REDUCTIONS FOR CHANGE THE SECTIONS SHAPES IN THE VENTILATION AND CONDITIONING INSTALLATIONS

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Abstract
This paper aims to solve some reductions that are part of the ventilation and conditioning installations, whose routes are subject to limited space and possibilities of installation. The drawing unfoldings and cutting sheets to obtain the bending operations and combining of parts or subassemblies of complex form, is a common application met in industry. A role in achieving efficient ventilation installations has channel sections, which can be of various shapes, introducing new types of sections, namely the platoval.
This paper solves the linking parts between the platoval-circular sections, respectively circular-circular (asymmetric). The three such forms, taken as example, are commonly found in ventilation installations. The application is solved for certain values of pipe size, any size may be taken in the application, respecting the method of unfold. Of course there are other methods of establishing of the unfoldings of these sections, but the presented, is a relatively new method, that we believe that present a greater interest to specialists in the field.
The precision of the execution for needed templates unfolded depends on the chosen method for obtaining the unfoldings, the eventually *errors due to the mode of assimilation of* the *geometrical corps, which compose* the *platoval sections, with the known.*

Keywords: section, cone, cylinder, rotating, section, unfolding

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1. INTRODUCTION

The ventilation pipes from the silo linking the technological transport equipment with the ventilators and the separation dust catchers. They are made, mostly, of sheets whose thickness is taken according to the diameter pipes. These pipes are made, usually, with a circular section (fig.1). To achieve a network of aspiration is necessary, that the first, the main pipe, connected only in a certain way with the secondary pipes of ramification, because any change of direction of the air is causing losses of supplementary pressure. These losses are even greater with the change direction are more sudden. For these reasons, the connections make changes in direction as extended. With both the angle formed by the pipe axis with the axis of shunt bus is lower, with both losses pressure ramifications are lower.

A role in achieving of an efficient ventilation installation has the sections and the pipes forms of fluid transport. The platoval-circular sections, in various forms, are becoming more common. This paper solves, by the methods of the descriptive geometry, the linking between the platoval-circular sections, by knowing the unfolding necessary to get the templates to their tracing.

It should be noted that the various objects encountered in practice are treated with classical geometric corps (cylinder, cone, prism, pyramid) and the methods of obtaining of their unfolding is based on getting classical unfolding corps, which are similar, the eventually errors due to the approximations made of the methods used.

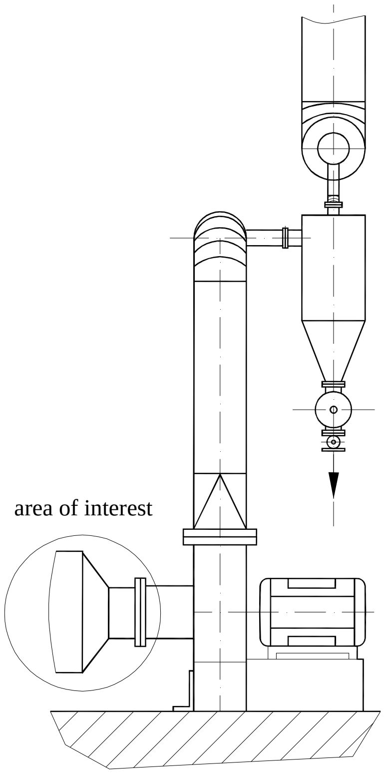

Figure 1. The schema of the dust catcher

2. DESCRIPTION OF THE METHOD

This paper presents three cases of these sections, each with its own peculiarities of obtaining the unfolding.

Case I - reduction connecting a platoval section with a circular section.

In the figure 2 is the double orthogonal projection of a reduction connecting a platoval section, with a circular section. The horizontal projection of the circular section is overlapping with the horizontal projection of the platoval section. These coincidences introduce a new type of surface, the cylindrical surface type. The unfolding of the part from the figure 1 consists of four types of surfaces, namely a cylindrical cloth (I), one triangular (II) and two conical clothes (III, IV).

To determine the unfolding of the object from figure 1 is sufficient to know the unfolding of a half piece, the other half being symmetrical.

a) the unfolding of the cylindrical cloth I. It is sufficient to know the generating dimensions $\overline{RS}$ and the cylinder radius with the center in O_2. The true size of these elements is $\overline{R_oS_o}$ and $\overline{T_oS_o} = 2\pi r/4$ (where r is the radius of the cylinder base), measured in the vertical plane. So, the converting by unfolding of the cylinder quarter O_2 is $T_0S_0R_0Q_0$.

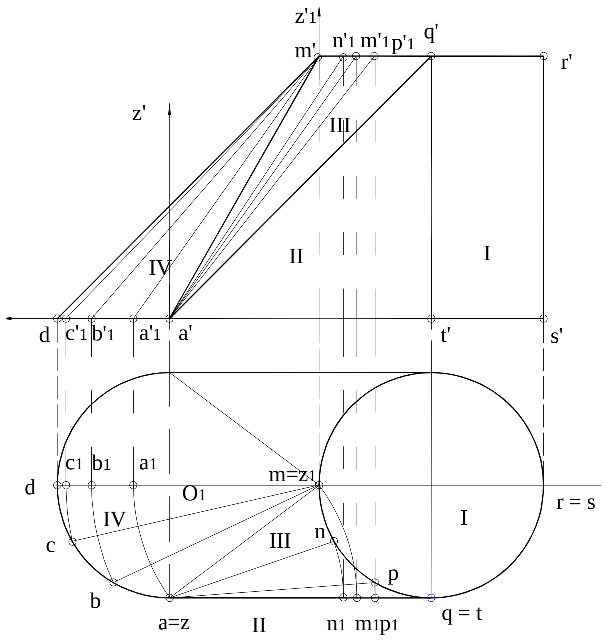

Figure 2: Double orthogonal projection of a platoval reduction with a circular section

b) the unfolding of the triangular cloth II. It is a triangle with a cathetus $\overline{A_oT_o} = \overline{O_1O_2}$, $\overline{T_oQ_o} = \overline{R_oS_o}$, and the hypotenuse is measured in real size in the vertical plane $\overline{A_oQ_o} = \overline{a'_1q'_2}$. The converting by unfold is $\Delta A_oT_oQ_o$.

c) the unfolding of the conical cloth III. To determine the unfolding, are considered it belong to an oblique cone, which unfolding can be obtained by assimilating the conical surface with a surface formed of flat triangles. The bases of the triangles are chords of the basic circle of the cylinder having the centre in O_2. The number of these triangles is greater, the required precision of the construction is better.

The triangles construction requires the knowledge of the generators length of the cone. From among the generators of the cone, only $\overline{AQ}$ is projected in the vertical plane in real size. For some others, that are certain straight lines, it is necessary a rotation, which bring the generators parallel to the vertical plane.

The rotation is around a vertical axis that contains the vertex cone $a'z'$.

Thus, the projection of the point m from the horizontal plane will be m_1, and the corresponding generator will be $m_1^{'}$, the true size of the generating being $\overline{A_0M_1}$, rotated around the vertical axis $a^{'}z^{'}$, which contains the vertex of the cone.

The drawing of the cone unfolding involves adding the triangles $\Delta A_oQ_oP_o$, $\Delta A_oP_{10}N_{10}$, $\Delta A_0N_{10}M_{10}$. Joining the points $Q_0, P_{10}, N_{10}, M_{10}$ with a smooth curve, the unfolding of the conical cloth is obtained.

d) the unfolding of the conical cloth IV. It is obtained similarly with the conical cloth III. The rotation is around the vertical axis, which contains the cone vertex mz_1. The drawing of the cone unfolding involves adding the triangles $\Delta M_{10}A_0B_{10}$, $\Delta M_{10}B_{10}C_{10}$, $\Delta M_{10}C_{10}D_0$. Joining the points A_0, B_{10}, C_{10}, D_0 with a smooth curve is obtained the cloth cone unfolding. To find all the unfolded area we need to mirror the surface obtained previously around the straight line $\overline{S_0R_0}$ (fig. 3).

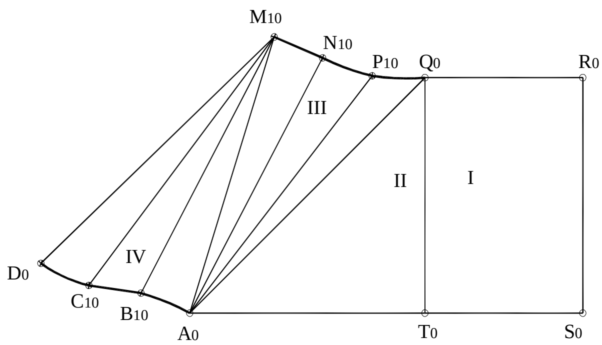

Figure 3: Unfolding of the platoval reduction with a circular section

Case II - Reducing connecting a platoval section with a symmetrical circular section

The figure 4 presents a different situation, encountered in practice, where the reduction which connect the circular section, is symmetrical. The platoval base is located in the horizontal plane of projection, and the circular base in a level plan. The reduction is made of conical cloths and triangular faces. The lateral surface of the object is symmetrical and consists of three types of surfaces, two conical cloths and one trapezoidal.

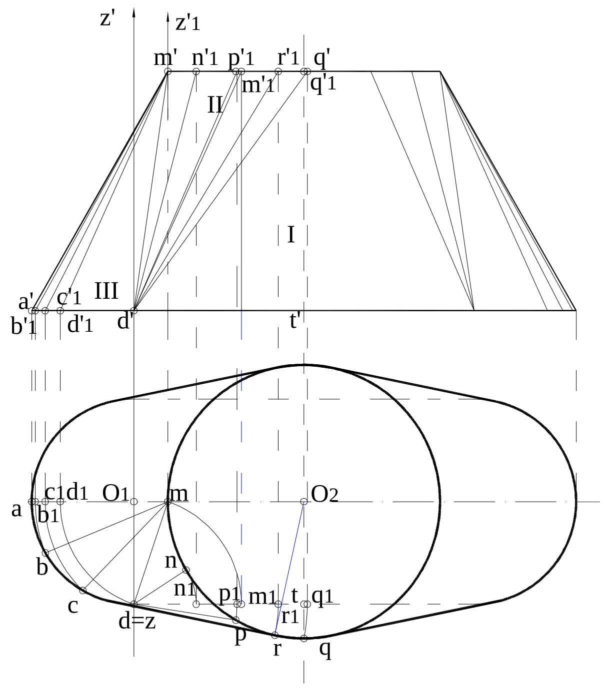

Figure 4: Double orthogonal projection of a reduction which connect a platoval section with a symmetrical circular section

a) the unfolding of the trapezoidal surface I. It has the great base equal to the distance between the centers $\overline{O_1O_2} = \overline{D_0T_0}$, the low base $\overline{R_{01}Q_{01}} = \text{arc}(rq)$, where the point $R(r, r^{'})$ is the tangent point of the cylinders O_1 and O_2. To find the true size of sides $\overline{D_0R_{01}}$ and $\overline{T_0Q_{01}}$, they are rotated around the dz axis.

b) the unfolding of the conical cloth II. It is obtained on the same principle with the previous case, assimilating the conical surface with a surface composed of flat triangles. The true size of these triangles, are fond rotating them around a vertical axis containing the vertex of the cone $d^{'}z$. In this way $\overline{D_0M_0}$ is equal with $\overline{d'm'_1}$ which is rotated ..., $\overline{D_0R_{01}}$ is equal with $\overline{d'r'_1}$. The length of the distance between points $\overline{M_0N_{01}} = \overline{mn}$, ..., $\overline{P_{10}R_{01}} = \overline{pr}$. Uniting $M_0N_{01}P_{01}R_{01}$ with a smooth curve is obtained the unfolding of the conical cloth.

c) the unfolding of the conical cloth III. It is obtained similarly with the conical cloth II. The rotation is around the vertical axis which contains the vertex of the cone $m'z'_1$. The drawing of the cone unfolding involves adding the triangles $\Delta M_0D_0C_0$, $\Delta M_0C_0B_0$, $\Delta M_0B_0A_0$. Uniting $A_0B_0C_0D_0$ with a smooth curve is obtained the unfolding of the conical cloth III.

The unfolding of the portion formed of the surfaces I, II, III is shown in the figure 5. To find the entire developed area not only have to rotate the entire figure, first around $\overline{Q_{01}T_0}$, and then all around the generatrix $\overline{A_0M_0}$.

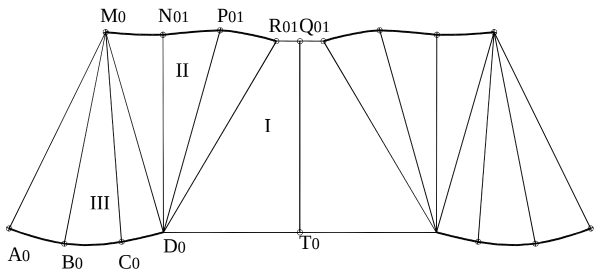

Figure 5: Unfolding of the connection which join platoval section with a symmetrical circular section

Case III – Reduction which connect a cylindrical section with another circular, tangent at a point

In the figure 6 is presented the double orthogonal projection of a reduction where the horizontal projections of the two bases are tangent in a point, so that the surface generator is vertical in that point.

The piece is composed of conical clothes, with alternate vertex on the circle located in the horizontal plane, namely the level plane.

To get the unfolding, are divided both the large and small bases in a number of equal parts. To find the true size of the unfolding (fig. 7) the projections of the large and small base of the figure are situated in the horizontal plane, and for generators, except $\overline{A_01_0} = \overline{a'_11'}$ and $\overline{C_03_0} = \overline{c'_13'}$, which are in true size in the vertical plane, the others should be rotated around the axis $az, bz_1, 2z_2, cz_3$, so $\overline{A_02_0} = \overline{a'_12'}$, $\overline{B_02_0} = \overline{b'_12'_1}$ ...

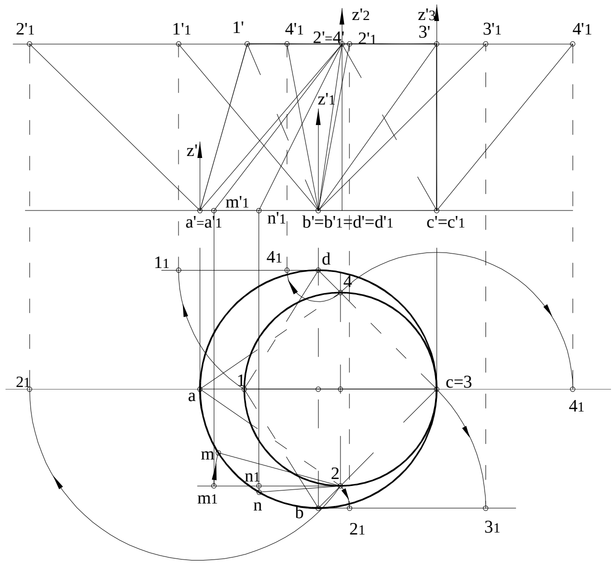

Figure 6: Double orthogonal projection of a reduction, which connect two sections of cylindrical section, tangent in a point.

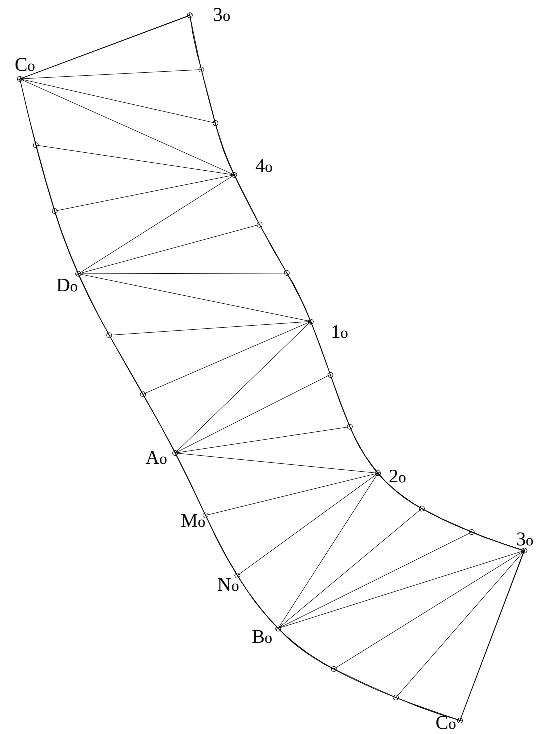

Figure 7: Unfolding of the connection which join two cylindrical sections, tangential in a point

3. CONCLUSION

For the correct execution of pieces or subassemblies, with complex form, which meet the requirements, the methods of descriptive geometry are absolutely necessary. Resolve the difficulties of the producing templates, by determining the types of the surfaces that are part of that, is very necessary. Any errors occurring in execution of the templates is due not so the measurement methods and performance of the unfolding but classical approximation of the industrial corps known from the geometry.

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