4

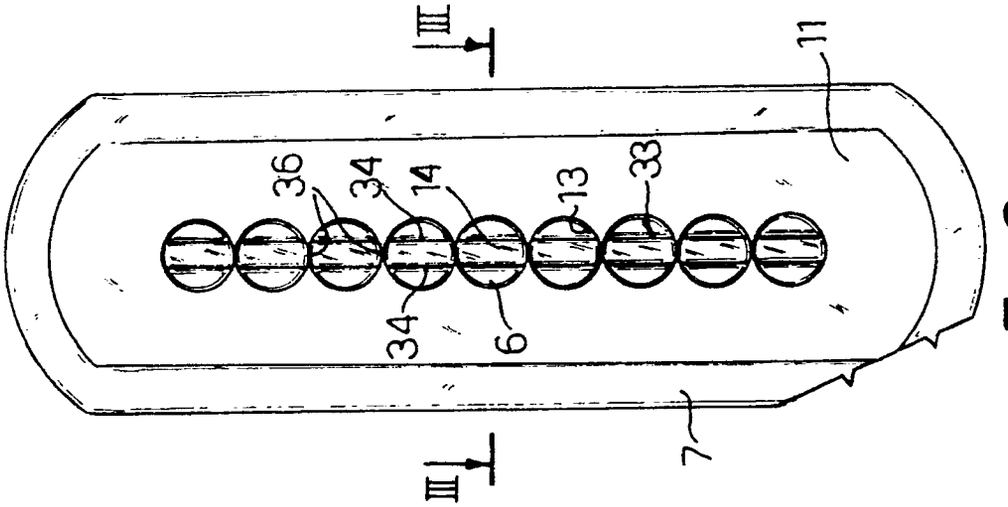

Fig. 2

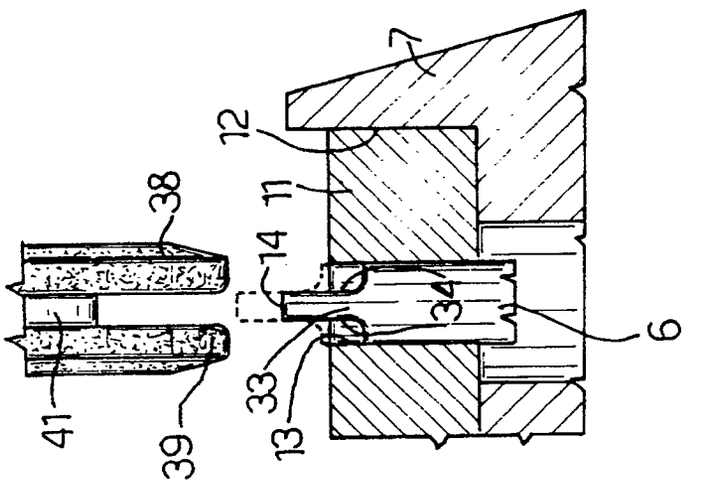

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number

EP 91 10 6236

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	US-A-3 822 005 (R.H. MURAT) * claim 1; figures 1,2 *	1,2	B 41 J 2/255
A	PATENT ABSTRACTS OF JAPAN vol. 10, no. 114 (M-473)(2171), 26 April 1986; & JP - A - 60242069 (NIPPON DENKI K.K.) 02.12.1985 * the whole document *	1	
A	PATENT ABSTRACTS OF JAPAN vol. 12, no. 378 (M-751)(3225), 11 October 1988; & JP - A - 63130354 (HITACHI LTD.) 02.06.1988 * the whole document *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B 41 J

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
Berlin	25 July 91	ZOPF K

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
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E: earlier patent document, but published on, or after the filing date
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