уменьшает прочность формного материала. Краска, воздействуя на поверхность печатной формы, создает вторичные структуры, присутствие которых может быть как положительными, так и отрицательными. Имеющиеся в краске абразивные вещества (красители, пигменты, сиккативы) увеличивают износ.

Также следует отнести к числу факторов, определяющих состояние печатных форм, скорость печатания, влияющую на величину и периодичность нагрузок. При повышении скорости печатания уменьшается время контакта, изменяется характер деформации и увеличивается давление на печать.

Таким образом, представленные в работе выражения определяют основные параметры растровой точки, которые изменяются в процессе изнашивания. Анализ результатов расчетов позволит выделить основные факторы, влияющие на состояние печатной формы и выработать комплекс мер, направленных на корректирование этих факторов.

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RESEARCHES OF DURABILITY OF RELIEF ELEMENTS AND BRAILLE OF TACTILES BOOKS ASSESSING THE TYPE OF MATERIALS

Introduction. There are currently over 7 thousands of visual impairment people live in Lithuania, in European Union live

7.4 million and about 285 million people have visual impairment of which 39 million are blindness [1].

An increasingly important social issue is the integration of people with disabilities. European blind union (EBU) and national organizations of blind people of Western countries are trying that all kind of information become more accessible as possible.

Books in human life play important role thus for blind people they are also important. Both in Lithuania and globally the selection of tactile books is very limited. They can be found only in specialized institutions. Only few new publications of tactile and Braille books are published per year in European Union for blind people.

Relief elements used in tactile books provide for blind people a possibility to understand the image by touching each element of view sequentially. It is important that relief image consists of simple and clear shape. Also the correct character of layout of relief graphical information and ratio of text and relief element is important [2].

The most common problem is the suitability for touching understanding of relief visual images. The problems related with creation practice of visual images (graphical images) for blind people at this moment are very relevant as in infancy of such practice. The ways to transfer the writing or images into tactile format were start looking at similar time – at the end of eighteenth century [3].

Lot of attention is given for creation and understanding of tactile maps. In this field recently are working Graf C. (University of Bremen) [4], McCallum D. (Anglia Polytechnic University)[5], Jehoel S., Rowell J. and Ungar S. (University of Surrey) [6].

In tactile books the text is imparted by Braille and the relief images could be created from relief planes and contours or contours of dots or their whole. Different technologies could be used to form Braille and relief elements. The selection of such technologies depends on character of relief images, their quantity, durability, used materials and etc. The aim of this paper is to determine the durability of Braille dots and relief elements used in relief books assessing the types of materials and forming.

Experimental object and the methods. Research object – printouts of relief elements and Braille formed on different materials using different forming technologies.

During reading a book is affected by various factors including and mechanical. Experimental tests were carried out in order to assess the effect of mechanical impact to geometrical parameters of Braille and relief elements using samples formed different technologies and materials. The elements were formed using embossing, screen and thermography. Tested materials were selected considering to a wider possibility of tactile books use.

During testing it was investigated how mechanical impact (abrasion) changes geometrical parameters of Braille dots and relief elements. Testing conditions were close to exploitation (temperature – +21±1 °C and 50±2 % relative humidity), simulating reading with fingers.

The measurement of height *h* of relief elements and Braille (see Fig. 1) were carried out using calibrated thickness measuring device – micrometer Vogel Germany that scale interval 0.01 mm and specialized device FAG BRAI³ Braille Dot Checker (FAG Graphic Systems SA company).

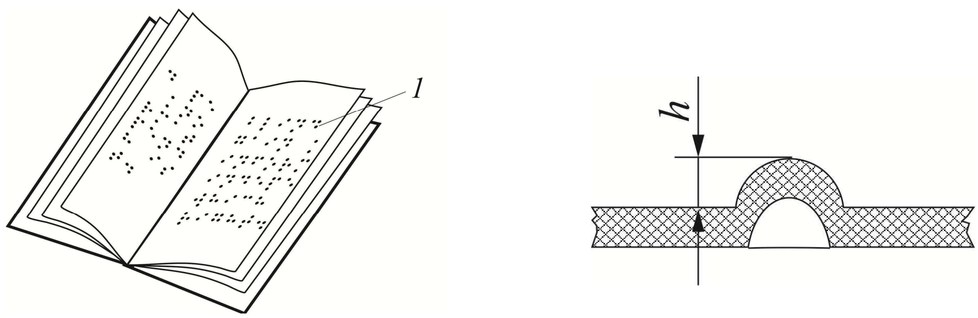

Fig. 1 Book with Braille (1) that main geometrical parameter – Braille dot height (*h*)

Findings of experimental researches. Findings of resistance to mechanical impact of relief elements and Braille dots printed using screen printing on different materials (paper, paperboard and polymer) and formed using embossing on paperboard are shown in Fig. 2. Findings of relief elements and Braille dots height after mechanical impact in determined time intervals (from 1 min to 60 min, i.e. up to 1692 m of mechanical impact path) are seen in given dependences. It is determined (see Fig. 2, curves 1-5) that depending on material type on which the Braille dots were printed using screen printing, relief dots wear differently because plastisolic inks during printing due different interaction of materials macromolecules and at the same time structural properties differently adheres on materials surface. It is determined that Braille dots height formed on paperboard Arktika GC1 decreased – 45 %, on paperboard Multicolor Mirabell GD2 – 14 %, on coated paper Polaris – 23 %, on uncoated paper Munken Pure – 12 %, on polymer PP – 33 % from initial value of Braille dot height. The height of relief element formed using embossing (see Fig. 2, curves 10-11) on recycled paperboard Multicolor Mirabell GD2 decreased 31 % from initial height and the change of relief elements height decrease on cellulose mass paperboard Alaska GC2 – 26 %.

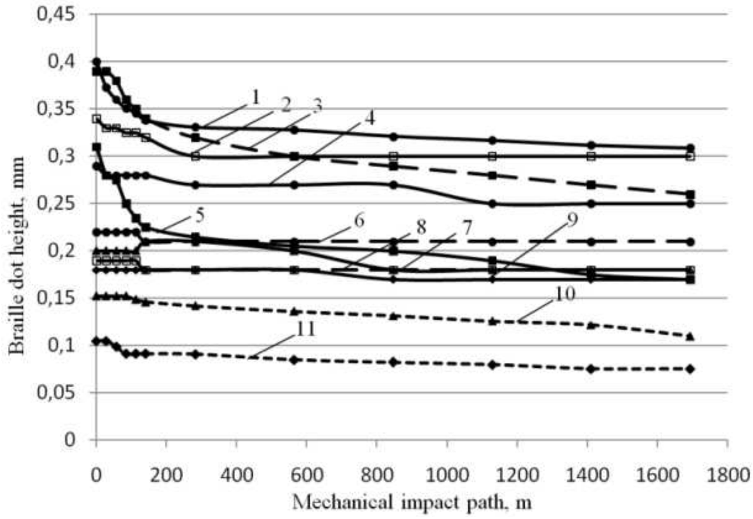

Fig. 2 Braille dot height change under different mechanical effect way length (mechanical impact path 1692 m) when Braille is formed using screen printing on different materials: 1 – on paper uncoated Munken Pure, 2 – on paper coated Polaris, 3 – on polymer PP, 4 – on paperboard Multicolor Mirabell GD2, 5 – on paperboard Arktika GC1;when Braille is formed using thermography on different materials: 6 – on paperboard Arktika GC1, 7 – on paperboard Multicolor Mirabell GD2,8 – on paper uncoated Munken Pure, 9 – on paper coated Polaris; when Braille is embossing on different materials: 10 – on paperboard Multicolor Mirabell GD2, 11 – on paperboard Alaska GC1

It is determined that Braille and relief elements formed using thermography (see Fig. 2, curves 6-9) are most durable thus this Braille forming type is appropriate to use on all materials used for tactile books.

More suitable forming type of Braille and relief elements on various materials used for tactile books could be selected by analyzing the findings of these researches.

Conclusions. Thermography printing is innovative and durable forming type for tactile books.

Relief elements are more durable when embossed on cellulose mass paperboard. The surfaces of relief elements formed on recycled mass paperboard undergo plucks of fibers that worsen the readability.

It was determined that Braille dots and relief elements formed using screen printing and plastisolic inks are not durable under mechanical impact thus such type of forming is not recommended for tactile books printing.

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