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RESEARCH ARTICLE

An Acceptable Way to Build Images of Circles and Spheres (Spheres) In Clear Images

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Abstract

This article shows that axonometric projections of circles are a key factor in the construction of surfaces such as cylinders, cones, spheres, constrictions, and freeform rotating surfaces.

KEYWORDS

Axonometry, ellipse, sphere, ball, oval, isometry, projection.

INTRODUCTION

Young engineers who are growing up in higher education institutions in our country should be prepared to improve and integrate the existing technical technology and production and construction areas and engineering resources, as well as to realize the work in these areas at a high level in the future, in the short term.Muhandislik fanlaridan tayyorlanayotgan yosh muhandislarning grafik ma’lumotlarni qabul qilish, qayta ishlay olishi, ularni zamonaviy grafik dasturlar vositasida kompyuterda tasvirlash malaka va tajribalariga ega boʻlishi muhim omillardan hisoblanadi.

Only then can they achieve the easy assimilation of difficult topics by students in their engineering activities by developing animated electronic tools.

The teaching of the topic of axonometric projections in lectures and practical classes during the lessons showed that the theoretical and practical aspects of the educational process are not organized at the level of modern requirements.

The development of engineering graphics and descriptive geometry is largely due to the work of Gaspar Monge. He was one of the first to describe a method for depicting orthogonal projections of spatial objects and objects simultaneously on three mutually perpendicular planes (corresponding to the Cartesian coordinate planes). This systematized the creation of an epure (drawing) by joining mutually perpendicular planes.

He showed that the study of the epure of objects and objects is equivalent to spatial comparison. Descriptive geometry became an independent science as a new discipline and soon began to be taught in the Higher Technical Schools of European countries from the beginning of the 19th century.

The teaching of descriptive geometry in Russia began in 1810 at the "Institute of Road Communications Engineers (now the Leningrad Institute of Railway Engineers)" in St. Petersburg, and later at other technical universities. Students of the French engineer Gaspar Monge for teaching drawing geometry-A.Ya.Fabr, A.A.Batankur and K.I.The Potes were invited.

In 1814, Yakov Alexandrovich Sevastyanov (1796-1849), who graduated from this institute, was appointed a tutor in descriptive geometry. Sevastyanov began giving independent lectures in Russian in 1818, and in 1821 he published the first original textbook in Russian on this subject, "Fundamentals of Descriptive Geometry." In 1824, at the age of 28, Sevastyanov was awarded the title of professor. Sevastyanov was the first Russian professor of descriptive geometry, and his role in creating Russian terminology in this field was enormous.

The development of methods of teaching drawing geometry in Russia was greatly influenced by the scientific and engineering activities of professors Nikolai Ivanovich Makarov-(1824-1904) and Valerian Ivanovich Kurdyumov (1853-1904).

According to the French scientist and engineer Gaspar Monge, the founder of the science of descriptive geometry, descriptive geometry is a language understandable to all nations in the world, that is, "the language of technology." Descriptive geometry is a famous Russian scientist V.I.Kurdyumov described it as "the grammar of the language of technology."

Later, the theoretical foundations of the drawing geometry were developed by academician-crystallographer E.S.Fedorov (1853-1919), prof. N.A.Ri¬nin (1877-1942), prof. N.A.Gla¬golev (1888-1945), prof. A.I.Dobryakov (1895-1947), prof. N.F.Reflected in the works of Chetverukhin (1891-1974) and others.

On the basis of all the collected data on the theory of axonometry, summarizing them in 1853, Karl Polke (1810-1876yy) developed the basic theorem of axonometry in parallel projections in content that is not without doubts. This theorem was later improved by his student Schwarz in 1864. But this theorem did not receive any convincing content.

Detailed and in-depth information about axonometric projections is provided in Ye.A.Glazunov and N.V.This was described in the book "Axonometry" written by Chetverukhin in 1953.

In our republic, the topic of "Axonometric Projections" was studied by Rakhim Khorunov in 1953, who wrote a dissertation for the degree of Candidate of Sciences in the specialty 05.01.01. and defended it in Leningrad.

In 1853, Karl Polke developed the fundamental theorem of axonomy. YeGlazunov and N.V.Chetverukhins can be found in "Axonometry" and R.It would not be an exaggeration to say that the defense of khorunov's candidate's dissertation seemed to be devoted to the 100th anniversary of this theorem.

Since the terms orthographic projections, projections, and isometric projections are so common, we felt it necessary to explain their meaning and essence.

As a clear image, perceiving the three-dimensional existing objects given in space (or the fantastic-theoretical abstract three-dimensional object urine perceived constructively in our minds) by hand (without drawing tools) with the quality and peculiarity of the mind seen by the observer, its abstract urine is told in the plane (paper or cloth or polotno surface)to the graphic expression-image performed in They are performed by talented people in society - artists, as a result of their inherent emotional perception and perception.

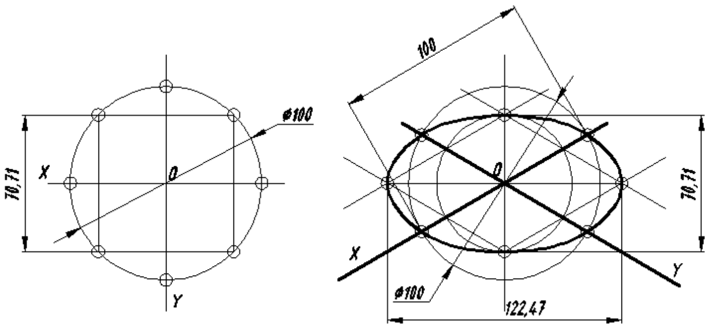
Projection is a two-dimensional image of three-dimensional objects in space, created on a projection plane using a projection apparatus consisting of a projection center or direction and a projection plane.

In the construction of surfaces such as cylinders, cones, spheres, and surfaces of revolution with arbitrary generators, the axometric projections of circles are a key factor. As is known from school drawing, the axonometric projection of a circle is an ellipse, Figure 1.

Figure 1 shows an ellipse constructed using 8 points on a circle with a diameter of 100 mm.

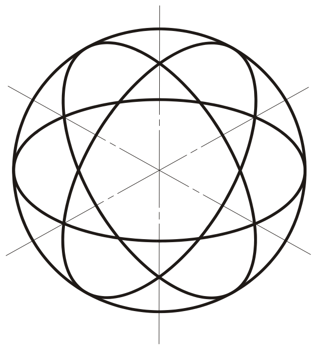
In this case, the major axis of the ellipse will be 122.47 mm, and the minor axis will be 70.71 mm. These parameters are the theoretical dimensions of the ellipse axes.

Among the simple rotational surfaces, the sphere-sphere surface occupies a special place. Because its main and additional views are represented by circles.



1- Figure

Therefore, its clear image is a circle, the diameter of which is 1.22 times greater than the given circle diameter. In axonometry, ellipses of its equator parallel to the plane of horizontal H projections, Prime meridian parallel to the plane of frontal V projections, and meridian lines parallel to the plane of profile W projections are constructed, Figure 2.



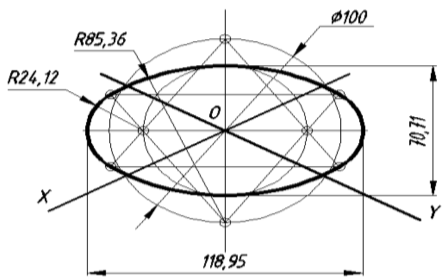
2- Figure

Figure 2 shows that to create a volumetric representation of a sphere, it is not enough to draw a single outer circle with a diameter of 1.22ϕ (ϕ is the diameter of the given circle), but three ellipses must be constructed.

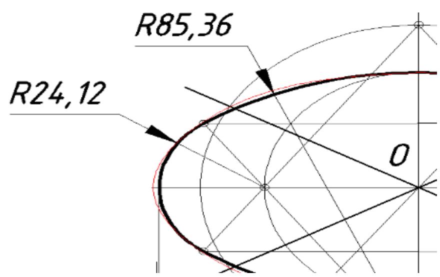
If instead of a sphere we have rotational surfaces or parts consisting of several components, it will be necessary to construct ellipses using at least 8 points of circles of many different diameters, as in Figure 1.

It is natural that this requires a lot of work and time.

In practice, in order to reduce labor and time consumption, theoretical ellipses are replaced by ovals-conditional ellipses consisting of four - Center circular arcs (upper and lower large and right and left small radius slices) defined in standards closer to them, Figure 3. Figure 4 shows a practical, i.e. with a conditional Ellipse, comparing the theoretical Ellipse. While its smaller axis is the same as the theoretical one, the larger axis would be slightly (by 3.52 mm) smaller. It is also common to construct conditional ellipses-ovals of circles in isometric projections, as shown in Figure 5.

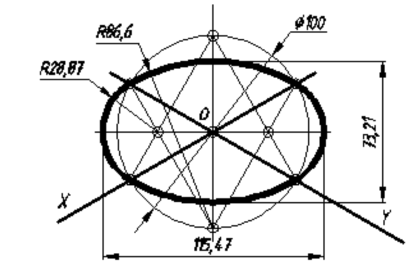


3- Figure



4-

However, this method makes the small bullet 2.5 mm larger and the large bullet 7 mm smaller. Although the parameters of such a conditional ellipse-oval differ significantly from the theoretical ones, it fully and sufficiently represents the fact that a circle is depicted as a conditional ellipse-oval in isometric projections.



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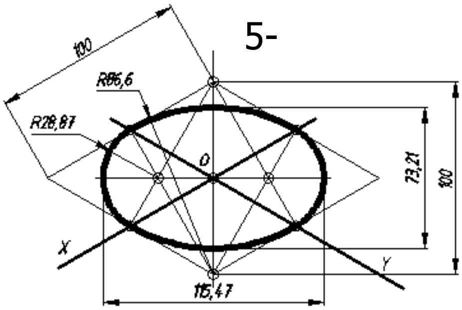


6- Figure

The following factors have contributed to the widespread use of this method in practice:

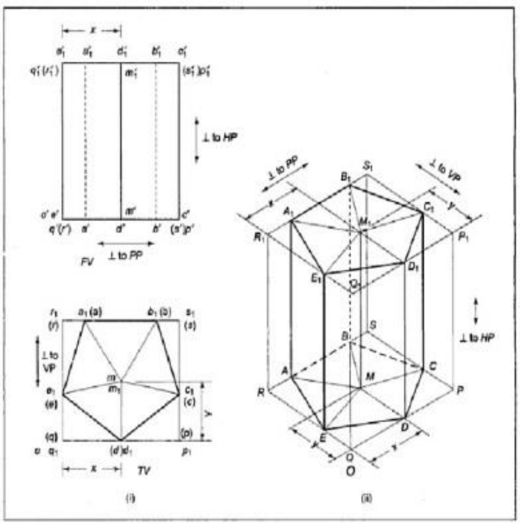
- first, fewer and simpler graphical operations - manipulations are performed compared to the method specified in the standard;

- the point of transition of the major and minor arcs, formed at the intersection of the given circle with the X and Y axes;

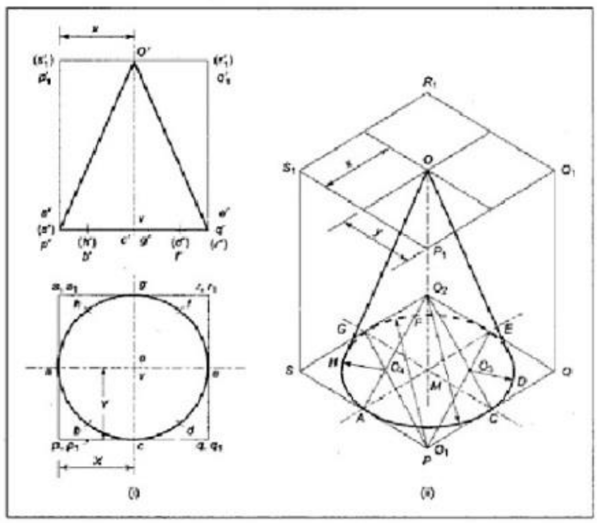
- and thirdly, easy and convenient detection of the center of ARCs, which are large (formed from the intersection of a vertical center line with a given circle) and small (formed from the intersection of a large ARC Center and straight lines passing through the intersection of a circle arc with X, Y axes);

- fourthly, this method is exactly the method used in foreign experiments, Figure 6.

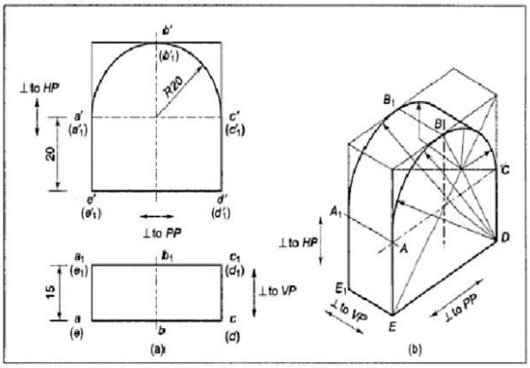
In this foreign experience, a rectangle-square is drawn outside the circle, similar to polygons, and an oval is constructed on its basis, which is close to the isometry of the circle, Figures 7, 8, 9, 10.



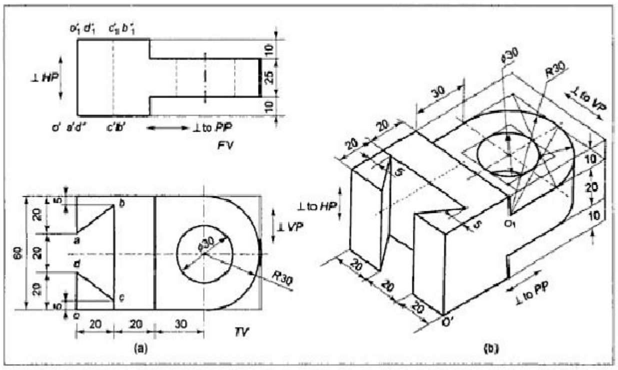
7- Figure



8- Figure



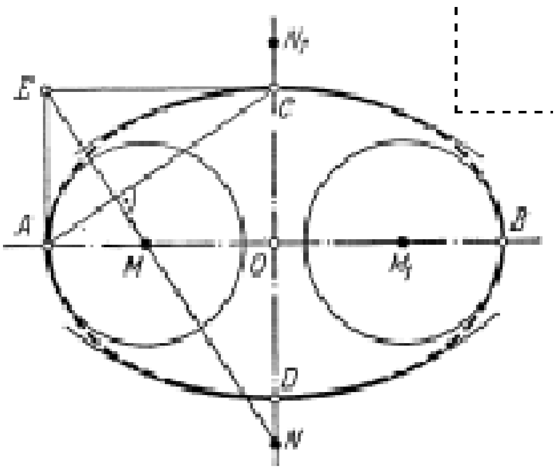
9- Figure



10- Figure

Before the construction of such a popular oval, attempts were made to develop ovals that were very close to the theoretical ellipse. One of these was proposed by Glazunov and Chetverukhin, Figure 1.

The authors constructed this oval as follows, using the radii of curvature of the vertices of the theoretical ellipse axes A, B, C, D:



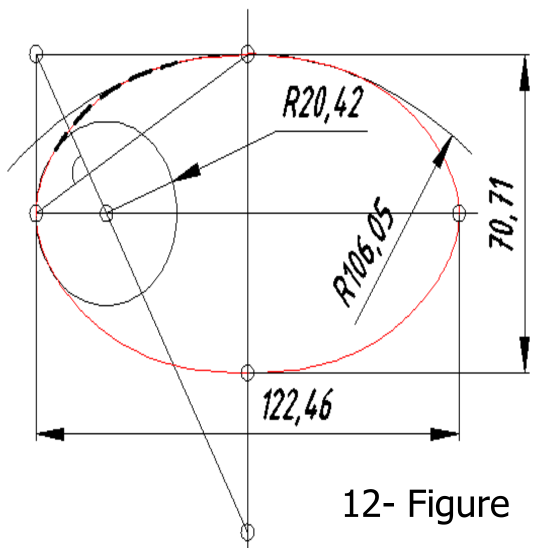
11- Figure

1. The ellipse is completed into a right-angled triangle AES, as in Figure 11, by joining the ends of the major and minor axes A and C and calling it the hypotenuse;

2. From point E of this triangle, a perpendicular is drawn to the hypotenuse, intersecting it with the major and minor axes at points M and N. In this case, point M is the center of the arcs of the circle passing through points A and B, and point N is the center of the arcs of the circle passing through points C and D;

3. Arcs are drawn from the center M to MA and from the center N to NC, and the arcs drawn using a lekalo are smoothly connected. As a result, a quarter of the oval is constructed. The remaining parts of the oval are constructed using symmetrical shapes.

Figure 12 depicts a quarter, upper left arm of an Oval made in this manner. Comparing it with the theoretical Ellipse described in red, we see that such an oval is built very close to the theoretical Ellipse.



12- Figure

A similar situation can be observed in the second oval, built according to the parameters of the major and minor axes, Figures 13, 14. The first (upper left) part of such an oval (as well as its symmetric parts) will be more convex than the theoretical ellipse. .

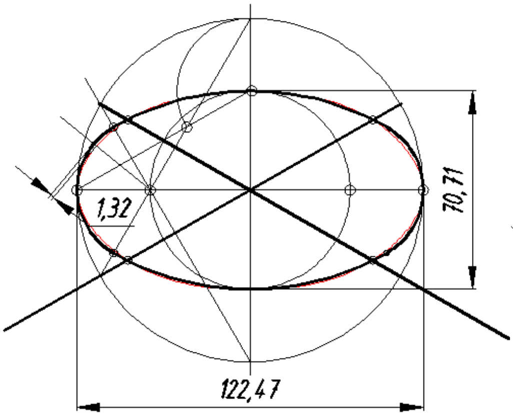
1. The circle drawn in the graph is not directly involved in the

construction of the circle. Only its diameter is used to find the values of the major and minor axes;

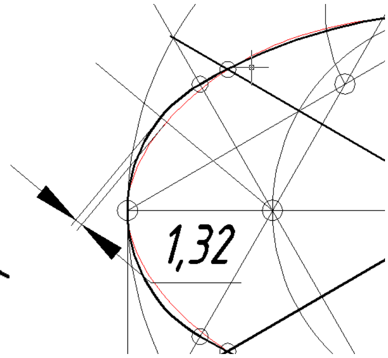
2. The absence of the X and Y axes, which are the main components of axonometric projections, in the construction of such ovals;

3. The use of a template to draw the first oval requires great skill, as well as the approximate location of the connecting points;, which are the main components of axonometric projections, in the construction of such ovals;

3. The use of a template to draw the first oval requires great skill, as well as the approximate location of the connecting points;



13- Figure



14- Figure

4. Too many graphical operations when creating the second oval.

Such inconveniences and disadvantages make it difficult, laborious, and time-consuming to calculate the construction of such ovals in many different sizes and situations. Therefore, they have no practical application. .

Students find ways to independently overcome problems they may encounter when solving subject-related problems. In addition, students can work on themselves and conduct independent research during the process of independent learning.

REFERENCES

1. E.Roʻziyev, A.Ashirboyev. Muhandislik grafikasini oʻqitish metodikasi. -T. "Yangi asr avlodi" nashriyoti., 2010.
2. I.Rahmonov. Chizmalarni chizish va oʻqish. -T. «Oʻqituvchi» nashriyoti., 1992.
3. Kozim Gafurovich Malikov. THEORY AND PRACTICE OF CONSTRUCTION OF AXONOMERTIC PROJECTS. European Journal of Research and Reflection in Educational Sciences. Vol. 8 No. 9, 2020 ISSN 2056-5852.
4. Kozim Gafurovich Malikov. Axonometry New Practical raphical ethods For Determining System Parameters. Psychology and Education Journal, 2021, 58, 2, 5710-5718.
5. Б. Байметов Тасвирий санъат фанларининг инновацион тараққиёти ва стратегиялари // Ўқув-услубий мажмуа. Тошкент – 2019. 159 б.
6. Л. Баранов Место и роль геометрического ядра в современной САПР // САПР и Графика. 2002. – №6. – С. 111-113.
7. К. Евченко Выбор геометрического моделировщика // САПР и Графика. 2002. –№2. – С. 108-113.
8. К.Маликов Аксономертик проекцияларни қуриш назарияси ва амалиёти. Тошкент давлат педагогика университети илмий ахборотлари. Аниқ фанлар. 3/2017 (12).
9. Л.А Найниш. Дидактические основы и пути оптимизации процесса обучения начертательной геометрии: Дисс... д-ра пед. наук. – Пенза, 2000 –412с.
10. Development of Students' creative abilities through teaching landscape painting. Talipov, N.K, Talipov, N.N, Yuldasheva, N.I, Jabbarov, R.R, Muratov, K.K. Journal of Critical Reviews, 2020, 7(6), страницы 227–230
11. The effect of the amount of lithium in aluminum lithium alloys on the property of fluidity. Tursunbaev, S., Ashirbaev, A., Valiev, A., Xalimov, M., Tashimov, N. E3S Web of Conferences, 2023, 414, 04010
12. Principles of using scientific discoveries in modernization

of the art education system. Bulatov, S.S, Mansurov, N.A, Tashimov, N.E, Gulomova, N.K, Tulanova, D.J. Journal of Critical Reviews, 2020, 7(11), страницы 396–398