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PROBLEM OF CONFORMITY OF PROJECTIONS OF THE GEOMETRICAL IMAGE AND PRODUCT VIEWS

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Present work provides necessity of maintenance of integrity of discipline "Engineering Graphics". The common issues and essential steps of their resolution are identified. It is shown that the construction of a geometrical model of the part is a necessary condition for the development of the design documentation.

Keywords: an image, a geometric model, a complex drawing, product design documentation.

Formulation of the problem. The normative educational discipline "Engineering Graphics" is structurally composed of three parts: engineering geometry, engineering drawing, engineering computer graphics. To ensure the integrity of the discipline "Engineering Graphics" you need unity and continuity of concepts and methods of its various parts. In engineering geometry, a complex two-dimensional drawing of the image is formed by the method of orthogonal projection onto three mutually perpendicular planes with the subsequent juxtaposition of the horizontal and profile plane with the frontal plane of projections. Thus, the complex drawing of the geometric image consists of its front, horizontal and profile projections [1-8]. The alignment of the horizontal and profile planes of the projections with the frontal plane is achieved by turning these planes around the axes located between the rotated planes and the fixed frontal plane.

In engineering drawing, the product drawing is also formed by the method of orthogonal projection onto six faces of the cube covering the object, cutting the cube along the edges and combining all the faces with the front face [2, 3]. The product drawing consists of a front view A (front view), a top view B, a left view C, a right view D, a bottom view E and a rear view F.

The mutual arrangement of views in the drawing of the article depends on the relative positioning of the elements of the orthogonal projection device [2, 8].

The problem (contradiction) is that, in order to ensure the unity of the various parts of the discipline "Engineering Graphics", the use of an independent method of drawing a product must depend on the chosen octant and the method of constructing the geometric model of this product. In other words, the independent choice of the location of the views in the drawing of the product must correspond to the location of the projections of

the geometric image of the object in the complex drawing constructed in a certain octant. The solution of such a contradiction will allow ensuring the conformity of methods and concepts of engineering geometry and engineering drawing.

Analysis of recent research and publications. One of the main sections of engineering graphics is engineering geometry for constructing a geometric model of an object [1, 2, 5-8, 11]. Methods for constructing a geometric model are described in the works of professors Mikhailenko VE, Vanin VV, Kovalev SN, Naidysh VM, Podkorytov AN, Skidan IA, Ryzhova NN, Frolova S.A. And other scientists [3, 4].

At the same time, two methods of forming species in the drawing are proposed by international standards: the projection method for the first octant and the projection method for the third octant [9, 10].

Using the projection method for the third octant leads to a loss of visibility of the complex drawing of the geometric image. This geometric model of the product makes it difficult to determine the positional properties and metric characteristics of the object.

Formulation of the purpose of the article. The purpose of this study is to reveal the essence of the problem of the correspondence between projections of a geometric image and product types.

Objectives of the study:

1. In accordance with international standards [9, 10] to reveal the essence of the location of product types in the projection method for the third octant of the American measurement system [11].

2. Construct a complex geometric image drawing using the orthogonal projection method for the third octant of the American measurement system [11].

3. Prove the loss of visibility of the complex drawing of the geometric image, constructed for the third octant according to the location of the product types standard for this octant [9, 10].

Main part. The projection method for the third octant is an orthographic representation in which the object is located, as seen by the observer, behind the coordination planes to which the object is orthogonally projected (Fig. 1). On each plane of projections the object is represented, as if seen orthogonally from an infinite distance through transparent planes of projections [10].

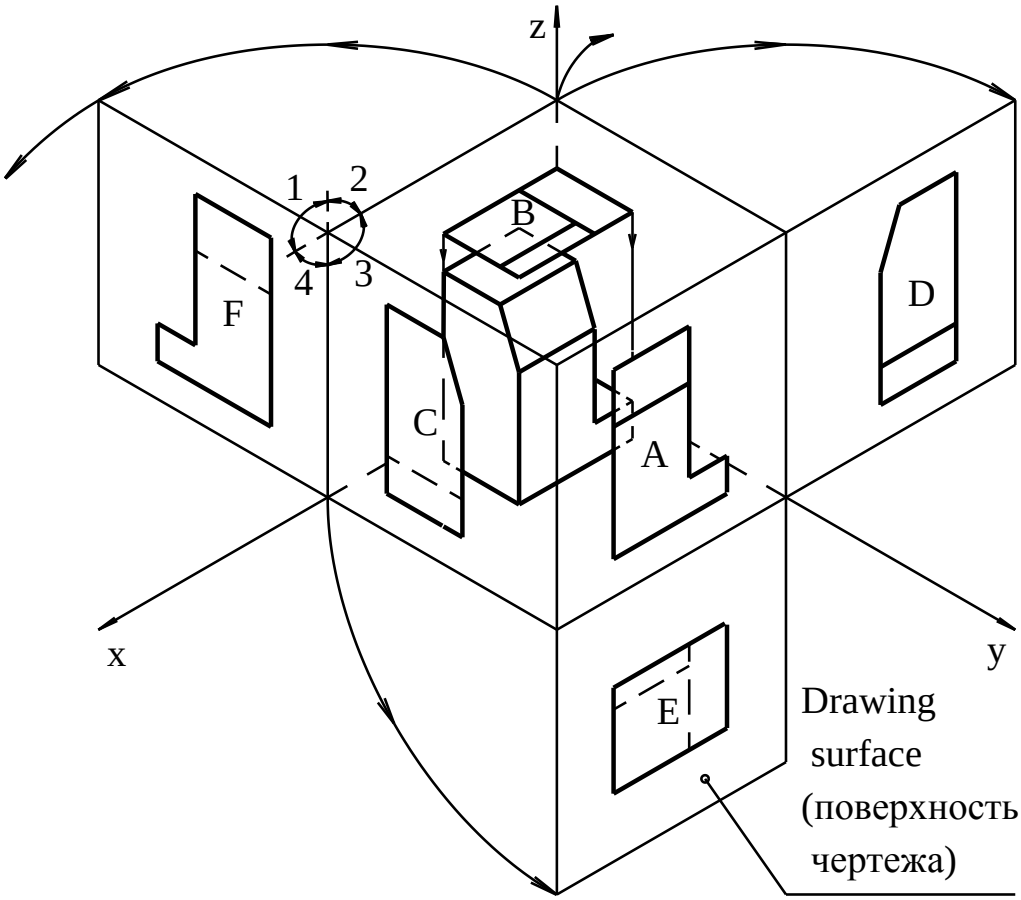

Fig. 1. The location of the object of investigation in the enclosing cube and the direction of rotation of the projection planes when aligned

The positions of different species, relative to the main (frontal) type A, are determined by the rotation of these projection planes around the lines coinciding with the coordination axes (or parallel axes) [10]. The planes rotate until completely aligned with the coordination plane (the surface of the drawing) on which the main front view A is projected (Figure 2).

In accordance with the principle of visibility, a complex drawing of a straight line segment for the third octant in the American measurement system is made (fig. 3). The bottom view is on the top of the front view, and the left view is to the right of the front view (fig. 3).

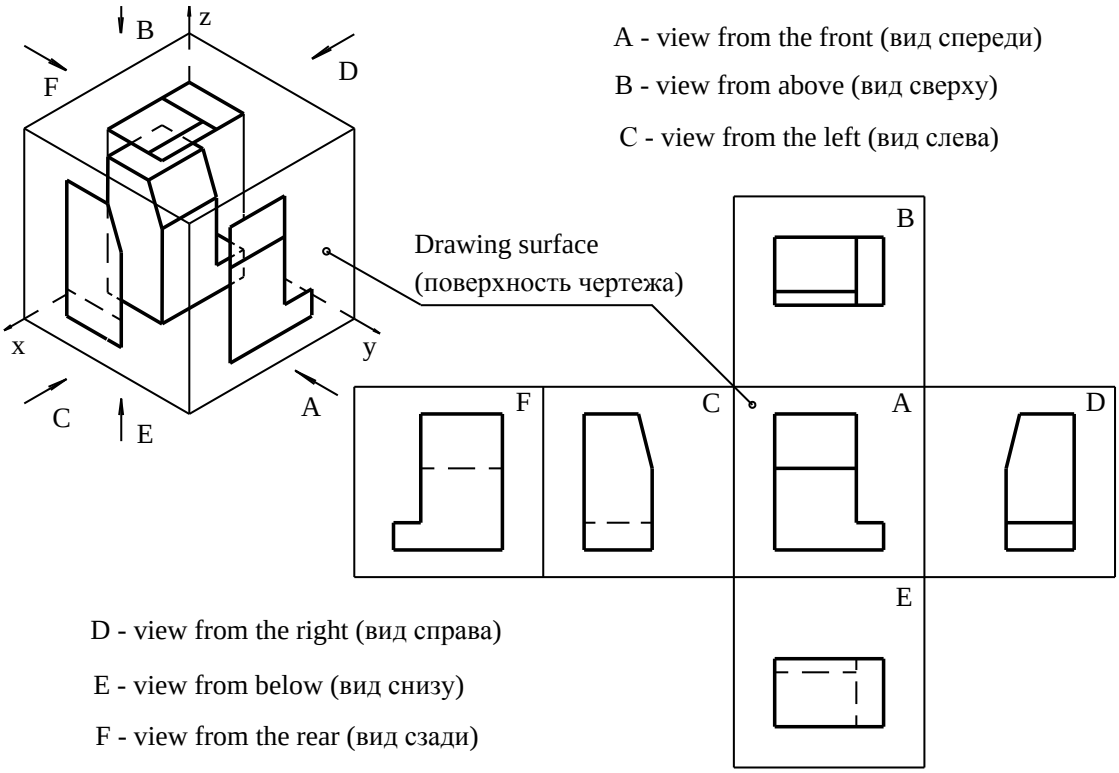

Fig. 2. Standard arrangement of product types for the third octant method

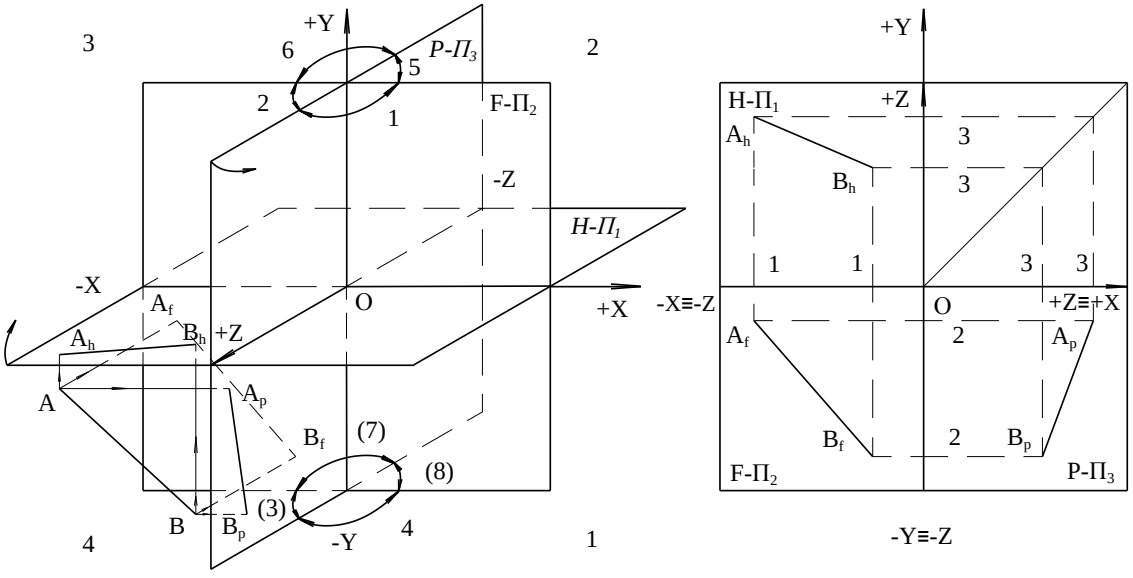

Fig. 3. Complex drawing of a straight line segment for the third octant in the American measurement system [11]

In accordance with the international standard for the layout of the view from below below the front view and the left view to the left of the front view, the complex drawing of the segment is rebuilt (fig. 4).

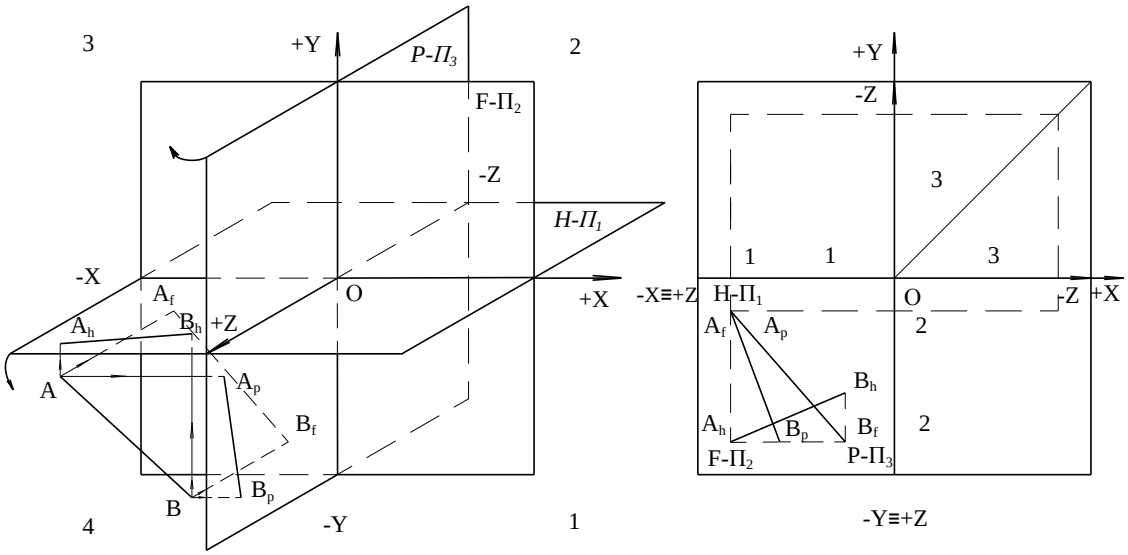

Fig. 4. Complex drawing of a straight line segment for the third octant in accordance with the international standard

Conclusions.

1. The performed study proves the loss of visibility of the complex drawing of the geometric image (Figure 4), constructed for the third octant according to the international standard for this octant arrangement of the product types.

2. To eliminate the revealed contradiction, it is recommended to apply the method of formation of the first octant species.

Literature

1. Браилов А. Ю. Компьютерная инженерная графика в среде T–FLEX: преобразования двухмерных и трехмерных моделей изделий / А. Ю. Браилов – Киев: Каравелла, 2007. – 176 с.
2. Браилов А. Ю. Инженерная геометрия / А. Ю. Браилов – Киев: Каравелла, 2013. – 456 с.
3. Михайленко В. Є. Інженерна та комп'ютерна графіка / В. Є. Михайленко, В. М. Найдиш, А. М. Подкоритов, І. А. Скидан – Київ: Вища школа, 2001. – 350 с.
4. Михайленко В. Е. Инженерная и компьютерная графика / В. Е. Михайленко, В. В. Ванин, С. Н Ковалёв – К.: Каравелла, 2013. – 328 с.
5. Brailov A. Yu. Principles of Design and Technological Development of Product // International Journal of ADVANCES IN MACHINING AND FORMING OPERATIONS // International Science Press. – ISP, 2011. – Vol. 3. – Num. 1. – P. 11–17 (Detroit, Michigan, USA).
6. Brailov A. Yu. Laws of projective connections // Proceedings of the Fifteenth International Conference on Geometry and Graphics (Montreal, CANADA). – ISGG, 2012. – P. 121–122.

7. Brailov A. Yu. The general approach to the solution of typical engineering geometrical problems // Proc. of the 16-th Int. Conf. on Geom. and Graph. (AUSTRIA). – ISGG, Innsbruck University Press, 2014. – P. 444–458.
8. Brailov A. Yu. Engineering Graphics. Theoretical Foundations of Engineering Geometry for Design. – Springer International Publishing, 2016. – 340 p (ISBN 978-3-319-29717-0, DOI 10.1007/978-3-319-29719-4).
9. BRITISH STANDARD BS 8888: 2011 Technical product documentation and specification (BS EN ISO 5456-2). – London: BSI Standard Publication, 2011. – pp. 94 (ISBN 978-0-580-72757-3).
10. INDIAN STANDARD IS 15021 (Part 2): 2001, ISO 5456-2: 1996 Technical drawings – projection methods. Part 2 Orthographic representations. – New Delhi: Bureau of Indian standards, 2001. – 12 p.
11. Ryan D.L. CAD/CAE descriptive geometry. Daniel L. Ryan. Boca Raton: CRC Press, 1992. – 209 p.