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COMPUTER REALIZATION OF „GEOMETRIZATION" OF TEACHING DESCRIPTIVE GEOMETRY

Available computer programmes allow making a large number of drawings when preparing a lecture or instruction. We may create long sequences of drawings representing the algorithms (dynamics) generating the construction. This approach of teaching descriptive geometry allows to eliminate, if all possible, a text describing a given construction. It is known, that on the turn of the 19^{th} century there was the conception of crass ignorance of drawing in geometry (e.g. well known monograph of R. Sturm, where we don't find a drawing). It is obvious that would be nonsense in descriptive geometry, where the drawing is a general subject of consideration. It would be an anachronistic statement, but we say ones more: a drawing is the essence of the descriptive geometry.

In teaching of descriptive geometry, for every complicated construction, we should explicate, divide, take pieces (atoms) and arrange in sequence. Then the algorithm of construction consists in e.g. five to twenty figures. The authors present the new suggestion of preparation of lectures and instructions in the above meaning. This approach corresponds with modern conception of window-icon structure of present computer programmes. It is a realization of a guiding principle given in paper [1]. The elaboration is realised in two ways: as a help to lectures printed on the paper and as a computer program-"film". The preparation such as „teach yourself" manual is very important because of the small amount of hours provided for the lectures and training.

The profile perspective of the interior of room. We construct now the profile perspective of the interior of room (Fig1) with a door-way (*80cm×240cm*) (Fig.1c) and a window opening (*320cm×220cm*) (Fig.1d). Additionaly there are a wardrobe (*120cm×40cm×220cm*) (Fig.1c) and a writing-table (*120cm×80cm×80cm*) (Fig.1a) in the room. Next we establish a source of light to determine the shadows off all the objects. Figure 1b shows the location of a writing-table and orthographic projection of the source of light. We set a scale as *1:40*. Then *1 m = 2,5 cm*. We suppose that the horizon height is *1,6 m*, the background depth δ=*3 m*. We establish the revolved section of the reduced perspective eye $O^{1/2x}$, the reduced vanishing point $Z_2^{1/2}$ (a direction of the horizontal edges of the side wall).

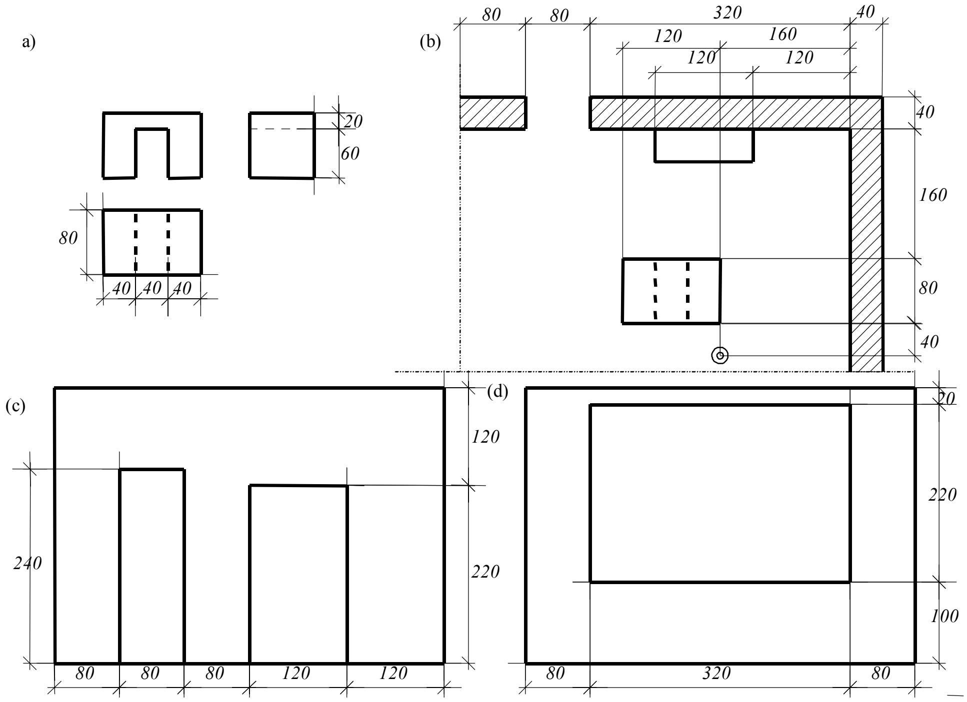

Fig.1.

In Fig.2 we find a vanishing point Z_2 multiplying a distance of point $Z_2^{1/2}$ by 2. We construct a vanishing scale on a line perpendicular to horizon passing through the general point O^{τ}. In Fig.3 we determine: reduced vanishing point $Z_1^{1/2}$ of direction perpendicular to direction defining by the vanishing point $Z_2^{1/2}$ (we draw a perpendicular line to a segment $O^{1/2x}$ $Z_2^{1/2}$); reduced vanishing point $Z_3^{1/2}$ of the direction of diagonal of floor tile (from the angle 45 degree with the directions of edges of walls) and vanishing point Z_3; reduced measured point $M_1^{1/2}$ and measured point M_1. We determine a later vanishing scale in the point $Z_1^{1/2}$ (Fig.4).

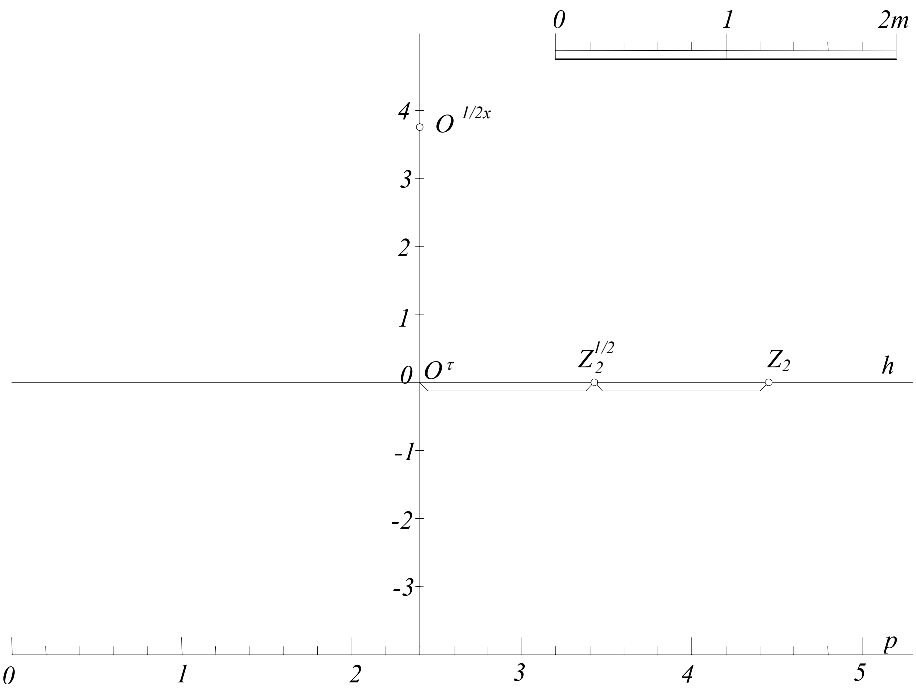

Fig.2.

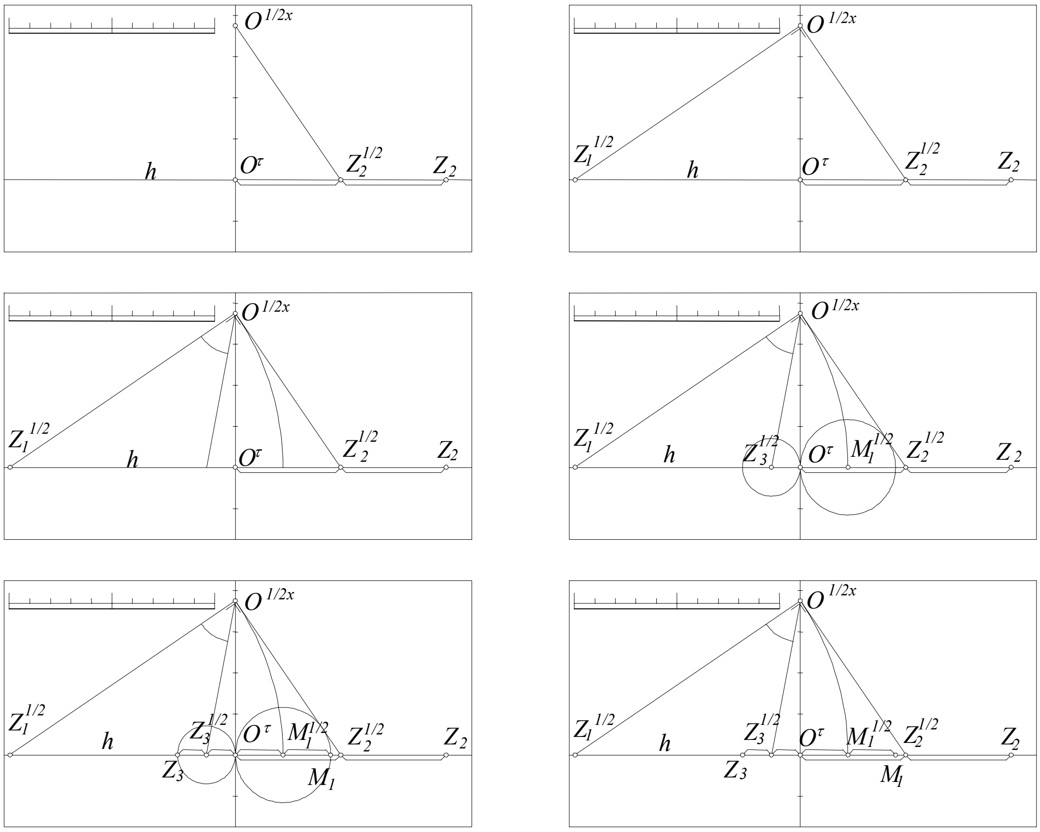

Fig.3.

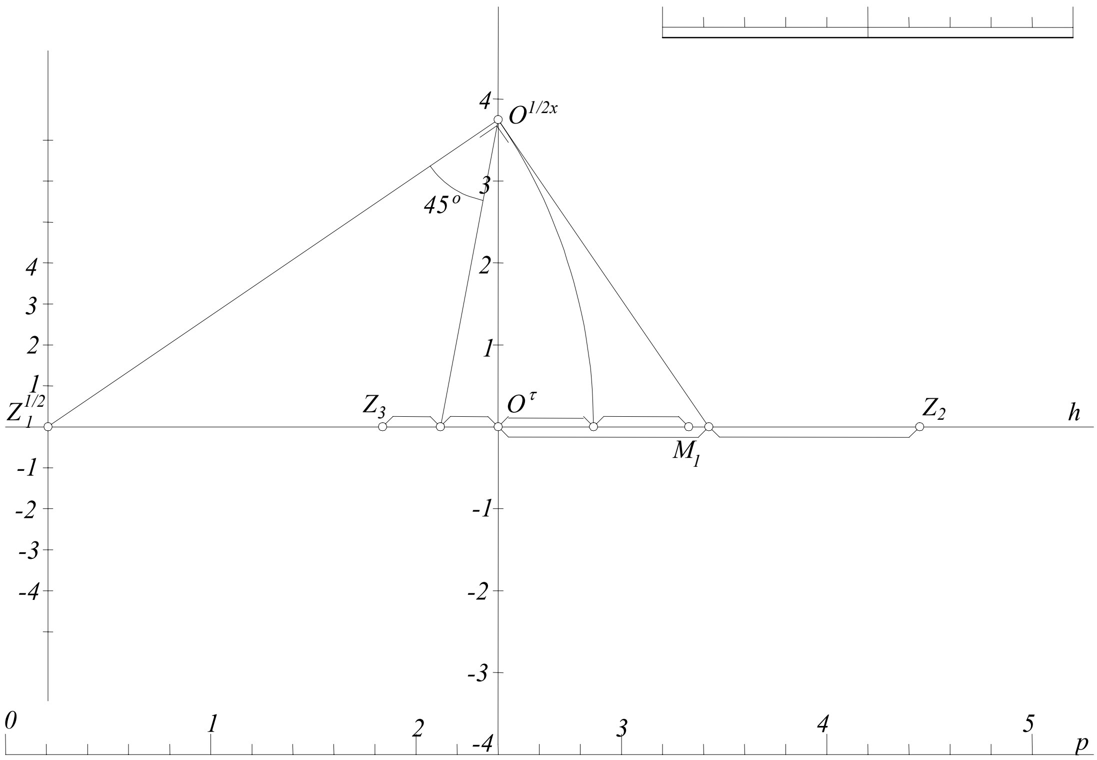

Fig.4.

A unit on this scale is twice smaller than the former one. From endpoints of segment lying on the base line we draw two lines: the former from the point Z_2, the later from the point Z_1, which we do not find in our drawing. In later case using the vanishing scales we draw a line between two points –2 and –3 in the same proportion (Fig.5).

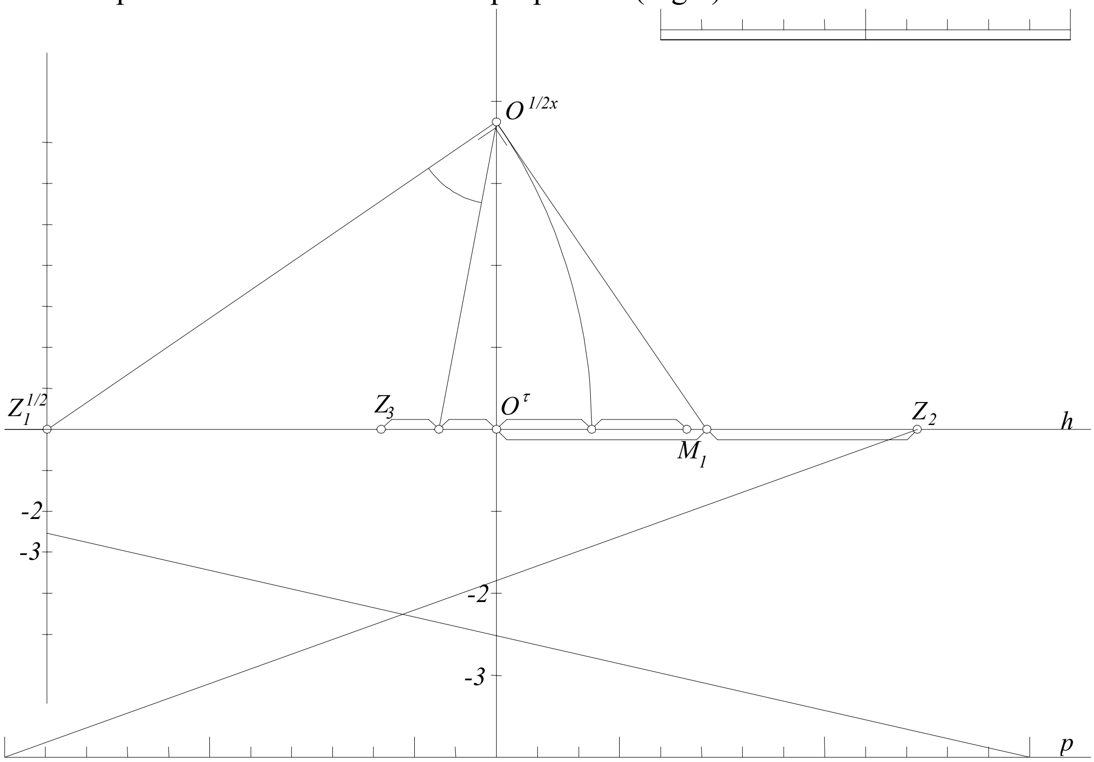

Fig.5.

From the measured point M_1 we draw the measured rays one after another preserving the distance (*40 cm*) on the base line *p* (Fig.6). The former ray we draw through the intersecting point of lines going from points Z_1 and Z_2 . Therefore we translate the scale on the base *p* beginnig from the first ray.

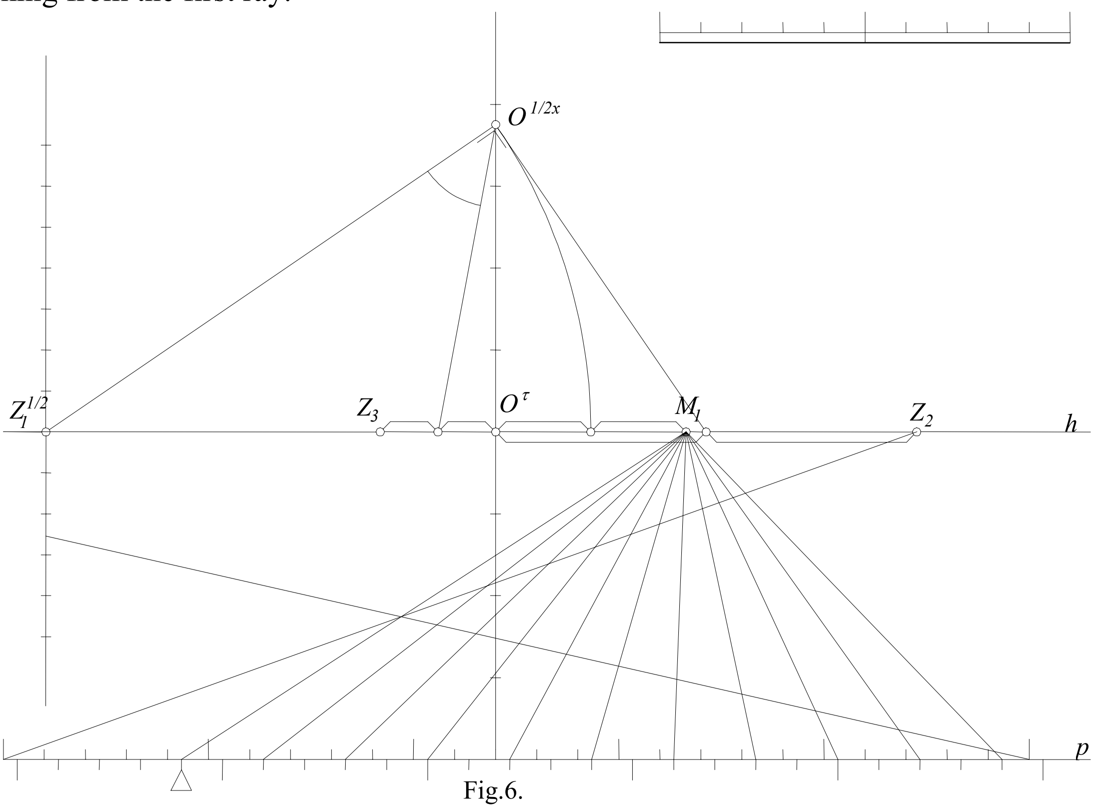

Fig.6.

Then on the line passing through point Z_1 we measure off many segments the same lines. Next, we connect the ends of the previously obtained segments with point Z_2. We obtain the floor lines (Fig.7).

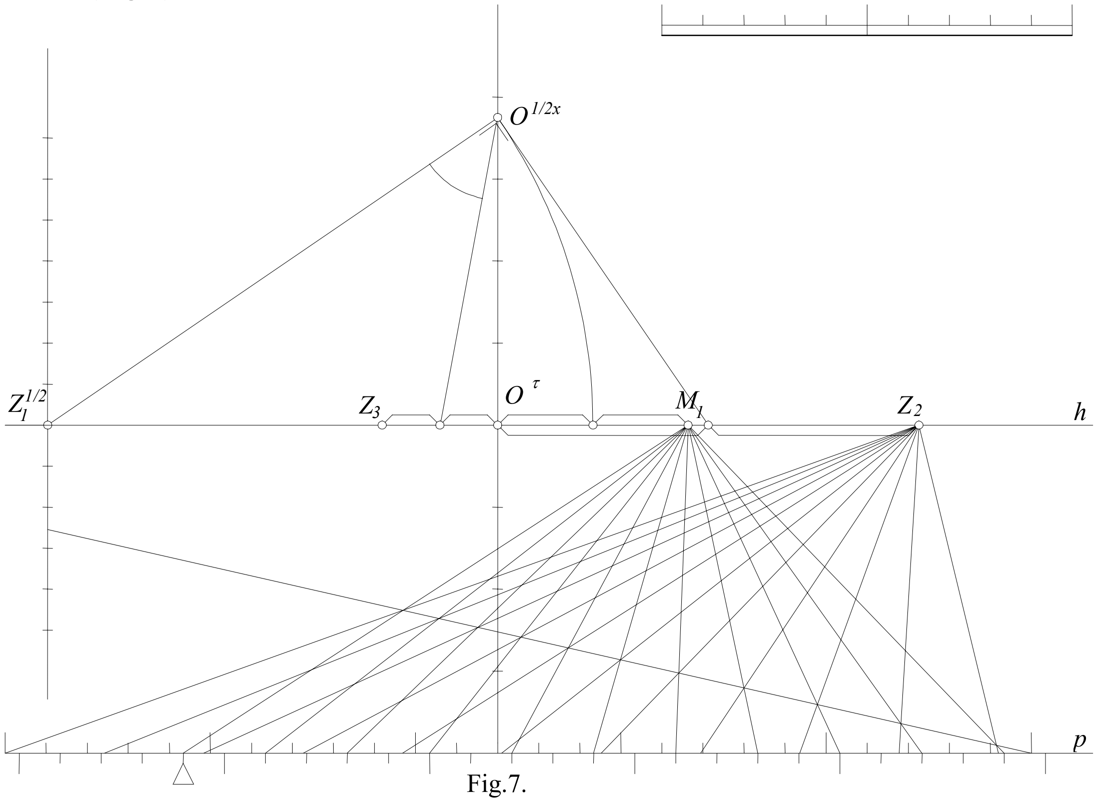

Fig.7.

For clarity, we erase the lines passing through point M_1 (Fig.8).

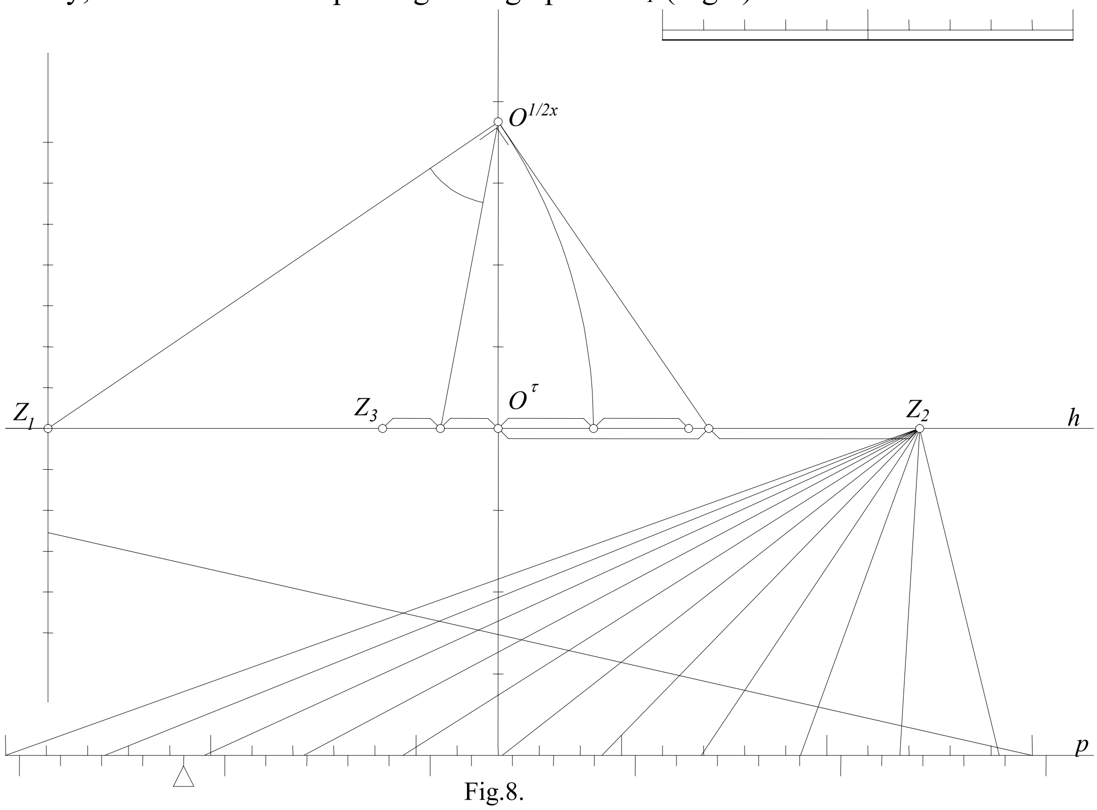

Fig.8.

From point Z_3 we draw a few diagonal lines of squares (tiles) of floor (Fig.9).

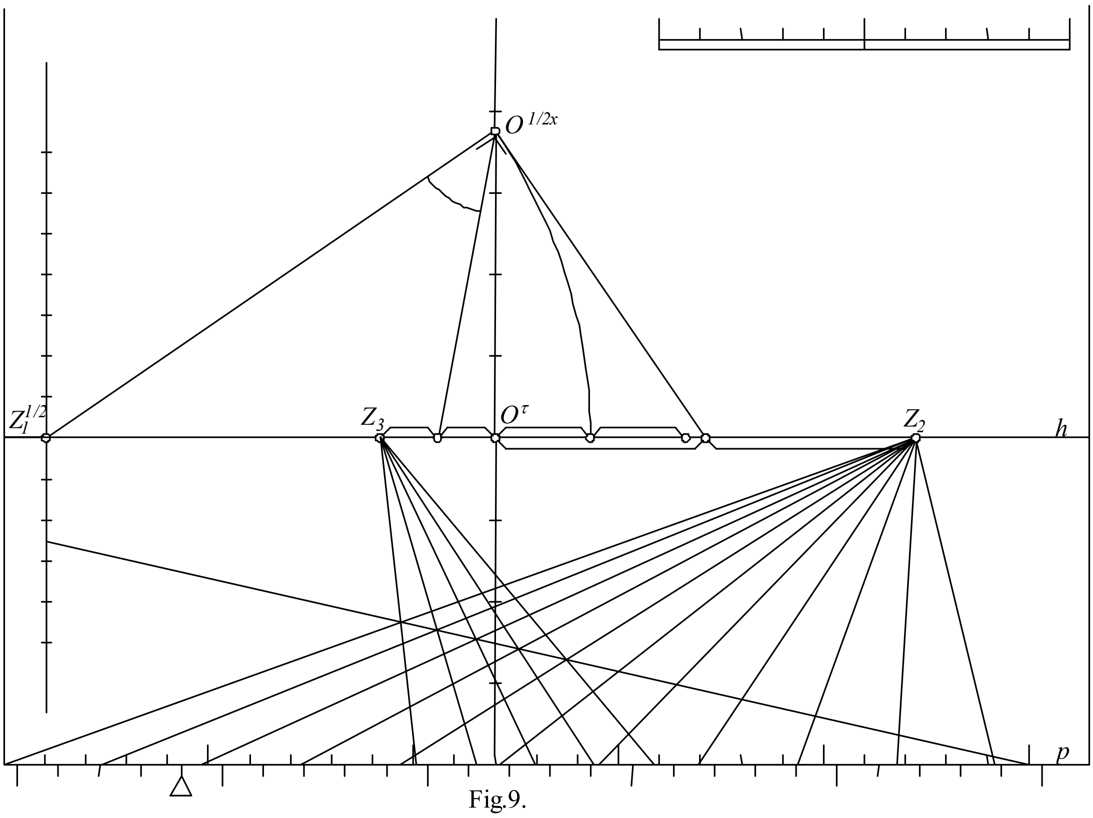

Fig.9.

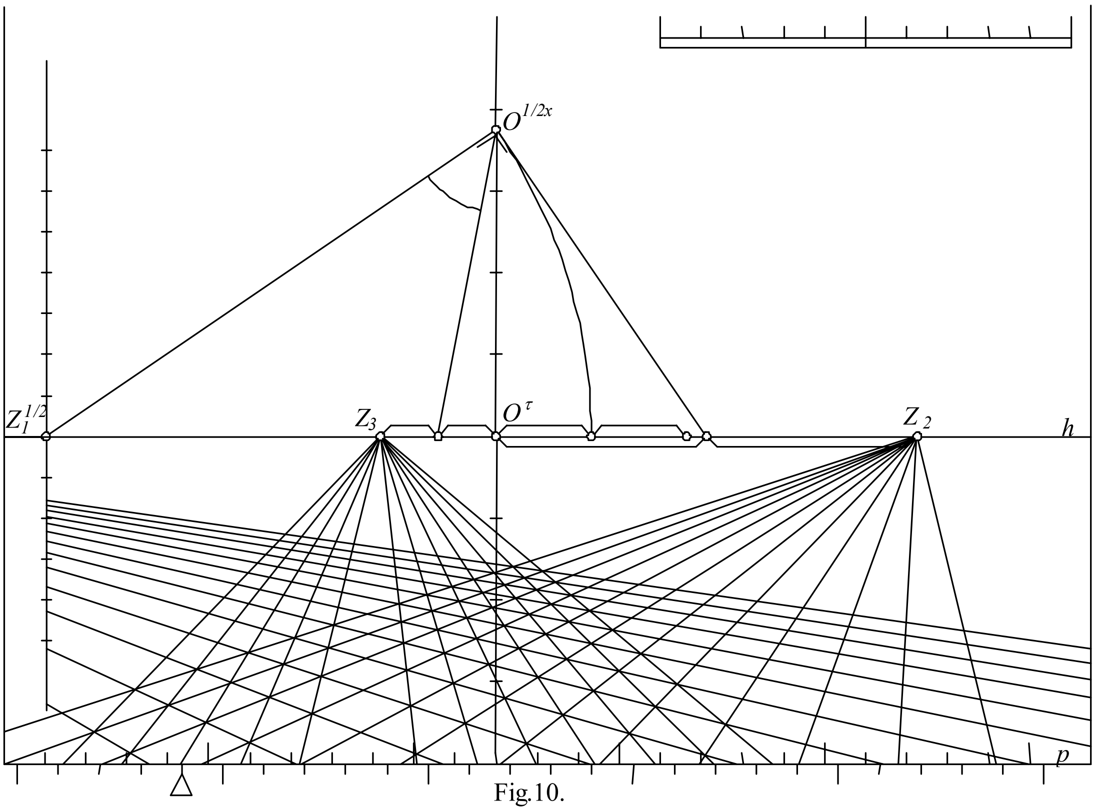

Fig.10.

The lines, obtained above, determine the vertices of squares of floor tile (Fig.10). Through these vertices we draw the lines of the later direction of floor tile lines. If needed, we draw additional diagonal lines from point Z_3 . The lines belonging to two directions are drawn by rule of feedback. To construct the door-way, window opening and wardrobe, from suitable vertices of squares of floor tile we draw the lines perpendicular to base plane. (Fig.11). To determine the height of the door-way, wardrobe and window opening we draw a vertical scale (on line perpendicular to the line of base).

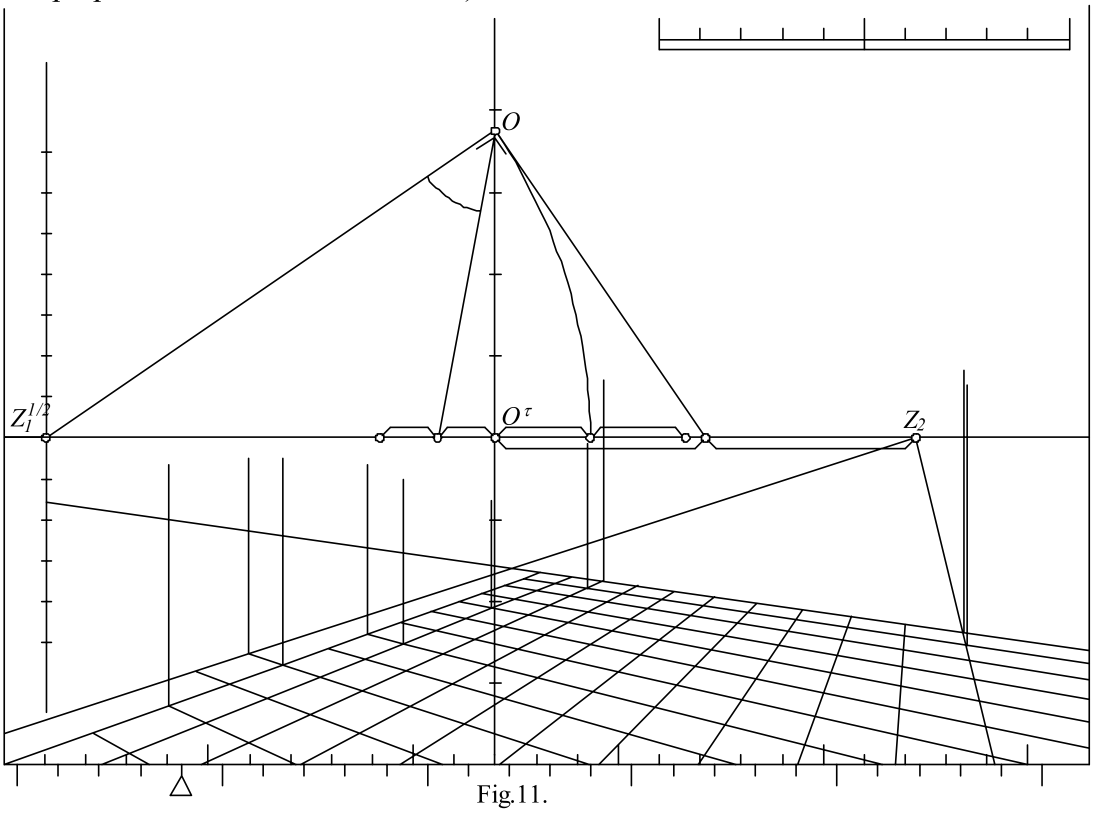

Fig.11.

Next, we draw the lines passing through point Z_2 and through suitable points of the scale on the line perpendicular to background (Fig.12).

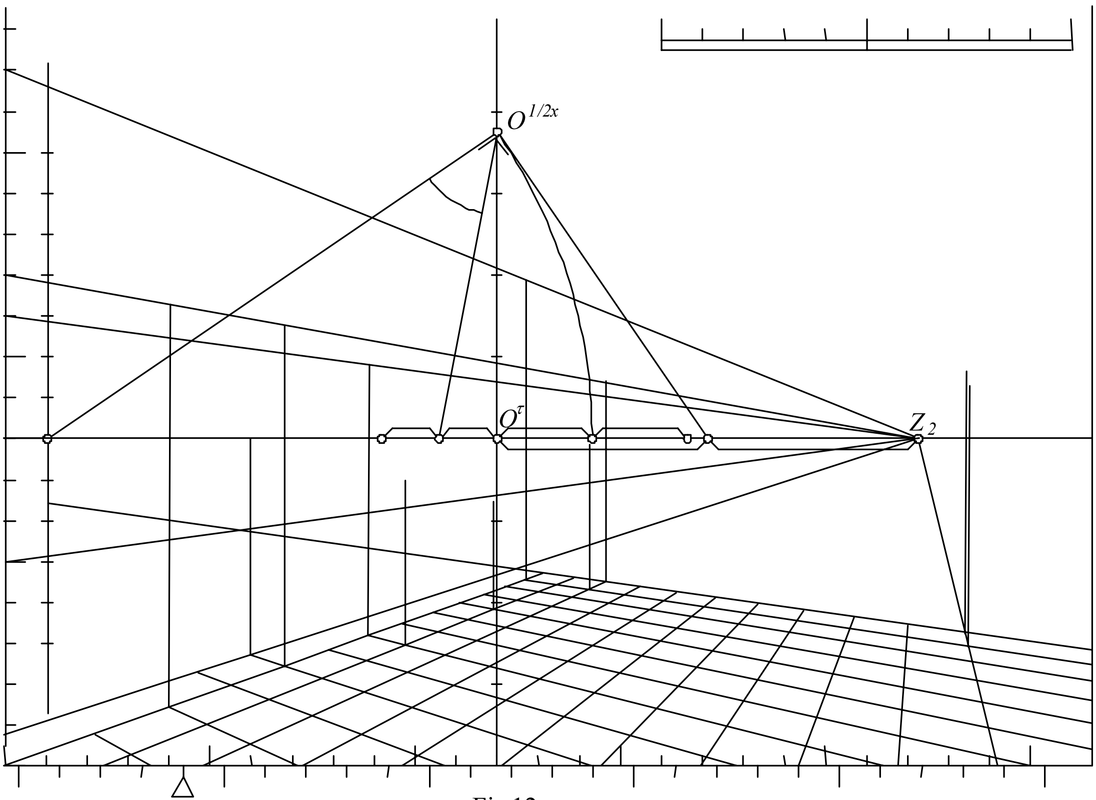

Fig.12.

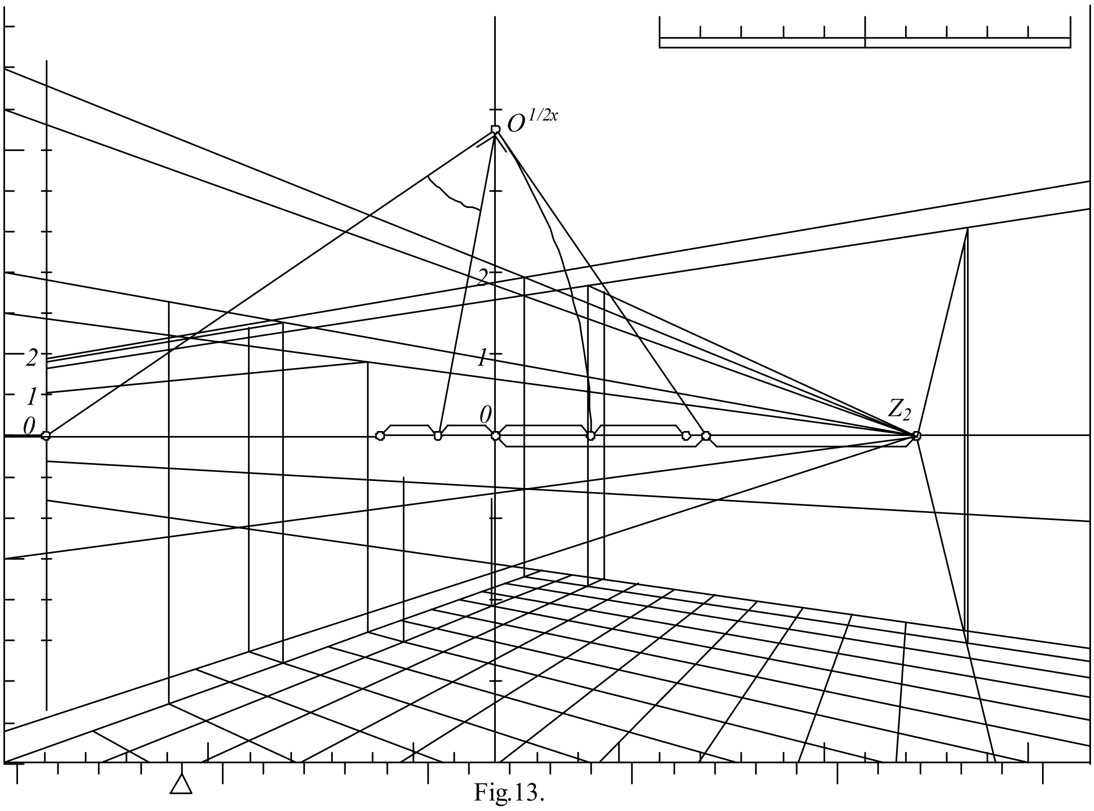

Fig.13.

The dimensions of the window opening, door-way and wardrobe are moved on the walls by means of two directions. Using the converge scales we draw the apropriate lines. We draw the lines lying near point *2* between points *1* and *2* on both scales. We have to remember about the proportion on both scales (Fig.13).

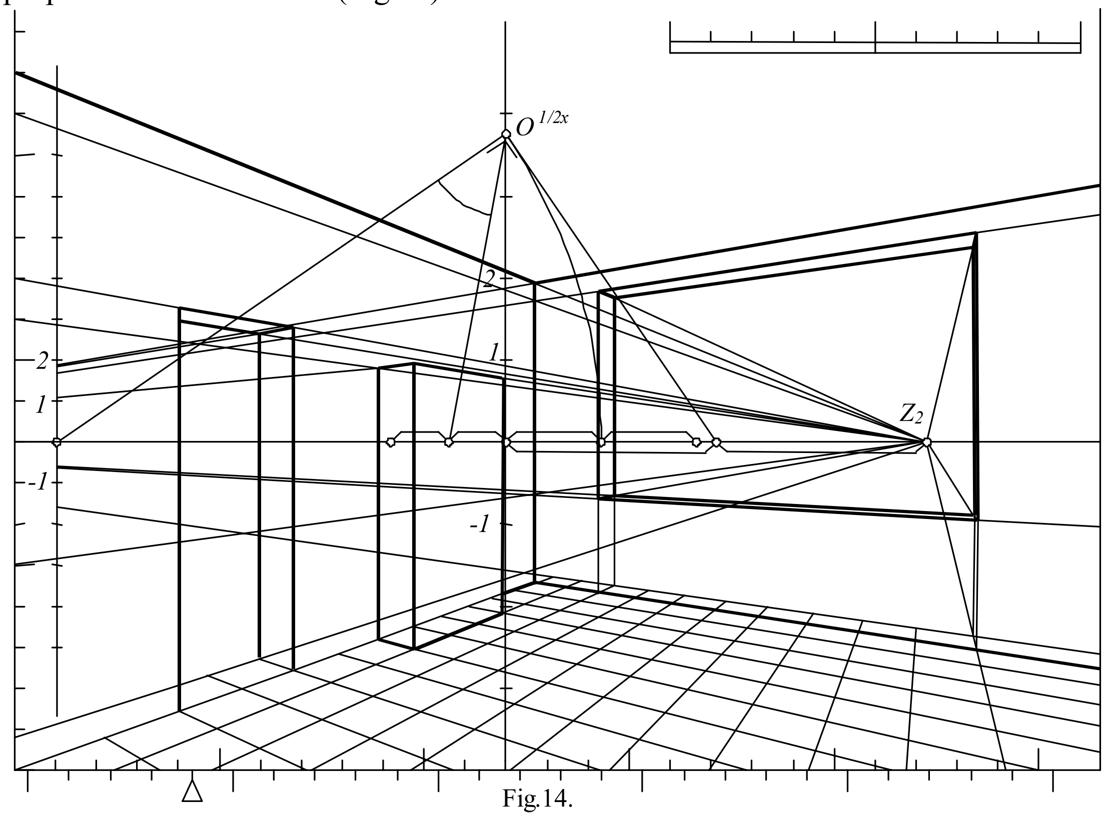

Fig.14.

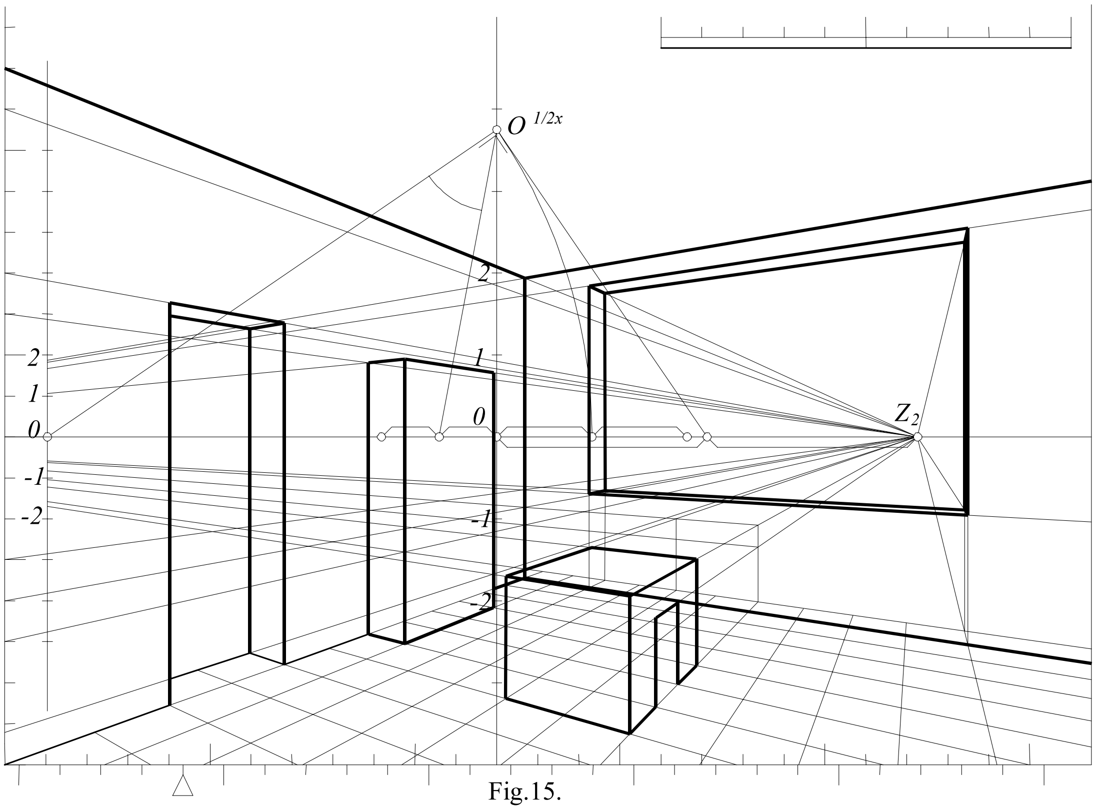

Fig.15.

It is worthwhile noticing that the vertical dimensions of the writing-table are obtained by means of vertical scale (Fig.15). To this end we draw the lines on two walls through the points of vertical scale. To construct the shadows of all objects in the interior of the room we establish the position of the source of light (the point *S*). Earlier, we set the orthographic projection on the floor S'^{s} of this point. The construction of shadows show Fig.16–18. On Fig. 18 we erase the auxiliary construct lines of the objects in the interior of the room. To expose the construction of the shadow of the interior objects we erase the auxiliary construct lines of the objects in the interior of the room (Fig.18).

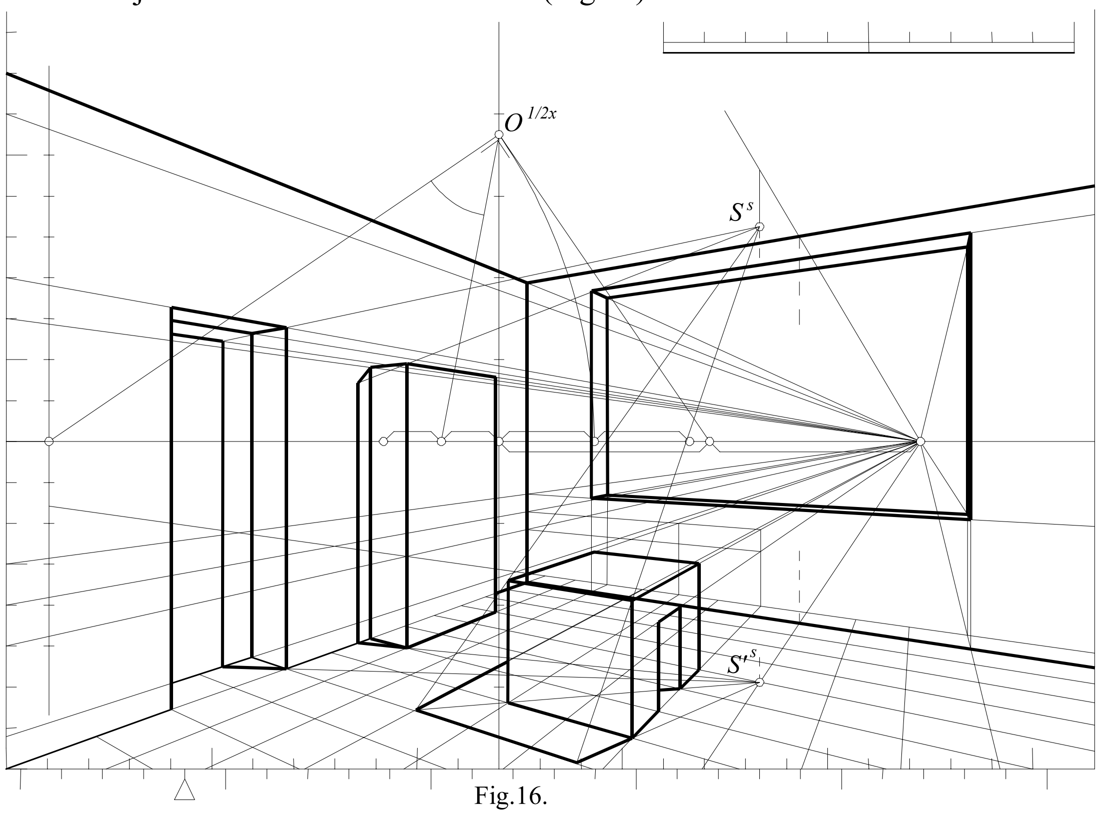

Fig.16.

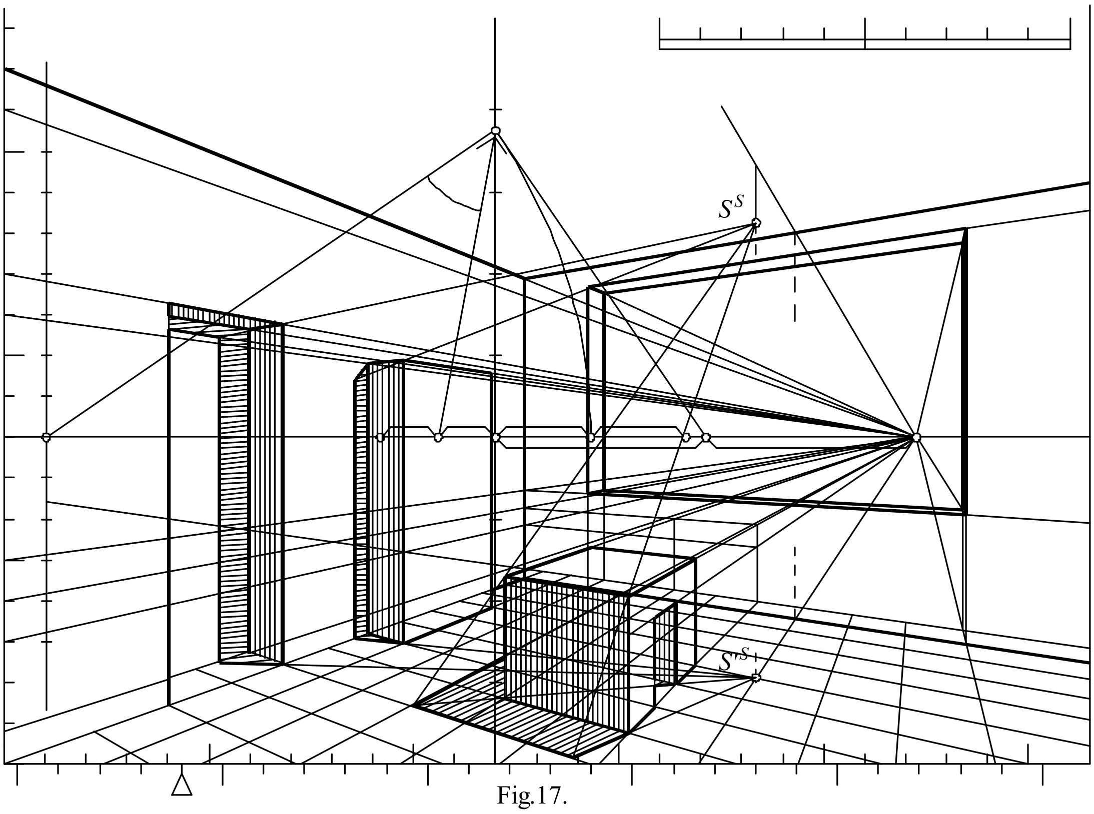

Fig.17.

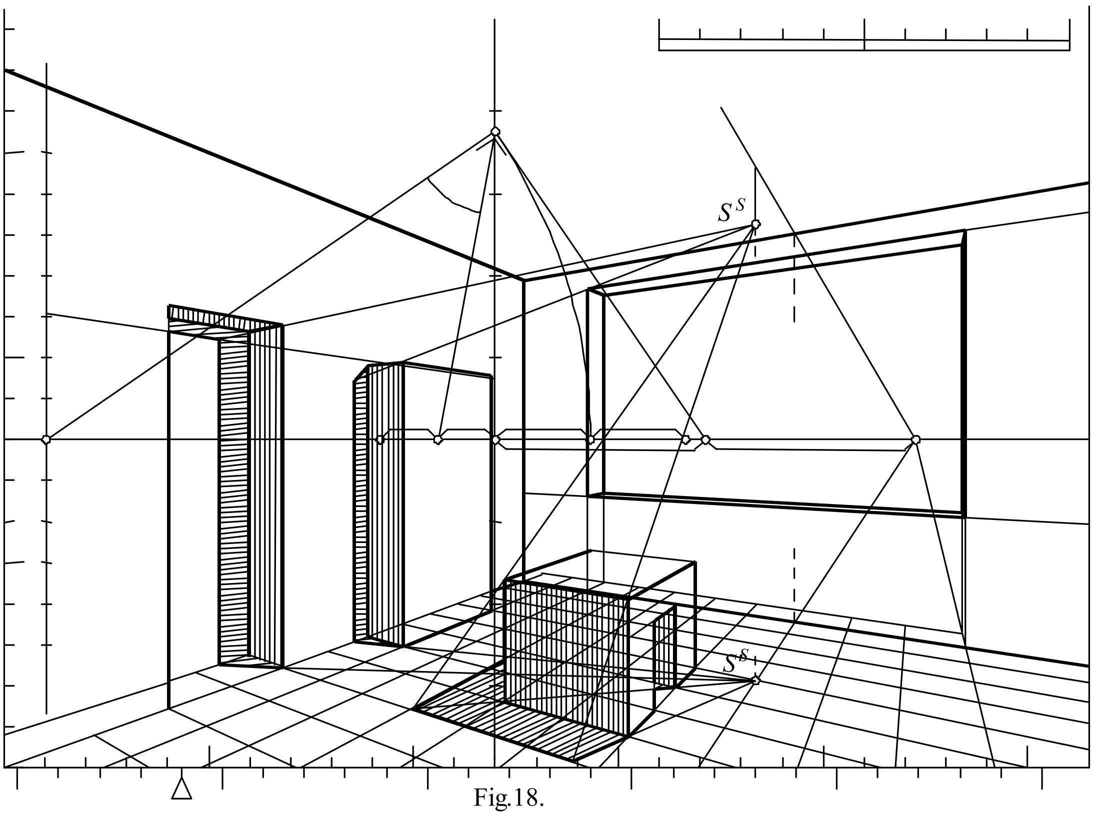

Fig.18.

To expose the real interior of the room we erase the all auxiliary construct lines (Fig.19).

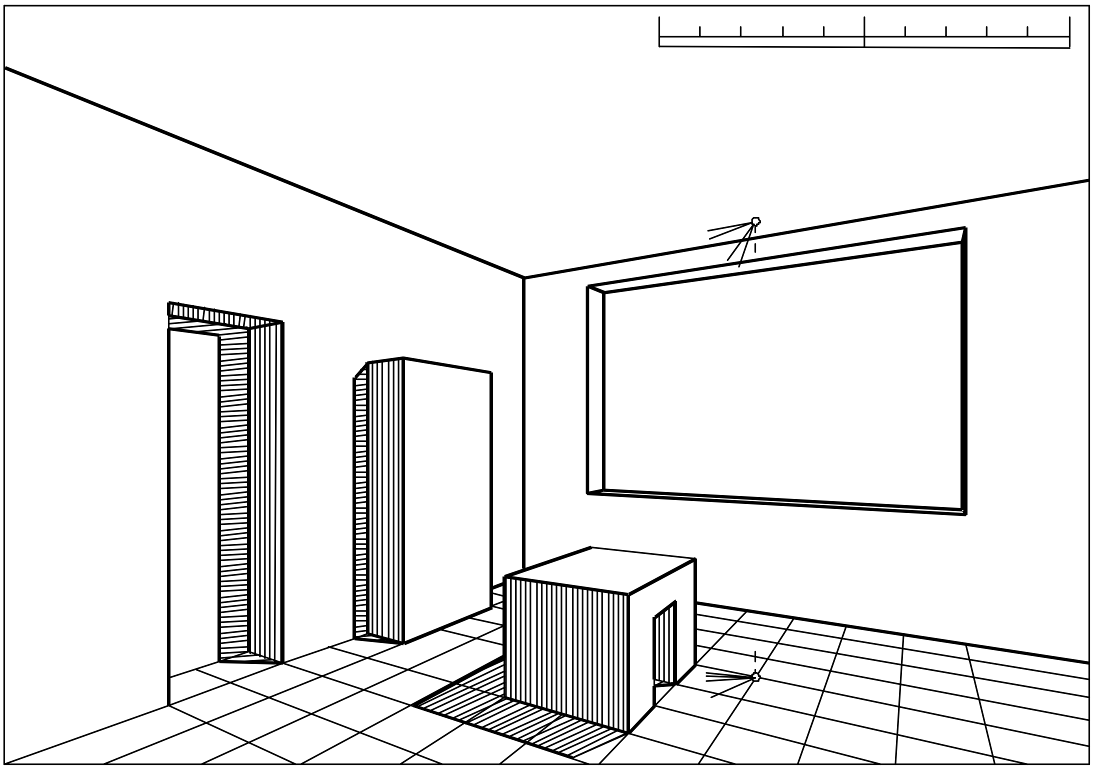

Fig.19.

References:

[1] E. Koźniewski: „*Geometria wykreślna inna niż dawniej*”, I Ogólnopolskie Seminarium „Nowoczesne metody nauczania geometrii wykreślnej i elementów podstaw konstrukcji inżynierskich” Wisła’94.

[2] J. Owerczuk: „*W poszukiwaniu nowego modelu nauczania geometrii wykreślnej*”, Biuletyn Polskiego Towarzystwa Geometrii i Grafiki Inżynierskiej, Zeszyt 6, Grudzień’98.

KOMPUTEROWA REALIZACJA „GEOMETRYZACJI” NAUCZANIA GEOMETRII WYKREŚLNEJ

Graficzne programy komputerowe dają możliwość szybkiego wykreślania olbrzymiej liczby rysunków. Możliwe jest więc tworzenie odpowiednio długich sekwencji rysunków obrazujących dynamikę powstawania konstrukcji. Pozwala to na daleko idącą oszczędność w zakresie tekstu towarzyszącego konstrukcji. Tekst w geometrii wykreślnej jest bowiem uciążliwym balastem. Problem polega więc na umiejętnym eliminowaniu udziału tekstu na korzyść rozbudowanych, rozczłonkowanych, ustawionych w sekwencję czytelnych rysunków. Jest to obecnie ogólny trend w nauczaniu. Autorzy prezentują propozycje takiego właśnie ujęcia materiału w formie bogatego „tekstu geometrycznego”. Podejście to, jawiące się jako bardzo obiecujące w dydaktyce, ściśle koresponduje także ze współczesną okienkowo-ikonową koncepcją budowy programów komputerowych.