MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
Kyiv National University of Construction and Architecture

DESCRIPTIVE GEOMETRY. ANGULAR AND FRONTAL PERSPECTIVE OF THREE-DIMENSIONAL DESIGN ELEMENTS

Methodological Guidelines for Performing Graphic Works for Students Pursuing the First (Bachelor's) Level of Higher Education in Specialties B2 «Design» and B4 «Fine Arts, Decorative Arts, and Restoration. »

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К95

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This manual presents the step-by-step process for constructing angular (two-point) and frontal (one-point) perspective drawings using three-dimensional letters as examples. Students are required to complete several perspective drawings of volumetric alphabet letters. The manual includes tasks and detailed explanations of how to construct both frontal and angular perspectives.

Intended for students majoring in B2 "Design", B4 "Fine Arts, Decorative Arts, and Restoration."

Кутова та фронтальна перспектива об'ємних елементів дизайну
К95 [Електронний ресурс]: методичні вказівки до виконання графічних робіт / уклад.: В.Ф. Ус, Л.С. Іванова, О.В. Мостовенко. – Київ: КНУБА, 2026. – 22 с.

Розглянуто послідовність виконання кутової та фронтальної перспективи на прикладі креслення об'ємних літер. Студенти мають виконати декілька креслень перспективи об'ємних літер абетки. Наведено завдання та пояснення покрокового виконання побудови фронтальної та кутової перспективи.

Призначено для здобувачів першого (бакалаврського) рівня вищої освіти, що навчаються за спеціальностями В2 «Дизайн», В4 «Образотворче мистецтво, декоративне мистецтво, реставрація»

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General Provisions

Descriptive geometry is a branch of geometry that studies spatial objects and their relationships through their representations on a plane.

For designers and artists, mastering the methods of perspective is essential for accurately depicting objects as they appear to the human eye in real life.

Purpose of the Guidelines. To develop practical skills in constructing perspective projections of three-dimensional design elements.

Scope of the Guidelines. The manual includes exercises aimed at mastering the techniques of constructing angular (two-point) and frontal (one-point) perspectives of three-dimensional letters. These exercises are designed to help students apply perspective drawing methods in the design of signage, advertising objects, and other spatial compositions.

Assignment. Students are required to complete hand-drawn perspective drawings of three-dimensional alphabet letters in both frontal (one-point) and angular (two-point) perspective. All drawings must be completed in pencil, by hand, on A3 format paper. Each student selects letters corresponding to their own initials. The work should include both self-shadows and cast shadows constructed in perspective.

Today, three-dimensional elements are considered one of the most effective tools in visual advertising. Such design solutions are most often seen on the façades of buildings that house shops, office centers, or shopping complexes. Volumetric forms create a sense of depth, making signage more noticeable and memorable compared to flat graphics. Combined with lighting effects, they attract attention even at night.

From one perspective, this type of advertising captures the attention of potential customers; from another, it becomes a familiar element of the building’s façade and even a recognizable symbol of the place itself. Three-dimensional letters in advertising serve not only as an eye-catching feature but also as an additional medium for conveying information.

Volumetric lettering is one of the most striking and expressive forms of outdoor advertising — it rarely goes unnoticed. Well-designed letterforms can transform a brand’s image and enhance the visual appeal of an interior. This makes them one of the most effective means of engaging a target audience with a campaign, product, or brand.

When used as exterior signage — greeting customers at a store entrance, for example — such lettering effectively becomes the business’s visual calling

card. A sign is a powerful branding instrument that creates the first impression of a company and influences potential clients' decisions. Moreover, these advertising elements help customers navigate spaces more easily and intuitively.

A well-designed sign can catch the eye of a passerby from a distance — whether on a busy street or inside a shopping mall filled with colorful displays and competing visual stimuli. The more original and distinctive the sign, the greater the chance for a brand to stand out — and the signage itself can become an integral part of the urban landscape.



Fig. 1. Advertising sign with dimensional letters. Photo: Us V., 2025

1. Perspective Projections and Fundamental Principles.

Perspective is the branch of descriptive geometry that studies the theory and methods of constructing perspective representations of objects.

In descriptive geometry, perspective drawings are constructed using the method of central projection. Let us consider the fundamental components of perspective construction. The perspective projection of any point A is the point of intersection between the projecting ray drawn from the center of projection S (also called the station point or viewpoint) and the picture plane (K). In perspective drawing, the picture plane is the imaginary surface onto which the object is projected. Depending on its shape, different types of perspective are obtained: a linear (planar) perspective, when the picture plane is flat like a sheet of paper; a cylindrical perspective, when the plane is curved like a panoramic screen; a spherical (dome) perspective, when the surface resembles a planetarium dome.

The ground plane (Π) represents the horizontal surface on which the object rests. Between the observer and the object lies the picture plane (K) — also called the projection plane or simply the picture surface. The picture plane

K is positioned perpendicular to the ground plane *Π*. The intersection line of these two planes is called the ground line (*OO*). We choose a station point *S* as the location of the observer's eye. Its orthogonal projection onto the ground plane is denoted C_0, known as the station point on the plan. The central (or principal) ray C*P* is drawn perpendicular from point *C* to the picture plane *K*; the distance C*P* is called the visual distance or distance from the station point to the picture plane. The intersection point *P* is called the principal point of the picture, and its orthogonal projection onto the ground plane is P_0 — the foot of the principal point. The line *hh* represents the horizon line; it lies within the picture plane, runs parallel to the ground line, and passes through the principal point *P*.

The perspective projection of point *A* (see Fig. 2) is the point A^K, formed by the intersection of the projecting ray *CA* with the picture plane *K*. To obtain a reversible perspective image of the point, one must also construct the perspective of the horizontal projection of the same point A_1. This will be the point $A^K{}_1$, determined by the intersection of the projecting ray CA_1 with the picture plane.

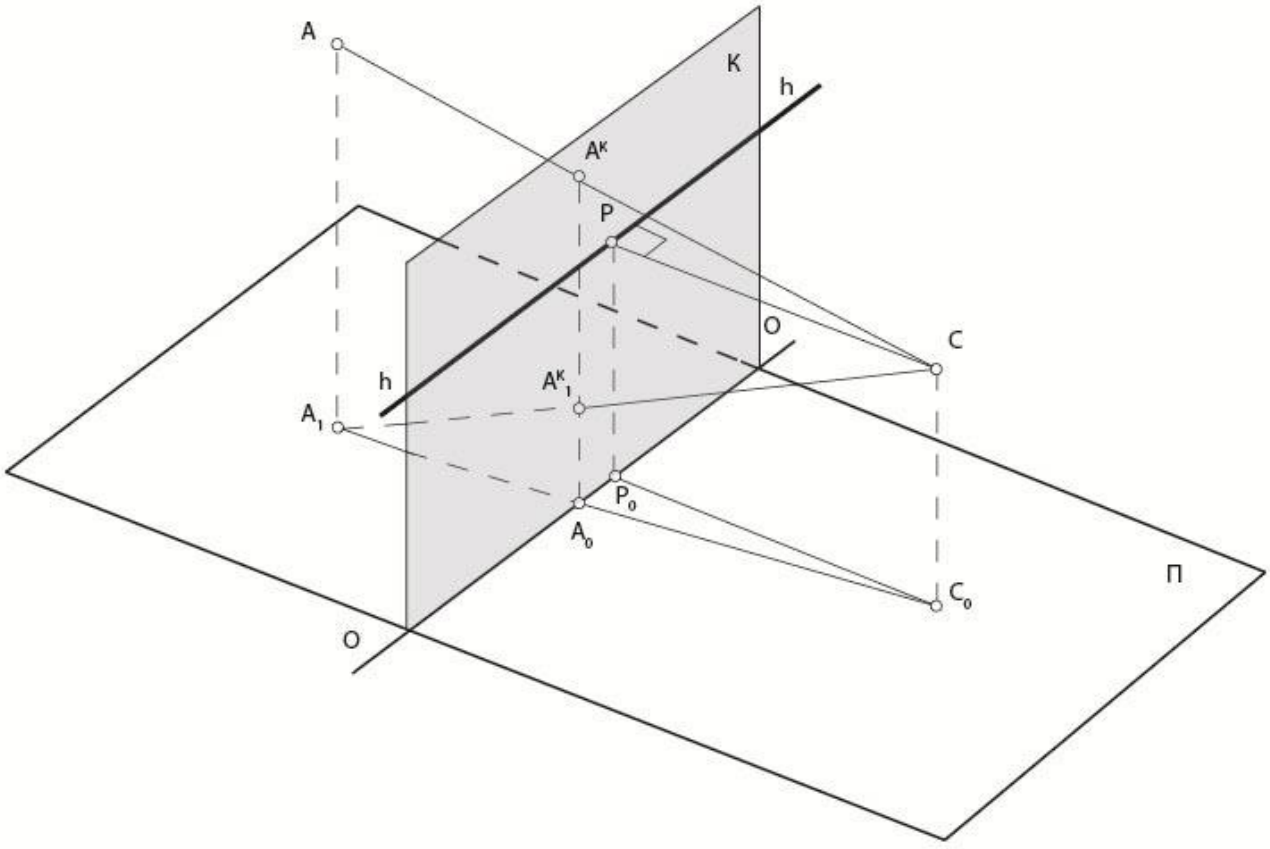


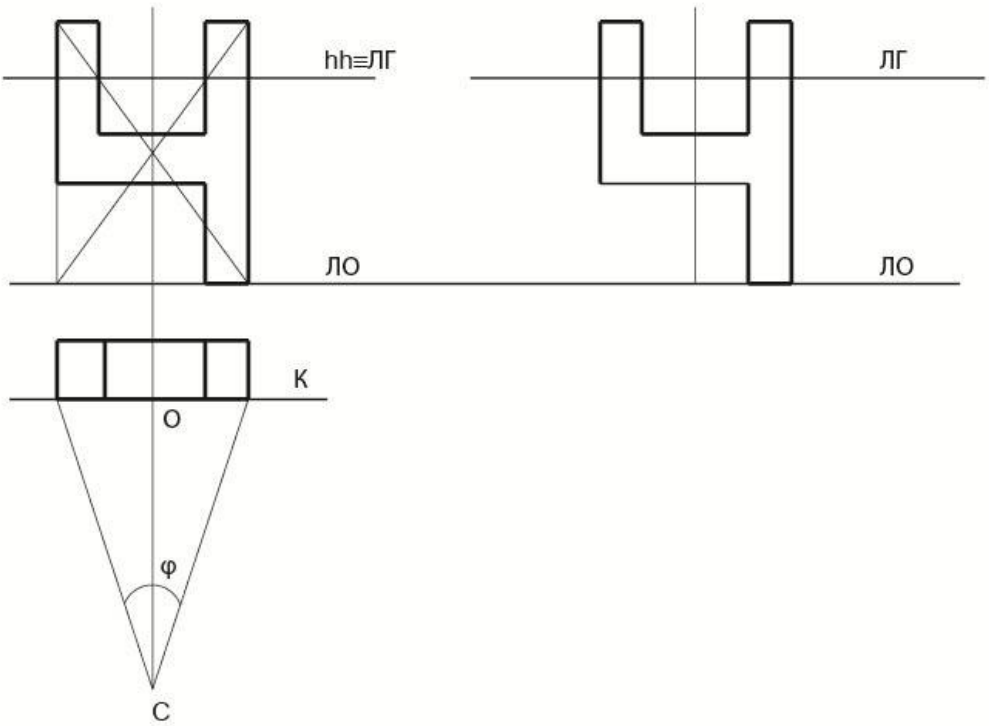
Fig. 2. Fundamental Principles of Perspective Projections

2. Constructing a Three-Dimensional Letter in Frontal (One-Point) Perspective.

Frontal perspective is a type of perspective projection in which the picture plane is positioned parallel to one of the principal planes of the object.

Characteristics of Frontal Perspective:

- Lines that are perpendicular to the picture plane converge at the principal vanishing point (*P*).
- Lines that are parallel to the picture plane remain parallel to the horizon line and to the ground line.
- Lines that are directed toward the observer also converge at the principal point (*P*).
- Lines at 45° to the picture plane converge at the vanishing points (distance points) on the horizon line, located one visual distance from the principal point.



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Fig. 3. Selection of the elements of the frontal perspective

Let us construct an object in frontal perspective.

As an example, we will use the three-dimensional letter “Ch” (Cyrillic Ч). Begin by creating two orthographic projections of the letter — the front elevation and the plan view — in projectional alignment (see Fig. 3). On the plan view, select a station point (*C*) so that the central ray is perpendicular to the front plane of the object. The angle of vision (φ) is set to 30°, ensuring that the entire object fits within the cone of vision. On the front projection, draw the

horizon line (*hh*) — its position may be chosen arbitrarily. The picture plane (*K*) passes through the front face of the object. Therefore, on the perspective drawing, the letter Ч will appear identical in shape to its front elevation, because objects located on the picture plane are represented in their true size in perspective.

On the horizon line, locate the vanishing point (*O*) — the intersection of the central ray with the horizon line — and its projection onto the picture plane (O_1) (see Fig. 4). On the plan view, determine the points where the picture plane intersects the projecting rays *CG* and *CJ*. On the perspective drawing, mark the distances *OJ* and *OG* from the point O_1. Connect the vanishing point *O* with the corners of the letter, and from points *G* and *J*, draw verticals upward. The intersections of these rays define the depth of the letter Ч in perspective.

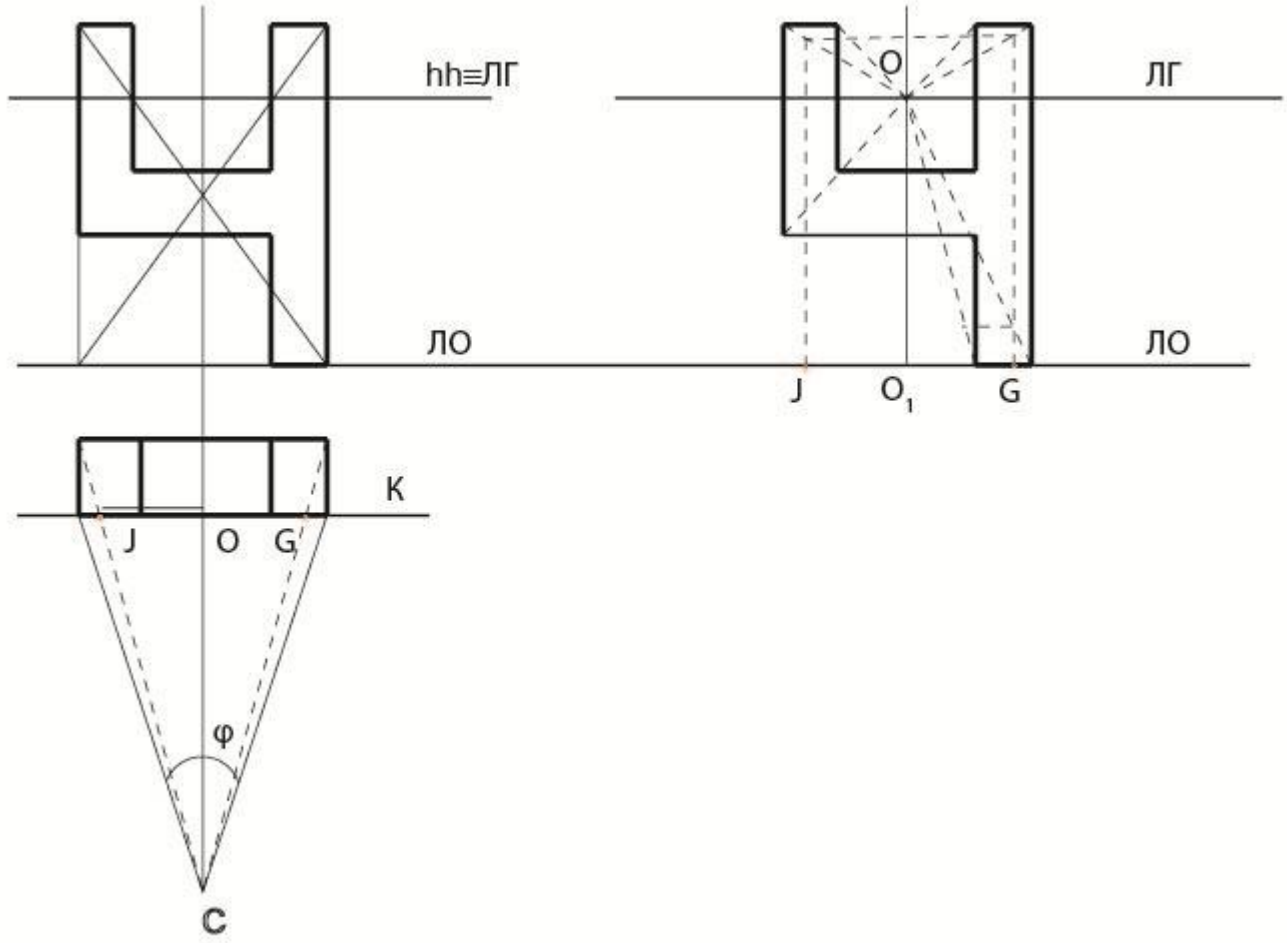


Fig. 4. Construction of auxiliary lines and points of frontal perspective

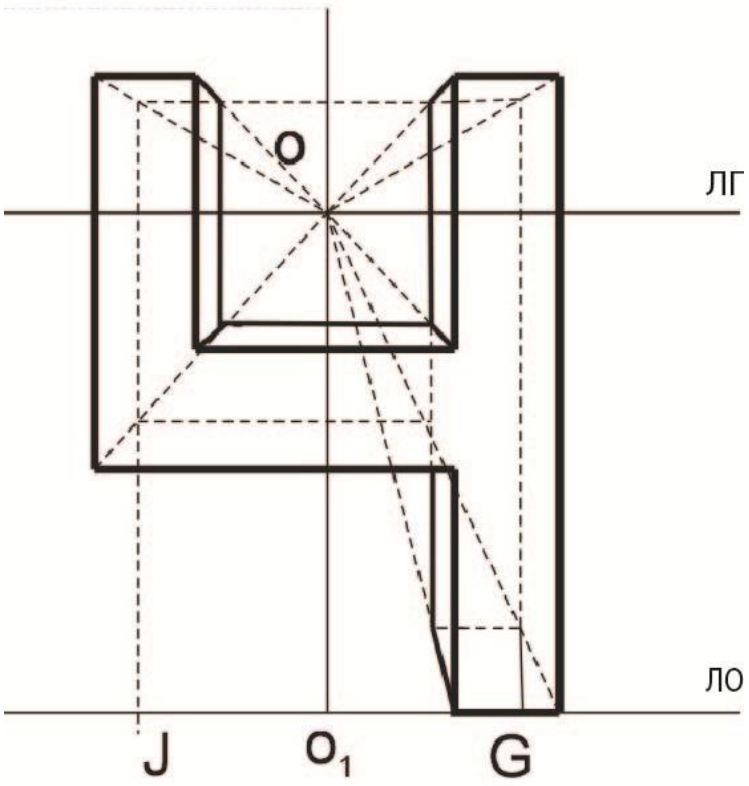


Fig. 5. Final view of the frontal perspective

Constructing Shadows in Frontal Perspective

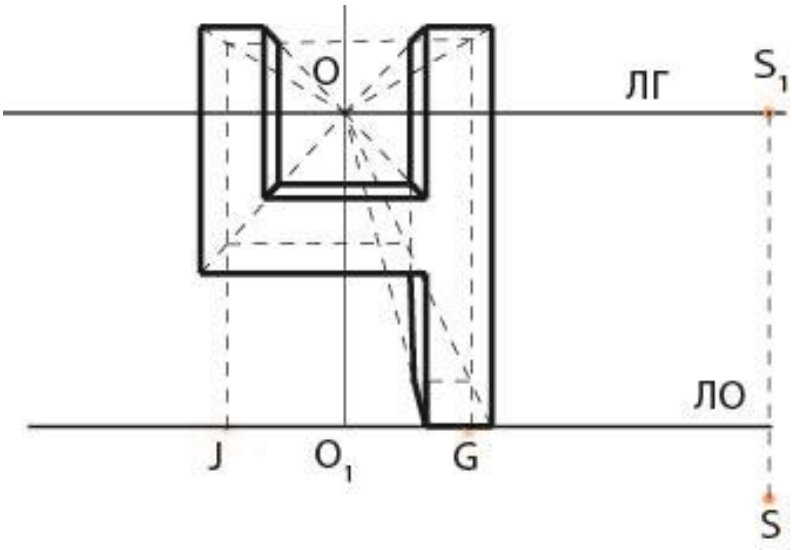


Fig. 6. Selecting a light source

To build shadows in frontal perspective, first select the light source (*S*). Specify the sun's position, the direction of the rays, and their projection (S_1) onto the ground plane (see Fig. 6). Construct the shadow from the vertical edge G on the

frontal projection, then project shadows from the rear faces of the object. The intersection of the light rays and their projections on the ground plane defines the cast shadow.

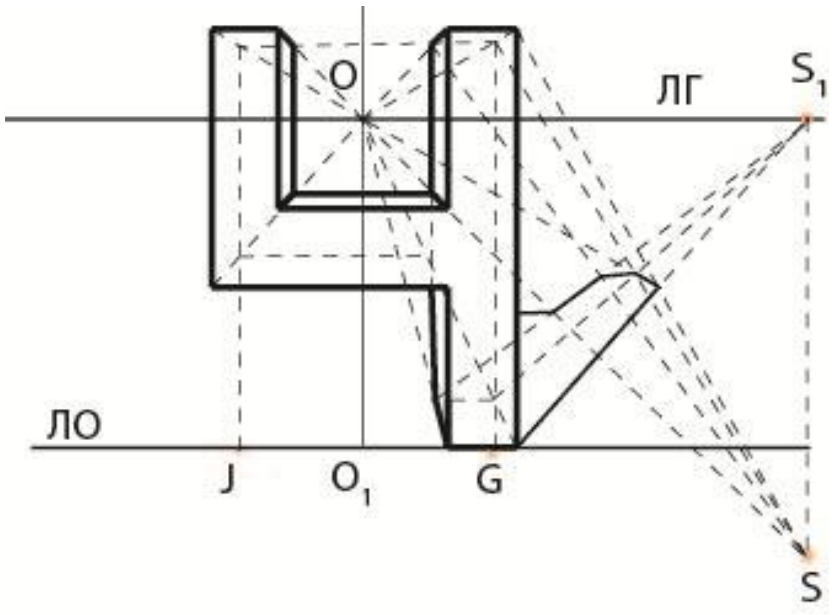


Fig. 7. The first step in constructing a cast shadow in frontal perspective

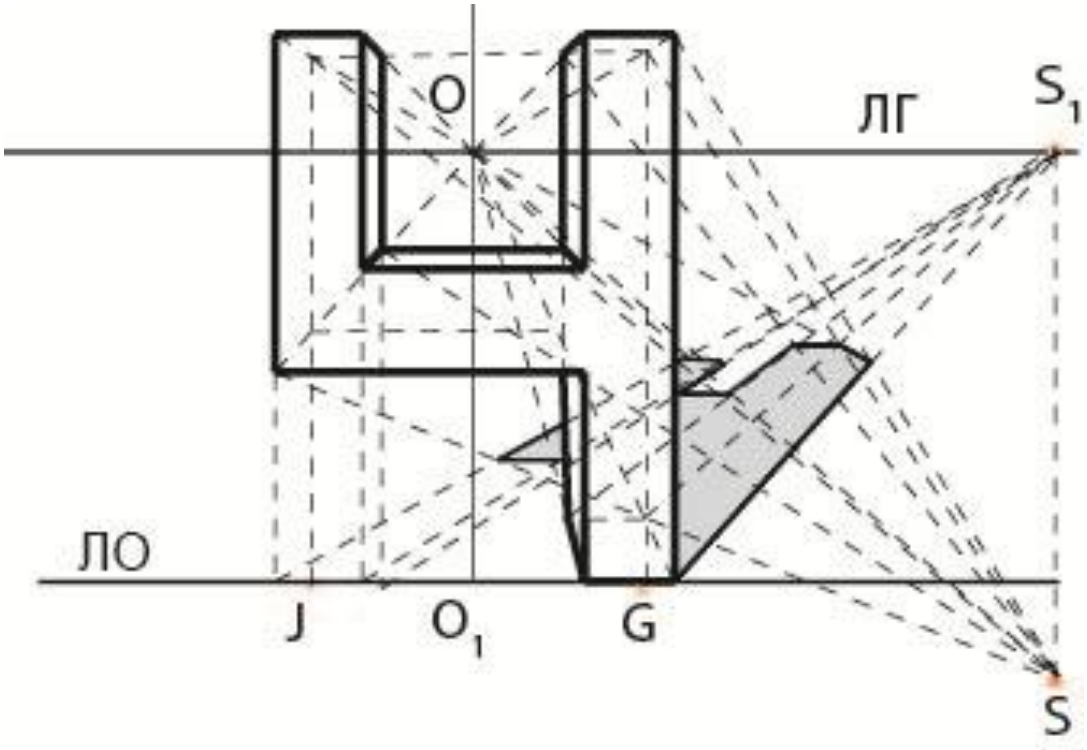


Fig. 8. Final view of the frontal perspective of the three-dimensional letter Ч with shadows

3. Constructing a Three-Dimensional Letter in Angular (Two-Point) Perspective.

Angular perspective is a type of perspective projection in which the picture plane is positioned at an angle to the object.

Characteristics of Angular Perspective:

- Lines that share the same direction converge at a common vanishing point.
- Horizontal and vertical lines in ground plan converge in perspective toward the vanishing points (F_1 and F_2) on the horizon line, located to the left and right of the principal point (P).

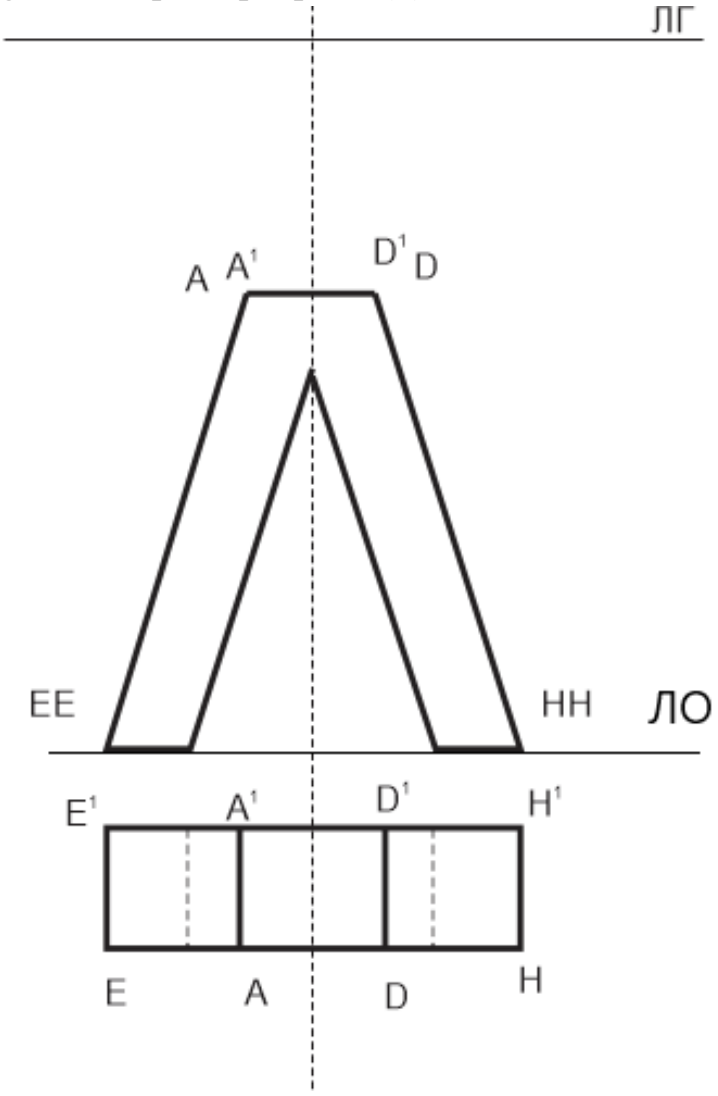


Fig. 9. Orthogonal projections of the three-dimensional letter Л

Let us construct the perspective of a three-dimensional letter “L” (Cyrillic Л). Begin with two orthographic projections of the letter — front elevation and plan view — in projectional alignment (see Fig. 9).

Set the horizon line slightly above the object.

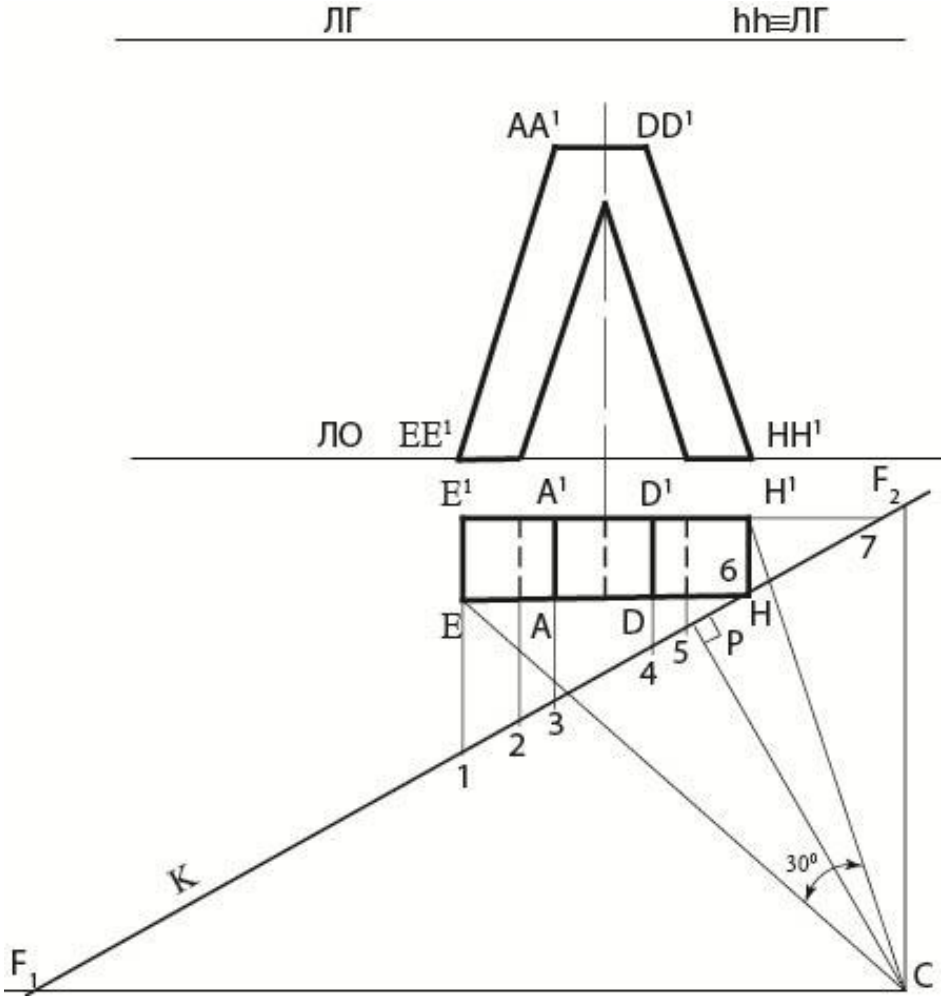


Fig. 10. Angular perspective parameters

Next, define the perspective parameters. Choose the picture plane *(K)* so that it passes through one of the elements of the letter — for example, point *H* (see Fig. 10). Select the station point (*C*) and draw the principal ray *CP*, perpendicular to the picture plane. Set the angle of vision (φ) to 30°, ensuring that the object fits within the cone of vision.

On the picture plane line, establish the vanishing points F_1 and F_2 using rays drawn parallel to the principal planes of the object.

Constructing the Angular Perspective

Draw the ground line (*ЛО*) — the base of the picture plane. Mark the principal point (P_0), then draw the horizon line (*ЛГ*) parallel to the ground line at a distance PP_0 above it. From the principal point *P,* measure along the horizon line the distances PF_1 and PF_2, and mark the vanishing points F_1 and F_2.

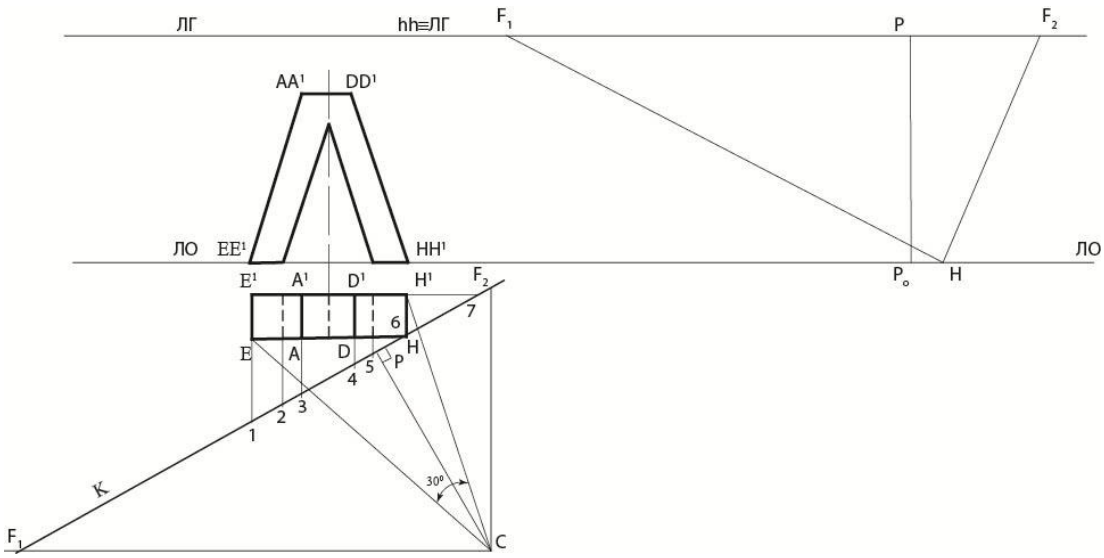


Fig. 11. The first step in constructing an angular perspective

Locate point H on the ground line using its plan distance PH, taken from the horizontal projection.

Draw rays HF_1 and HF_2 (see Fig. 11); these define the base contour of the letter. Next, construct points 3, 4, 5, 6 along the picture plane and connect them to the vanishing point F_2.

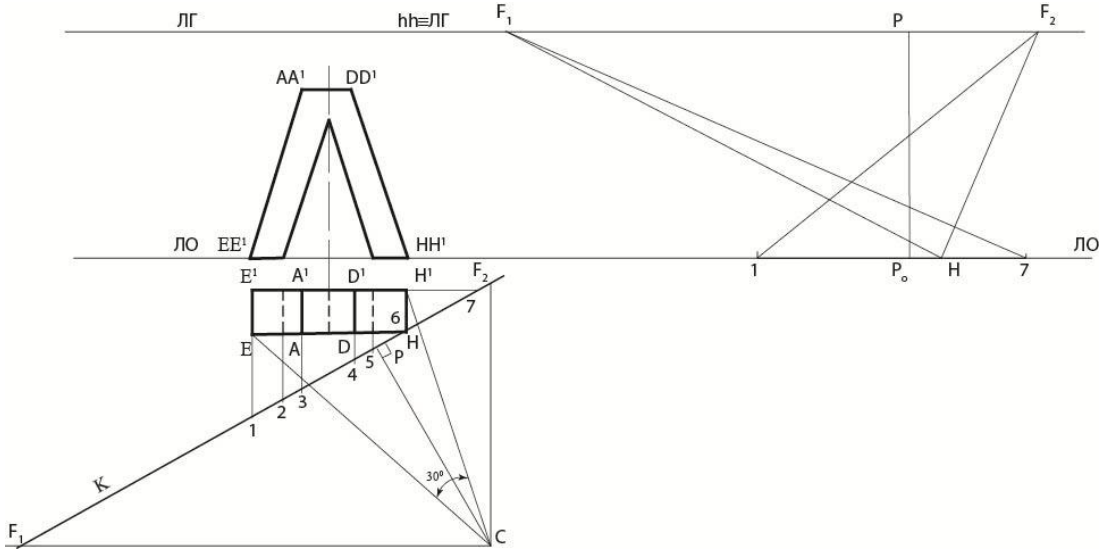


Fig. 12. The second step in constructing an angular perspective

From point *H*, draw a vertical line and mark on it the true height of the letter. Connect the upper endpoint to F_1. On the ground line, find the projections of points *3* and *4* as before; with these, you can now construct the front contour of the letter *Л* in perspective (see Fig. 13).

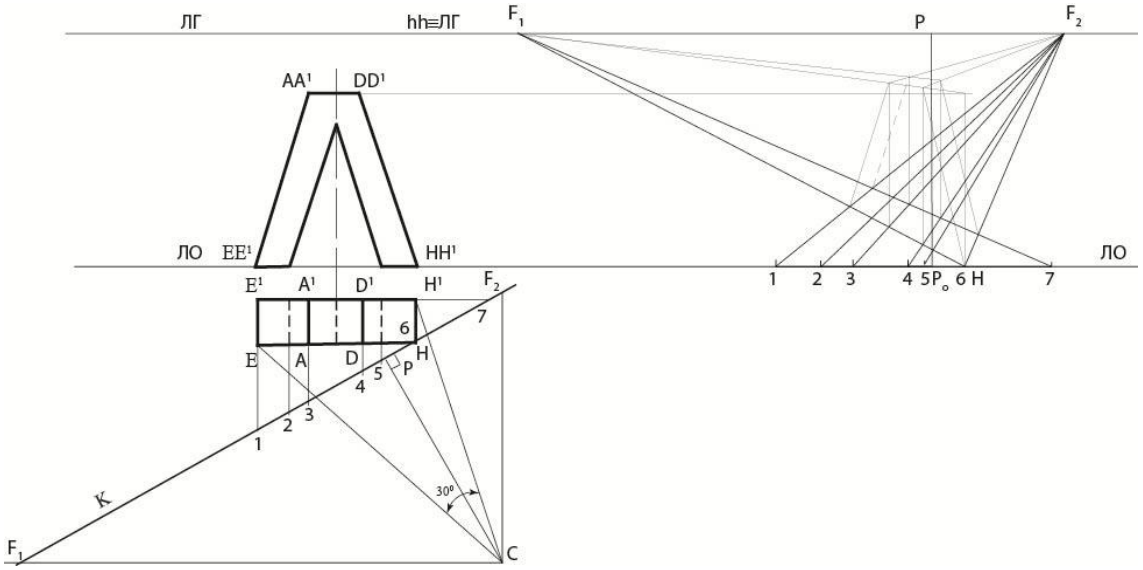


Fig. 13. The third step in constructing an angular perspective

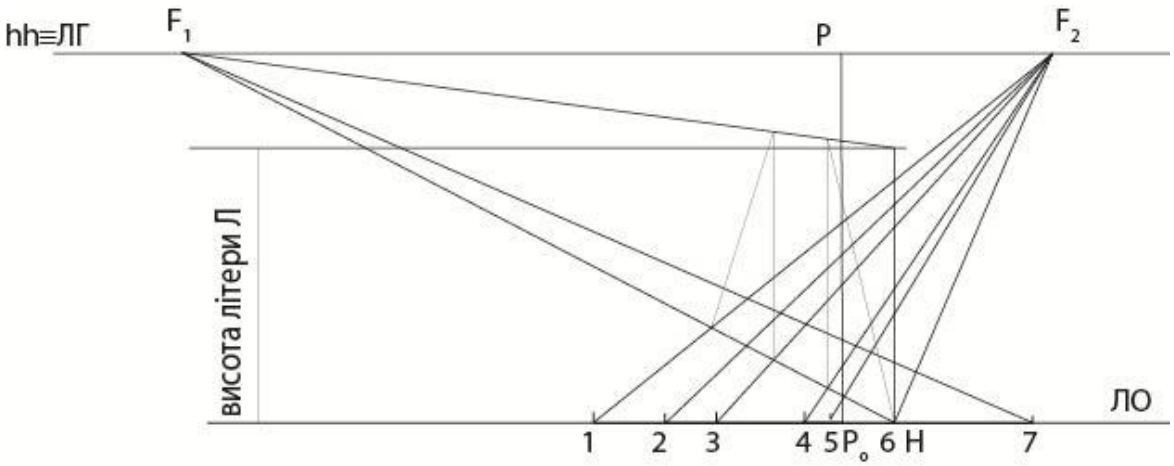


Fig. 13a. The third step in constructing an angular perspective (zoomed in)

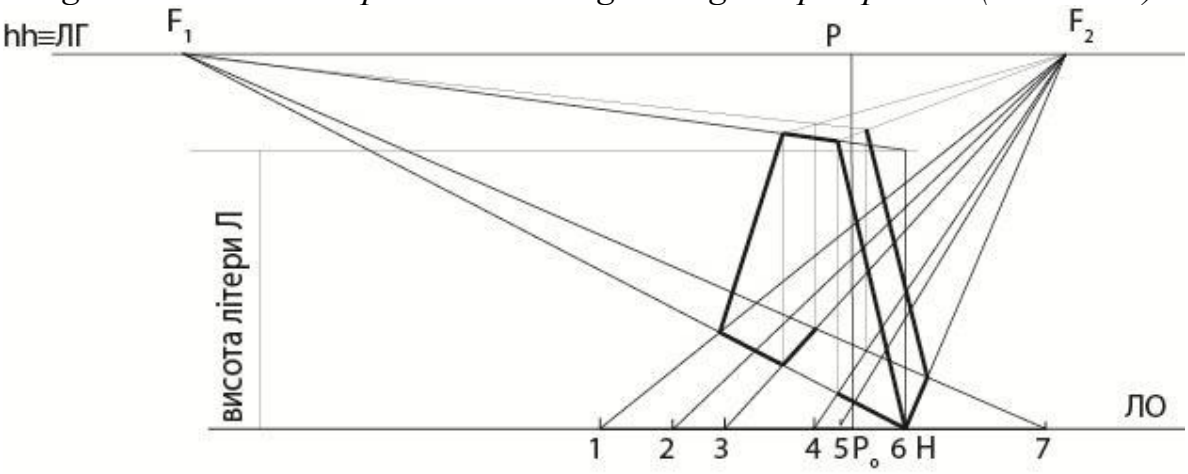


Fig. 14. The fourth step in constructing an angular perspective

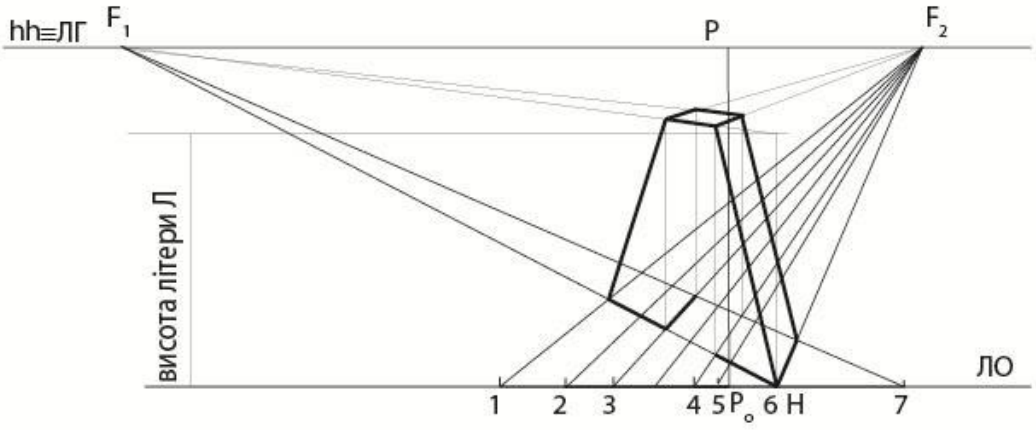


Fig. 15. The fifth step in constructing an angular perspective

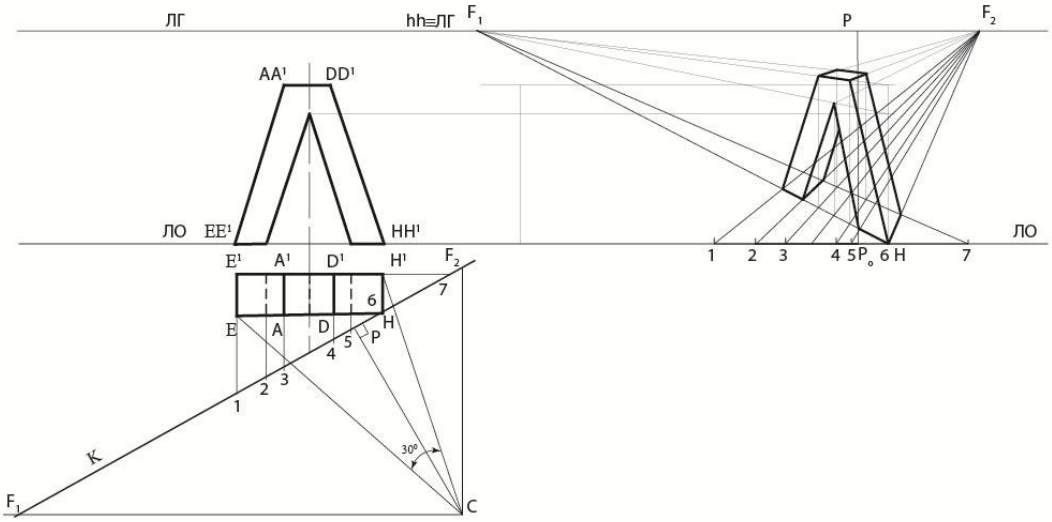


Fig. 16. The sixth step in constructing an angular perspective

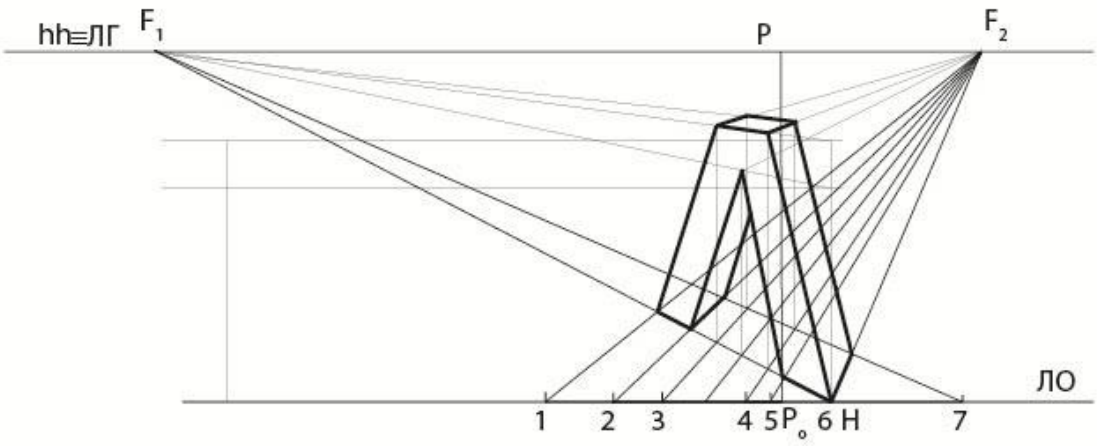


Fig. 17. Selecting the visible outline of the letter Л

Continue by constructing the invisible edges, thus completing the three-dimensional form of the letter in angular perspective.

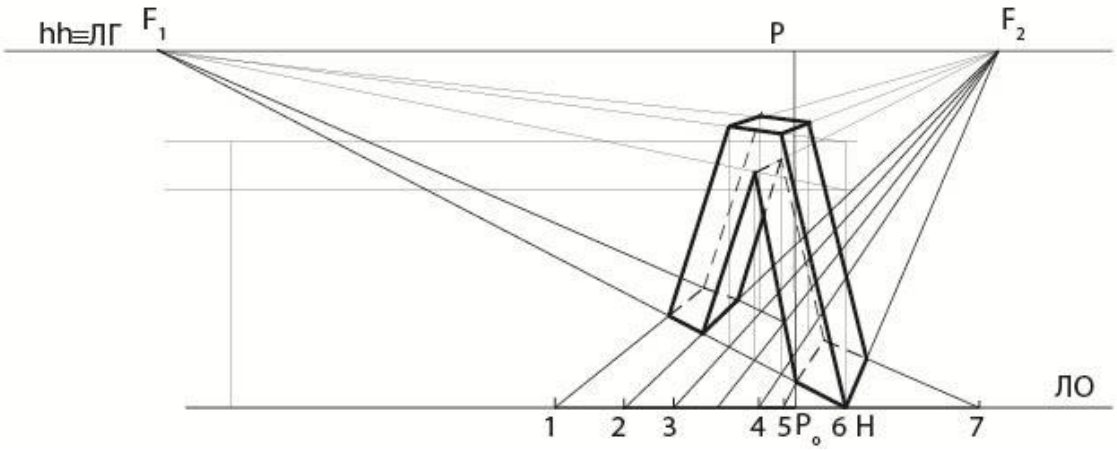


Fig. 18. Construction of invisible edges of an object in angular perspective

Constructing Cast Shadows in Angular Perspective.

Set the direction of sunlight so that the rays l and l_1 run parallel to the picture plane (see Fig. 19). Determine the area of self-shadow. The boundary of the cast shadow is defined as the shadow of this self-shadow edge: $H–D–D_1–A_1…$

Begin by constructing the cast shadow from point D. Project point D vertically downward onto the ground plane to obtain D_n — the intersection of the vertical with the ray HF_1. From point D, draw a ray parallel to l, and from D_n draw a ray parallel to l_1. Their intersection gives the projection of the cast shadow of point D.

Repeat the same procedure for point D_1 (see Fig. 20).

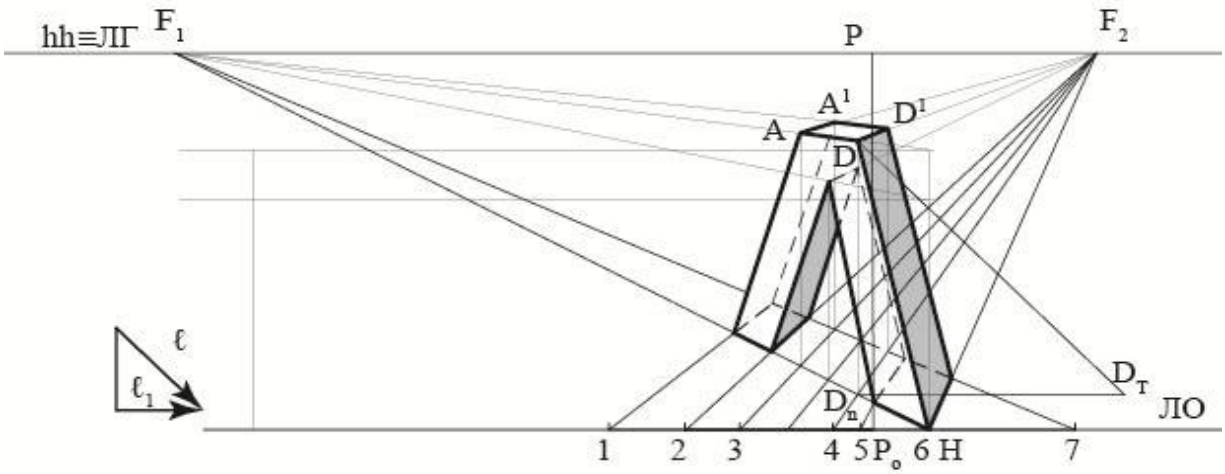


Fig. 19. Selection of the direction of light rays and the principle of constructing the shadow cast by an any point

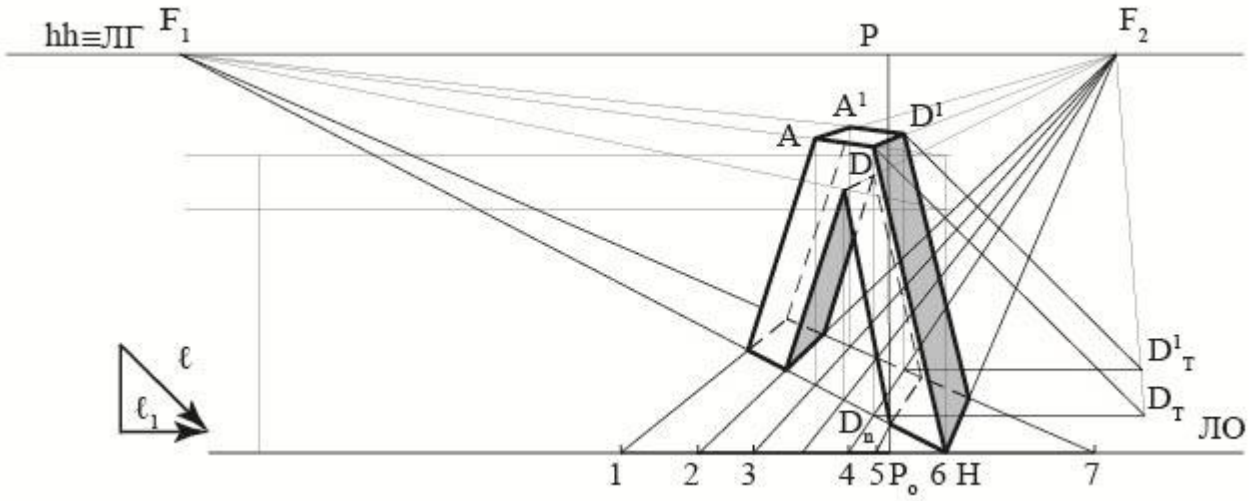


Fig. 20. The second step in constructing a cast shadow in angular perspective

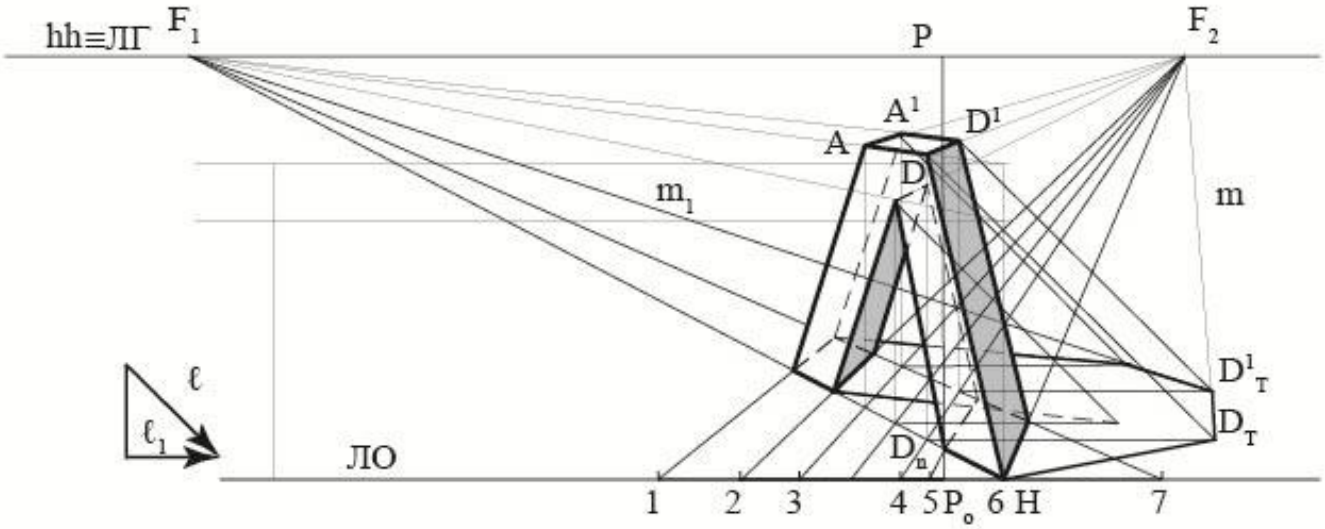


Fig. 21. The third step in constructing a cast shadow in angular perspective

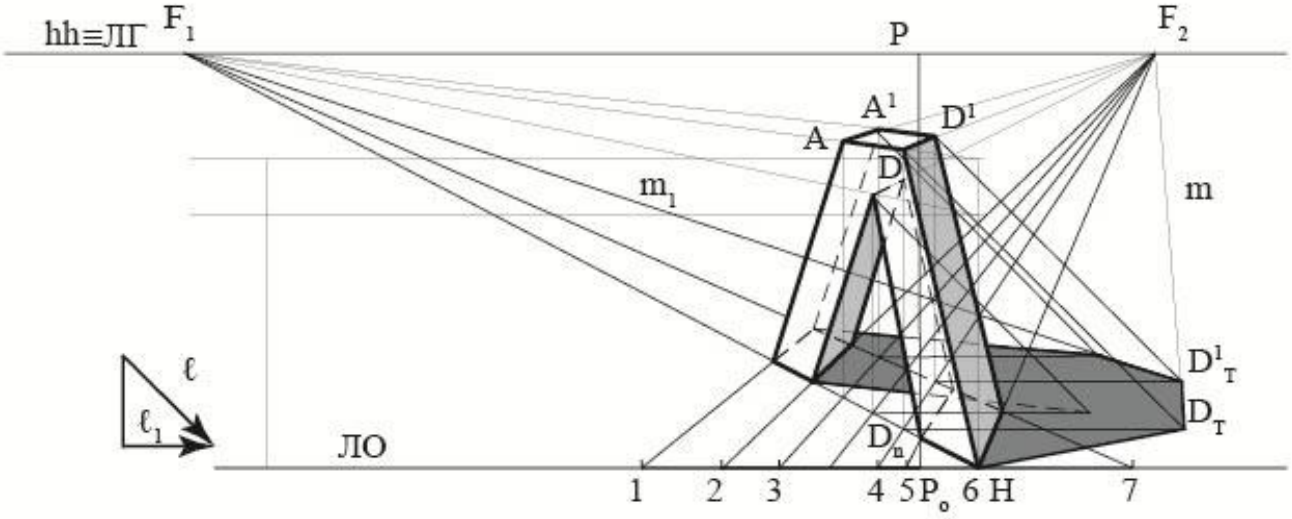
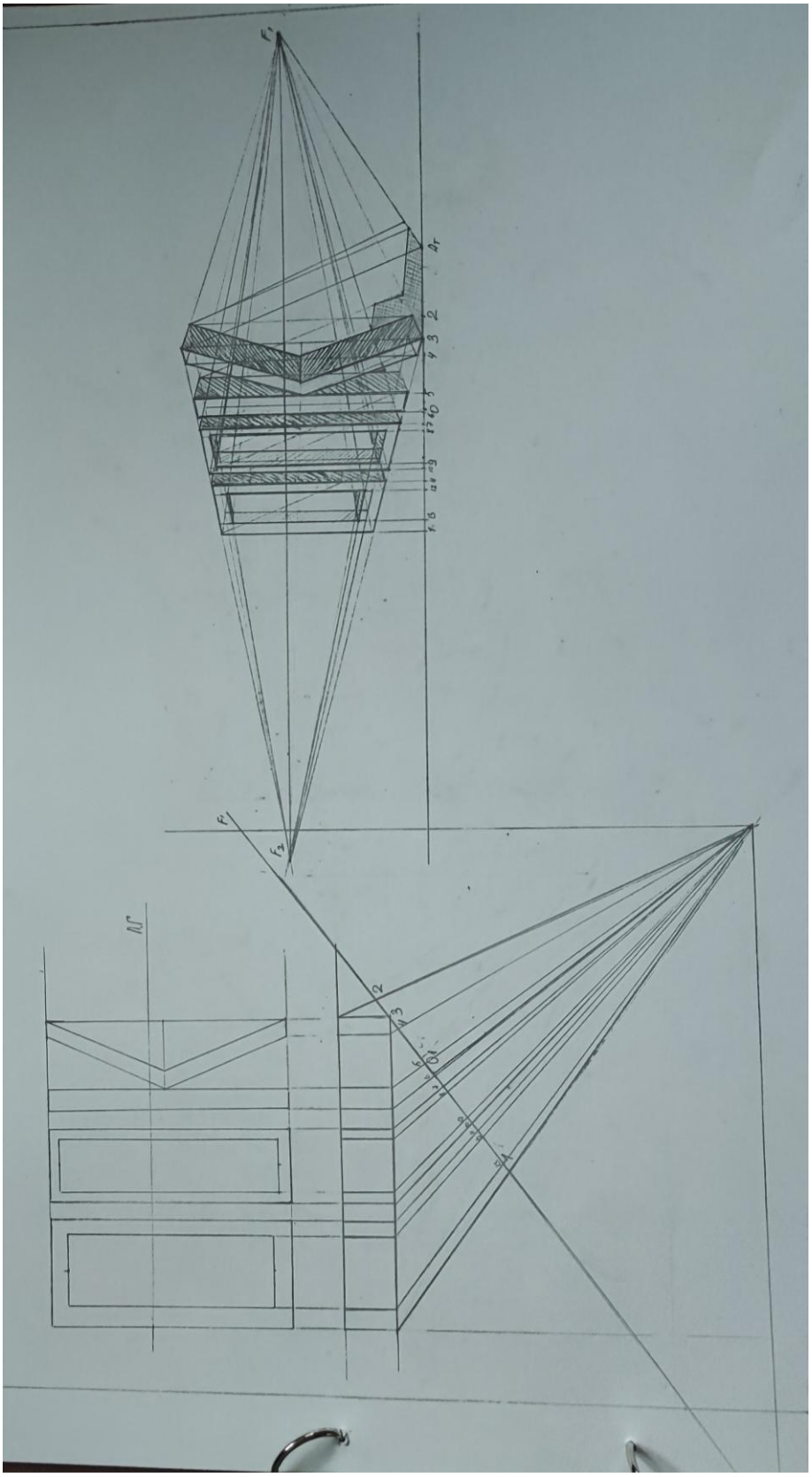
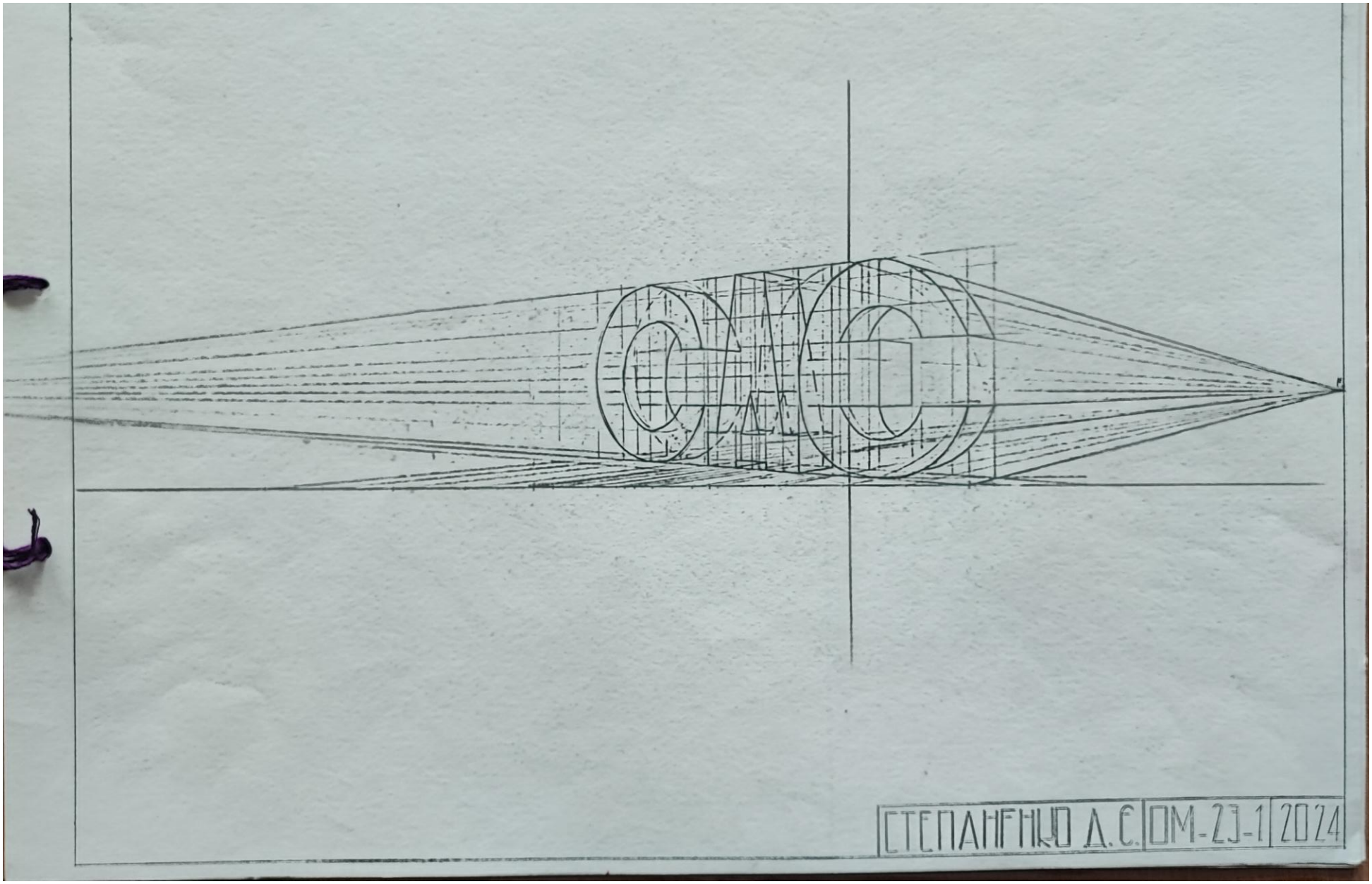


Fig. 22. Completely constructed cast shadow in angular perspective

4. Examples of Perspective Drawings of Three-Dimensional Design Elements

5. 



СТЕПАНЧИКО Д.С.	ОМ-23-1	2024

Recommended Reading

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2. **Ratnychyn, V. M.** (2007). *Perspective.* Kyiv: Vyshcha Shkola. 136 p.
3. **Kovalov, S. M. (et al.)** (2019). *Descriptive Geometry: Orthographic Projections. Part 1.*
   Edited by S. M. Kovalov. Kyiv National University of Construction and Architecture (KNUCA). Kyiv: KNUCA. 166 p.
4. **Pustiulha, S. I., & Samostian, V. R.** (2021). *Computer Engineering Graphics in SketchUp: Textbook.* Lutsk: Vezha. 260 p.

Course resources

DESCRIPTIVE GEOMETRY. ANGULAR AND FRONTAL PERSPECTIVE OF THREE-DIMENSIONAL DESIGN ELEMENTS

Methodological Guidelines for Performing Graphic Works for Students Pursuing the First (Bachelor's) Level of Higher Education in Specialties B2 «Design» and B4 «Fine Arts, Decorative Arts, and Restoration. »

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