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A New Method of Writing and Reading for the Visually Impaired

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Abstract – In this article, I am presenting a new method of writing and reading for the visually impaired and deaf-blind people that includes letters, numerals, punctuation marks, typographical symbols, mathematical symbols, and command keys.

Keywords – Visually Impaired; Method Of Writing Amd Reading.

I. Introduction

In this article, I am presenting a new method of writing and reading for the visually impaired and the deaf-blind people that includes letters, numerals, punctuation marks, typographical symbols, mathematical symbols and command keys, all of this with the aim to replace the Braille system.

II. Historical Background

Braille is a tactile method of raised dots representing letters of the alphabet. To read braille, the fingers gently glide over a special paper that has been embossed with a braille code. Braille has been an effective means of communication for blind persons since 1829 when it was invented in Paris, France, by Louis Braille. At the age of three, he wounded his right eye with a cobbler´s tool while playing in his father´s workshop. Louis´s left eye became inflamed apparently due to sympathetic ophthalmia and he eventually lost the sight in that eye. At the age of five, Louis Braille was completely blind [1].

The basis of the braille method is known as a braille cell. The cell is comprised of six dots numbered in a specific order (Fig. 1). Each dot or combination of dots represents a letter of the alphabet and also of numbers and certain punctuation marks and a few symbols. For example, in the braille alphabet (Fig. 2) you will see that dot 1 corresponds to the letter “a”, dots 1 and 2 to the letter “b”, and dots 1 and 4 to the letter “c”. Numbers and punctuation marks are also represented in braille.

The braille numbers are announced by a sign using dots 3, 4 and 6 followed by the one of the first ten alphabetic letters.

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Fig. 1

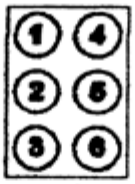
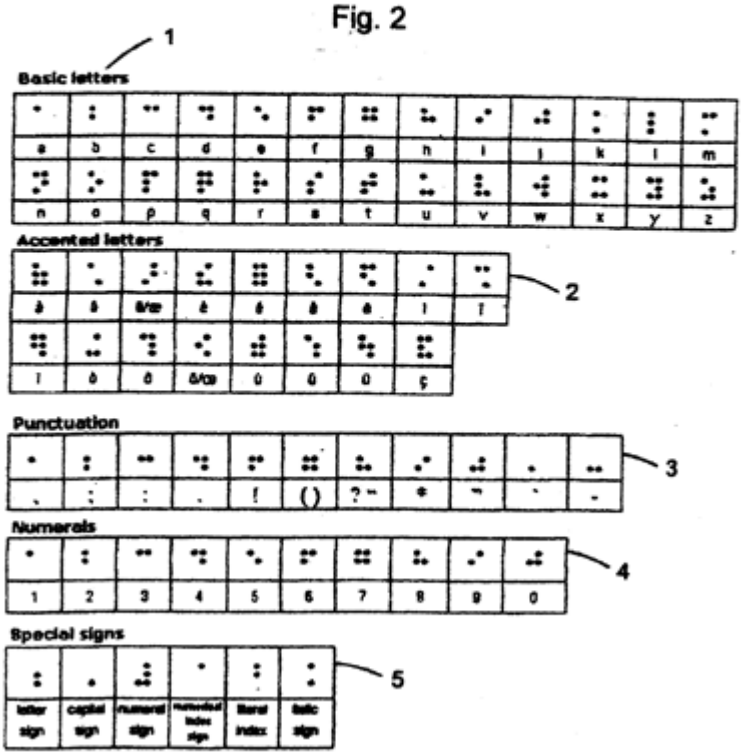


Fig. 2



III. Description of the New Method

The new method described here, uses embossed glyphs on an uncoated copy paper in order to represent different alphabets such as the Latin alphabet (Fig. 3), Mathematical Greek (Fig. 4), Russian (Fig.5), Old German (Fig.6), Turkish (Fig.7) and possibly alphabets of other foreign languages such as Arabic, Chinese, Japanese and Korean. This method enables the entering of unctuation marks, typographical symbols and a wide range of mathematical symbols. The letters are represented by one or two straight lines plus one dot, and the numbers are represented by a single vertical line and one square dot or small circle. In such a way the numbers can be perceived as cardinals or ordinals depending on the use of a square dot or a small circle. This is in contrast with the braille method that uses a prefix or indicator with one of the first ten letters of the Latin alphabet which makes it very difficult to do mathematical operations.

The main problem with the present Braille method is the limitation of the number of the characters resulting from the 6-dot braille cell which is restricted to 63 combination only.

The extension from 6-dot to 8-dot code, such as the Gardner-Salinas [2]or the Luxembourgish methods, helped some way by increasing the number of possible representations to 256 different characters but with the resultant enlarged cell the perception of each character is more difficult because of the relatively small size of the finger's tip.

The Unified English Braille (UEB) [3] uses the standard 6-dot braille so a different set of rules have been developed over the years to represent literary text, mathematics and science, computer software, and other varieties of written material. As a result, braille users who desire to read or write a large range of materials need to learn a different set of rules depending on what kind of materials they are reading at a given time. Rules were often not compatible from one system to the next so the reader would need to be notified as the text in a book moved from computer braille to the Nemeth code [4] for instance.

Another problem is that the Braille method is too difficult to learn and the proof of this is that, according to the 2015 Annual Report from the American Printing House for the Blind, in the United States only 8.6% were registered as braille readers. This is important because the ability to read braille correlates with a higher level of education, a higher likelihood of employment and higher income. ALTERNATIVES TO THE BRAILLE METHOD

For almost 200 years the braille method has been the universal standard for the visually impaired but with advanced text-to-speech technology and smartphone applications the braille method is losing relevance in the communication for this group of people. Besides the fact that braille is difficult to learn, its capacity is very limited so alternative methods have been proposed to improve literacy among the visually impaired. It is for this reason that different methods have been proposed such as the 8 dots method [2], as mentioned before, the Moon method [5] and the ELIA frames [6]

The 8 dots braille developed jointly by John Gardner of Oregon State University and Norberto Salinas of the University of Kansas [2], despite being more complete than the 6 dots braille, is more difficulty to learn because the 8 dots cells are bigger and consequently, more difficult to be perceived by the fingertip.

The Moon method is made in shapes that are easier to recognize [5]. The characters are quite large and do bear resemblance to the letters which means that persons who lost their vision during their life, can find their way easier around Moon written language than around braille. The ELIA frames designed by Andrew Chepaitis [6] aspires to replace the braille through an easy to learn method based on the letterforms of the Latin alphabet. The main disadvantage of this method is that the frames are quite large which means that they will take up to16 times more space than the present method. The main problem with the Moon and the ELIA frames is that both of them have a very limited number of characters which does not allow the display of punctuation marks, typographical and mathematical symbols.

IV. BRIEF SUMMARY OF THE NEW METHOD

The present method overcomes the above-mentioned difficulties by providing a universal code that can be used with different materials. The main advantage of the new method is that it can use a combination of lines and dots to represent the glyphs in their simplest form. For instance, all the letters are represented by a combination of one or two straight lines plus one small dot. The numbers can be represented in their simplest form, without the need of indicators as in the braille method. In addition, the numbers can be differentiated into cardinal or ordinal numbers, as mentioned before, by using the lower case for the cardinal numbers and the high case for the ordinal numbers.

The present method is an adaptation of the writing method described in the Lineographic input system disclosed in a US Patent and it is aimed to provide a tactile reading method for the blind or visually impaired and also a new method of writing and reading for the deaf-blind people. In this manner the three methods complement each other and open the possibility of increasing the literacy and scientific activity of the visually impaired people by using these three methods.

For example, blind people could communicate each other or receive newspaper information and text messages through the technological advantages of the computer software and hardware. In addition, the blind people can communicate each other by using the keypad of the Lineographic alphanumeric system traced on the palm of their hands.

V. OBJECTS AND ADVANTAGES OF THE NEW METHOD

Accordingly, it is the object of the new method to provide a universal system that can be used in literary work, mathematics, science, computer software, and other varieties of written materials. It is a further object of the new method to provide a tactile reading method for the blind, visually impaired and the deaf-blind people. In such a way, the blind and visually impaired can read without any difficulty by feeling with the tip of one finger since the size of the glyphs are 62.5% smaller than the braille cell (5x3 mm versus 6x4 mm). Even more, it is possible to reduce the size of the glyphs to 4x3 mm which signifies a reduction of 50%. Additionally, the deaf-blind people can write and read using the palm of their own hands.

It is still a further object of the new method to provide a method that uses a combination of lines and dots to represent letters and numbers. The numbers are represented in their simplest way by using one straight vertical line plus a square dot or a small circle which will identify the number as a cardinal or an ordinal number.

It is still a further object of the new method to provide bold and cursive fonts which is impossible to do with the braille system. It is still a further object of the new method to provide a system that is easy to learn since it does not require the use of complex indicators for the interpretation of mathematical expressions. The mathematical symbols are represented by a combination of straight and curved lines and sometimes adding one or two dots.

It is a further object of the new method to allow to a person with normal vision to read the characters described in the new method without mayor difficulty. It is a further object of the new method to eliminate the use of the special braille paper by using letter size bond paper. In such a way it will get rid of bulky and heavy reading materials. It is a further object of the new method to use a modified Lineographic System for the deaf-blind people by using the skin receptors of the hand´s palm. In such a way the deaf blind can communicate each other by sending and receiving text messages by making taps and linear traces on their own hands according to the alphanumeric system. Finally, it is the object of the new method to provide a system that allows the use of more than 270 mathematical symbols.

VI. Detailed Description of the New Method

With reference to the drawings, Fig. 3 depicts the Latin alphabet according to the new reading method with glyphs in their normal size (5x3 mm). It is important to note that the glyphs representing the letters are a combination of one or two straight lines plus one dot. The dot is slightly bigger than the dots used in the braille method, and the capital letters are slightly bigger (6x3mm) than the lower case letters. This will eliminate the use of the special capital marks of the braille method.

Fig. 3 Latin Alphabet cm scale

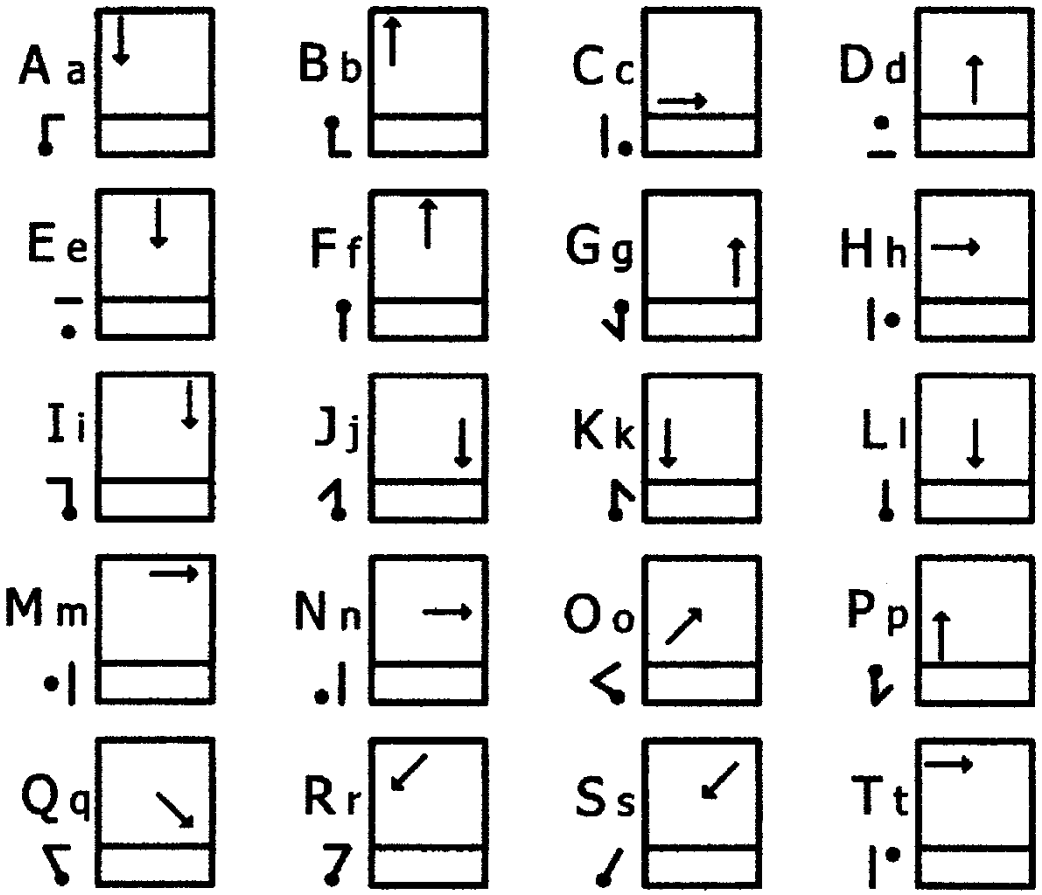


Fig. 4 shows the Mathematical Greek alphabet according to the new reading method that are different to the Latin alphabet so there is no confusion within the two alphabets. The capitalization process is the same as in the Latin alphabet. Fig. 5 shows the Russian alphabet according to the new reading method that includes some characters proper of this language. The capitalization process remains the same as to the Latin alphabet.

Fig. 4 **Mathematic Greek Alphabet**

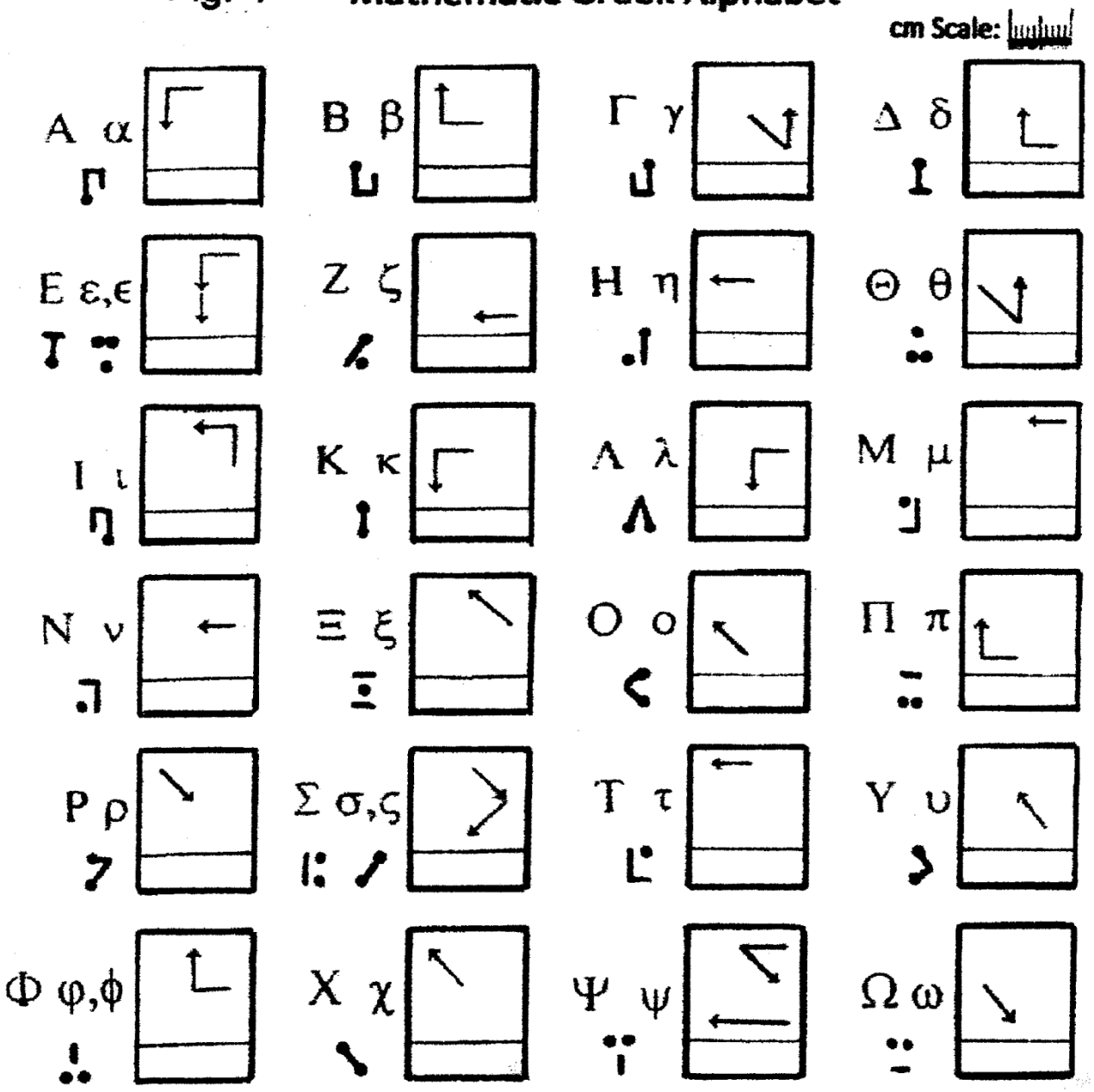


Fig. 5 Russian Alphabet cm scale

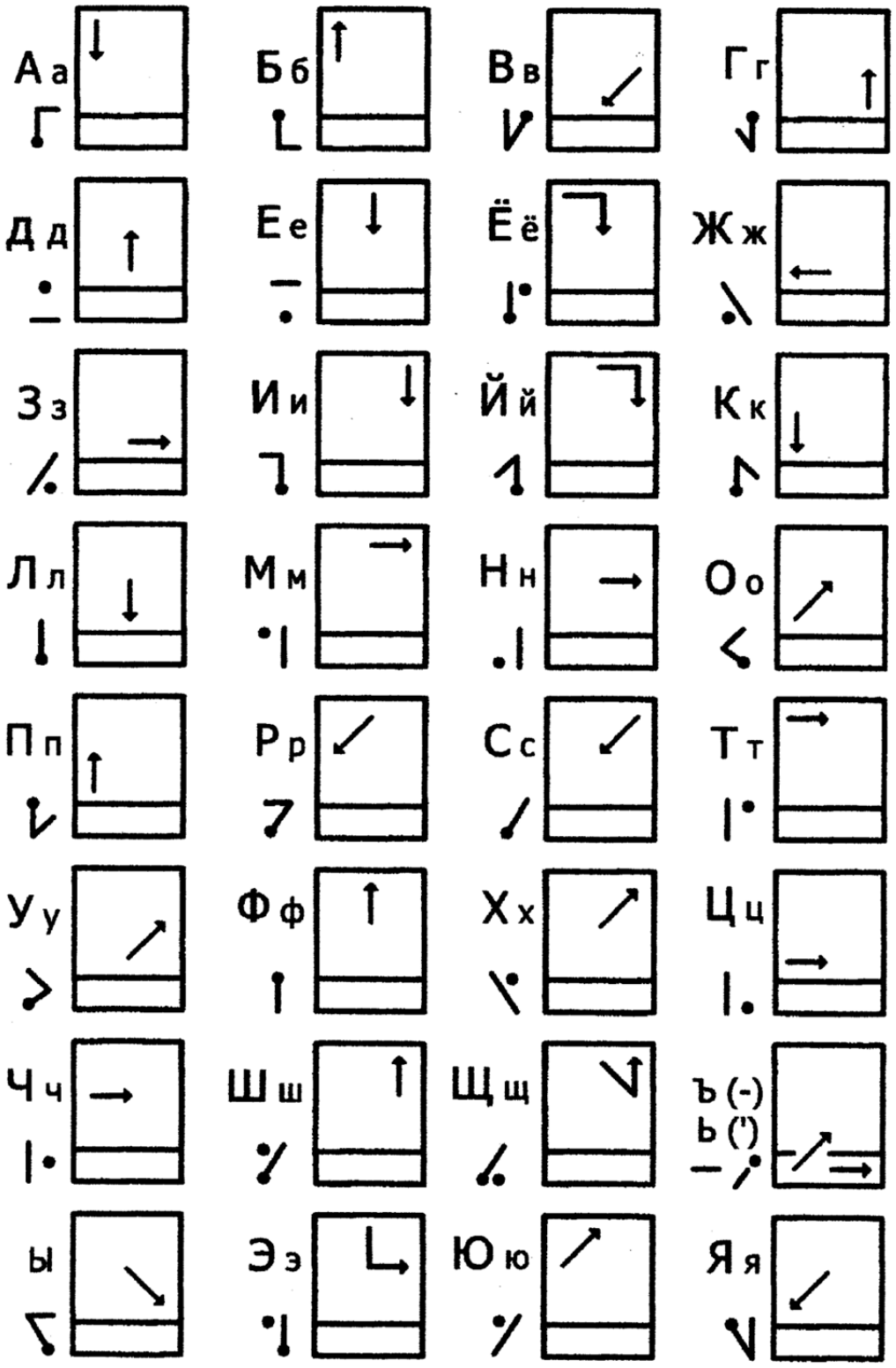


Fig. 6 shows the Old German alphabet according to the new reading method that can be used with certain mathematical symbols and also as a complement in some complex languages such as the Chinese, Arabic, Vietnamese, Thai, Icelandic, Albanian, Japanese, Gaelic, Hungarian, Croatian, etc. Please note that the glyphs of this alphabet contain curved lines instead of the straight lines of the Latin alphabet.

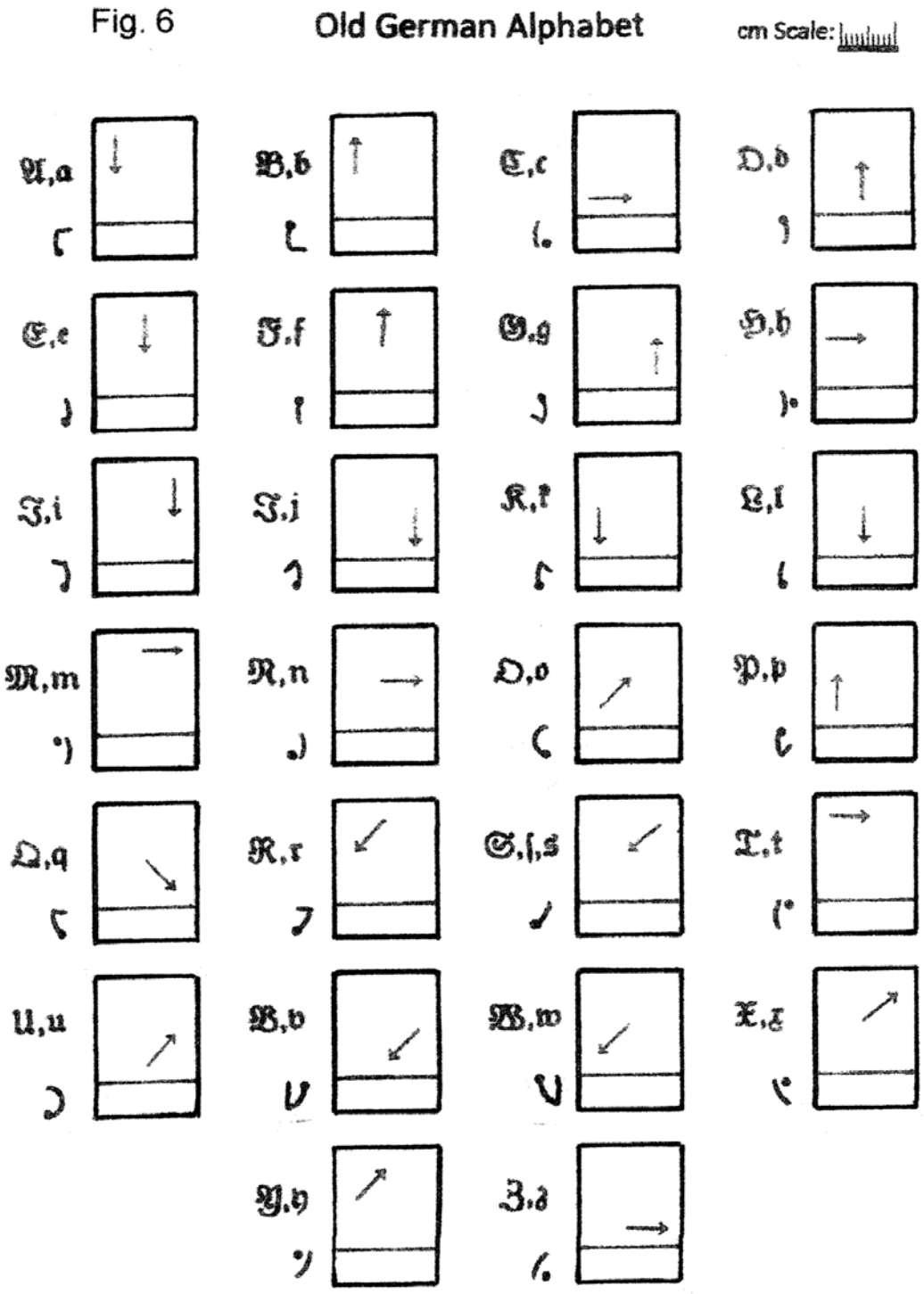
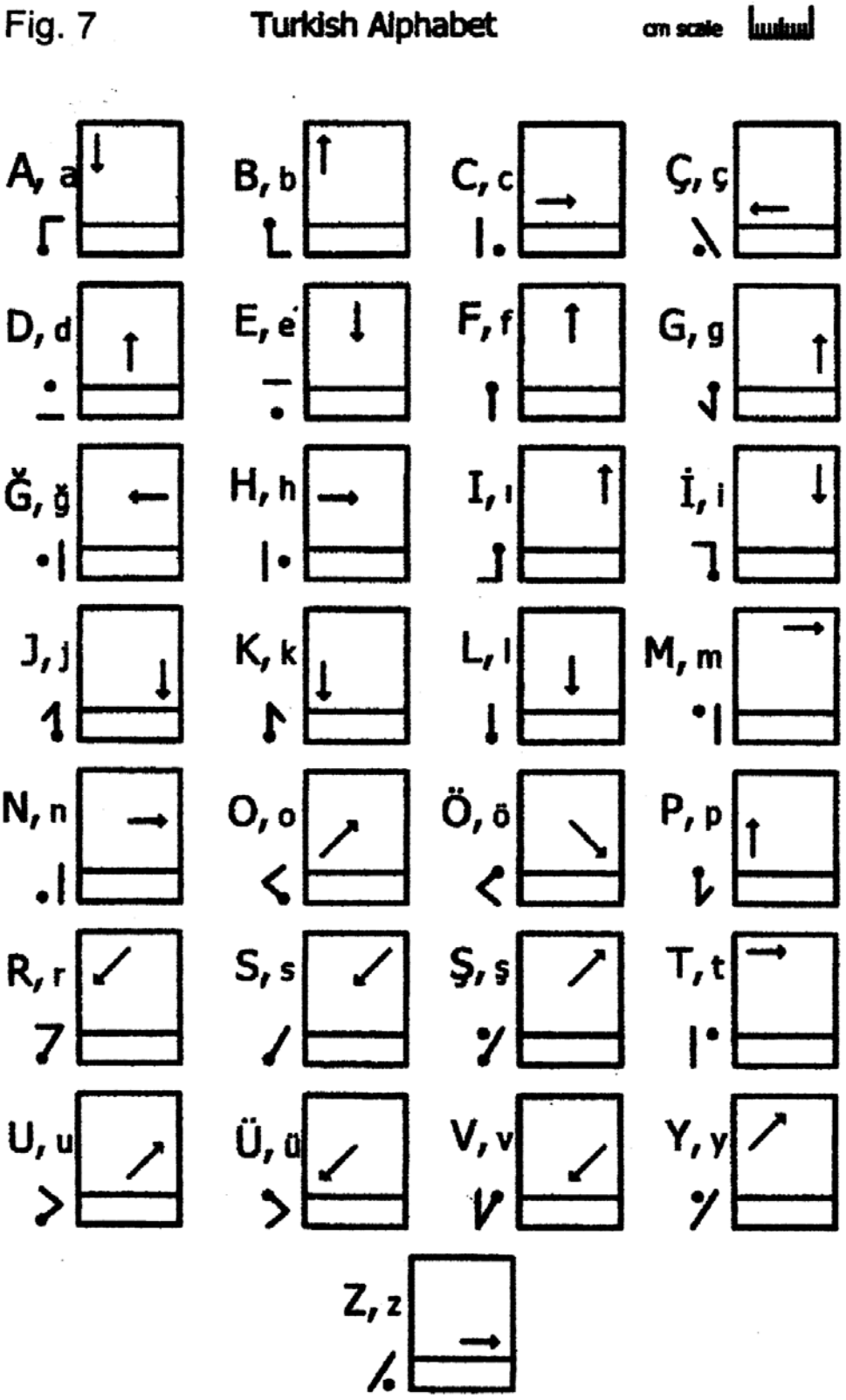


Fig. 7 shows the Turkish alphabet as an example of how the Latin alphabet can be adapted to a different alphabet without a mayor difficulty. Similar adaptations could be made by linguistics in different parts of the world.



Fig, 8 shows the Punctuation Marks according to the new reading method with the more frequently used marks. The size of some glyphs is bigger (6-7 mm) than the size of the letters. The special accents are placed after the letter that is supposed to be accented.

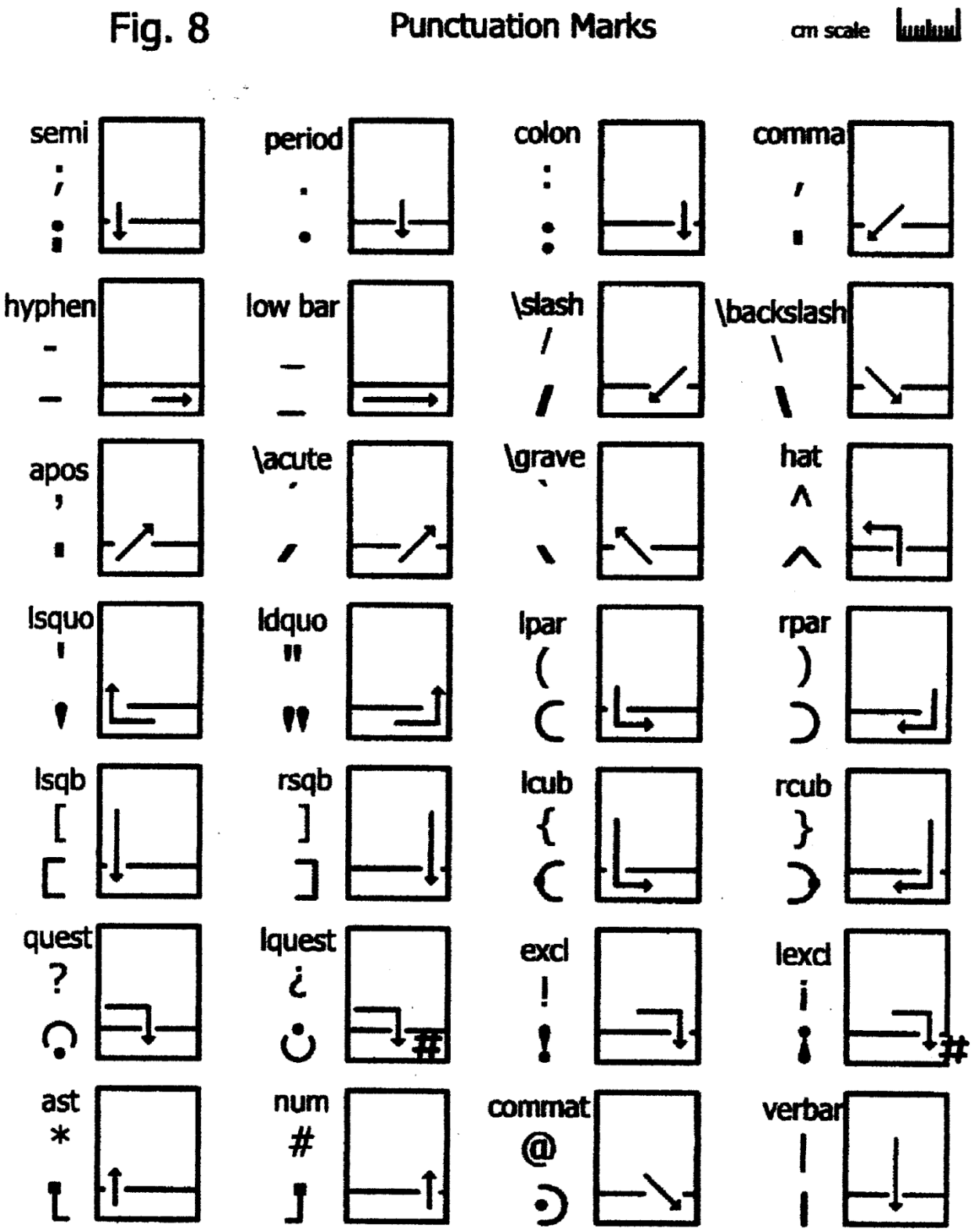


Fig. 9 shows the Typographic Symbols according to the new reading method. In general, the glyphs are bigger (6-7mm in high) that the letter glyphs.

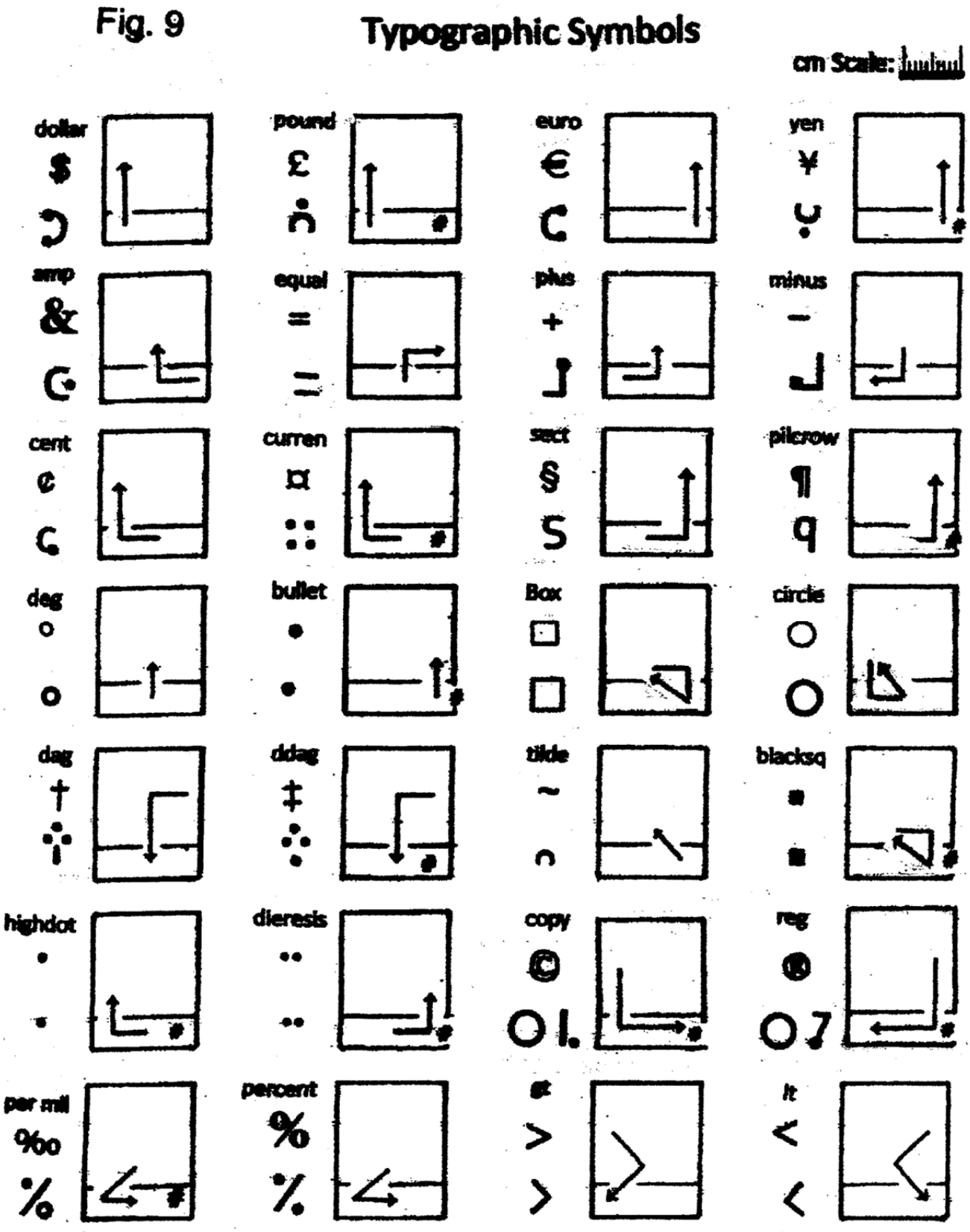
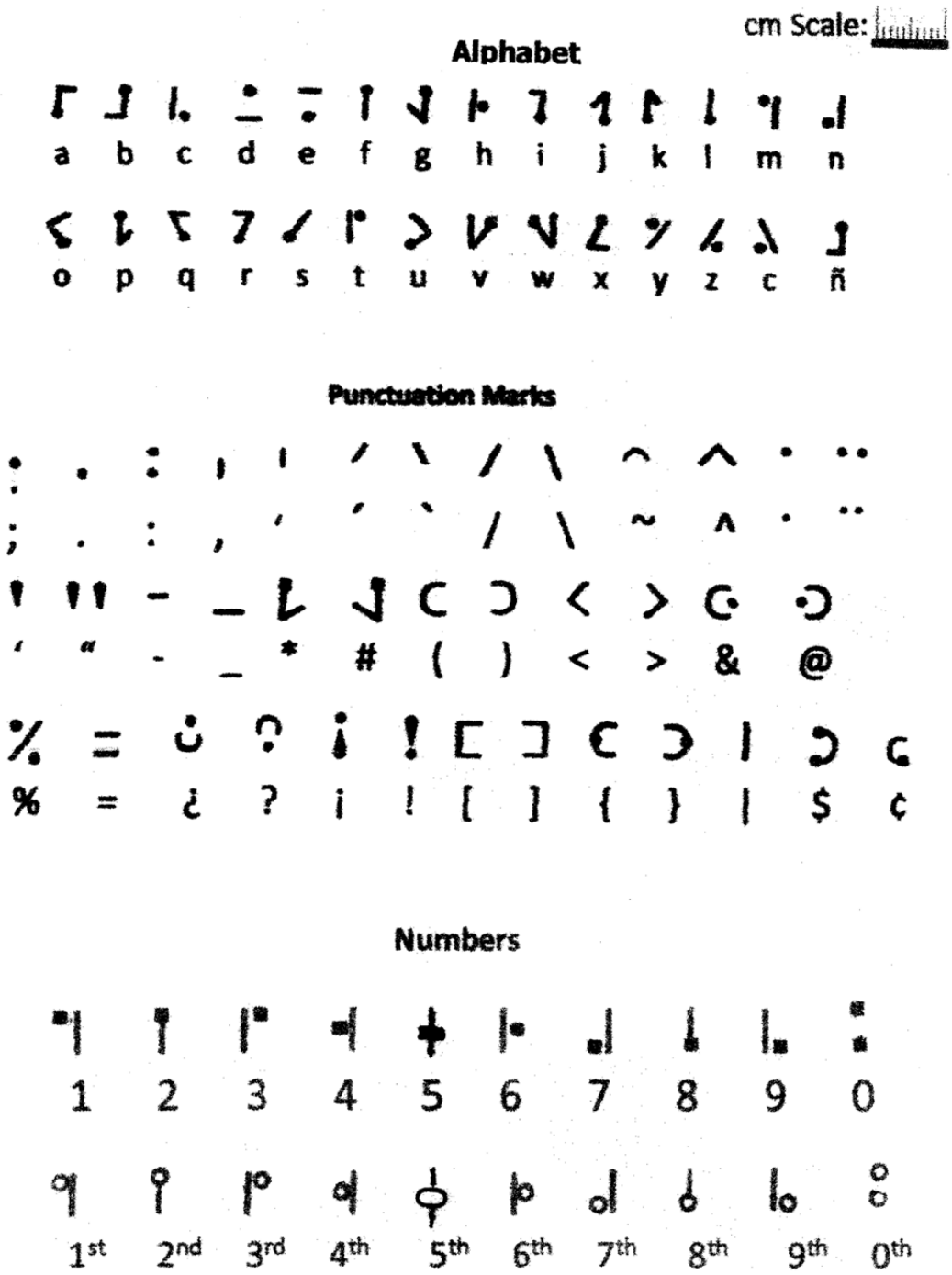


Fig. 10 shows the Basic Characters according to the new reading method that are needed in the regular daily use. The number glyphs are also bigger than the letter glyphs as in the regular typographic settings.

Fig.10 **Basic Characters**



Figs. 11A and B shows the letter glyphs according to the new reading method that are slightly slanted (10°) to convert them into Cursive font (slanted forwards) or Bold font (slanted backwards).

Fig. 11A *Italic Font Alphabet*

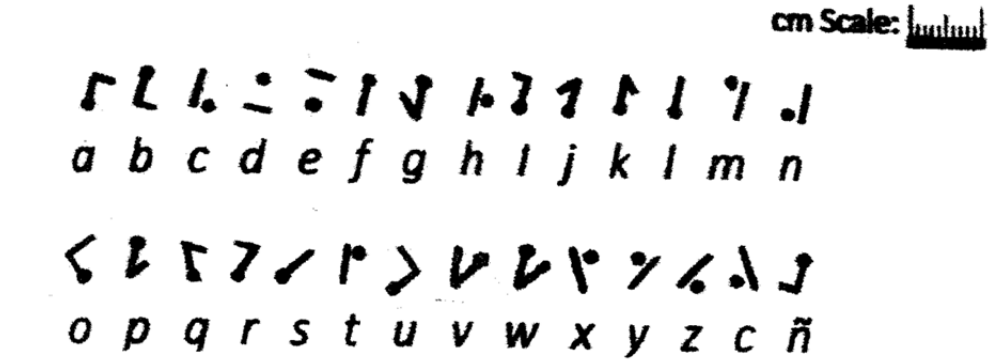
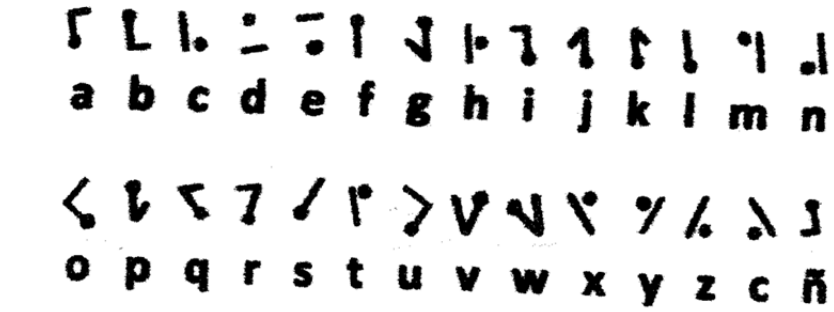


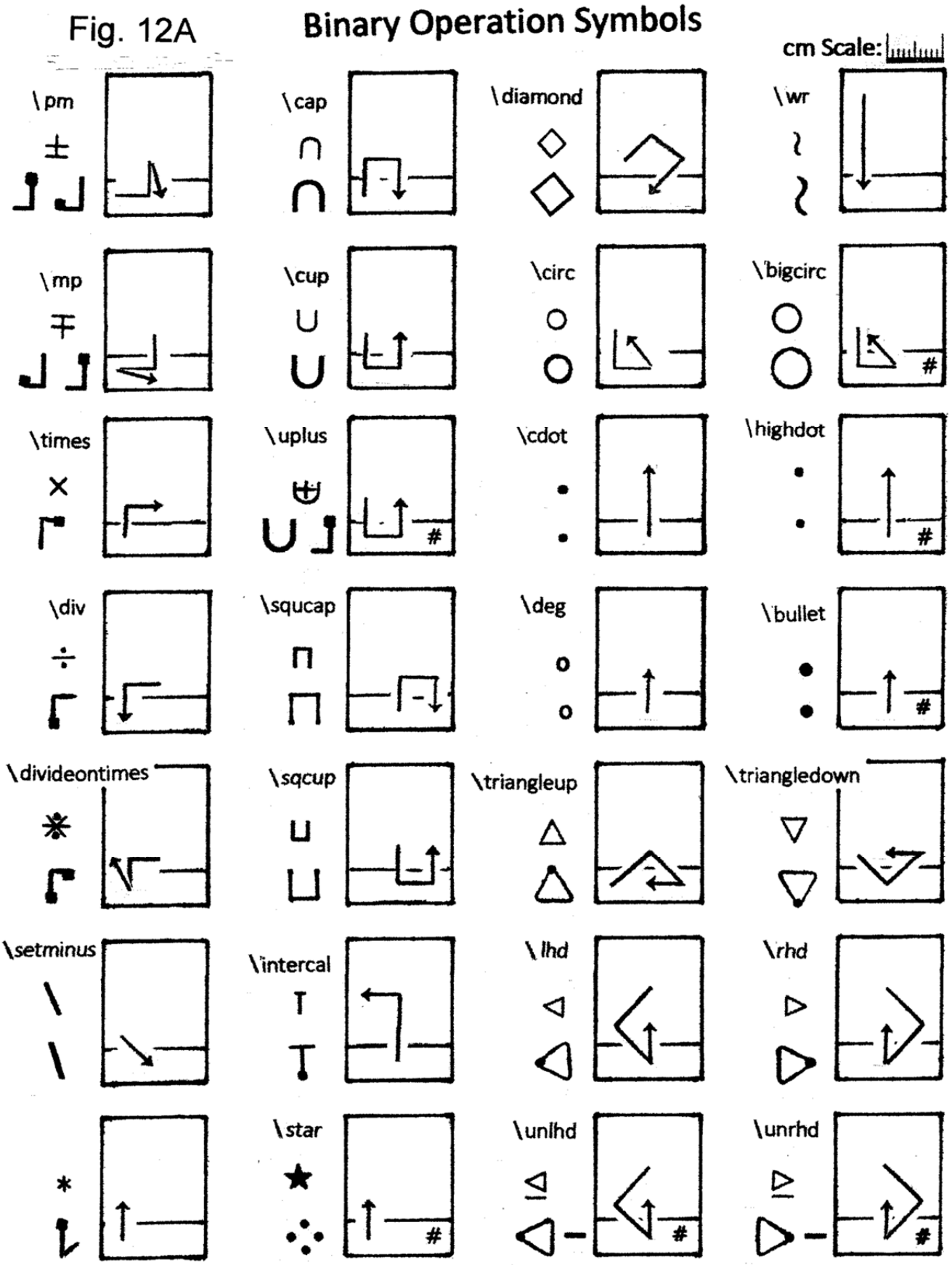
Fig. 11B **Bold Font Alphabet**

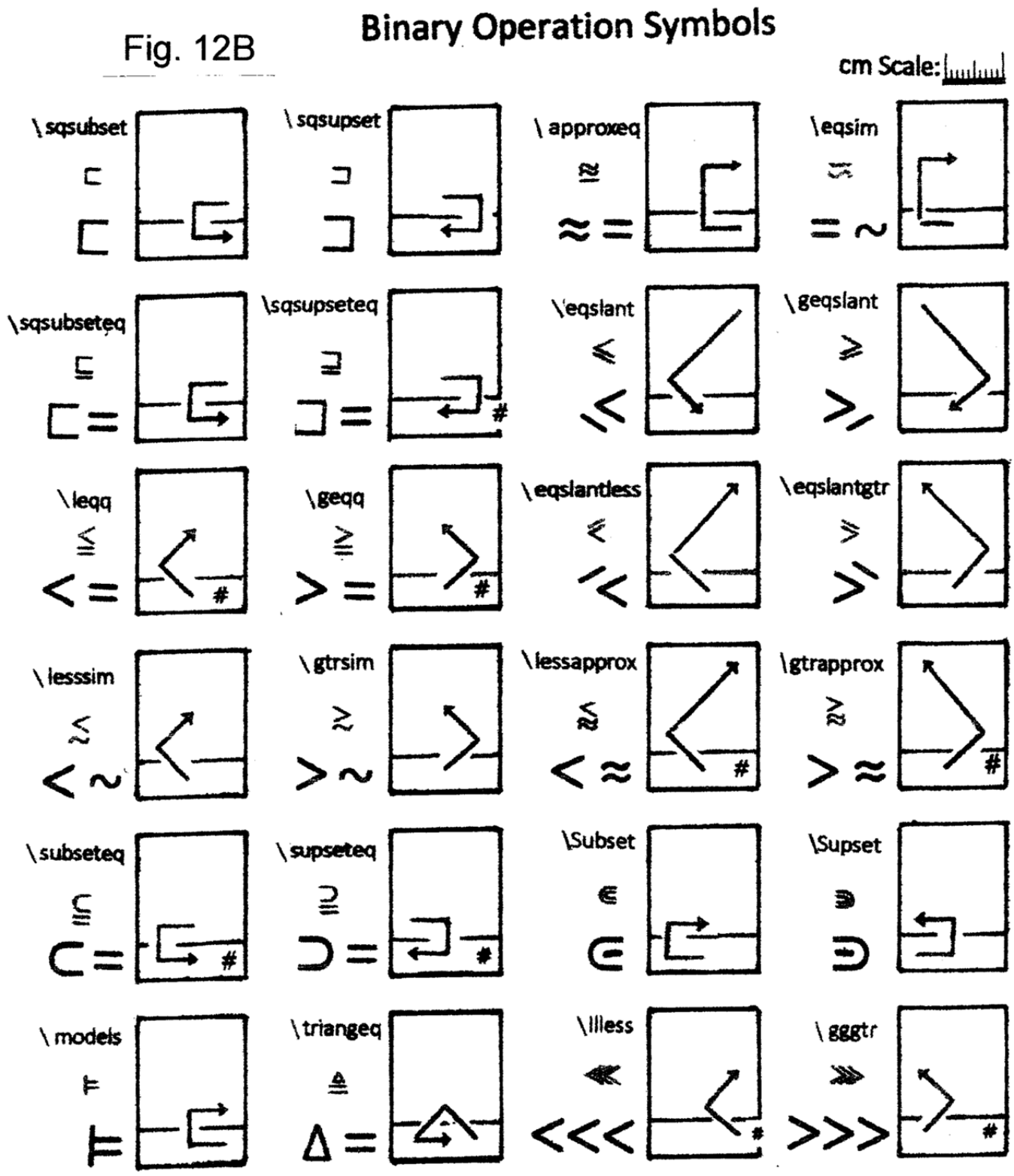


The following figures are destined for the use of blind and poor vision persons that are interested in the field of mathematical sciences. The description of the glyphs is given using the LATEX system.

Figs. 12 A and B show the Binary Operation Symbols used in mathematical expressions and according to the new reading method.

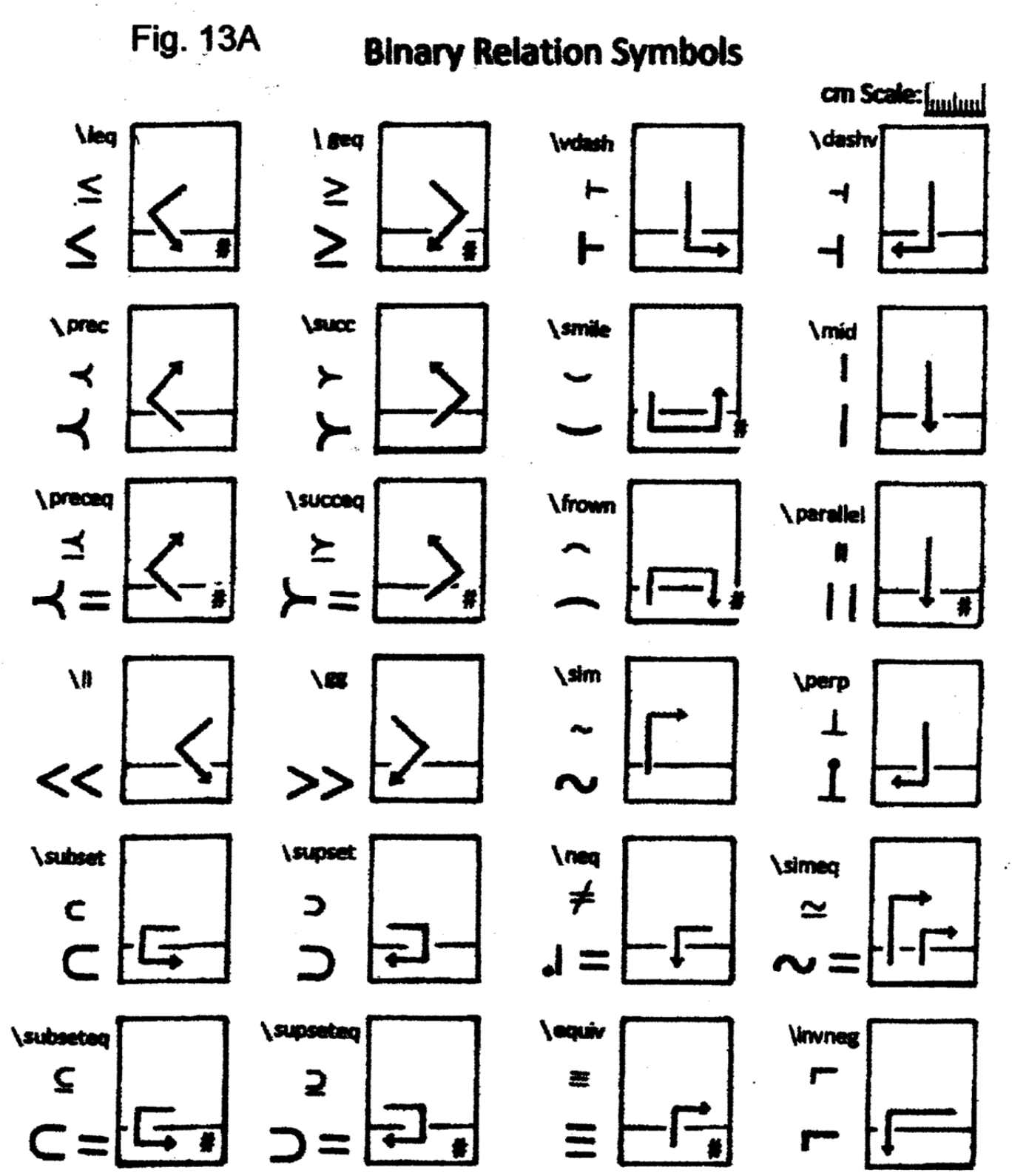
Fig. 12A

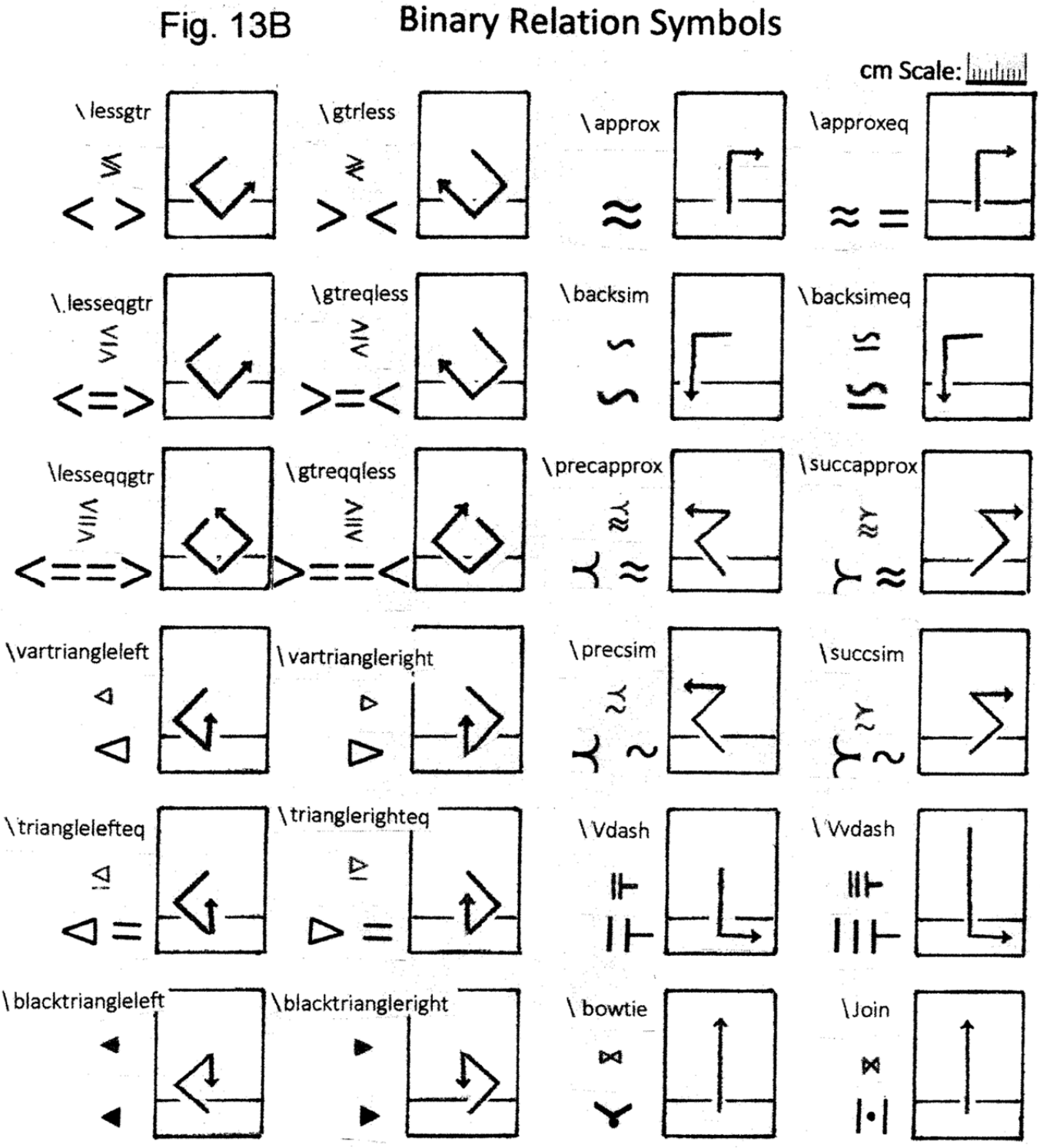

Binary Operation Symbols
cm Scale:
\pm
\cap
\diamond
\wr
\mp
\cup
\circ
\bigcirc
\times
\uplus
\cdot
\highdot
\div
\sqcap
\deg
\bullet
\divideontimes
\sqcup
\triangleup
\triangledown
\setminus
\intercal
\lhd
\rhd
\star
\unlhd
\unrhd



Figs. 13 A, B and C show the Binary Relation Symbols used in mathematical expressions and according to the new reading method.

Fig. 13A


Binary Relation Symbols
cm Scale:
\leq
\geq
\vdash
\dashv
\prec
\succ
\smile
\mid
\preceq
\succeq
\frown
\parallel
\ll
\gg
\sim
\perp
\subset
\supset
\neq
\simeq
\subseteq
\supseteq
\equiv
\invneg



Figs 14 A and B shows the Arrow Symbols used in mathematical expressions and according to the new reading method.

Fig. 14A

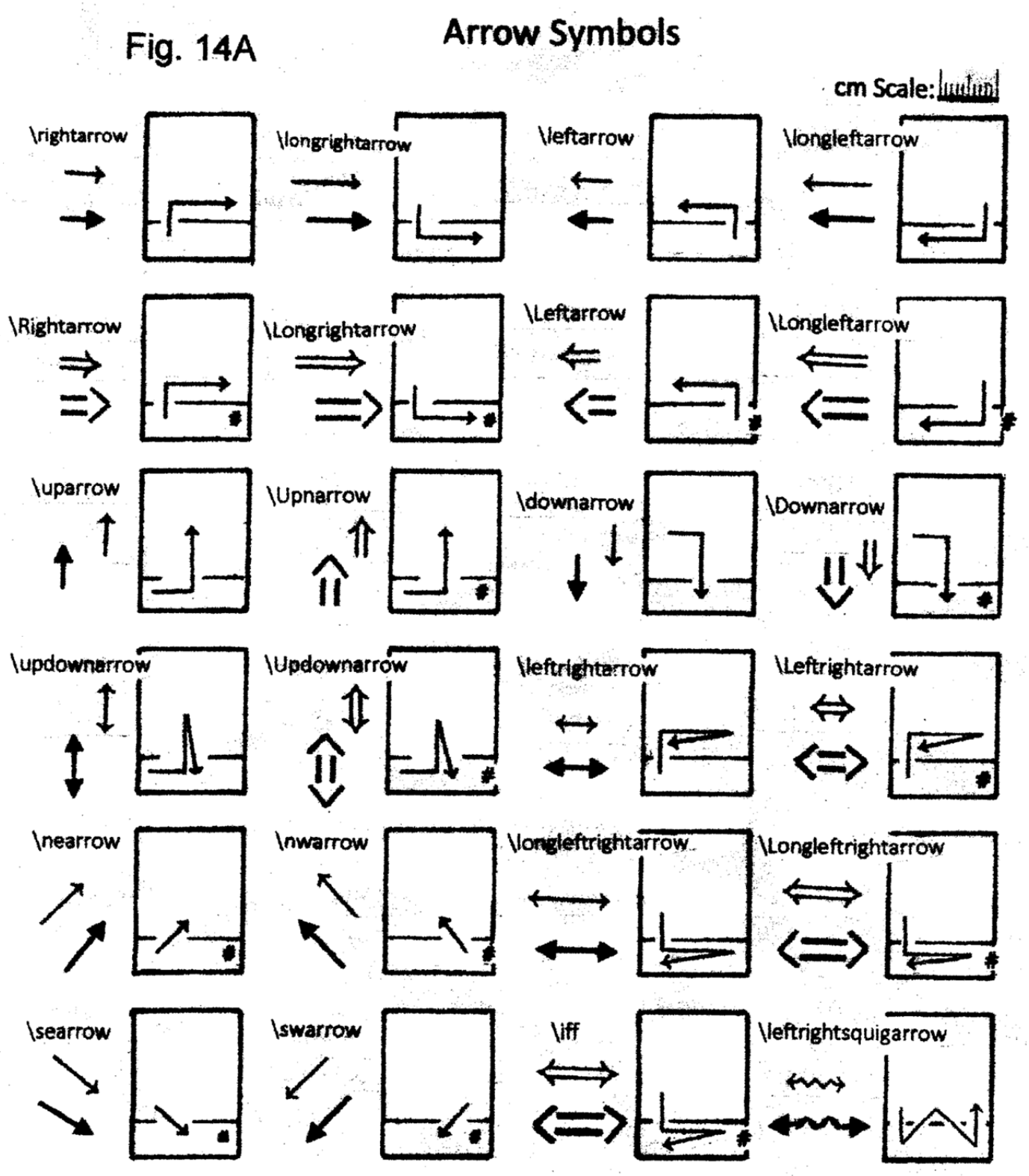
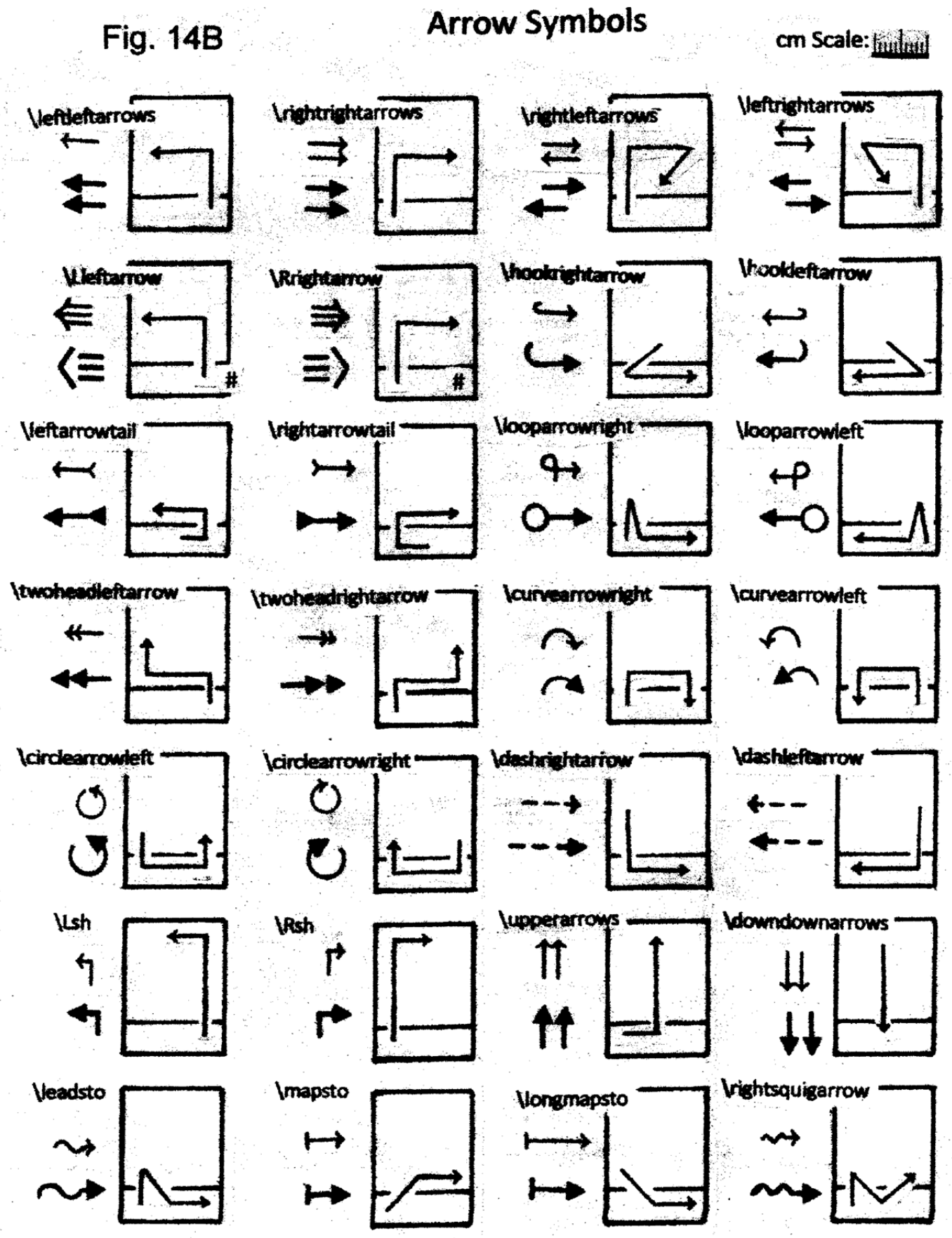
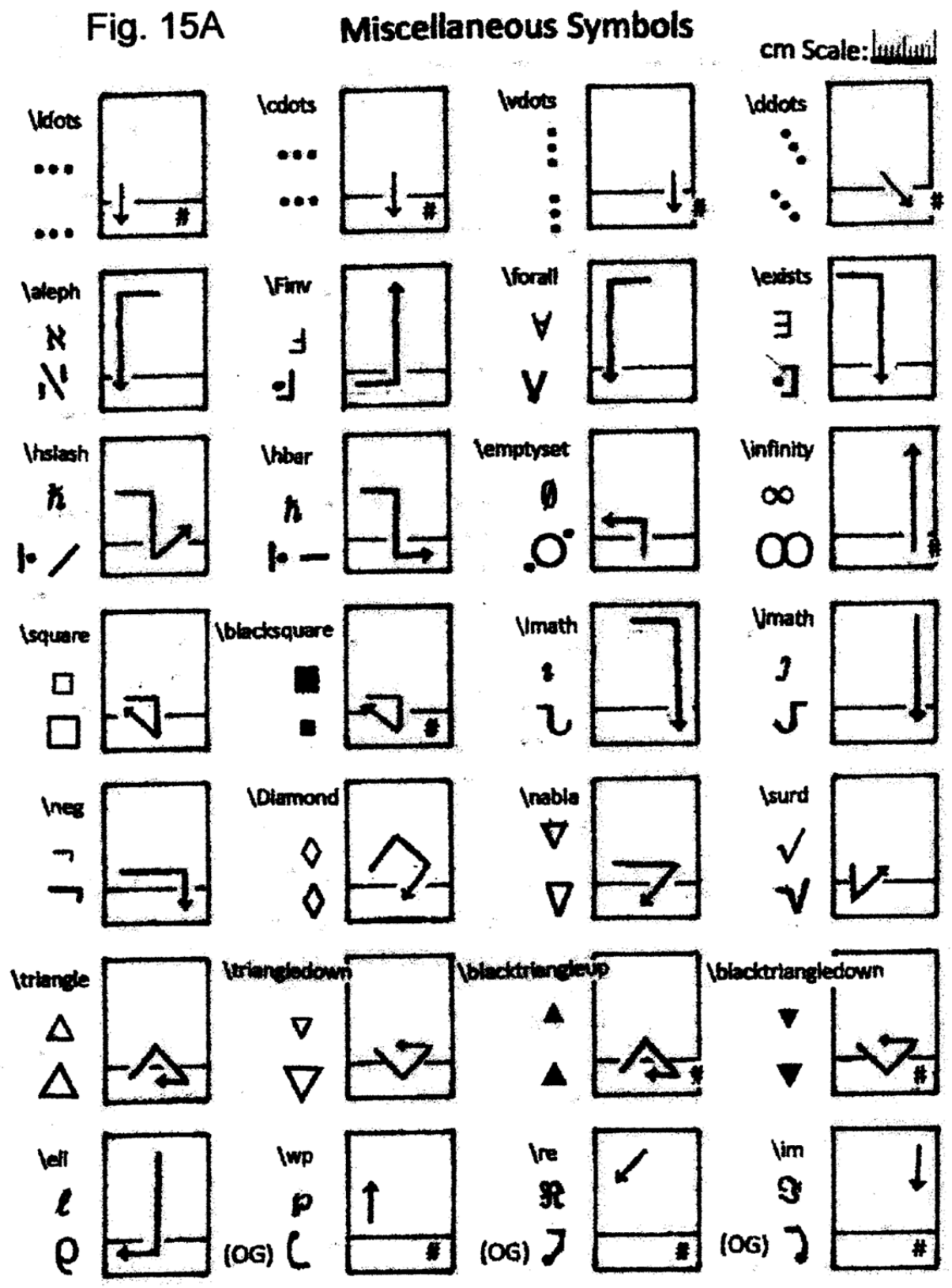

Arrow Symbols
cm Scale:
\rightarrow
\longrightarrow
\leftarrow
\longleftarrow
\Rightarrow
\Longrightarrow
\Leftarrow
\Longleftarrow
\uparrow
\Uparrow
\downarrow
\Downarrow
\updownarrow
\Updownarrow
\leftrightarrow
\Leftrightarrow
\nearrow
\nwarrow
\longleftrightarrow
\Longleftrightarrow
\searrow
\swarrow
\iff
\leftrightsquigarrow

Fig. 14B


Arrow Symbols
cm Scale:
\leftleftarrows
\rightrightarrows
\rightleftarrows
\leftrightarrows
\Leftarrow
\Rightarrow
\hookrightarrow
\hookleftarrow
\leftarrowtail
\rightarrowtail
\looparrowright
\looparrowleft
\twoheadleftarrow
\twoheadrightarrow
\curvearrowright
\curvearrowleft
\circlearrowleft
\circlearrowright
\dashrightarrow
\dashleftarrow
\Lsh
\Rsh
\upuparrows
\downdownarrows
\leadsto
\mapsto
\longmapsto
\rightsquigarrow

Figs. 15 A and B show the Miscellaneous Symbols in mathematical expressions and according to the new reading method.



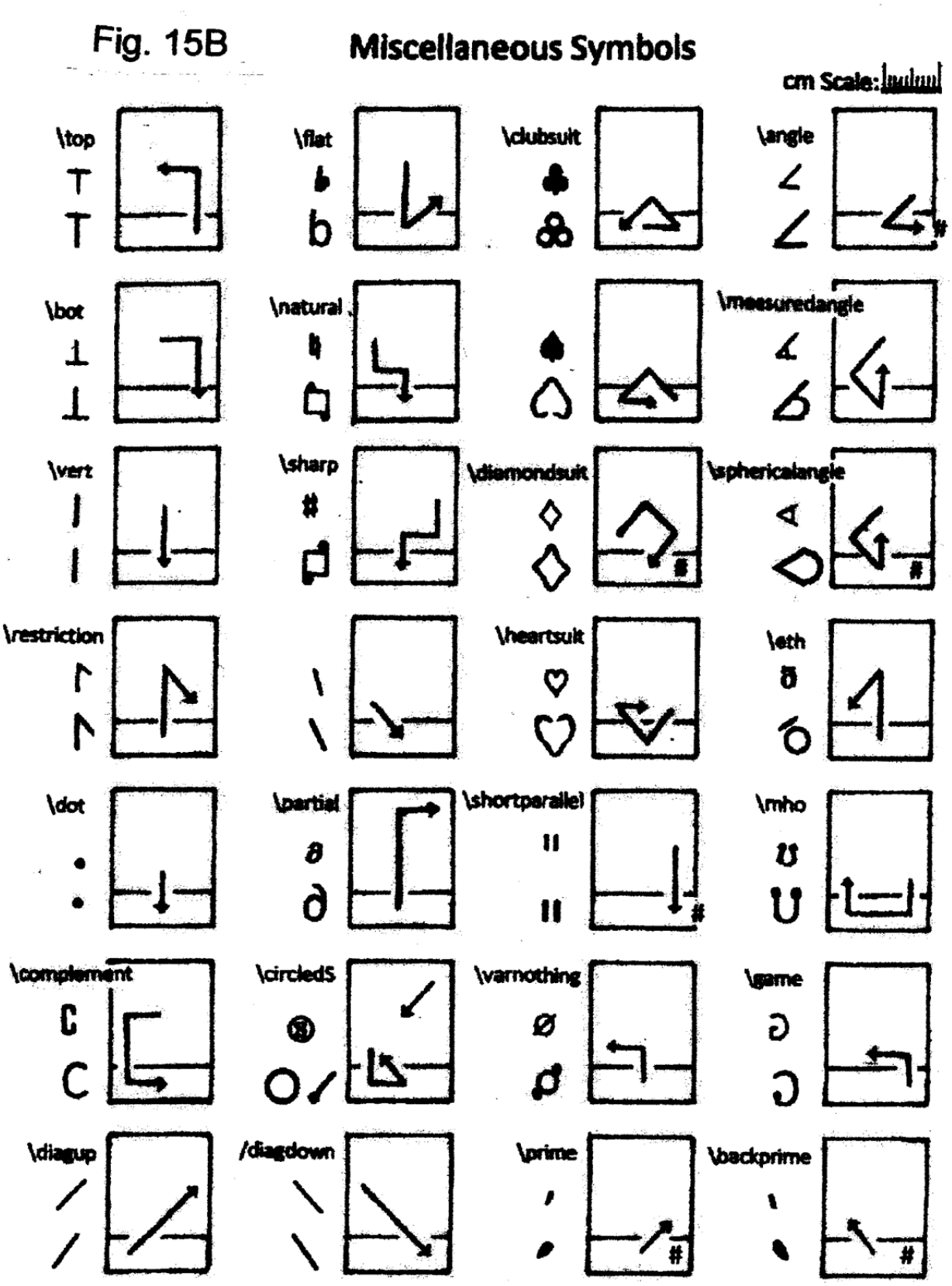


Fig. 16 shows the Delimiters Symbols used in mathematical expressions and according to the new method of reading.

Fig. 16

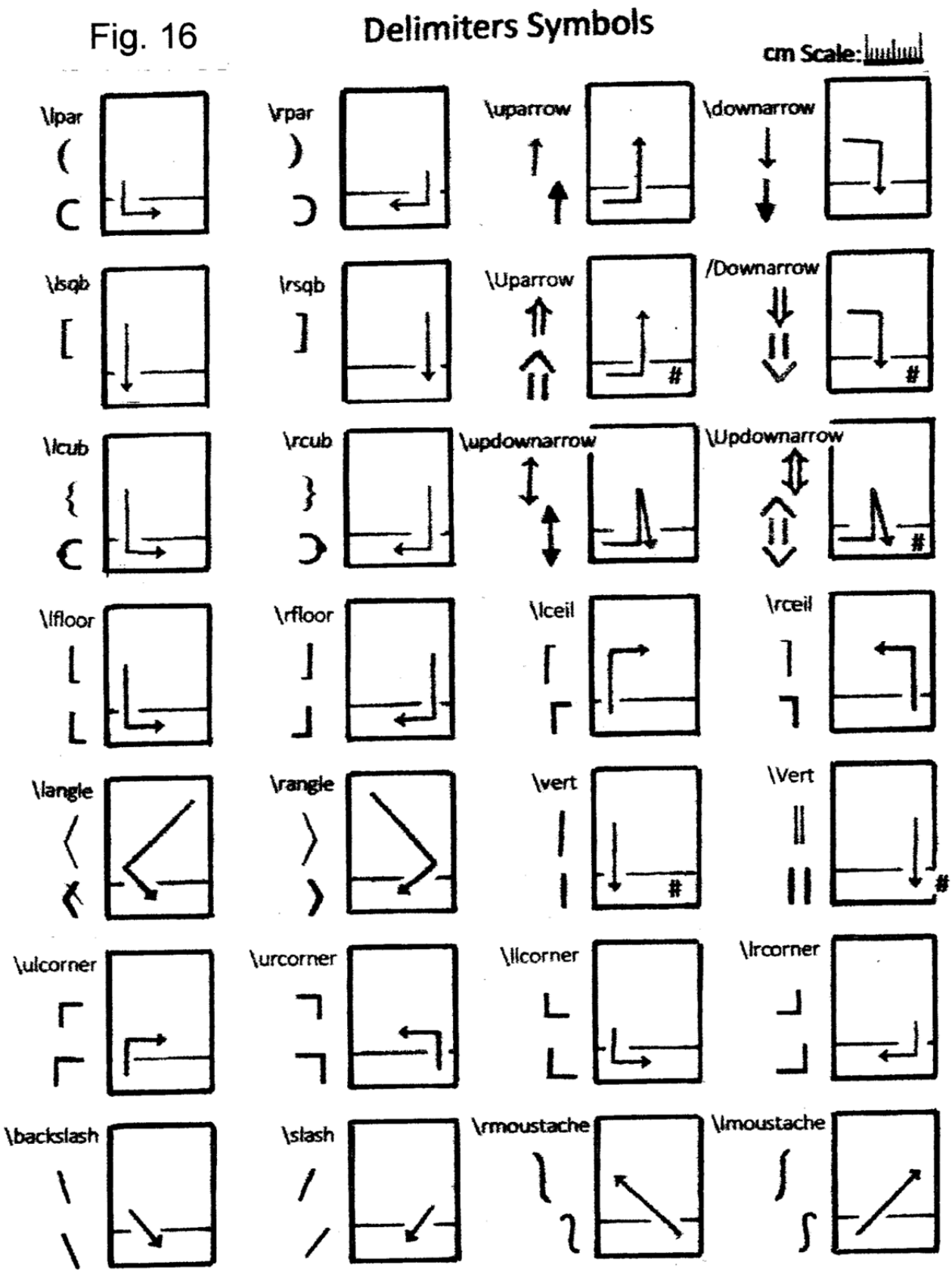

Delimiters Symbols
cm Scale:
\lpar
\rpar
\uparrow
\downarrow
\lsqb
\rsqb
\Uparrow
/Downarrow
\lcub
\rcub
\updownarrow
\Updownarrow
\lfloor
\rfloor
\lceil
\rceil
\langle
\rangle
\vert
\Vert
\ulcorner
\urcorner
\llcorner
\lrcorner
\backslash
\slash
\rmoustache
\lmoustache

Fig. 17 shows the Big Size Symbols used in mathematical expressions and according to the new reading method.

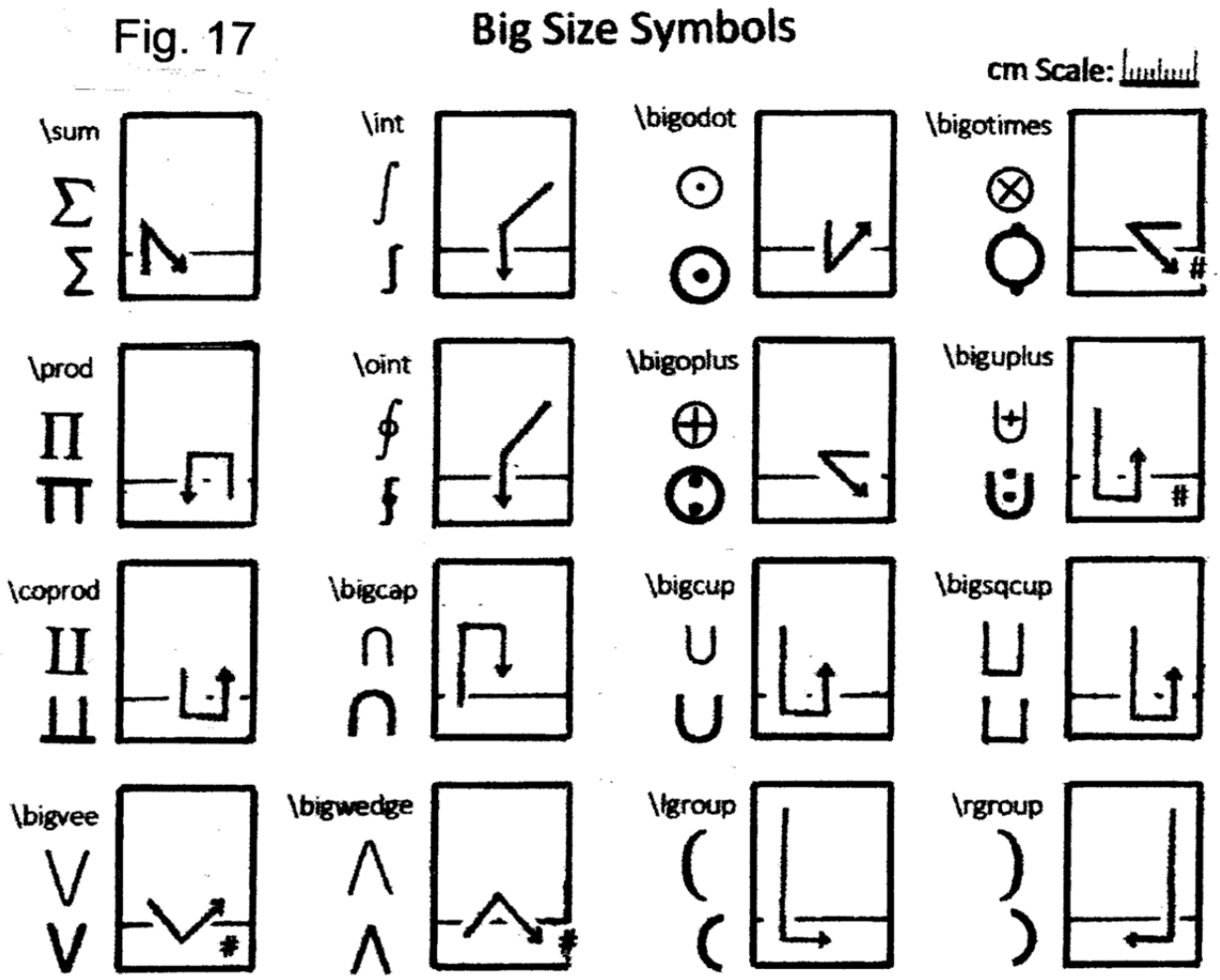


Fig. 18A shows a keypad for the new method that will facilitate its use for people with normal vision.

Fig. 18A

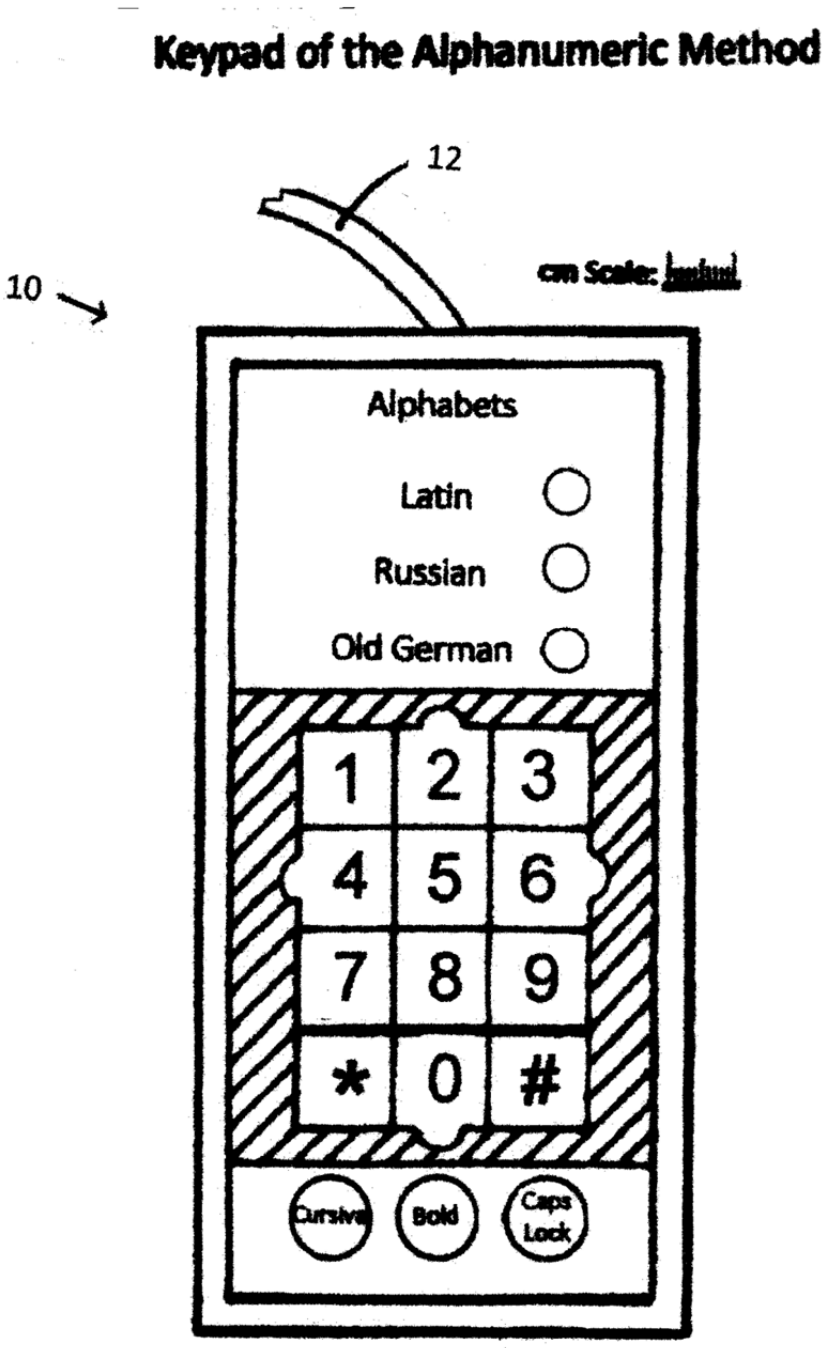


Fig. 18B shows a modified keypad in order to facilitate its use for the blind and the visually impaired. Said modified keypad can generate the glyphs of the Alphabets (1): Latin (2), Russian (3), (or any other language) and Old German (4) with its correspondent touch sensitive raised circles (10, 11 and 12). It is provided with a raised frame (5) and guiding notches (6) and also with raised marks (13 and 14) and a raised divisional line (15) to facilitate the location of the keys. This line divides the keys destined for the letters (upper three rows) and the keys on the lower row that are associated with the command keys, punctuation marks, typographical and mathematical symbols. It should be noted that the lines forming the keypad grid are just painted. The

raised circle (9) is the equivalent of the Capitals Lock of the regular keypad. Raised circles (7) and (8) correspond to the Cursive and Bold fonts.

Fig. 18B **Modified Keypad for the Blind**

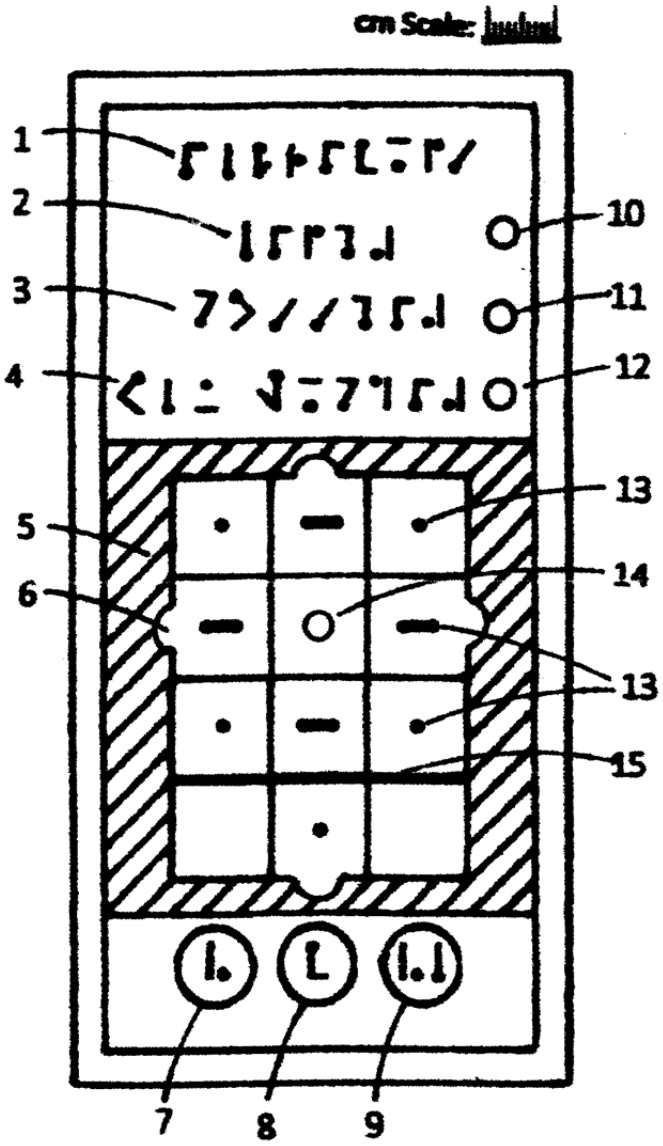


Fig. 19 shows a lineographic keypad traced on the palm of the left hand for use of the blind and deaf-blind people. This traced grid can be made using an eyebrow pencil, initially, for teaching purposes. This new method does not require the use of any machine or computer and is ready to be used anywhere. In such a way the blind and deaf-blind persons can communicate each other by sending or receiving text messages on their own hands. Making a tap with the index finger on the asterisk cell * will indicate 'Space', and a tap on the pound cell # will indicate 'Shift'. The letters can be entered by making short traces on the corresponding cells, and the numbers can be entered by tapping directly on the corresponding cells. In addition, the method can be complemented with a few maneuvers, for instance, one tap on the upper edge of the hand could mean 'attention', two taps would indicate OK or 'very good', and three taps would signify 'greetings' or 'hello' or 'see you later'. Also, by rubbing on the same edge would mean 'error' or 'erase'. A few arithmetic symbols will help in the teaching process, for instance, 'equal' is entered by making a continuous trace on the cells 0, 5, and 6, 'non-equal' on the cells 6, 5 and 0, 'plus' on *, 0 and 8, 'minus' on 8, 0 and *. To teach the numbers on the palm keypad one can start by tapping once on the upper edge of the index finger to indicate number 1 followed by the symbol 'equal' and then tapping on the cell 1 of the keypad. By tapping twice on the index

finger to indicate the number 2 followed by the symbol ‘equal’ and tapping on the cell 2 of the keypad. Tapping three times on the same finger to indicate the number 3 followed by the symbol ‘equal’ and then tapping on the cell 3 of the keypad. The same procedure should be done for the following numbers. The same scheme can be used for the alphabetic letters by showing common objects like a pencil or a book and spelling the word on the palm keypad.

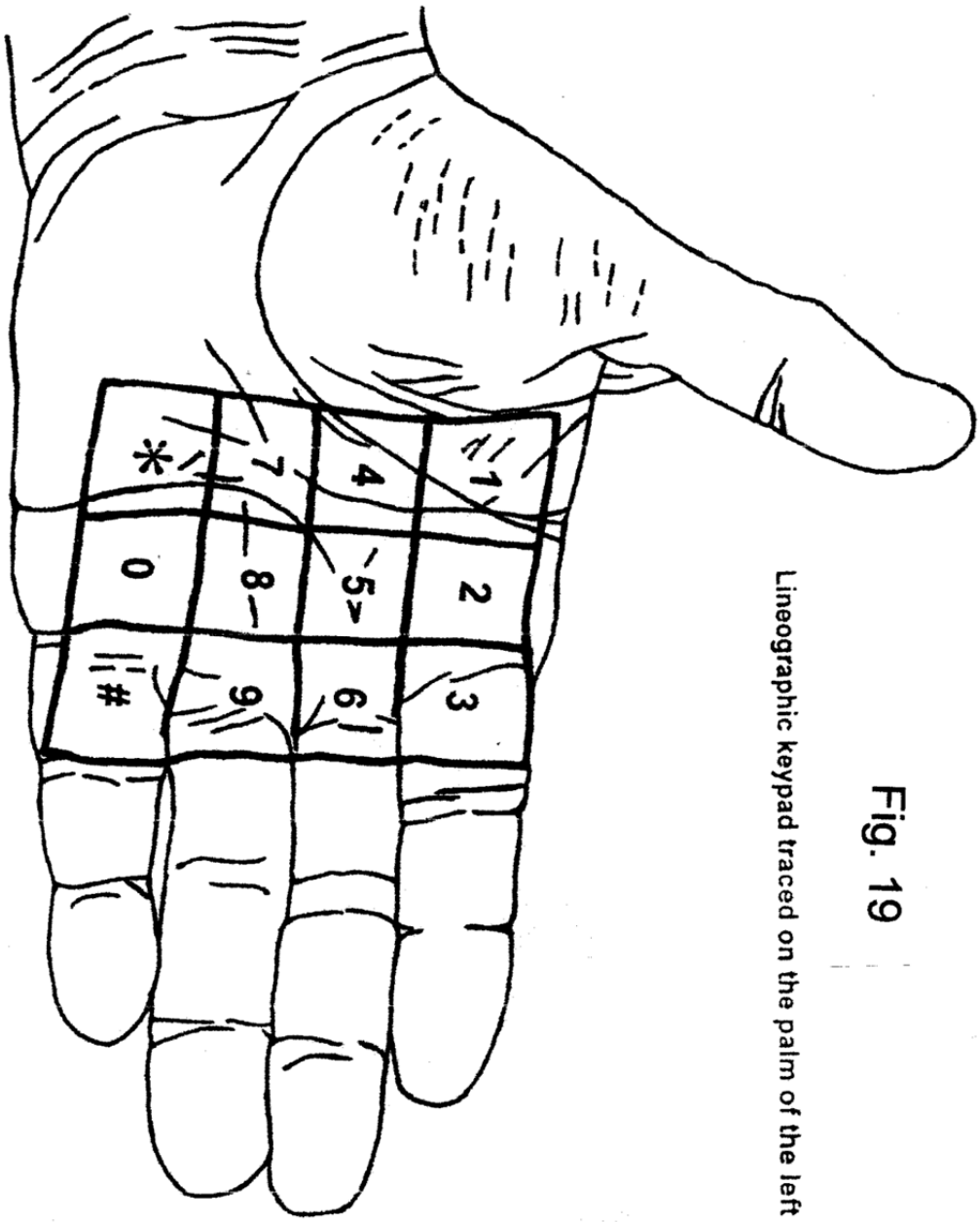
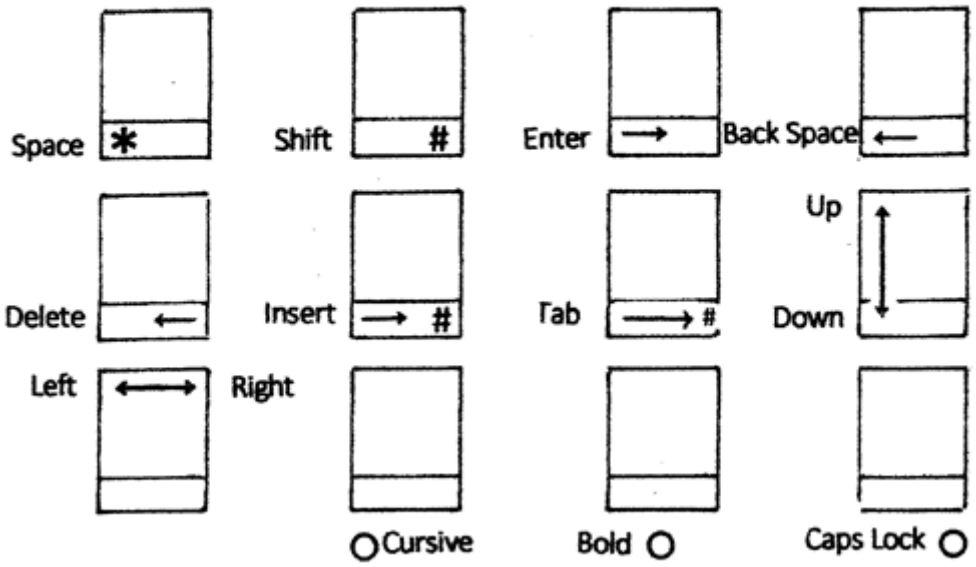


Fig. 19

Lineographic keypad traced on the palm of the left hand

Fig. 20 shows the Command Keys for the lineographic keypad.

Fig. 20 Command Keys



VII. Summary

Here I am presenting a new writing and reading method for the blind and visually impaired that uses the keypad described in the Lineographic System, plus a combination of lines and dots for representation of the alphabetic letters, numbers punctuation marks, typographical and mathematical symbols. This new method uses small, embossed glyphs on regular letter bond paper that can be recognized instantaneously by the tip of one finger. In addition, the new method can be used by the deaf-blind and blind people by tracing the keypad of the Lineographic System on the palm of the left hand. The new method provides a truly universal code that can be used in literary work, mathematics, science, computer software and other varieties of writing materials.

VIII. Legends of the Figures

Figs. 1 and 2 describes the braille cell comprised of six dots numbered in a specific order, and the braille alphabet (1) with accented Letters (2), punctuation marks (3), numerals (4), and special signs (5).

Fig. 3 shows the Latin alphabet using the lineographic system of writing plus the glyphs of the new reading method.

Fig. 4 shows the Mathematical Greek alphabet using the lineographic system of writing plus the glyphs of the new reading method.

Fig. 5 shows the Russian alphabet using the lineographic system of writing plus the glyphs of the new reading method.

Fig. 6 shows the Old German alphabet using the lineographic system of writing plus the glyphs of the new reading method.

Fig. 7 shows the Turkish alphabet using the lineographic system of writing plus the glyphs of the new reading method.

Fig. 8 shows the Punctuation Marks using the lineographic system plus the glyphs of the new reading method.

Fig. 9 shows the Typographic Symbols using the lineographic system plus the glyphs of the new reading method.

Fig.10 shows the Basic Characters of the new reading method.

Fig. 11A shows the letters of the Latin alphabet in the cursive font.

Fig 11B shows the letters on the Latin alphabet in the bold form.

Figs. 12 A and B show the Binary Operation symbols using the lineographic system of writing plus the new reading method.

Figs. 13 A, B and C show the Binary Relation symbols using the lineographic system of writing plus the new reading method.

Figs. 14 A and B show the Arrow symbols using the lineographic system of writing plus the new reading method.

Figs. 15 A and B show the Miscellaneous symbols using the lineographic system of writing plus the new reading method.

Fig. 16 shows the Delimiters symbols using the lineographic system of writing plus the new reading method.

Fig. 17 shows the Big Size symbols using the lineographic system of writing plus the new reading method.

Fig. 18 A shows the Keypad of the lineographic system destined to the people with normal vision.

Fig. 18 B shows the Modified Keypad for the blind.

Fig.19 shows the lineographic Keypad traced on the palm of the left hand.

Fig. 20 shows the Command Keys of the lineographic keypad.

References

[1] Jiménez J, Olea J, Torres J, et al. Biography of Louis Braille and invention of the braille alphabet. DOI:/10.1016/j.survophthal.200810.006
[2] Gardner-Salinas braille codes. Wikipedia
[3] Simpson, C. The rules of the Unified English Braille (2nd. Ed.). International Council on the English Braille (ICEB). http://iceb.org/rules%20of%20unified%20English%20braille%202013.pdf
[4] Nemeth, A. The Nemeth Braille Code for Mathematics and Science Notation. 1972 Revision. American Printing House for the Blind (1972).
[5] An introduction to the Moon alphabet. http:/www.bsblind.co.uk/full/moon/moontype.him
[6] ELIA frames. Website: http://www.theliaidea.com/