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(19)(CA) **APPLICATION FOR CANADIAN PATENT** (12)

(54) Device for Use in Braille Printing or Paperless Braille Communication

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(73) Same as inventor

(57) 11 Claims

ABSTRACT

A device for forming Braille characters for tactile sensation or impression onto an embossable substrate includes a substantially block-like main body. At least one array of six Braille printing pins is contained in the block in a 2 X 3 Braille cell configuration. Each said pin is contained in a first cylindrical bore and is movable between a retracted position whereby it does not protrude from the block, and an extended position whereby the tip of the pin protrudes from the block. Means are associated with each said pin for maintaining each pin in an extended position.

The present invention relates to the field of Braille communication. In particular, the present invention provides a Braille communications device suitable for use in a Braille printer or as a paperless Braille device.

Braille printers use devices for embossing Braille characters onto heavy gauge paper. Each character or symbol in the Braille alphabet is represented by a unique combination of raised dots in a two wide by three high Braille cell. These dots are conventionally embossed onto a piece of paper in one of two ways. The more traditional way is by the use of embossing dies arranged in a manner of a typewriter. As each character of a word is to be embossed, the appropriate die is pressed against a paper substrate behind which is situated a template having indentations aligned with the dots of a six-dot Braille cell. The disadvantage of this form of printer is a very large number of unique dies must be provided, one for each character. Each must be moved from a resting area to the paper and then moved away for the printing of a single character. It will therefore be appreciated that this form of printing is quite slow. It is also quite expensive, since these dies are expensive. Moreover, it is a very noisy way to print, as the dies are swung onto the template from their holding area with considerable force.

More recently, Braille printers have been developed utilizing computer technology. These use printing heads exemplified by the

printer head shown in Applicant's U.S. Patent No. 4,735,516. In this form of printer, a row of solenoid driven printing pins are moved back and forth across a paper substrate, embossing individual Braille dots in a line of Braille characters. The paper substrate is advanced incrementally after each pass of the printing head, so that after three passes, a line of Braille characters will be fully embossed. This form of printing, while also expensive, is very fast. However, it remains expensive, and is fairly noisy. Also, it consumes a considerable amount of power, so it is suitable for stationary applications primarily.

The object of the present invention is to provide a fairly low cost device for use in Braille printing. A further object is to provide such a device that will be less noisy than devices currently in use. Another object of the present invention is to provide such a device that is also adaptable for paperless Braille communication.

In a broad aspect, the present invention relates to a device for forming Braille characters for tactile sensation or impression onto an embossable substrate including: i) a substantially block-like main body; ii) at least one array of six Braille printing pins contained in said block in a 2 X 3 Braille cell configuration, each said pin being contained in a first cylindrical bore and being movable between a retracted position whereby said pin does not protrude from said block, and an extended position whereby the tip

of said pin protrudes from said block; and iii) means associated with each said pin for maintaining each said pin in an extended position.

In drawings that illustrate the present invention by way of example:

Figure 1 is a perspective view of a Braille print head according to the present invention;

Figure 2 is a cross sectional view of the printhead of of Figure 1;

Figure 3 is a detail view of the junction between a solenoid and a rod which is mounted to a Braille printing pin in the printing head of Figure 1;

Figure 4 is a further detail of the solenoid and rod illustrated in Figure 3; and

Figure 5 is a perspective view of an assembly of two printing heads on a track.

Referring now to the drawings, it will be seen that each printing head 1 comprises a block on which are mounted six solenoids 2. The plunger 3 of each solenoid 2 terminates in a rod 4 which is withdrawn, as the solenoid is electrically activated, through a bore 5, away from a second rod 6 that extends transversely from the end of rod 4 on the solenoid.

Rod 4 extending from the solenoid terminates in a profiled cam surface 7 having an inclination of about 30° from the horizontal (given the direction of rod 4 as horizontal). Where rod 4 is joined to the end of solenoid plunger 3, there is provided a radially outwardly extending flange 8. Between flange 8 and the inner end of the cylinder 9 of the solenoid 2, there is a spring 10 which exerts force against cylinder 9 and flange 8 to press rod 4 to the end of bore 5 except when the solenoid is activated. Immediately adjacent cam surface 7 on rod 4 in a flat surface 11 on which the second rod 6 rests when rod 4 is in its forward position. When the solenoid 2 is activated, then, rod 4 will be withdrawn, and rod 6 will slide down cam surface 7. The extent of withdrawal of rod 4 is selected to permit rod 6 to slide down far enough so as to retract from the upper surface of block 1 a Braille printing pin 12 extending co-axially upwardly from the upper end of rod 6.

Between the upper end of rod 6 and the upper surface of the block 1, there is a compression spring 13 bearing against the rod 6 to press it downwardly. The upper end of the spring 13 bears against a plate 14 which is screwed to the upper surface of the block. Plate 14 is apertured with six holes arranged in the shape of a Braille cell. Plate 14 may be removed for maintenance purposes, for instance to replace worn printing pins 12.

It will be observed that three complete arrangements of solenoid, horizontal rod, vertical rod and printing pin are

provided on each side of the block 1, to yield a total of six printing pins - enough to print a Braille character. Because of the size of a solenoid, the solenoids are arranged on three levels, with the top solenoid being provided for the printing pin closest to the side of the block from which the solenoid extends, and the bottom solenoid being operatively connected to the pin furthest therefrom in the vertical row of pins.

The solenoids are electrically connected to a driver board receiving signals from a CPU. For each character to be formed by the array of six printing pins on a block, all six solenoids are simultaneously fed a signal, either to retract or to remain stationary. Those solenoids which retract will cause their associated Braille pin to retract. The particular combination of unretracted pins remaining will form a Braille character.

The Braille character forming device described above may be utilized in two distinct ways: as a paperless Braille communication device, or in a Braille printing device as a printing head.

In its first mode of utilization, as a paperless communication device, one or more blocks, connected to a suitable electronic driver, are provided with the plate 14 on their upper surface accessible by the fingertips of a person. Communication of information via the device is then possible by operating the device to form one character (or series of characters) after another at a

desired speed. The characters are sensed by the fingertips of the person using the device as they are formed. A device of this kind may be connected, in a manner that will be possible for one skilled in the art, to an optical scanner, so that visually readable characters may be converted directly to tactile Braille characters. In this way, it is not necessary to prepare a Braille text of a visually readable text for a person to read the text in Braille.

Alternately, the device of the present invention may be utilized for form a novel printing mechanism for a Braille printer. With reference to Figure 5, it will be seen that one or more printing head blocks 1 of the present invention may be mounted on a pair of rails 15 which may be cylindrical shafts which pass through apertures 16 on the blocks. The apertures may be provided with suitable friction reducing bushings. The blocks are movable back and forth across a printing area that will correspond to the width of a piece of standard Braille printing paper. A suitable means of moving the block or blocks across the page would be a stepper motor connected by a belt drive to the block or blocks. Alternatively, one of the shafts on which the blocks are mounted may be threaded and engagable with corresponding threads in the aperture of the blocks through which is passes. Rotation of such a threaded shaft will move the block.

Located immediately above the blocks, on a similar set of two shafts, one of which may be similarly threaded, are embossers,

which are solid blocks having a pattern of indentations on their surface facing the said printing blocks, of six Braille dots. This pattern of indentations is aligned with the pattern of Braille pins on the print blocks. Moreover, one of the two shafts on which the embossers is mounted is fixed, and one is movable. The said fixed shaft acts as a hinge about which the embosser may pivot to be moved. The other shaft is affixed at each end to a fairly powerful solenoid, whereby actuation of the solenoids on which the movable shaft is mounted will cause the embosser to move against the print blocks and emboss Braille characters. In operation then, Braille is printed as follows:

i) a conventional paper feed, which may be a tractor feed or a rubber roller moves a piece of embossable Braille printing paper into position, so that it is between the print blocks and embossers;

ii) the solenoids in the print blocks are activated to form the appropriate Braille characters in the pins projecting therefrom;

iii) the solenoids supporting the embossers are activated to press the embossers against the print blocks and form characters;

iv) the solenoids in the blocks are activated;

v) the print blocks and embossers, which remain aligned at all times, are then moved over to form the next character, until a row of characters is formed;

vi) the paper is then advanced one row of characters;

vii) a new row of characters is then formed, in the manner described above, and the process continues, until a page of characters is formed.

It will be understood that utilizing the appropriate software, printing may proceed in a back and forth motion so it is not necessary to move the print blocks and embossers all the way to a starting position on the left before each line of print.

It is to be understood that the examples described above are not meant to limit the scope of the present invention. It is expected that numerous variants will be obvious to the person skilled in the design of Braille printing apparatus, without any departure from the spirit of the present invention. The appended claims, properly construed, form the only limitation upon the scope of the present invention.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A device for forming Braille characters for tactile sensation or impression onto an embossable substrate including:

i) a substantially block-like main body;

ii) at least one array of six Braille printing pins contained in said block in a 2 X 3 Braille cell configuration, each said pin being contained in a first cylindrical bore and being movable between a retracted position whereby said pin does not protrude from said block, and an extended position whereby the tip of said pin protrudes from said block; and

iii) means associated with each said pin for maintaining each said pin in an extended position.

2. A device as claimed in Claim 1, wherein in association with each said pin, there are provided in said block a second cylindrical bore perpendicular to the first and intersecting the lowermost end thereof, and said means (iii) comprises a horizontal rod movable in said bore to a position beneath said pin to push said pin to its extended position and hold it there.

3. A device as claimed in Claim 2, wherein each said pin extends co-axially outwardly from a vertical rod of greater diameter than a said pin, and there is provided a spring

extending from the uppermost portion of said rod, around said pin and against an apertured plate secured to the upper surface of said block, through which said pins may be extended.

4. A device as claimed in Claim 3, wherein each said horizontal rod terminates in an inclined cam surface that bears against the lowermost end of a said vertical rod, whereby forward motion of said horizontal rod causes said vertical rod to move up.

5. A device as claimed in Claim 4, wherein each said horizontal rod extends co-axially outwardly from an electrically activatable solenoid having a plunger of greater diameter than a said horizontal rod, there being a spring provided in said second cylinder bearing against said plunger, whereby activation of said solenoid causes said horizontal rod to move forward, and upon deactivation thereof, said spring pushes said plunger and horizontal rod away from said vertical rod.

6. A device as claimed in Claim 5, wherein the solenoids associated with the vertical row of Braille dots in a cell are aligned in a stacked relationship, whereby the vertical and horizontal rods for each one are parallel to each other but on different levels in the block.

7. A device as claimed in Claim 6, wherein for the dot furthest from said stacked solenoids, said horizontal rod is located in the lowermost position in the block, with the vertical rod being of a corresponding long dimension.

8. A device as claimed in Claim 5, 6 or 7, wherein said solenoids are driven by a C.P.U. to be activated simultaneously and sequentially to form predetermined combinations of desired Braille characters to be sensed in a tactile manner as words or symbols.

9. A device as claimed in Claim 5, 6 or 7, mounted for movement on a rail across a substrate to be embossed with Braille characters, there being provided on the other side of said substrate a template movable on a rail across said substrate and having a Braille cell of dots formed as impressions therein, said impressions being alignable with the pins from said device when said pins are extended.

10. A device as claimed in Claim 9, wherein said template is mounted in a pivoting manner on said rail, and means are provided to press said template against said device, thereby to emboss a Braille character on a substrate between said template and said device.

11. A device wherein said solenoids of said device, the movement of said device and template on said rails, and the movement of said template against said device, are all driven by a C.P.U. to sequentially form Braille characters on a said substrate.

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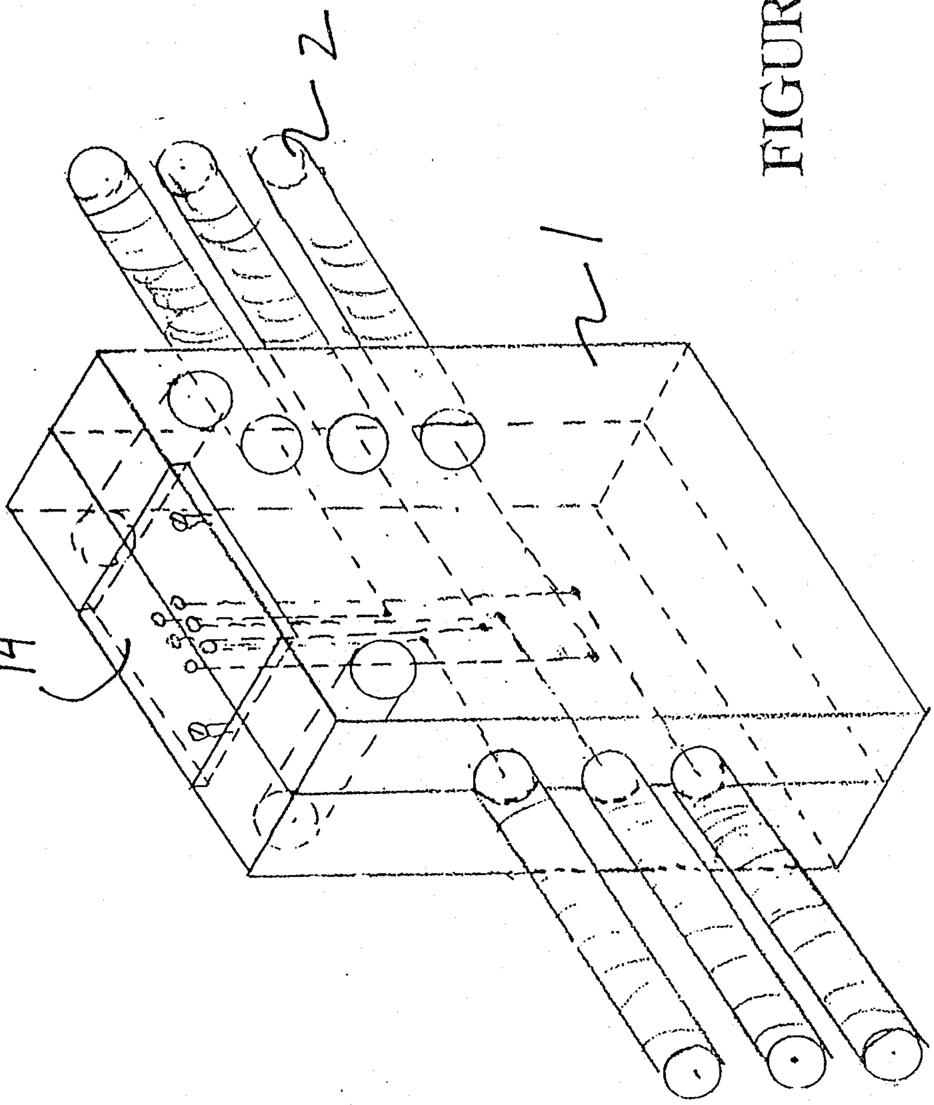
FIGURE 1



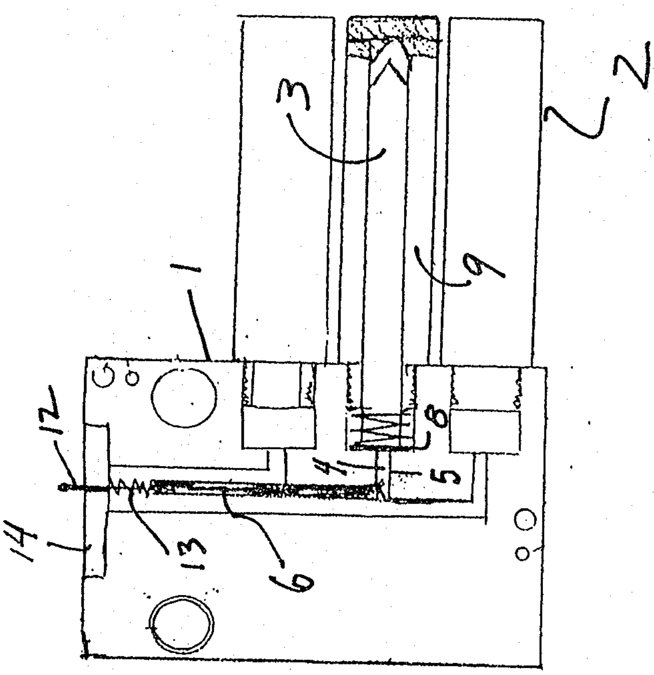


FIGURE 2

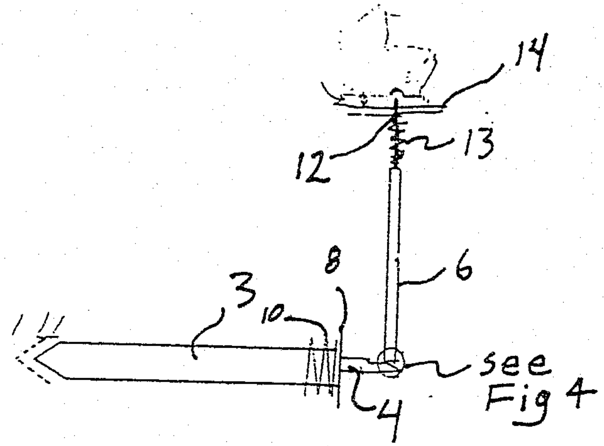


FIGURE 3

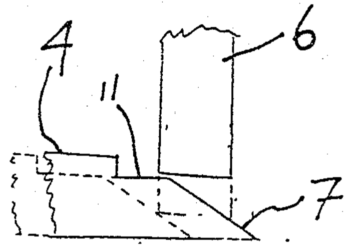


FIGURE 4

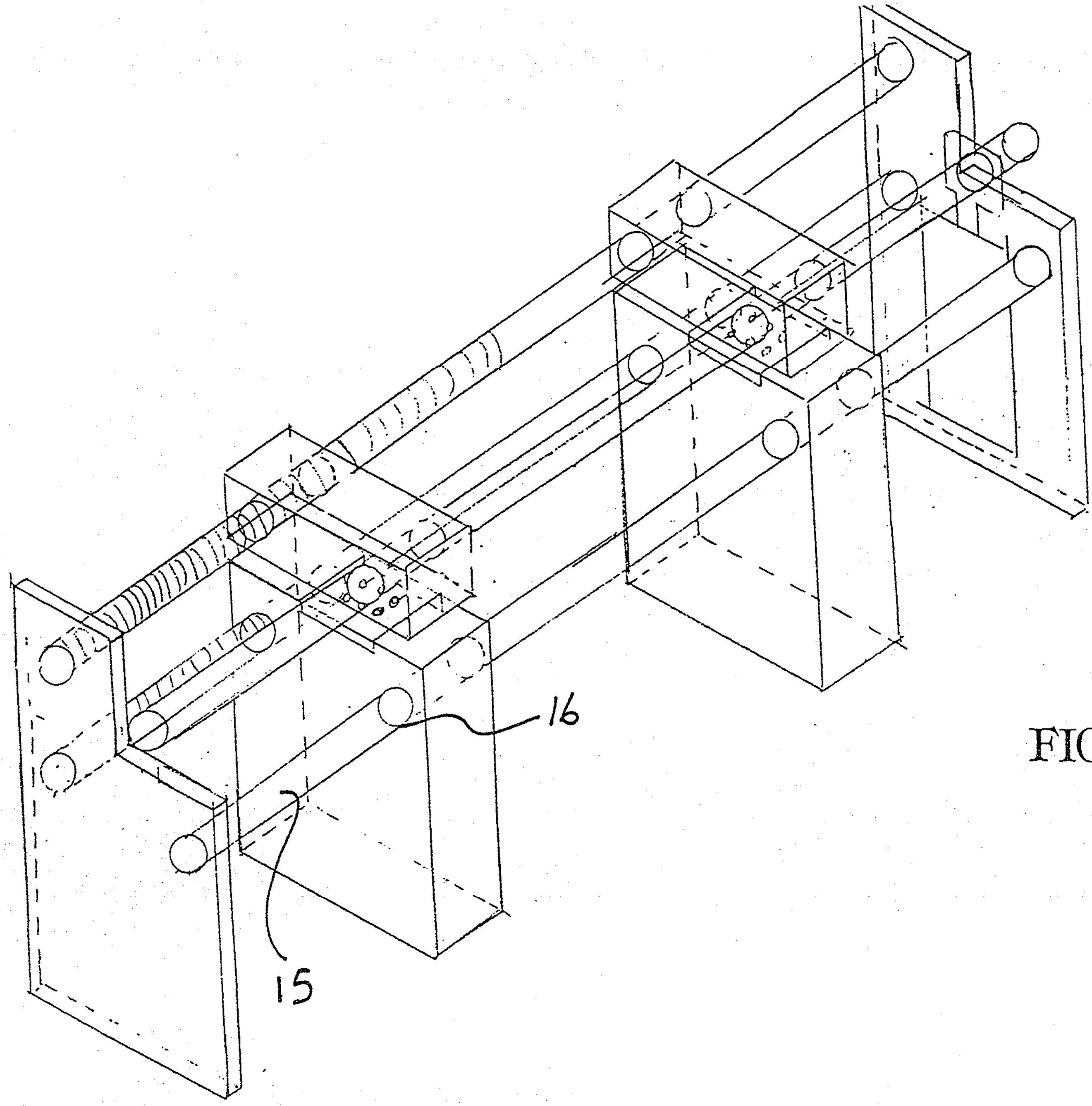


FIGURE 5