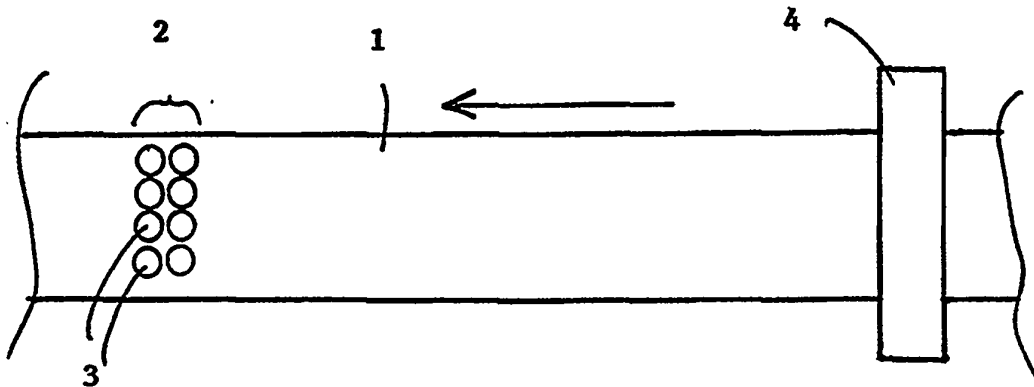




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<p>(21) International Application Number: PCT/FI95/00333 (22) International Filing Date: 9 June 1995 (09.06.95) (30) Priority Data: 942737 10 June 1994 (10.06.94) FI (71)(72) Applicant and Inventor: VALKAS, Timo [FI/FI]; Kuuse- lantie 5, FIN-03600 Karkkila (FI). (74) Agent: LAITINEN, Pauli, S.; Patentti-Laitinen Oy, P.O. Box 24, FIN-02341 Espoo (FI).</p>	<p>(81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SI, SK, TJ, TT, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD, SZ, UG).</p> <p>Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments. In English translation (filed in Finnish).</i></p>	

(54) Title: A METHOD AND A DEVICE FOR PRODUCING SYMBOLS OR SHAPES



(57) Abstract

The invention concerns a method and a device for producing symbols, such as Braille, in thermoplastic material. The plastic material according to the invention is brought to its softening temperature at the point intended for a symbol and the softened point is raised to form a symbol embossed on the surface of the material. This may be done by miniature hot air jets, for example.

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A method and a device for producing symbols or shapes

This invention concerns a method and a device for producing symbols or shapes, and, more specifically but not exclusively, for producing writing for the blind, otherwise known as Braille.

These days Braille can be produced in several different ways. At its most simple, a stylus is used to press a special writing paper into pits in a plate under the paper, thus forming raised dots. This method is slow and time-consuming because the text must be produced in a mirror image, as the writing is read on the other side of the paper from that on which the writing is produced.

Other known methods include mechanical and electric typewriters. Mechanical typewriters need to apply great force to produce the raised dot patterns on the paper. Mechanical machines in particular are heavy and not easily portable.

More advanced systems are also known in which the basic principle is to use stylus-like equipment, as in the system described above, to fashion the desired symbols or embossed patterns in the special writing medium. These systems are printer-type systems. A fundamental feature of all of the above-mentioned systems is that the symbols made with them are permanent and it is impossible to edit the text and to remove errors, for example.

Another well-known system is a device in which the symbols are formed by protruding pins, which are directly identified in order to read the text. Editing is possible, but the disadvantages of the system are, for example, the expense of the device per symbol and the fact that no permanent output is created, even though such may be desired. Instead, the symbols are replaced by new ones as the writing progresses.

The purpose of the current invention is to produce a method and a device capable of forming the desired symbols in the writing medium at a reasonable price and, if necessary, of erasing the symbols from the medium either continuously or automatically, or at specific points and in a variety of ways, after which the medium can be re-used for the same purpose.

An additional purpose of the invention is to apply its concepts to the production of symbols, shapes and three-dimensional forms other than Braille.

The above-mentioned and other benefits and advantages of the invention are achieved in the ways presented as characteristic of the invention in the attached patent claims.

The invention will now be described in more detail with reference to the attached drawings, in which

Figure 1 presents, in simplified plan view, the basic principle of the device developed to implement the method according to the invention, and

Figure 2 presents a schematic side view of the device according to Figure 1.

The basic concept of the invention is that texts or shapes can be formed, by a method and a device according to the invention, on a thermoplastic material. An essential part of the basic concept is that the material can be made to change its form by heating it at specific places to approximately its softening temperature, and by subjecting the heated places to a force sufficient to fashion an identifiable raised symbol protruding from the surface of the material.

An essential principle of one embodiment of the invention is that the plastic material is heated in precise places, most

usually in points, particularly when Braille is produced by the method and device according to the invention. When the method and device of the invention are used to make larger symbols or shapes, it may be advantageous to use a larger heating area than points.

In order to produce the above-mentioned solutions according to the invention, the following exemplary types of solutions can be applied. Hot air jets can be used for forming/heating, making it possible for the heating, the forming of the symbols and the subsequent cooling to take place in a very short period. In practice, the two first phases are carried out simultaneously and the third phase, cooling, takes place immediately afterwards.

As an example of other means and equipment, it is possible to use a drum-like device equipped with hot spots at the desired points, through which heat is transferred to the output material either by physical contact or by radiation. In this case, a separate phase is required to form the heated points into identifiable shapes. This phase can be assisted by positive or negative pressure applied to the output material, as is later explained.

A third option is to use heated stylus devices, which are brought into contact with the particular output material, causing the material to soften at the points of contact. At the same time, the stylus devices press the material into the appropriate symbol. If so desired and when so needed, a cooling phase may be linked to the use of the stylus devices.

Figure 1, showing a sheet-like material 1 on which symbols/shapes can be made, illustrates the principle of one embodiment of the invention. The sheet-like material 1 may be continuous (as shown in Figure 1) or cut into separate sheets (as normal-sized sheets of writing paper) and may be made of a suitable plastic material.

According to one embodiment of the invention, presented in principle in Figure 1, the continuous material 1 travels from right to left, moving in the same manner as the ribbon in a normal typewriter, one symbol at a time. The symbol is formed in this case by a desired configuration of "nozzles" 3 making up the dot matrix 2 which are activated or not activated according to a given program. When the nozzles 3 are activated, they direct a jet of hot air against the sheet 1 for a desired time period. The nozzles can be configured as desired in such a matrix form that suits the purpose. The two by four dot matrix presented is one possibility.

The task of the air jet is threefold. First, it heats the material to the softening temperature or somewhere near it. Second, the pressure of the air jet raises the softened point so as to form a Braille dot. Third, the heat of the air jet is stopped, after which the jet cools the plastic material until it reaches a state in which it keeps its shape. Naturally, cooling can be carried out in other ways as well. Thus, the area raised into dots forms tangible symbols that can be read with the fingers.

If there is a need for writing on separate sheets of material, in the same manner as with a normal typewriter, it is possible to use a mobile writing head 2 containing a nozzle matrix 3, as described above, or some other suitable heating method. The symbols will be written in the same way as above, one character at a time from left to right, using the mobile writing head. The writing head 2 and the matrix can be moved in any suitable way whatsoever by using normal mechanisms known from matrix printers or typewriters, for example.

In the third embodiment we start from the premise that the writing mechanism can be selected, as desired, to encompass any possibility ranging from one dot to a dot complex covering the entire output area. It is clear that the

selection criteria are speed, price and suitability. The use of one "nozzle" is a slow, though inexpensive way of making characters or other symbols, whereas a nozzle system covering the entire sheet is an expensive, but quick way to solve the problem. The best end result is indeed somewhere between these two embodiments.

In the method and device according to the invention, it is possible to use a solution for forming dots, or as an aid in forming them, whereby negative pressure is used on that side of the material from which the dots protrude, or correspondingly, positive pressure is used on the opposite side to perform the final raising of those points which have been rendered malleable by heating into readable raised dots. There is indeed reason to use this method when such heating methods are used which, by themselves, are not capable of shaping the dot-like points of softened material. This can be arranged according to the invention by designing the structure so that the continuous or separate sheet is enclosed in a space in which positive or negative pressure pulses are sufficient to perform the above-mentioned task.

The situation mentioned above is illustrated schematically in Figure 2, a side view of a device according to this invention, in which a continuous sheet 1 passes through a chamber-like part 5 which has been added to the parts shown in Figure 1. Positive pressure, which enters the chamber 5 by a connector, raises the heated points of the sheet material 1. Correspondingly, negative pressure can be applied to the space above the material 1. Positive and negative pressure pulses do not need an air-tight container 5; rather a space with restricted air flows is sufficient. This being the case, the openings through which the material 1 travels do not need to be completely air-tight.

Another significant benefit of the method and device according to the invention is that the writing material can be re-used. This characteristic is possible because an

essential feature of thermoplastic material is a certain "memory" of its earlier state. Therefore, by heating the material, upon which symbols have already been produced, to a certain temperature, it reverts to its former state and can be re-used for writing. In Figure 1, this kind of "reverting device" is marked with the reference number 4. If so desired, the device 4 can also contain rolls or corresponding equipment which can assist in the reversion process. The device 4 should be placed at the point of entry of the writing material 1.

A second alternative is that the writing head itself carries out the heating of the material, enabling the retraction of the old symbols before it again heats the material in order to form symbols. If required, cooling can be carried out as an intermediate phase, so that the material is suitable for creating new symbols. Symbol removal can occur one dot at a time, or one Braille character at a time or in larger groups. When needed, it is possible to use the same equipment for removing the symbols as is used for creating new symbols. As described above, it is also possible, if necessary, to use mechanical devices to assist the removal of symbols or the reversion of the entire output material.

Very many plastic grades, which are so-called thermoplastic types having a characteristic softening temperature, are suitable for use as writing materials in accordance with the invention. With regard to the choice of softening temperature, it is beneficial to use a material whose softening temperature is quite low, but not so low that the material changes its shape in ways that are not intended.

The method and device according to the invention can also be applied to the production of other symbols than dots, for, depending on the control system, the same principle applies equally well to the production of shapes. Thus, for example, the same system of hot air nozzles or other heating equipment is used to heat larger areas than points to the

softening temperature, either at one time or in several phases, producing larger shapes than dots in the writing material. For example, one can proceed so that the heating of the material and the application of pressure alternate, and the final shape is the result of a series of phases. As an additional phase, it is possible to use the dimensions of the raised shapes to control the next work phase.

The invention is described above at the level of principles, so that anyone who has worked in technology will understand that several different methods can be used in practical applications.

Claims

1. A method of producing symbols and shapes, such as Braille, by the selective heating of certain parts of the writing sheet, characterized in that the writing sheet is made of thermoplastic material, and that selected parts of this sheet are heated to the softening temperature, and that symbols or shapes are formed in the heated parts of the sheet by changing the form of the sheet.
2. A method according to claim 1, characterized in that raised dots or other symbols are formed in the writing sheet by the precise blowing of heated air at an area where a symbol, such as a dot, is to be formed, until the plastic material has reached its softening temperature.
3. A method according to claim 1, characterized in that raised dots or other symbols are formed in the writing sheet by using heated stylus devices to selectively heat the writing sheet and to raise the symbols from the surface of the sheet.
4. A method according to claim 1, characterized in that raised dots or other symbols are formed in the writing sheet by heating the area where a symbol, such as a dot, is to be formed by means of precisely directed radiation or convection heat, until the plastic material has reached its softening temperature.
5. A method according to claims 1 or 4, characterized in that, at those parts of the plastic material where the softening temperature has been reached, dots or other symbols are raised from the surface with the help of negative pressure on one side of the sheet or, correspondingly, positive pressure on the other side.
6. A method according to claims 1 or 2, characterized in that raised dots or other symbols are produced by blowing

heated air at a part of the sheet where a symbol is to be formed with a force that is sufficient to raise the symbol up from the surface of the sheet.

5 7. A method according to any of the previous claims, characterized in that the production of new symbols requires the removal of the symbols made earlier in the plastic material by subjecting the plastic material to heat treatment.

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8. A device for producing symbols and shapes, such as Braille characters, on a writing sheet, characterized in that it comprises a system (3) for the precise heating of an area where a symbol is required and equipment for raising the symbol from the surface of the sheet.

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9. A device according to claim 8, characterized in that the system (3) is of a type which itself creates the force necessary to raise the symbols so that they protrude from the sheet.

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10. A device according to claim 9, characterized in that the system (3) comprises nozzles for the precise blowing of heated air to the precise part of the sheet where the symbols are to be formed, or that the system (3) is composed of heated stylus devices.

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11. A device according to claim 8, characterized in that the equipment for raising the symbols from the surface of the sheet includes positive pressure and/or negative pressure devices.

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12. A device according to any of the claims 8-11, characterized in that it includes equipment for obliterating the symbols previously produced in the material, so that the material can be re-used.

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13. A device according to claim 12, characterized in that

the equipment for obliterating the used material includes heating equipment, so that the said equipment may be formed from the system (3) itself and may possibly be a roll device.

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14. The use of plastic material, which reverts to its earlier form under heat treatment, for producing symbols and shapes such as Braille.

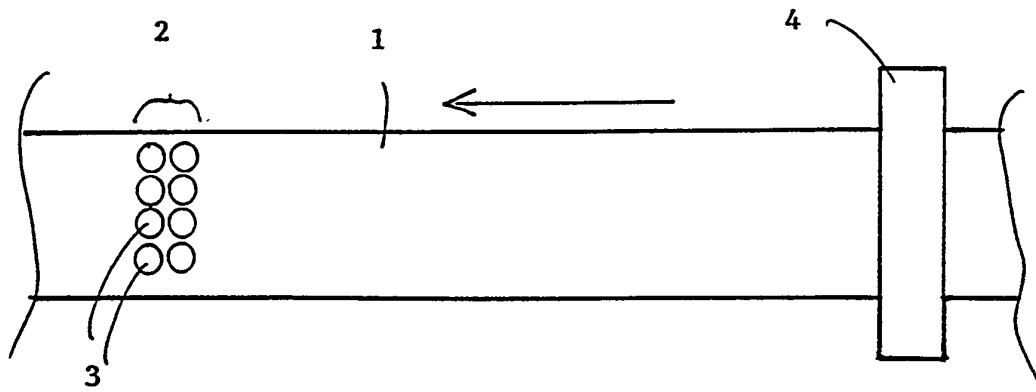


FIG. 1

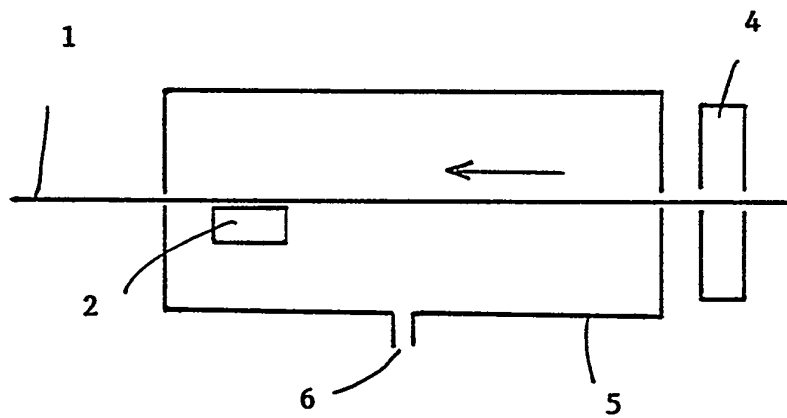


FIG. 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 95/00333

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B41M 3/16, B41J 3/32, B41L 13/12, G09B 21/02
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B41M, B41J, B41L, G09B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Derwent's abstract, No 94- 99033/12, week 9412, ABSTRACT OF SU, 1791158 (VOSKOBOINIKOV I G), 30 January 1993 (30.01.93)	1-2,4-6,8-11
Y	--	7,12-14
X	Derwent's abstract, No 88-321023/45, week 8845, ABSTRACT OF SU, 1391954 (VOSKOBOINIKOV I G), 30 April 1988 (30.04.88)	1,3,8-9
Y	--	7,12-14
Y	US 5244288 A (H. NAGAOKA ET AL), 14 Sept 1993 (14.09.93), figure 1, abstract	7,12-14
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Further documents are listed in the continuation of Box C.

See patent family annex.

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Date of the actual completion of the international search

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4268615 A (Y. YONEZAWA), 19 May 1981 (19.05.81) --	1-14
A	WO 9203296 A1 (EASTMAN KODAK COMPANY), 5 March 1992 (05.03.92) -- -----	1-14

INTERNATIONAL SEARCH REPORT

28/08/95

International application No.

PCT/FI 95/00333

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US-A- 5244288	14/09/93	EP-A, A, A 0525922 JP-A- 6095586	03/02/93 08/04/94
US-A- 4268615	19/05/81	NONE	
WO-A1- 9203296	05/03/92	DE-D, T- 69103274 EP-A, B- 0546080 JP-T- 6500510 US-A- 5125996	30/03/95 16/06/93 20/01/94 30/06/92