Austrian Journal of Technical and Natural Sciences, 2026 No 5–6
ISSN 2310-5607

PREMIER Publishing
ppublishing.org

DOI:10.29013/AJT-26-5.6-179-185

ECOSYSTEM OF OIL PAINT PREPARATION. (Preparation of oil paints for use and application in contemporary painting with psychological rehabilitation functions)

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Cite: *Liakh M. (2026). Ecosystem of oil paint preparation. (Preparation of oil paints for use and application in contemporary painting with psychological rehabilitation functions). Austrian Journal of Technical and Natural Sciences 2026, No 5–6.* https://doi.org/10.29013/AJT-26-5.6-179-185

Abstract

The article discusses an innovative approach to the preparation of oil paints for the restoration of works of art based on dynamic vortex mixing technologies. The author proposes the use of specialized vortex generators that provide highly homogeneous mixing of pigment powders with oil-based solvents, increase the contact time between components, and enable the microencapsulation of pigment particles within a shell formed by an ultra-pure oil component. Particular attention is given to improving the stability, durability, and overall quality of the paint layer through the use of ultra-pure raw materials, including alpha-lecithin derived from chicken eggs and the natural preservative lysozyme.

The article describes the design and operating principles of a vortex mixing system, emphasizing its manufacturability, scalability, and suitability for use in restoration workshops. The proposed technology combines advanced component preparation, vortex mixing, and microencapsulation processes to create high-quality restoration paints with enhanced performance characteristics. It is argued that such an integrated approach can significantly improve the quality of restoration work and extend the preservation lifespan of restored artworks.

Keywords: *Paints; Oil paints; Oil paint mixing; Oil paint preparation; Preparation of oil paint components; Dynamic mixing; Vortex mixing; New materials; Stability and durability of oil paint*

Introduction:

The author of this publication, as a specialist in gemstone geology and an artist creating innovative artistic compositions, proposes considering the feasibility of an innovative transformation of the process used to manufacture highly homogeneous oil paints, particularly for restoration work, where the quality and durability of the materials employed are of decisive importance.

As is known from the history of technology, all oil paints previously used by artists were produced from entirely natural

components, with chicken egg yolk serving as the oil medium.

Even today, it remains difficult to completely separate the yolk (egg oil) from the egg white (albumin).

Figure 1.

As a result, traces of albumin are almost always present in the egg oil, while traces of egg oil remain in the albumin.

This condition of the paint medium causes the paint to lose its uniformity and homogeneity relatively quickly.

When historical paint layers are examined under a microscope, destructive phenomena such as paint shrinkage, deformation, and cracking of the outer paint surface can be clearly observed.

Over time, these processes lead to the gradual deterioration of the paint layer and the loss of the artwork's original appearance.

During restoration work, it is naturally necessary to use paints whose composition and production methods are as close as possible to the original materials.

Even under modern conditions, this remains a difficult task.

In other words, if the objective is to use paints for restoration that possess chemical compositions and properties equivalent to the original materials, it becomes necessary to reproduce the manufacturing methods and technologies used in previous centuries, effectively returning the modern restoration process to the challenges associated with medieval oil paint production.

Both historically and today, the key challenge has been achieving the most complete possible separation of egg yolk oil from egg white albumin.

The issue of homogeneous mixing also remains important, but it is secondary because obtaining pure initial paint components largely determines the final quality of the paint in virtually all respects.

Therefore, in order to address all stages involved in the creation of a new type of oil paint for restoration applications through an innovative approach, an equally integrated and comprehensive solution is required for each material and technological operation involved in the overall process.

– The first issue is the production of pure or even ultra-pure egg oil.

– The second issue is the production of a natural preservative for the paint to ensure its stability and durability.

– The third issue is the reliable and rapid mixing of pigment powder with ultra-pure egg oil.

– The fourth issue is the encapsulation of pigment microparticles within a shell of ultra-pure egg oil.

– The fifth issue is the coating of the capsules produced during mixing, consisting of a pigment particle core and an ultra-pure egg oil shell, with a liquid natural preservative.

Assuming that the issues of obtaining ultra-pure egg oil and an equally pure natural preservative have been solved.

Mixing and encapsulation, which are technologically much more complex, require a detailed explanation.

There are technologies known as vortex mixing.

The implementation of such technologies requires special vortex generators, which are

joined along the axis in the quantity needed to ensure the specified production capacity.

In this generator, the pigment in the form of micropowder is placed in the central axial opening, while egg oil or its equivalent is supplied under pressure into an annular trapezoidal channel, from where it passes through peripheral axial channels into tangential channels and is then injected into the pigment.

The tangential channels are designed so that the oil outlet openings range from 5 to 10 microns.

The dispersion of the sprayed oil also forms droplets ranging from 5 to 10 microns.

The topology of the tangential channels is designed and produced in such a way that the injection from each channel follows a spiral trajectory.

Since the number of such channels in a single generator may reach 15, this generator provides 15 spirals at the pigment inlet, whose injection transforms the pigment and spiral oil flows in the axial opening of the generator into a vortex tube, where microencapsulation takes place.

Figure 2.

There is another important factor arising from the properties of the vortex tube – the contact time between the oil and the pigment within such a tube increases by at least 3.5 times compared with conventional mechanical mixing, while the linear flow velocity of the mixture remains unchanged.

Vortex generators are relatively easy to manufacture and operate and can function with virtually any type of pump, which is particularly important for restoration applications.

The following sectional model illustrates these characteristics.

Generators of this type can be manufactured at any scale, which is also important for restoration work, where the required quantity of paint is extremely small while quality requirements remain exceptionally high.

The following three-dimensional models of various stages of paint preparation system assembly demonstrate the simplicity of the installation while maintaining full functionality.

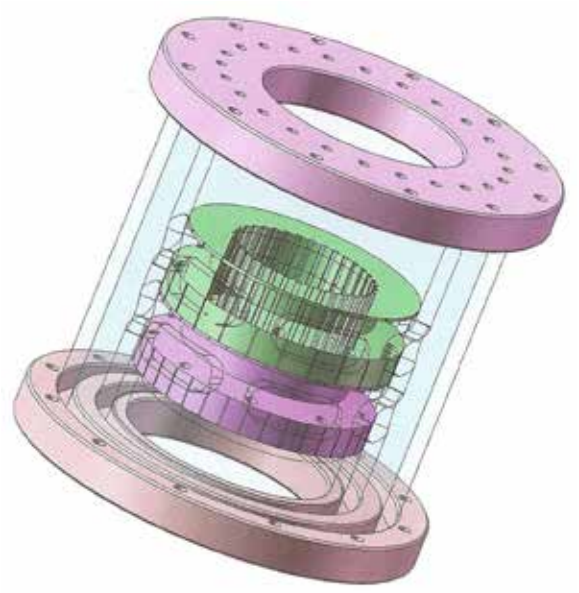
Such a system can be connected to any pump supplying the oil medium, simplifying its use at restoration sites of any type.

The diameter of such a vortex generator determines its productivity, making it possible to assume that, for local mixing of paint components in restoration work, a diameter not exceeding 35 mm would be sufficient.

The overall concept of this system is very simple and allows all components to be manufactured using basic geometric forms, which in turn enables operation by personnel without specialized production skills.

This design also contributes to low manufacturing costs, which is an important consideration when establishing a restoration facility.

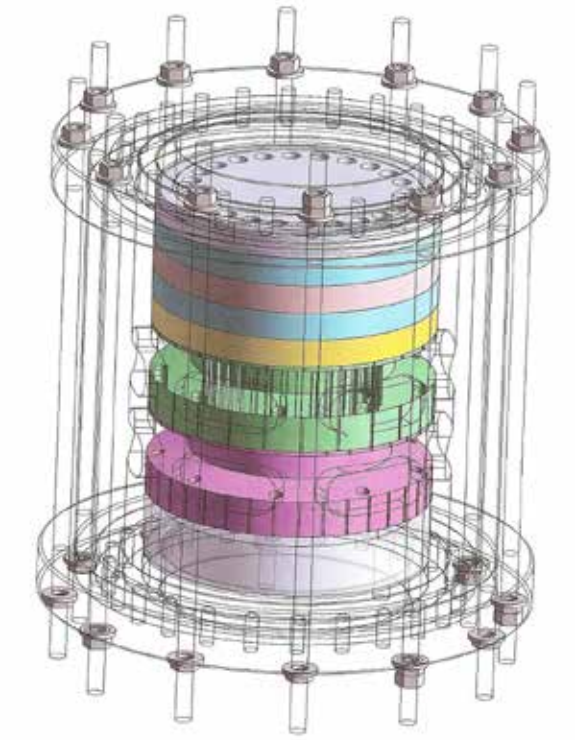
Figure 3.



The author presents device models that demonstrate the simplicity and manufacturability of all components, as well as the ease of assembly and operation under restoration workshop conditions.

Figure 4.

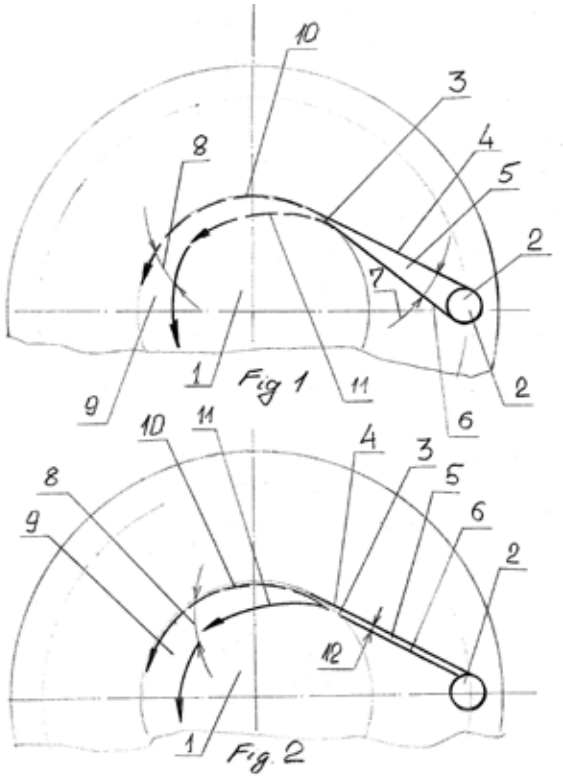
Figure 5.



As can be seen from the models, all housing components automatically center the vortex generators in contact with them, eliminating the need for numerous specialized parts and significantly reducing the cost of the system while maintaining the required level of paint preparation quality.

The assembly of the system is carried out using standard threaded rods, which further simplifies both the design and operation of the installation.

Figure 6.



The presented diagrams provide a detailed illustration of the dynamic mechanisms responsible for the formation of the vortex tube within the encapsulated paint preparation system.

As can be seen from the diagrams, the mechanisms involved in vortex tube formation are sufficiently simple and reliable to enable the practical use of such a system under real restoration workshop conditions.

The following diagrams present versions of the system incorporating various modifications, including filtering elements manufactured from carbon-carbon composite materials.

Figure 7.

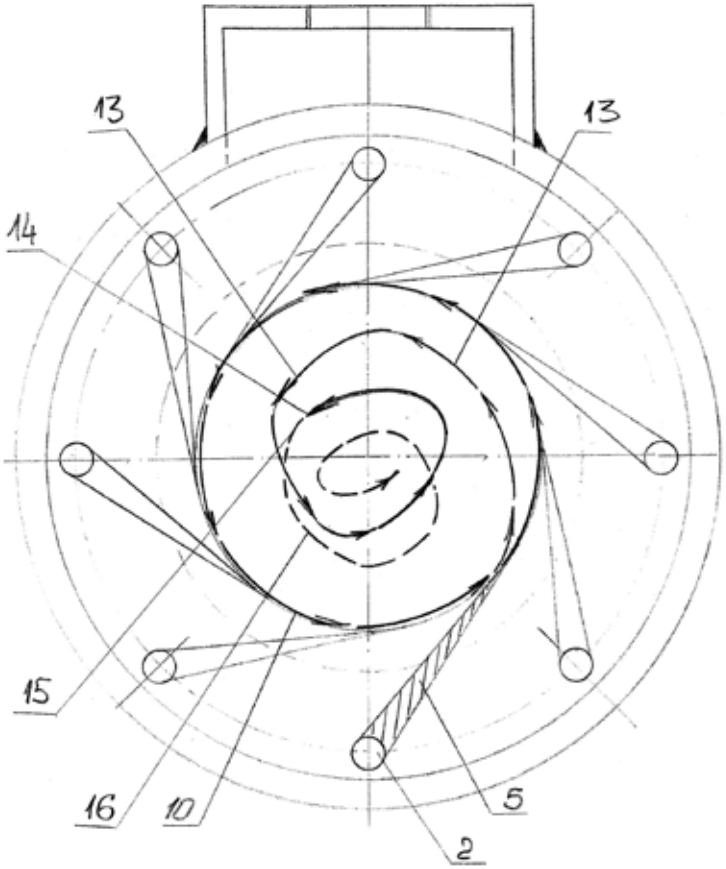
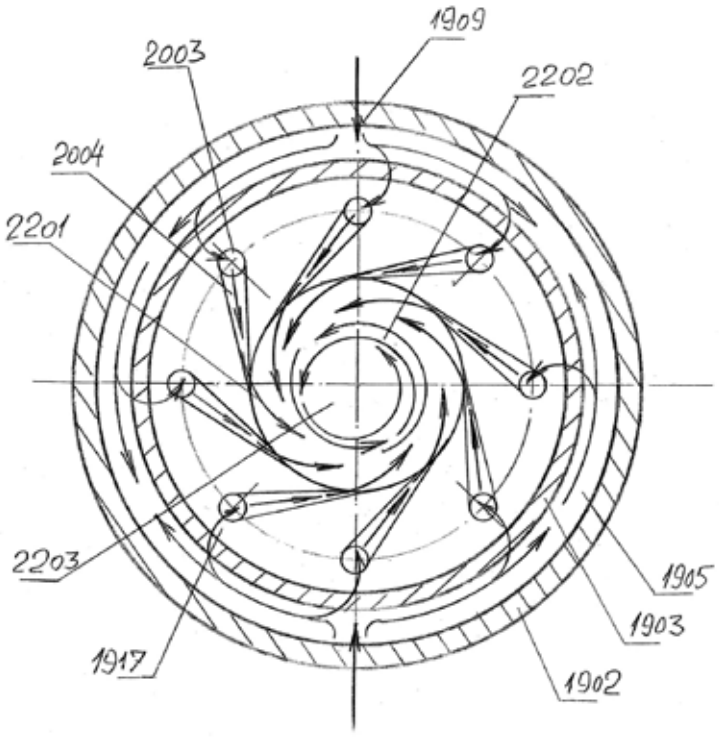


Figure 8.



After describing the vortex mixing system itself, the author proposes returning to the question of selecting the oil component used as the paint medium.

In this regard, a new innovative technology for processing chicken eggs is proposed.

According to this technology, eggs – including non-standard or lower-grade eggs – are processed using a specialized method to produce an ultra-pure egg powder.

Subsequently, special solvents are used to extract alpha-lecithin from the powder. Alpha-lecithin serves as an equivalent to the oil medium used in paint production while significantly surpassing conventional oil in terms of purity.

Figure 9.

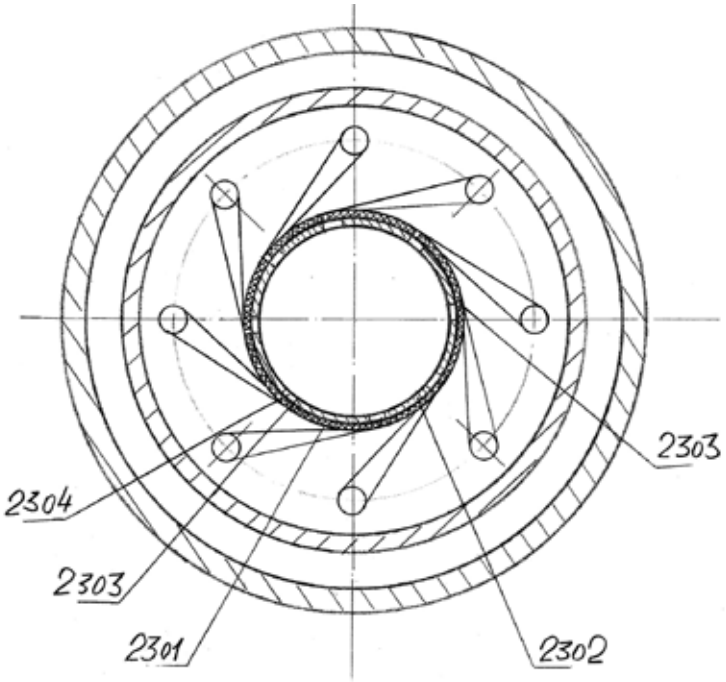


Figure 10.

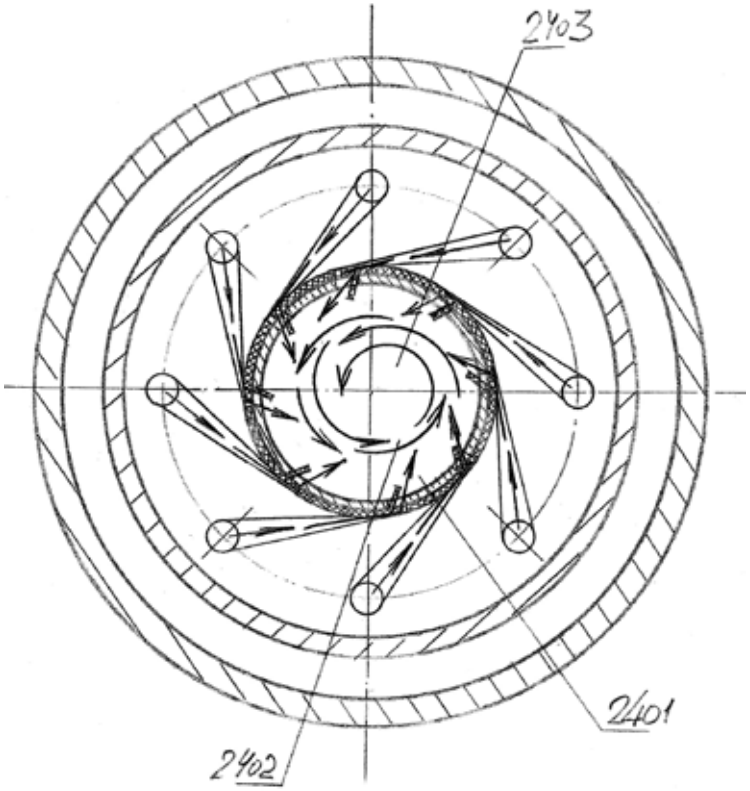
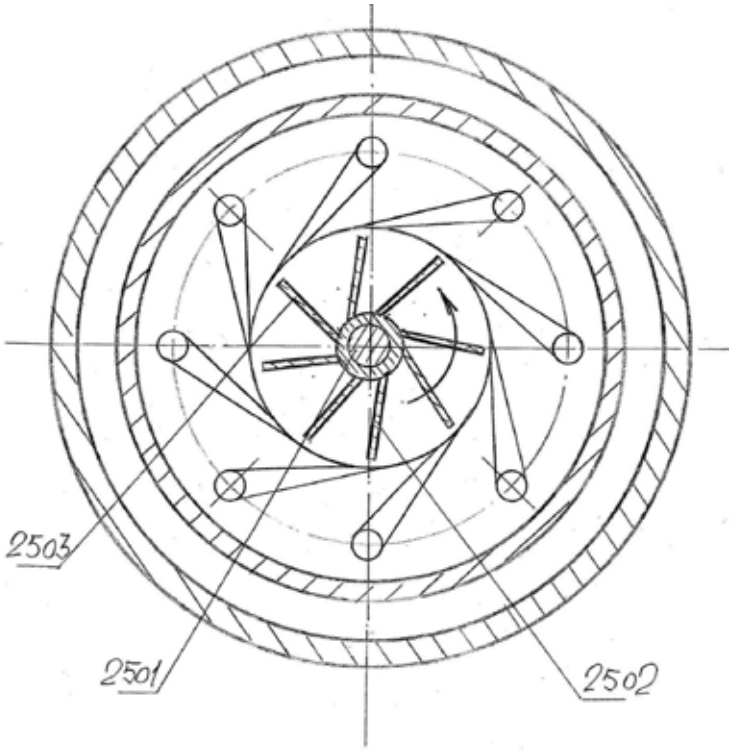


Figure 11.



During the same egg-processing procedure, ultra-pure lysozyme is also obtained as a natural preservative.

Thus, the proposed restoration paint is based on an entirely pure set of materials ultimately derived from the same chicken eggs traditionally used in paint production, but processed to achieve a substantially higher level of purity.

According to the author, such a paint could significantly improve the cleanliness and quality of art restoration processes while extending the service life of restored paintings and enhancing their long-term preservation.

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submitted 26.05.2026;
accepted for publication 02.06.2026;
published 30.06.2026

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