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

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Description

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 known from the document US-A-3 822 005 a device for printing characters by points, wherein the printing elements are formed of superimposed blades, the end portion of which is laterally tapered to form the printing tip. The blades are guided by a guiding member bevel-edged on the side of the already printed character, so as to render the last printed character visible.

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 selectively activated by a corresponding series of electromagnets, at least the portion of said pins adjacent to said printing position being arranged in a vertical row, characterised in that each one of said pins presents a printing surface substantially in the form of a rectangle wherein the size of the shorter side is comprised between 1/4 and 1/2 of the size of the longer side, said longer side being parallel to said row, whereby a simultaneously operation of a group of adjacent said pins causes the printing of a straightline vertical segment with a well defined contour.

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 as defined by the claims. 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 selectively activated by a corresponding series of electromagnets (19), at least the portion of said pins (6) adjacent to said printing position being arranged in a vertical row, characterised in that each one of said pins (6) presents a printing surface (14) substantially in the form of a rectangle wherein the size of the shorter side (36) is comprised between 1/4 and 1/2 of the size of the longer side (34), said longer side (34) being parallel to said row, whereby a simultaneously operation of a group of adjacent said pins (6) causes the printing of a straightline vertical segment with a well defined contour.

2. A print head as claimed in claim 1, characterised in that said electromagnets (19) are circumferentially arranged in a cylindricalbody (17) and are selectively operated in such a manner as to print characters having at least one thin vertical segment and being readable both visually and by a magnetic or optical character reader.

3. A print head as claimed in claim 1 or 2, characterised in 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 4, characterised in 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 printer head as claimed in claim 4, characterised in that said circular section body has a diameter of about 0.35 mm, said shorter side (36) being in the range from 0.12 to 0.13 mm for enabling the print head to print vertical segments of the CMC7 character font.

6. A print head as claimed in claim 4 or 5, characterised in that a portion 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.

7. A printer head as claimed in claim 6, characterised in that said actuating member consists of anchor (23) of said electromagnet (19), said portion (31) of said pin (6) being welded to the edge of one end (29) of said anchor (23).

8. A printer head as claimed in claim 6 or 7, characterised in that said tapered portion (33) is formed by flattening two parallel surfaces (34) 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 size of said shorter side (36).

9. A printer head as claimed in claim 8, characterised in that said tapered portions (33) of said pins (6) are so formed by fitting said print head on to a grinder fitted with said wheels (38, 39) and by machining said parallel surfaces (34) of all said pins (6) in a single grinding operation.

Patentansprüche

1. Ein Druckerkopf mit einer Reihe von Stiften (6), die gleitend in die Druckstellung geführt sind, wobei die Stifte (6) wahlweise durch eine entsprechende Reihe von Elektromagneten (19) betätigt werden, wobei wenigstens der Abschnitt der Stifte (6) nahe der Druckstellung in einer vertikalen Zeile angeordnet ist, dadurch gekennzeichnet, daß jeder einzelne der Stifte (6) eine Druckoberfläche (14) im wesentlichen in der Form eines Rechteckes darbietet, wobei die Länge der kürzeren Kante (36) zwischen einem Viertel und der Hälfte der Länge der längeren Kante (34) beträgt, wobei die längere Seite (34) parallel zu der Spalte angeordnet ist, wodurch ein gleichzeitiger Betrieb einer Gruppe von nebeneinanderliegenden Stiften (6) das Drucken eines geradlinigen vertikalen Segmentes mit einer genau definierten Kontur bewirkt.

2. Ein Druckerkopf nach Anspruch 1, dadurch gekennzeichnet, daß die Elektromagnete (19) am Umfang in einem zylindrischen Körper (17) angeordnet sind und wahlweise in einer solchen Weise betrieben werden, daß Zeichen mit wenigstens einem dünnen vertikalen Segment gedruckt werden und sowohl visuell als auch durch einen magnetischen oder optischen Zeichenleser lesbar sind.

3. Ein Druckerkopf nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Druckoberfläche (14) an einem sich verjüngenden Abschnitt (33) jedes Stiftes (6) angeordnet ist.

4. Ein Druckerkopf nach Anspruch 4, dadurch gekennzeichnet, daß jeder Stift (6) einen kreisabschnittsförmigen Körper hat, der in einem ent-

sprechenden Loch (13) in einem gemeinsamen Führungsteil (11) geführt ist, so daß die kürzere Kante (36) des Rechtecks die Form eines Bogens hat.

5. Ein Druckerkopf nach Anspruch 4, dadurch gekennzeichnet, daß der kreisabschnittsförmige Körper einen Durchmesser von etwa 0,35 mm hat, wobei die kürzere Kante (36) im Bereich von 0,12 bis 0,13 mm ist, um den Druckerkopf in die Lage zu versetzen, senkrechte Segmente des CMC7-Zeichensatzes zu drucken.

6. Ein Druckerkopf nach Anspruch 4 oder 5, dadurch gekennzeichnet, daß ein Abschnitt des Stiftes (6) an ein Betätigungsglied (23) eines entsprechenden Elektromagneten (19) angeschweißt ist, um so die längere Kante (34) parallel zu der Spalte zu halten.

7. Ein Druckerkopf nach Anspruch 6, dadurch gekennzeichnet, daß das Betätigungsglied aus einem Anker des Elektromagneten (19) gebildet ist, wobei der Abschnitt (31) des Stiftes an die Kante eines Endes (29) des Ankers (23) angeschweißt ist.

8. Ein Druckerkopf nach Anspruch 6 oder 7, dadurch gekennzeichnet, daß der sich verjüngende Abschnitt (33) durch Abflachen zweier paralleler Oberflächen (34) eines Endabschnittes des Stiftes (6) mittels zweier nebeneinander angeordneter Diamanträder gebildet ist, die in einem Abstand voneinander getrennt ist, der gleich der Größe der kürzeren Kante (36) ist.

9. Ein Druckerkopf nach Anspruch 8, dadurch gekennzeichnet, daß die sich verjüngenden Abschnitte (33) der Stifte (6) so gestaltet sind, daß der Druckerkopf auf einen Schleifer aufgesetzt ist, der mit den Rädern (38, 39) verbunden ist, und daß die parallelen Oberflächen (34) aller Stifte (6) in einem einzigen Schleifvorgang bearbeitet werden.

Revendications

1. Tête d'impression comprenant une série d'aiguilles (6) guidées de manière coulissante vers une position d'impression, lesdites aiguilles (6) étant activées sélectivement par une série correspondante d'électroaimants (19), au moins la partie voisine de la position d'impression desdites aiguilles (6) étant disposée en rangée verticale, caractérisée en ce que chacune des aiguilles (6) présente une surface d'impression (14) de forme sensiblement rectangulaire, la taille du côté le plus petit (36) étant comprise entre 1/4 et 1/2 de la taille du côté le plus long (34), celui-ci étant parallèle à ladite rangée, de telle sorte que la commande simultanée d'un groupe d'aiguilles (6) voisines permet l'impression d'un segment vertical droit avec un contour bien défini.

2. Tête d'impression selon la revendication 1, caractérisée en ce que lesdits électroaimants (19) sont disposés circonférentiellement dans un corps cylindrique (17) et sont commandées sélectivement de telle sorte qu'ils puissent imprimer des caractères ayant au moins un segment vertical fin, lisibles à la fois visuellement et par un lecteur de caractères optique ou magnétique.

3. Tête d'impression selon l'une des revendications 1 ou 2, caractérisée en ce que la surface-d'impression (14) est située sur une partie effilée (33) de chaque aiguille (6).

4. Tête d'impression selon la revendication 4, caractérisée en ce que chaque aiguille (6) présente un corps de section circulaire guidé par un orifice correspondant (13) d'un organe (11) de guidage classique, de telle manière que le plus petit côté (36) de la partie rectangulaire présente la forme d'un arc.

5. Tête d'impression selon la revendication 4, caractérisée en ce que ledit corps à section circulaire a un diamètre d'environ 0,35 mm, le petit côté (36) étant de longueur comprise entre 0,12 à 0,13 mm, de manière à permettre à la tête d'impression d'imprimer des segments verticaux de la police de caractère CMC7.

6. Tête d'impression selon l'une des revendications 4 ou 5, caractérisée en ce qu'une partie de chaque aiguille (6) est soudée à un organe (23) activé par l'électroaimant (19) correspondant de telle manière à maintenir le côté (34) le plus long parallèle à ladite rangée.

7. Tête d'impression selon la revendication 6, caractérisée en ce que l'organe d'activation consiste en un levier (23) dudit électroaimant (19), ladite partie (31) d'aiguille (6) étant soudée à l'arête d'une l'extrémité (29) dudit levier (23).

8. Tête d'impression selon l'une des revendications 6 ou 7, caractérisée en ce que la partie effilée (33) est réalisée par aplanissement de deux surfaces parallèles (34) d'une extrémité de ladite aiguille (6) au moyen de deux roues

en diamant (38, 39) parallèles séparées par une distance égale à la taille du petit côté (36).

9. Tête d'impression selon la revendication 8, caractérisée en ce que la partie effilée (33) desdites aiguilles (6) est également réalisée en mettant ladite tête d'impression sur une meuleuse équipée desdites roues (38, 39) et en usinant les deux surfaces parallèles (34) de toutes lesdites aiguilles (6) en une seule opération de meulage.

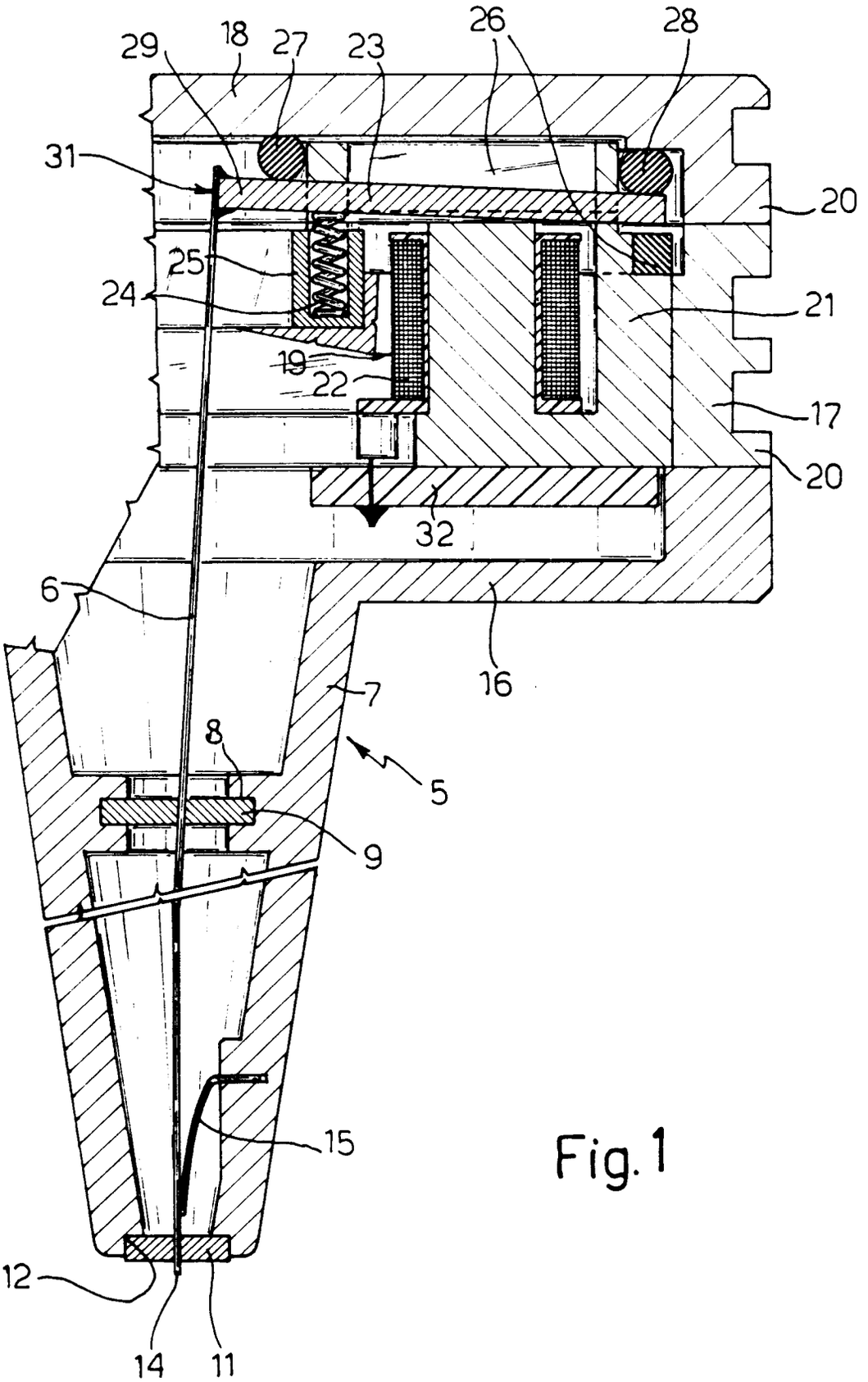

Fig. 1

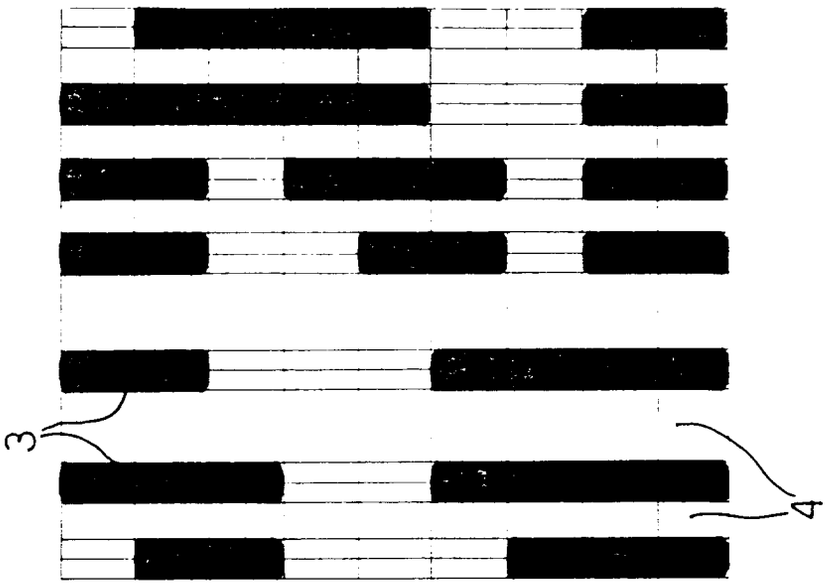

Fig. 4

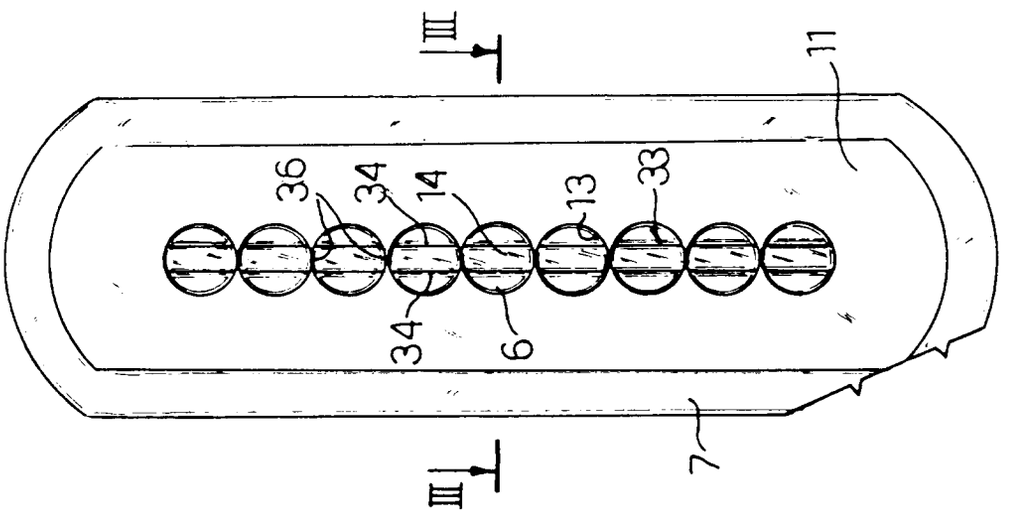

Fig. 2

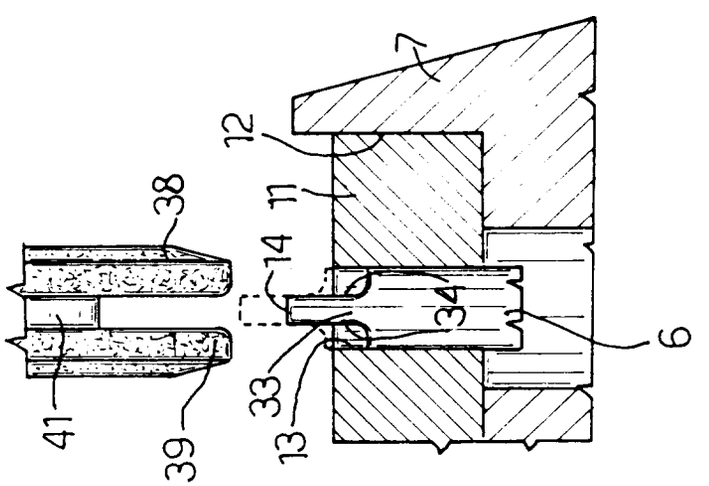

Fig. 3