On the world of forms of Wilhelm Ostwald

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1. Who was Wilhelm Ostwald?

From his curriculum vitae.

1853	September 2, born in Riga
1872-1875	Student of chemistry
1878	Doctor promotion at the age of 25 years
1881-1887	Full professor of chemistry at the Polytechnicum in Riga
1887-1906	Full professor of physical chemistry at the university of Leipzig
1906-1932	free working in Großbothen
1909	Nobel prize for chemistry for his investigation in catalysis

He wrote several widespreaded books. Some are devoted to his color theory. Beside his color theory he developed a theory of forms which has not been taken into account. We will analyse his world of forms.

2. The symmetry concept in Ostwald's approach to ornamentics (Ostwald pattern)

Still as a student he was interested in antique ornaments. In 1922 he published a procedure to get the most symmetrically plane filling pattern. The starting point is the point lattice of the trigonal or the quadratic or the hexagonal mosaic. The order of the point lattice dependes of the size of the edges.
Two types of Ostwald pattern can be built up for each of the 3 point lattices: reflection type and rotation type. We explain the procedure in modern mathematical language. Consider the symmetry group S of the fundamental pattern of order n or the rotation group R of the pattern.
Now Ostwald takes an arbitrary segment $\mathbf{s}$ joining any two chosen vertices. The Ostwald pattern composed by this "line of theme" $\mathbf{s}$ will be the orbit

$orb_S(\mathbf{s})$ resp. $orb_R(\mathbf{s})$ in the plane.

3. Ostwald pattern from a cristallographic point of view. Each Ostwald pattern has its symmetry group. This is one of the 17 Fedorov's Groups or wall paper groups. For the reflection type pattern there occur only the groups W_6^1 or W_4^1. (In the notation of the groups we follow [5]). For the rotation type pattern can be the groups W_6 or W_6^1 and W_4 or W_4^1.

4. Ostwald pattern generated by computer. The groups S and R are finitely generated. Therefore the Ostwald pattern can be given by a computer program.

5. How many Ostwald pattern there exist? Application of Polya's counting theory tells us the number of Ostwald pattern.

6. About Ostwald colored pattern. What are the symmetry groups? Many colored pattern could be found in the unpublished work of Ostwald. We will report on the answer to the mentioned question.

Literature

[1] Ostwald,W.: Die Harmonie der Formen. Leipzig 1922.

[2] Ostwald,W.: Die Welt der Formen. Entwicklung und Ordnung der gesetzlich-schönen Gebilde. (Mappen 1 u. 2) 1922, (Mappen 3 u. 4) 1923, 1925.

[3] Ostwald,W.: Unpublished papers. Zentralarchiv der Akademie der Wissenschaften DDR und Ostwald Gedenkstätte in Großbothen.

[4] Coxeter,H.S.M.: Unvergängliche Geometrie. Basel, Stuttgart 1963.

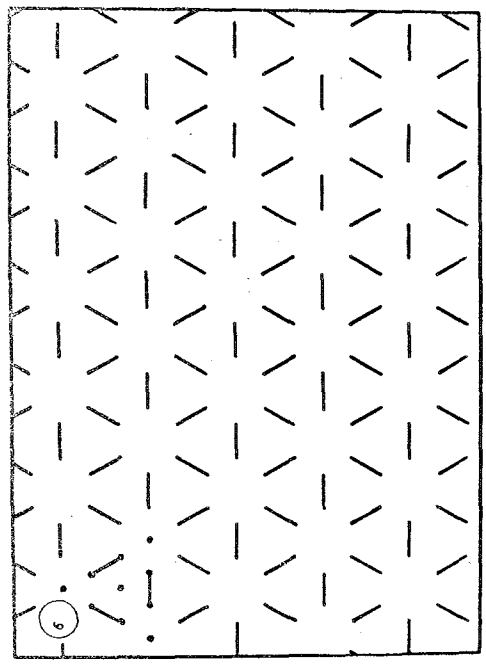
[5] Fejes Toth,L.: Reguläre Figuren. Leipzig 1965.

[6] Polya,G.: Über die Analogie der Kristallsymmetrie in der Ebene. Zeitschrift f. Kristallogr. 60, 1924.

[7] Flachsmeyer,J.: Geometrische Aspekte der Formenwelt von Wilhelm Ostwald. Wissenschaftliche Beiträge der Ernst-Moritz-Arndt-Universität Greifswald, submitted.

[8] Flachsmeyer,J.: Die geometrisch-ästhetische Formenwelt von Wilhelm Ostwald. Wissenschaft und Fortschritt 7, 1989.

[9] Flachsmeyer,J.: Symmetrien Ostwaldscher Muster. Alpha,Heft 2, 1989.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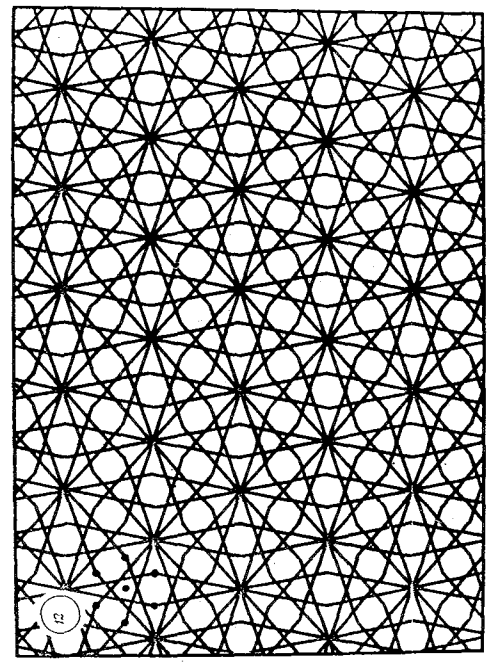
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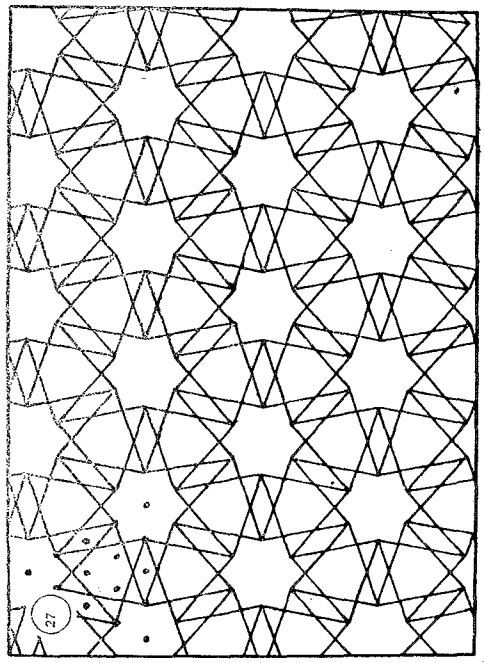
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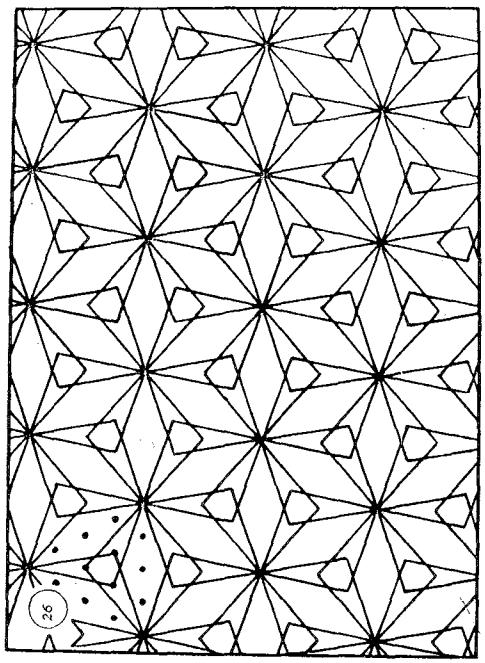
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