



DESIGN OF AN ENERGY-EFFICIENT CONSTRUCTION OF A WOOL WASHING BATH

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Аннотация:

Ushbu maqolada junni yuvish texnologiyasi uchun energiya tejamkor vannaning yangi konstruksiyasi ishlab chiqilgan. Taklif etilgan yechimda harakatlanuvchi detallarning soni va og'irligi kamaytirilgan, bu esa energiya sarfini kamaytirishga xizmat qiladi. Kompas-3D dasturida vannaning 3D modeli va konstruksiya sxemalari yaratilgan hamda ularning samaradorligi tahlil qilindi. Natijalar shuni ko'rsatdiki, yangi konstruksiya mavjud turlarga nisbatan energiya tejamkorlik ko'rsatkichini 18–22 % gacha oshiradi.

Аннотация:

В данной статье разработана новая энергосберегающая конструкция ванны для мойки шерсти. В предложенном решении уменьшено количество и масса подвижных деталей, что способствует снижению энергопотребления. В программе Kompas-3D создана 3D-модель ванны и конструктивные схемы, проведён анализ их эффективности. Результаты показали, что новая конструкция повышает энергоэффективность на 18–22 % по сравнению с существующими аналогами.

Abstract:

This article presents the design of a new energy-efficient construction of a wool washing bath. The proposed solution reduces the number and weight of moving parts, resulting in decreased energy consumption. A 3D model and construction schemes were developed using Kompas-3D software, and their performance was analyzed. The results demonstrate that the new design improves energy efficiency by 18–22% compared to existing types.

Kalit so'zlar: Jun yuvish, energiya tejamkorlik, mexanizm, konstruksiya.

Ключевые слова: Мойка шерсти, энергоэффективность, механизм, конструкция.

Key words: Wool washing, energy efficiency, mechanism, construction.

Introduction

Wool washing is one of the most important technological stages in textile processing. The efficiency of this process largely depends on the design of the washing bath and the mechanisms that provide continuous movement and cleaning of the wool. Traditional washing baths often contain a large number of moving elements, which increases the total mass of the system and energy consumption.

In the context of modern industrial requirements, improving the energy efficiency of equipment has become an urgent task. Therefore, the development of a simplified, lightweight, and efficient bath construction is an important step toward reducing production costs and increasing process sustainability.

The main goal of this research is to design an energy-efficient wool washing bath by reducing the number and weight of moving parts while maintaining the required washing quality.

Literature Review

Wool fibers are washed to remove fats, sweat, and plant and mineral waste. The essence of washing is that the washing solution must pass between the layers of dirty wool and over the fibers, wetting it.

Unwashed wool fibers consist of fat, sweat, moisture, and various contaminants. The amount of contamination ranges from 40% to 70% and depends on the age, sex and breed of sheep, land and climatic conditions, their feeding regime and conditions. Therefore, the processing mode of different types of wool fibers is different. The higher the degree of contamination, the more difficult it is to clean it.

The washing regime, the number of barrels required for washing, the amount of soap, soda, and other chemical agents in each barrel, the direction of the liquid and the procedure for delivering the solution to the barrel, the pressure of the clamping rollers, and the periodicity of cleaning are determined.

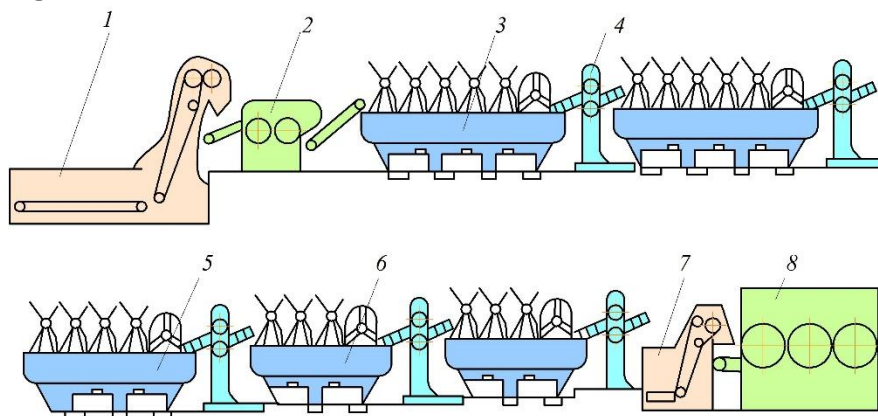


Figure 1. Wool washing unit.

Wool fibers are washed in hot water solutions using soap-soda or synthetic detergents.

Washing of wool fibers is carried out in wool washing machines, which are part of the wool washing unit.

The wool washing unit (Fig. 1) is a continuously operating device, consisting of an automatic feeder 1 for unwashed wool fibers, a scouring machine 2, several vats 3, 5, 6, and squeezing rollers 4 after each vat, as well as a washing machine with an automatic feeder 7 and a drying machine 8.

The unit's productivity is 750-1000 kg/hour. Wool fiber yield is 40-65%.

Research Methodology

Types of washing machines are widely available and differ mainly in their overall dimensions and the structure of their drive mechanisms. Currently, examples of foreign wool washing machines include the MP-5Sh, "Charpentier," "Petrie McNaught," "Textima," and BS-2A brands. They come in drum and sequential boiler designs.

The MP-5Sh machine consists of the following main parts: a conveyor 1 for loading raw materials into the boiler, a moistening device 2, a fixed fork 3, a movable fork 4, a boiler body 5, forks 6 for removing raw materials from the boiler, cones 7 forming the lower part, and a mesh bottom 8. Additionally, auxiliary mechanisms are available: a valve for discharging impurities, a wastewater tank, and a steam extraction pump.

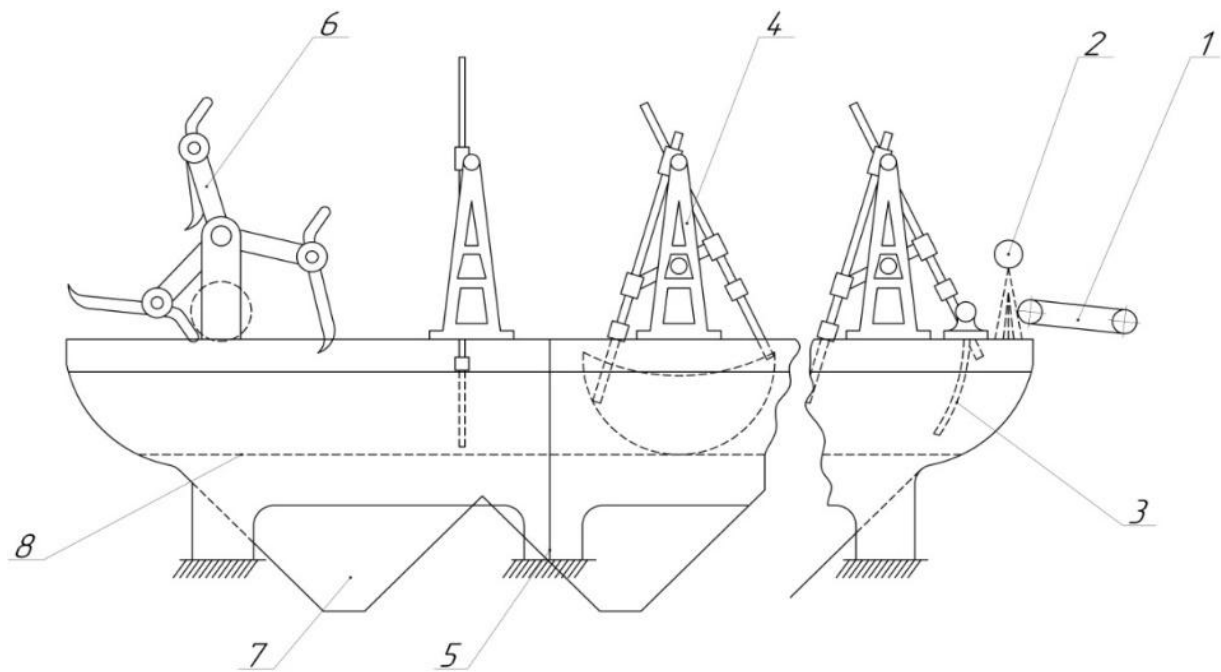


Figure 2. MP-5Sh Fork Washing Boiler

1-conveyor for unloading raw materials into the boiler; 2-moistening device;

3-fixed pitchfork; 4-movable paired pitchforks; 5-boiler body; 6-forks for removing raw materials from the boiler; 7-cones forming the lower part (wastewater tank); Grid bottom 8

Due to the large number of moving parts in this device, which we considered above, 3 electric motors were used to move them all. As can be seen, one of the main drawbacks of this device is its high energy consumption. Therefore, research was conducted to solve this problem, and an energy-saving design was developed.

Analysis and Results

When designing the proposed device, great attention was paid to reducing the number of moving parts. In this case, instead of the forks used for moving wool along the washing bath, a spiked mechanism was used. With the help of only one of the three electric motors used in the old-style mechanism, it was possible to move the parts of the newly created structure.

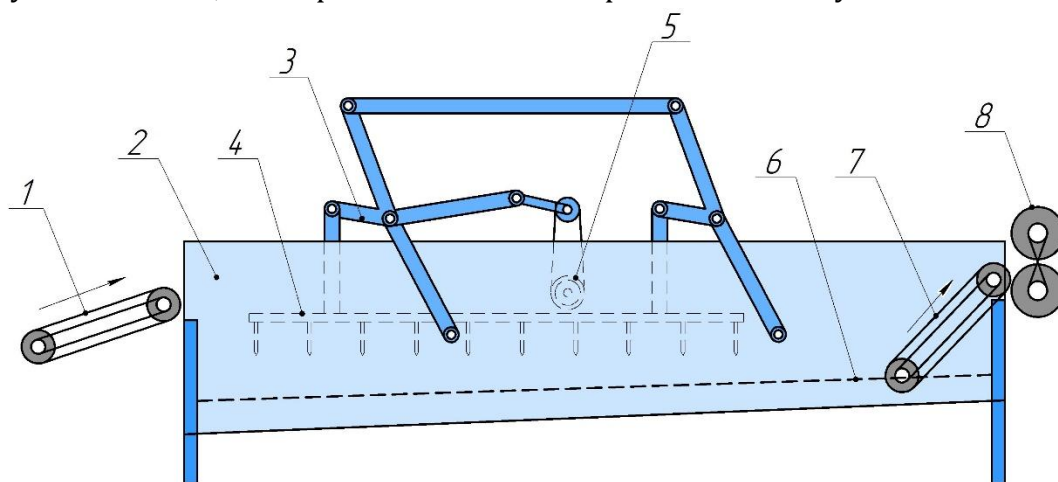


Figure 3. Proposed wool washing device.

1-feeding mechanism, 2-washing bath, 3-two-joint lever, 4-spikes, 5-electric motor, 6-slot, 7-discharge mechanism, 8-clamping rollers.

In this device (Fig. 3), there are 2 vessels or baths, which form the body or frame of the device and contain the washing liquid. Unwashed wool is fed into the container through the

feed conveyor (1), which is usually driven by belt or gear transmissions. When wool falls from the feeding conveyor into the container, a frame with pegs holds the wool, immerses it in the washing liquid, and moves it forward, towards the outlet conveyor (7).

Conclusion and Recommendations

The research confirms that reducing the number and weight of moving parts in a wool washing bath leads to considerable energy savings without compromising washing efficiency. The proposed energy-efficient construction is suitable for industrial applications and can be adapted to automated control systems.

Future studies will focus on integrating a feedback-based motion control system and evaluating the thermal energy reuse possibilities within the washing process.

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