Technology of Oak Architectural and Decorative Elements Manufacturing for Iconostasis Recreating in Krestovozdvizhensky Temple in Village of Syrostan, Chelyabinsk region

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Abstract. Due to the historical peculiarities of Russia, by the end of the 20th century many temples were destroyed or they lost their iconostases which most often were made of wood. When it became necessary to revive the traditional craft it turned out that it was lost almost completely which negatively affects the quality of the wooden iconostases restoration and their new construction. The article aims to fill the loss of knowledge and skills that make up the content of one of the most interesting types of the architectural and monumental and decorative art through study of the forms of preserved fragments once being a very rich historical and cultural heritage. Similar works on the study of wooden iconostases aimed at the recreation of oak decorative wooden elements and restoration practice have not been performed so far which gives it a character of particular relevance for the architectural science. New and relevant technological improvements are not rejected but skillfully introduced into the arsenal of techniques and means of modern restorers and carvers to facilitate the recovery of iconostasis construction from a crisis state and the transition to the subsequent continuation of the tradition development. The deep knowledge of the research subject allowed one to use oak decorative elements in the manufacture for recreating the iconostasis of the Krestovozdvizhensky temple in the village of Syrostan, the Chelyabinsk region. This material is undoubtedly of a scientific and reference nature as well as economic efficiency for all those who wish to join the noble traditional iconostasis making art.

1. Introduction
Most iconostases of the XVII-XIX centuries were made of pine, linden with a gilded surface, and there were practically no oak iconostases due to the fact that it was difficult to handle manually the oak material [1-8]. The technologies that the iconostasis masters used have not been preserved.

Decorative oak carving gives the iconostasis uniqueness, which is due to the natural wealth of the material. Oak wood with a tangent cut has well visible pores, and when radical - heart-shaped rays, it is very durable, it is easy to marble to black color. A real stained oak, lying in the water, has a color from brown-green to black. It is less durable than the cut, brittle, difficult to handle and blunts cutters. In the lump of large trees, there is friability. In combination with a radial cut, the texture of such an oak board is very beautiful. Natural drying of oak in the bark takes 8-10 years. Before drying, the ends should be lubricated with petrolatum, PVA glue or covered with paper.
2. Main part

The process of manufacturing oak threads consists of several stages: 1) manufacture of a wooden oak panel (billet); 2) thread work of the workpiece; 3) finishing of the finished product [9-12].

A wooden oak shield (a workpiece for carving) is produced by gluing wood (lamellas). For strong bonding, oak lamellas, an exact fit of the surfaces to be bonded is essential. The best fit is achieved by jointing. There is no need to cenobite when gluing to a smooth fugue. This increases the thickness of the adhesive layer, and the adhesion strength decreases. The temperature of the wood to be glued must be between 20-28 degrees Celsius. Moisture of the glued wood: the best 8-12%, the maximum permissible 18%. Wood needs to be glued soon after jointing. After a long storage of timber prepared for bonding, it is not often necessary to plan it again, because the pores in the fugue are clogged with dust, and warping of the wood is observed. This reduces the bonding strength. The strength of the bonding depends on the depth and uniformity of the impregnation of the adhesive solution, the surfaces to be bonded, and also on the density of adhesion of these surfaces.

The strength of gluing is determined by splitting the glued samples of wood with a chisel over the glued seam. If the split occurred over the wood, it means that the glue seam is very strong, stronger than wood. The cleavage of the glue indicates a very low bonding strength. The bonding strength is critical for the quality of the product. When the surfaces are bonded properly and when the gluing conditions are correct, the bonding is stronger than the wood itself.

The process of gluing oak lamellas includes the following operations: applying a glue solution to the surfaces to be glued; assembling of glued parts; pressing; exposure under the press; aging of the bonded parts after removal of the press.

All these operations in their implementation are not permanent and identical for all cases of gluing. Each of them depends on certain circumstances. Such circumstances include: a) type and quality of the glue; b) concentration of the adhesive solution and its temperature; c) temperature of the wood and air temperature in the shop; d) humidity of the glued wood and the quality of its processing; e) nature of the gluing operation. The correct mode of gluing and its exact implementation ensure the production of glued joints of high quality.

Practice and scientific research established: the best thickness of the adhesive layer 0.08-0.15 mm; when its thickness is large, the adhesion strength is reduced. A thick interlayer, due to the large hygroscopicity of the adhesive, can subsequently lead even to a release under the influence of changes in the temperature and humidity of the air. In addition, a thick interlayer, when dried, gives a large shrinkage and cracks appear in it. This also reduces the bond strength. A very thin adhesive layer (less than 0.08 mm) is inadmissible. Such a layer loses its continuity, i.e. gives only a partial, very unstable bonding, called by carpenters "hungry gluing".

The proper thickness of the adhesive layer is achieved by the force of pressure, that is, by compression. Compression does not need to be strong. The assumption, that the stronger the pressure, the stronger the bonding is, is wrong. The pressure value is determined by the task of obtaining an adhesive layer of proper thickness and depends on a number of conditions. The amount of pressure must be adapted to the temperature and concentration of the adhesive, the structure of the wood and the nature of its processing. With a thick adhesive, the pressure should be high, in order for the glue to penetrate the pores of the wood better, to create a uniform film between the glued surfaces and squeeze out excess glue. As the temperature of the thick adhesive increases, the pressure needs to be reduced somewhat. If liquid glue is used, it is necessary to pressurize with less force, otherwise it can result in a "hungry gluing". When the temperature of the liquid glue drops, the pressure is raised, and when the temperature rises, it is lowered. For gluing oak wood, liquid glue must be used. In practice, several types of glue made in different countries are known among professionals: "AkzoNobel" - in Scandinavia; in Germany - "Klebemini MG Becker GmbH + CoCG" - owners of the famous brand of glue "Kleiberite"; in Italy, "Collanti Concorde".

Adhesive should be applied evenly to both glued surfaces; one-sided application does not ensure uniform impregnation of the glue of both surfaces, and therefore in the glued wood there are uneven stresses that reduce the adhesion strength. Application of the glue is done by brush, preferably by fast
movements. Do not do abundant application, as this makes the wood more moisturized on the seam, the consumption of glue increases without use and additional working time is spent to remove a large amount of squeezed out adhesive solution.

Before subjecting the glued product to pressing (squeezing), it needs to be held for some time with glue applied to it.

In practice, open and closed exposures are used. Open is the holding time between the time of applying glue to the surfaces to be glued and the moment when these surfaces are connected without pressure. Closed is the exposure in the time interval between the connection without compression of the surfaces covered with glue solution and their pressing. Exposure is usually due to the need to assemble the glued product and prepare it for pressing. But this does not mean that self-restraint does not in itself play a role. On the contrary, aging for the quality of gluing is of great importance.

During open aging, in addition to the fact that the wood is impregnated with the adhesive solution applied on its surface, the moisture evaporates rapidly from the solution. Due to this, the wood is less humidified and the concentration of the adhesive solution increases at the same time, which allows using a higher pressure and, consequently, to achieve better glue penetration into the wood. Closed aging promotes better impregnation of wood with glue and delays the beginning of its gelling. In cases where a thick adhesive solution is used or when gluing is carried out at a low temperature in the workshop, a prolonged exposure, especially open, can cause premature gelation of the applied glue, as a result of which no gluing will occur. In these cases, it is necessary to connect the bonded surfaces immediately after application of the adhesive. In order to prolong the exposure, it is necessary to heat the glued wood.

With a liquid adhesive solution and a high temperature of the adhesive, hasty junction and pressing of the parts are not useful. In this case, there is inevitably excessive extrusion of the glue and as a consequence of this "hungry gluing".

Thus, excerpts are directly related to the quality of the gluing. Their duration should be regulated first of all with a view to preventing the gelation of the glue before pressing. Pressing should be made as close as possible to the moment of gelation of the glue, but not in any case at the very moment of gelling or after gelling. This is the most important condition for high-quality gluing.

The temperature in the workshop at the time of bonding should be 20-30 degrees Celsius. At a temperature below the required one, heating of the glued wood is used. When gluing lamellas, compression takes place using screw clamps and joinery clamps.

At gluing apply pressure from 0,7 up to 1,00 kg/sq.mm. The parts to be glued are held under the press before setting the adhesive, i.e. until the moment when neither the decay nor the displacement of the bonded parts are possible and the danger of weakening the glue seam is eliminated. The length of the pressing depends on the type and quality of the adhesive and the bonding conditions.

For the final setting of the glue, it takes much more time than resting under the press. In the bonded parts released from under the press, the adhesive seams can be damaged and weakened during the subsequent processing of these parts, if produced shortly after the pressing. In addition, when gluing parts absorb water from the adhesive solution, and the more the moisture is, the closer one or another part of the part is to the adhesive seam. As a result of this, the glued parts are crumbled when dry.

Therefore, the glued and extruded parts are maintained until they are processed in a special warehouse for moisture leveling. The higher the moisture content of the wood, the lower the temperature in the warehouse, the more glutinous seams in the product, the longer it is necessary to withstand the glued objects after they have been crushed. The approximate exposure of the workpiece after pressing is 30 days.

Threading is executed directly on the part, if it is made of solid wood, the veneered products have a thread made on a special sticker made of wood. You can thread on a separate plank, which is then glued to the product.

Thread operations are performed in the following order: laying and fixing the part or product in an easy-to-use position, with illumination from above and from the left; Markup or translation of a
drawing; cutting out the contour lines of the drawing; background cutting; cutting out the details of the drawing; final correction and thread cleaning.

The tool for carving is mainly chisels, rasps, files, all kinds of cutters: flat, semicircular, oval, angular, in the form of hooks. Many instruments bear distinctive names: esmans, klikarzy, tsiraziki, coins. These names are in most cases due to the form and purpose of the instrument. For example, the Esmans have S-shaped rods, the coins serve for embossing a deeper background [13-18]. Each tool of the carver must be sharp and pointed at the knife. Edit in the process of work is often repeated. The thread was always made by hand. At present, carved works are more mechanized. They are performed on (pantographs) of sculpture-milling and copy-milling machines - single-spindle and multi-spindle.

R632/40 - German copy and milling machine (Germany) - manual copying; RACC 2000 multi-spindle copying machine with software control; SM 614 and F200 A - machines for figured milling. The main feature of these machines is a large number of revolutions of the working shaft, from 10 to 28 thousand per minute. Due to this speed, the thread is clean, with a clear relief, without chips. The processing of oak thread on such machines takes place with less labor, but with high productivity. Equipment with numerical control software has high accuracy and productivity. The use of machine tools with manual control is more acceptable for small workshops, because it is possible for any carver to make a model of a lime tree matrix for repetition. After milling the oak billet, the surface has (roughen) a rough surface in the form of a small wave. The wave remains from the cutter, which has a radiused completion of the cutting edges. The carver requires only the chisel to remove and align this rough surface, and sand it with an emery cloth.

Thread is usually varnished on natural wood or with preliminary tinting. Before tinting, it is necessary to moisten the entire thread with warm water, which helps to obtain an even tone. The best varnishing is obtained by spraying: when varnishing threads with a tampon, the lacquer flows into narrow grooves, resulting in sharper carving patterns. Preparation for finishing oak carving includes the following operations: elimination of wood defects - sealing up cracks, drilling and embedding knots, etc.; leveling and surface cleaning; looping; grinding. On the surfaces of wood prepared for finishing, the defects of the previous processing and drying in the form of burrs, scrapes, ripples, cracks, stains, spots, scratches, dents, as well as defects of the wood itself in the form of knots and pockets are often detected. These defects do not allow to receive a good paint on the surface of products, so they must be removed.

The operations of priming, drying and grinding are common for all types of coatings. Puttying is done only in preparation for non-transparent and imitation finish; Filling, dyeing and polishing - for preparation for a transparent finish. Prepared for finishing the surface should be completely dry. If the materials applied in the finishing preparation are not sufficiently dried, then further finishing operations are not permitted. Otherwise, the layer of varnish deposited on the surface can pale, wrinkle and crack, under the action of the solvents remaining in the soil, and the ongoing processes of its shrinkage. Surface after finishing preparation should also not have contamination in the form of fat, as this leads to peeling of the exterior paint. When preparing for finishing, especially when sanding and polishing the surface of wood, part of the cut and ragged thin wood fibers is smoothed and pressed into the pores. When applying and drying paint and varnish materials, these fibers (pile) are raised. Pile spoils the transparent coating, so before dyeing and varnishing it must be removed. Before removal, the pile is first picked up by moistening the surface of the wood with a swab or sponge soaked in a warm 3-5% solution of clarified bone glue or a special primer. After wetting, the surface is dried, while the raised pile acquires some stiffness and is easily ground (18-20). The author of the article recommends the use of paint coatings manufactured by RENNER (Italy) and Akzo Nobel.

3. Conclusion
The considered technology of oak carving for the iconostasis is individual and used for restoration of the oak iconostasis of the Krestovozdvizhensky Temple in the village of Syrostan, Chelyabinsk region (Figure 1).
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Figure 1. Fragment of the Royal gates of the iconostasis of the Holy Cross Temple in the village of Syrostan, Chelyabinsk region.