REALIZATION OF A FUNCTIONAL HYDRAULIC SAWMILL BASED ON INNOVATIVE CONCEPTS

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RESEARCH ARTICLE

Abstract
By transforming classic cutting mechanisms, the hydraulic chainsaw manages to provide precision and efficiency in the wood processing process, minimizing material losses and optimizing the use of available resources. Also, this innovative technology allowed and allows cutting in multiple sizes and shapes, offering flexibility and versatility in production.

Keywords: saw, wood, milling, design
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INTRODUCTION

The hydraulic sawmill is a machine that plays an essential role in the process of cutting wood, and by applying the innovative concepts and ideas of Leonardo da Vinci, it is envisaged not only to significantly improve its efficiency, but also to expand its functionality. In this way, a firm step is taken towards the development and modernization of the wood processing industry, thus increasing competitiveness and adaptation to the requirements and standards of the 21st century (Bedini, 2007, Laurenza, 2006, Mândâcanu, 1999).

The hydraulic chainsaw represents a remarkable innovation in the precise and efficient cutting of wood, replacing traditional methods that, in addition to being less productive, also lead to a greater consumption of resources and a negative impact on the environment. By using Leonardo da Vinci's innovative concepts, the work proposes a revolutionary approach to woodworking, bringing significant benefits to both manufacturers and the environment.

Developed around hydraulic principles, the work aims to create an innovative chainsaw that generates and controls movement and force using advanced hydraulic systems. In addition, a damping system will be applied to ensure component protection and reduce noise, thus enhancing the reliability and efficiency of the device. With the help of a refined architecture and a compact design, the hydraulic chainsaw will be easy to handle and integrate into any working environment. This modern adaptation of Leonardo da Vinci's concepts materializes into an efficient and safe device, thus revolutionizing the woodworking industry (Bedini, 2007).

MATERIAL AND METHOD

The hydraulic sawmill is an extremely efficient and versatile machine used in the woodworking industry to cut logs into boards and beams of various sizes. It is based on the ingenious and innovative principles of hydraulics, successfully using the energy generated by moving fluids to provide considerable power in the cutting process.

One of the most impressive features of the hydraulic chainsaw is its outstanding efficiency. Due to the hydraulic principles used, it significantly reduces the physical effort required in the cutting process. Thus, work becomes easier and less tiring.

Another important feature of the hydraulic chainsaw is its adaptability. It can cut wood of various sizes and shapes, being able to adjust quickly and precisely according to the specific needs of the user.

Whether it is cutting thin boards for construction or massive beams for complex structures, the hydraulic saw always lives up to expectations (Barnes, 2004).

Figure 1 **Model of the hydraulic sawmill**

The importance of the hydraulic chainsaw da Vinci's hydraulic sawmill is significant for several reasons: it is an ingenious invention that demonstrates a deep understanding of mechanical and hydraulic principles; is a powerful and precise machine that allows wood to be cut much more efficiently than previous methods.; has a significant impact on the forestry industry and contributes to increased productivity and efficiency; plays an important role in the development of other hydraulic machines; continues to influence car design to this day (slideshare.net/slideshow/leonardo-da-vinci-138419523/138419523, 2024).

RESULTS AND DISSCUSIONS

The stages of hydraulic sawmill design include the following main activities. In the first stage, a detailed and exhaustive analysis of the requirements and specifications of the project is required (Ganea, 2010, Jain, 1989).

In the next stage, a rigorous and systematic selection of the components that will be part of the hydraulic sawmill system is carried out. Every possibility is analyzed and evaluated to ensure an effective integration and harmonious design of the system components. The importance of this step is crucial because the components must work in perfect sync and deliver superior performance (e-periodica.ch, 2024).

In the detailed design stage, a precise calculation and dimensioning of each individual component is carried out. Their mechanical, hydraulic and structural aspects are analyzed and evaluated to ensure that they will function in optimal parameters and that they will be durable over time.

All of these steps are essential to making an efficient and functional hydraulic sawmill project. Based on the innovative concepts of Leonardo da Vinci, the work represented a perfect combination of tradition and innovation, between technology and art. The resulting hydraulic chainsaw was not only an outstanding technical achievement, but also a work of art in itself, due to the attention to detail and professionalism involved in the design and construction process (Ganea, 2010).

In fig. 2 and 3 show the model of the hydraulic sawmill in 3D format (Derecichei. et al., 2013, Derecichei et al., 2017, Derecichei et al., 2018, Lucaci, et al., 2013, Lucaci, et al., 2016).

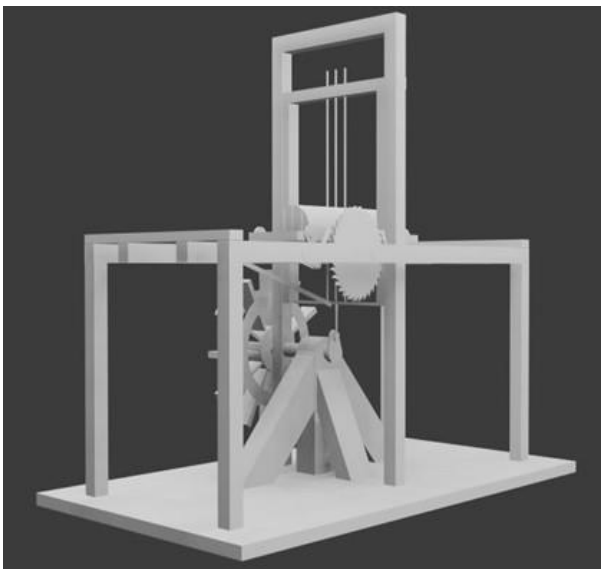

Figure 2 **Hydraulic chainsaw side view a.**

The calculation and dimensioning of the components is taken into account. This revolutionary project is based on the innovative concepts of Leonardo da Vinci, and our goal is to guarantee the perfect and safe operation of this hydraulic saw (Derecichei, 2020, Derecichei, 2019).

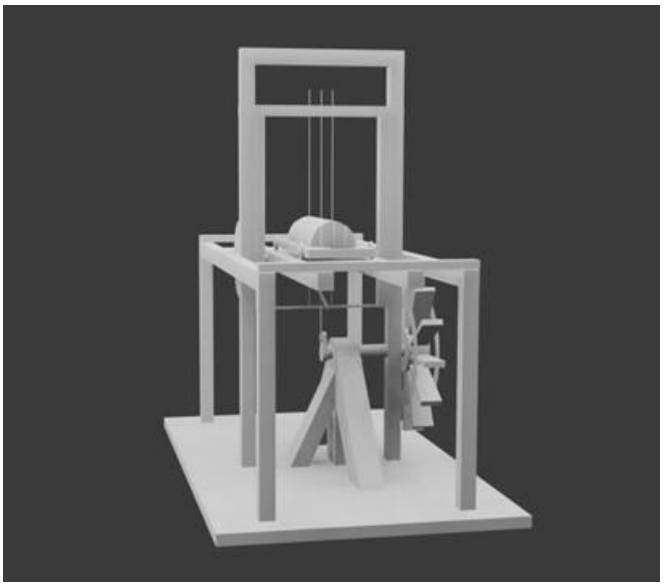

Figure 3 **Hydraulic sawmill side view b.**

The technological process of executing the hydraulic sawmill represents the final stage of the project, where all the components and assemblies necessary for its optimal operation will be made (Derecichei, 2013, Derecichei L. et al., 2014, Derecichei et al., 2015).

Each component must be assembled with great precision and care. The use of the best quality materials to ensure the durability and strength of the hydraulic saw is crucial in this process.

Planning and organizing the work is an essential stage in the construction of the hydraulic sawmill. Planning establishes the stages of execution, determines the time and resources required for each activity, as well as the order in which they will be carried out. Also, a detailed execution schedule is created to help follow-up and coordinate the works meticulously, considering that every detail counts in the construction process. Accurate calculations and sizing are carried out for each component (Derecichei, 2019).

Table 1

Log support table (A)

Nr. Crt.	Material	Size (cm)	Piece
1.	Wooden cabinets	3 x 100 x 5	2
2.	Wooden cabinets	2 x 35 x 5	2
3.	Wooden wheel	ϕ 4	4
4.	Wooden rod	ϕ 4x6	4
5.	Screw		8

Table 2

Consume norm for the benchmark – Table (D)

Nr. Crt.	Material	Size (cm)	Piece
1.	Board	20 x 100 x 2	2
2.	Board	10 x 100 x 2	1
3.	Board	4 x 100 x 2	2
4.	Board	4 x 46 x 2	2
5.	Screw	4 x 50	18

Choosing the wood material for the construction of a hydraulic sawmill is an essential process that requires a careful evaluation of the different types of wood available, their properties and how they fit the requirements of the project. Here is a detailed description of the procedure for choosing wood material (tehno-design.ro,2024).

The execution, assembly and assembly of the components is a crucial stage in the construction of the hydraulic sawmill. At this stage, all the designed components will be manufactured according to the chosen specifications and technologies, and then they will be assembled to make the final structure of the sawmill. Assembly and assembly presupposes compliance with the assembly order and index, the use of appropriate tools and equipment in order to carry out the project. It is extremely important that assembly and assembly are carried out with care and precision, to avoid possible errors or malfunctions that could affect the operation of the hydraulic saw.

Figure 4 **Assembling (wood processing company)**

Figure 5 **Assembling the component elements with screws (wood processing company)**

The steps that must be taken to make the saw are: splitting, cutting, planing, milling, drilling, hollowing, finishing (Derecichei, 2020).

The role of wood finishing: esthetic; surface protection; economic; replacing some valuable species with common species; giving a new look to wood products and wood-based materials; increasing the duration of use of finished wooden products; ecological - it is necessary to green the finishing technologies by reducing the noxes.

The frame assembly is the foundation of the entire structure of the hydraulic sawmill, ensuring the stability and support required for all other components. The process involves several detailed steps, each of which is crucial to the success of the project.

The following are the steps for mounting the frame: construction of the base; fixing the components. Adhesive has been applied to all contact surfaces to ensure a solid and durable bond. Nails were used to temporarily secure the pieces until the glue dried.

Fixing the axles, mounting the axles, mounting the hydraulic wheel, building the wheel; fixing the spokes; fixing the wheel: mounting on the axle; such as functionality check: several test rotations were performed to check the correct operation of the wheel and to ensure that there is no friction or obstruction.

CONCLUSIONS

Building a working model of a hydraulic saw inspired by the innovations of Leonardo da Vinci involved a complex and detailed process, from planning and design to the choice of materials and final assembly. As a result of this project, the following conclusions were drawn:

The importance of planning and technical details: accurate technical drawings are essential: the creation of detailed technical sketches and drawings allowed visualization

and planning for each stage of construction. All components have been correctly sized and positioned, preventing costly errors and saving time.

Choosing the right materials:
Pine wood was chosen for the core structure, providing the durability and strength needed to support the entire layout.

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