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Определение параметров трепальной машины для очистки шерстяных волокон

Ф.Б. Исмойилов, М.Х. Гаппарова, И.Ж. Кучкелдиев

Бухарский инженерно-технологический институт, Бухара, Узбекистан

Аннотация. В статье представлена информация о технологии первичной обработки шерсти. Изучены механизмы машин для производства шерсти и выявлены их конструктивные недостатки. Проанализированы конструкции и размеры колкового барабана. Были изучены конструкции рыхлительных (трепальных) машин, используемых в процессе разрыхления сырья. Проанализированы типы и принципы работы трепальных машин, работающих на предприятиях первичной переработки шерсти. Приведены технические характеристики машин. Отмечены негативные аспекты деталей механического воздействия на изделие. Объясняются дефекты трепальных машин и их влияние на сырьё. Предложена новая конструкция и принцип действия трепальной машины для получения высококачественных изделий. Расчетные характеристики машины обеспечивают высокую производительность, эффективное конструктивное исполнение и воздействие на продукт, низкое энергопотребление, энергоэффективность и эффективное рыхление. В этой машине подбирается оптимальный вариант технологических деталей, которые положительно влияют на естественные характеристики продукта.

Ключевые слова: шерстяное сырье, волокно, процесс разрыхления, загрязнение, очистка, хранение, сортировка, пух, прядение, ролик, решетка.

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Determination of parameters of a trepanning machine for cleaning wool fibers

F.B. Ismoyilov, M.H. Gapparova, I.J. Kuchkeldiev

Bukhara Engineering Technological Institute, Bukhara, Uzbekistan

Abstract. This article provides information about the technology of primary processing of wool and the feeding part of the baking machine. It analyzes the operating principle and types of baking machines at the enterprise of primary processing of wool. The disadvantages of baking machines affecting the

product are considered. The principle of work and the design of new baking machines for the manufacture of quality products are proposed. The article provides information about the technology of primary processing of wool. Studied the mechanisms of machines for the production of wool and identified their design flaws. The designs and sizes of the pegs of the peg drum are analyzed. The designs of the loosening machines used in the loosening process were studied. The types and principles of baking machines working at the enterprises of primary processing of wool are analyzed. The technical characteristics of the machines are given. The negative aspects of the details of the mechanical impact on the product are noted. Defects of baking machines and their effect on the product are explained. The design and operational principle of a new spraying machine for the preparation of high-quality products is proposed. The proposed characteristics of the machine have high performance, structural design, impact on the product, low energy consumption, energy efficiency and effective loosening. In this machine, the optimal version of parts that have a positive effect on the natural characteristics of the product is selected.

Keywords: wool raw materials, fiber, loosening process, pollution, cleaning, storage, sorting, fluff, spinning, roller, grate.

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INTRODUCTION

At the present time there is a development in the field of textiles and processing of wool raw materials. Technology processing of wool raw materials was developed before our era, it continues to the present time. Two main factors in the processing of raw wool: technology and high-quality wool raw materials. From past centuries to the present, the improvement of wool processing technology and the improvement of wool quality continues.

For the production of industrial wool raw materials, scientists have developed a breed of sheep with soft wool. At the same time, wool processing enterprises are being modernized and improved. The varieties of wool in the world vary depending on the climate of the region and the breed of sheep wool. The main indicators of wool appear in its fineness [1].

The process of preprocessing includes the acceptance of wool by quantity and quality, sorting and washing.

All natural sheep wool is divided into thin, semi-thin, semi-coarse and coarse. For the acceptance of wool in quality, a control classification is made with the sampling of wool for laboratory tests. Not all wool is subjected to the control classification, but only 10–20%; the results obtained apply to the entire incoming batch of raw materials.

Industrial sorting of wool is carried out manually on conveyor lines by separating the runes into separate parts, representing certain varieties with different physico-mechanical and

technological properties of the fiber (fineness, length, strength, condition, color). In the sorting process, wool production assortments are formed for subsequent preprocessing and spinning. The technology of wool primary processing is shown in the following figure (Figure 1).

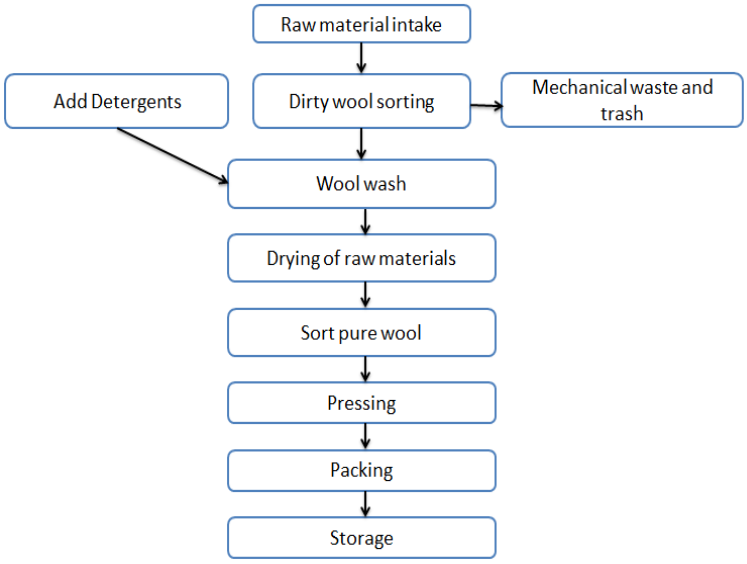


Figure 1. Technological scheme of wool processing.

In the production of primary processing of wool raw materials are taken into account the general indicators of raw materials. Separate technological processes for thin and coarse wool are selected. Each machine in the processing system processes the product and prepares the raw materials for the process of further processing. There are so many different types of wool loosening machines. Loosening machines used in the world differ in their structural structure and work efficiency. During the primary processing of wool, loosening machines are of great importance. The loosening machine is designed to loosen and clean 25-35% of wool contamination. If the woolen material is well loosened, it will be effective when washing the wool. As a result of mechanical action, the wool is loosened and cleaned. Here we must pay attention to the grade of wool. Otherwise, the mechanical effect on the raw material damages its natural properties. As a result, poor quality wool cannot be used in the spinning industry.

Partially loosened wool delivers wool to the lashing machine. The structure of the rollers can be grooved, smooth.

The power device of the scutching machine consists of a power grid and feed rollers. Feeder grids are made of wooden or metal strips attached to the belts or interconnected by rings and forming an endless canvas, worn on rollers. Feeding rollers take a layer of wool from the supply grid and clamp, hold it when exposed to drum spikes, thus contributing to loosening.

MATERIALS AND METHODS

There are several types of power devices. The most common device, consisting of two pairs of feed rollers (Figure 2, a): the first pair of corrugated rollers, the second - the upper roller corrugated, and the bottom smooth. The diameter of the rollers 100-150 mm. Both pairs receive a load to strengthen the clamping of the fibers. The speed of the second pair is 12-15% higher than the speed of the first pair, which ensures stretching of the tufts of wool. The grooved surface of the rollers contributes to a better clamping and holding of the fibers, and a smooth surface reduces the possibility of winding wool.

The device, consisting of one pair of feed rollers (Figure 2, b), is not different in operation from the previous one, but there is no pulling away of the tufts of wool. If there is insufficient clamping of the fibers, the drum splittings can snatch whole unshriven tufts of wool from the clamp.

One of the most common is the device, consisting of feeding rollers with curved teeth (Figure 2, c) - the teeth are bent in the direction opposite to the direction of rotation of the roller. Such a feeding pair reliably holds the wool layer until it is fully loosened; while the drum pegs loosen the front of the shreds, their back is in the roller clamp or loosened when the feed rollers are pulled out of the clamp by the teeth. Upper roller has a spring load. The diameter of the rollers 150-250 mm. In the process, the upper roller is cleared of wool with drum heads; On the lower roller, shreds of wool are placed on when the drum heads hit, therefore a special cleaning roller is installed to clean it, although this does not exclude the possibility of winding long wool on the lower roller.

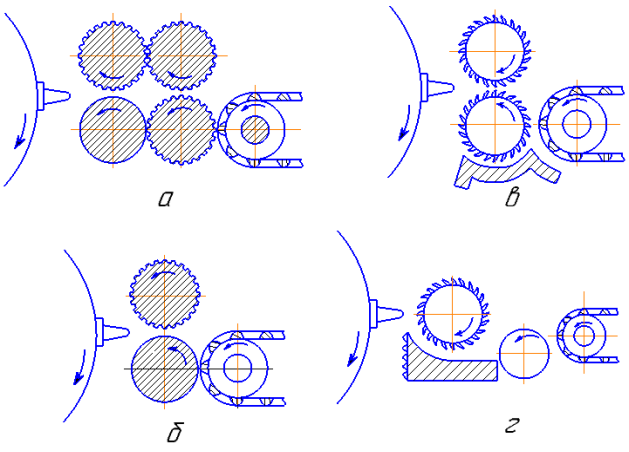


Figure 2. Types of power supply devices for scutching machines.

The desire to eliminate the winding of wool led to the creation of a feeding device with one (upper) feeding roller, where the lower roller was replaced by a fixed table (Figure 2, d). Part of the table has a concave shape and covers the roller teeth, thereby creating a good fiber clamp. The front part of the table is located obliquely and has holes through which a part of heavy mineral impurities falls out. Directly to the table adjoins the grate. This system eliminates the possibility of winding wool [2].

In all feeding devices, the bearings of the upper rollers lie in the guides and can move in the vertical direction. With the passage of a thick layer of wool, they rise, and then fall into place. All upper rollers are pressed to the bottom spring or lever-loading devices. The magnitude of the load is selected depending on the type of wool being processed: ragged and felted wool requires a stronger clamp.

The working surfaces of the feed rollers must be smooth and free of nicks and burrs that may cause the winding of the wool. Rollers should be cleaned regularly from adhering dirt.

On the drums of loosening wool, various forms of pegs are used. The effect of spikes on wool is different, they are used depending on the types of machines and types of products.

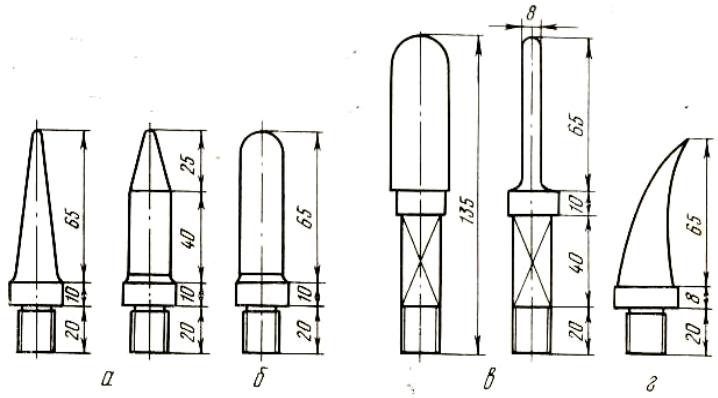


Figure 3. Forms of drums spinning machines.

Headset working bodies of scutching machines. The shape of the pegs, their size and frequency of placement on the drum affect the results of loosening and scutching, as well as the preservation of the fibers during this treatment. The shape of the pegs is chosen taking into account the absolute breaking load of wool fibers of various fineness and the degree of pileiness (density) of the tufts. The shape of the pegs are straight (cylindrical, conical, faceted) and curved.

Straight conic and cylindrical pegs (Figure 3, a and b) penetrate well into the mass of wool and easily leave it. The blow is applied to the streamlined surface of the pegs, and they do

not tear the fiber. Spikes of this shape are recommended to use for thinner and semi-thin wool, less ragged and having a smaller breaking load.

Straight cut pegs (Figure 3, c) have a rectangular cross-sectional shape and rounded edges of the faces, which reduces the shrinking ability of the peg. The working side of the spike is narrow, so it easily penetrates into the dense mass of wool, cutting it like a knife. Faceted splitting has a stronger effect on the fiber than conical and cylindrical, therefore, when pulling the felted tufts of wool, there is a breakage and destruction of the fibers. Faceted kolkovaya headset can be recommended for the treatment of semi-coarse and coarse ragged and felted wool, having a greater breaking load than thin wool.

Curved pegs (Figure 3, d) are used in the development of heavily felted wool. They have a round or oval cross-section and a pointed top. With the help of curved pegs, the landfills and felted runes, which were separated during sorting, are broken and pulled apart. This operation is accompanied by a massive fiber break, so the wool obtained from landfills has a significantly smaller average fiber length.

The surface of the spike, regardless of its shape, must be smooth, without burrs, so that the wool does not linger and easily leaves the pegs. On the drum, pegs are arranged in rows along its line, at a certain distance from each other, and in the planks they are fixed with a thread or pressed in a hot condition.

RESULTS

The process of loosening is as follows.

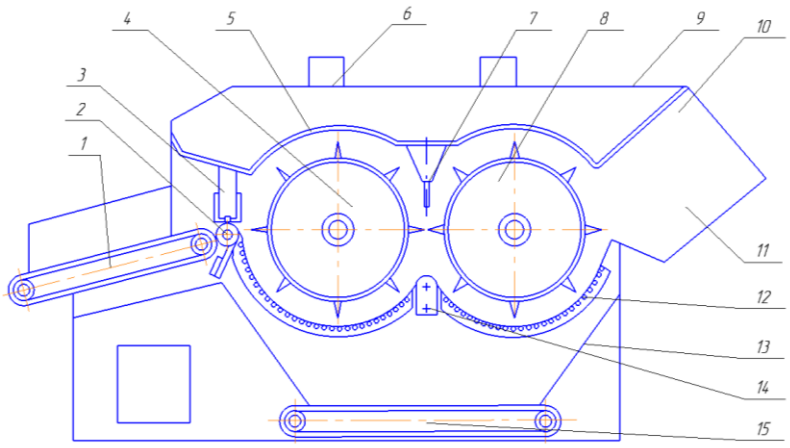


Figure 4. Breaking machine 2БТ-150-Ш.

After sorting the wool, the auto feeder AGSh-1 will be loaded into the bunker. The auto feeder sends wool to a loosening and tinder machine 2BT-150-Ш.

The double-drum scutching machine 2BT-150-Ш differs from the 2BT machines produced earlier by a larger working width and productivity.

In addition, it has a number of improvements that improve the process of scutching.

The scutching process on a 2BT-150-Ш car is carried out as follows. The auto feeder spreads the unwashed wool in a uniform layer on the nutrient grid 1 (Figure 4), moving at a speed of 0.067–0.133 m / s. The feeding rollers 2 (upper - corrugated, lower - smooth) capture the wool and feed it to the tipping chamber. The clamp in the supply pair is created by two springs 3 and reaches 1.75 kN. The upper roller rotates faster than the lower one, which ensures the straightening and shearing of the tufts of wool.

The first kolkuyu drum 4 has eight calyx and rotates at a speed of 12.5 m / s, the second drum 8 - at a speed of 14.3 m / s. The first drum hits the shreds of wool sandwiched in the feed rollers, loosens them into small shreds and drops them onto the grate 12 below it, and then pulls it along the grate. When this wool is additionally shaken and loosened, some impurities are separated from the wool and falls through the holes of the grate into the hopper 13, and then using the conveyor 15 is removed from the machine.

Further, the shreds of wool carried by the first drum's spikes are brought to the second drum's spikes, picked up by this drum, hit the prism 14, and again dragged along the grate to the outlet 11. The loosened and partially cleaned wool is ejected into the exit hole by centrifugal force. discharge conveyor. The visor 10 dampens the speed of the flying wool and changes the trajectory of its flight.

During the transition from the first drum to the second, separate shreds of wool can be held back by fixed pegs 7, which interact with the pegs of the second drum and additionally loosen the wool.

Above the reels is a perforated partition 5, and on top of the machine is covered with a casing 9. In the casing there are two nozzles 6 through which dusty air is drawn off from the machine [3].

This loosening machine is obsolete, therefore it has shortcomings including: during mechanical action of spikes on wool fiber, as a result of which wool wool is interrupted; The result is mechanical damage to the coat.

The design of various kolkovye drums and work efficiency is as follows.

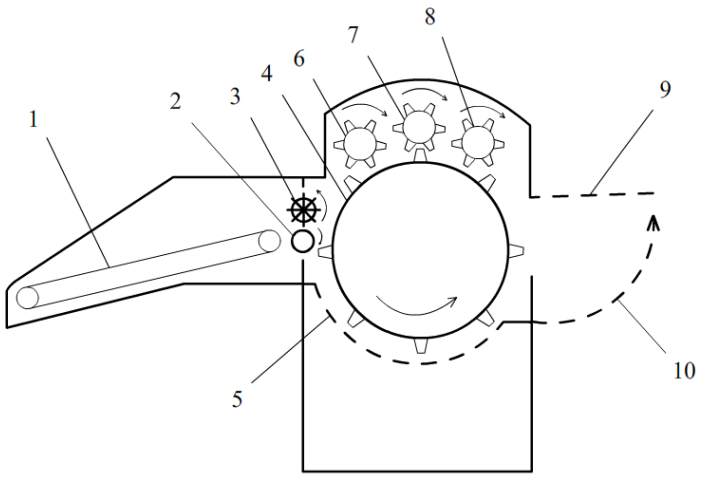
Treping machines of different designs have drums with 4, 8, 12, 16 and 24 rows of pegs. Completeness of loosening is characterized by the number of beats of the pegs, which receives 1 kg of unwashed wool when passing through a scutching machine:

$$P_к = (\kappa_1 m_1 n_{б_1} + \kappa_2 m_2 n_{б_2}) / \upsilon_{П.р} bq$$

where Pк - the fullness of loosening (the number of strokes); к1, к2 - the number of rows of pegs on the drum; m1, m2 - the number of pegs in the same row; nб1, nб2- drum rotation frequency, s^(-1); - the speed of the supply grid, m/s; b - width of the supply grid, м; q - is the mass of the wool flooring per 1 m2 of the supply grid, kg [4].

Various machines are widely used in the world for loosening and cleaning wool. The principle of loosening and cleaning wool is as follows (Figure 5).

The disadvantage of this machine is that the bulk of the well, nerazrytylennaya, not purified wool raw material leaves the machine. Designed on the machine mesh surface 5 for cleansing wool from impurities. If, instead of a grid surface, the grate is designed, then contamination is quickly released [5].



1 - feeding tape; 2, 3 – rollers; 3 - pointed roller; 4 - pointed drum; 5 - mesh surface; 6, 7, 8 - small drums; 9 – blades; 10 - angle louver.

Figure 5. Fearnought wool opener.

DISCUSSION AND CONCLUSION

A new loosening machine is recommended for good cleaning and loosening of wool raw materials (Figure 6). This machine is designed to separate the maximum number of shreds of wool in the fiber and to clean the dirt.

In order to increase the degree of loosening of wool, increase the degree of parallelization of fibers and increase the cleaning effect, an improved threading machine has been developed [6].

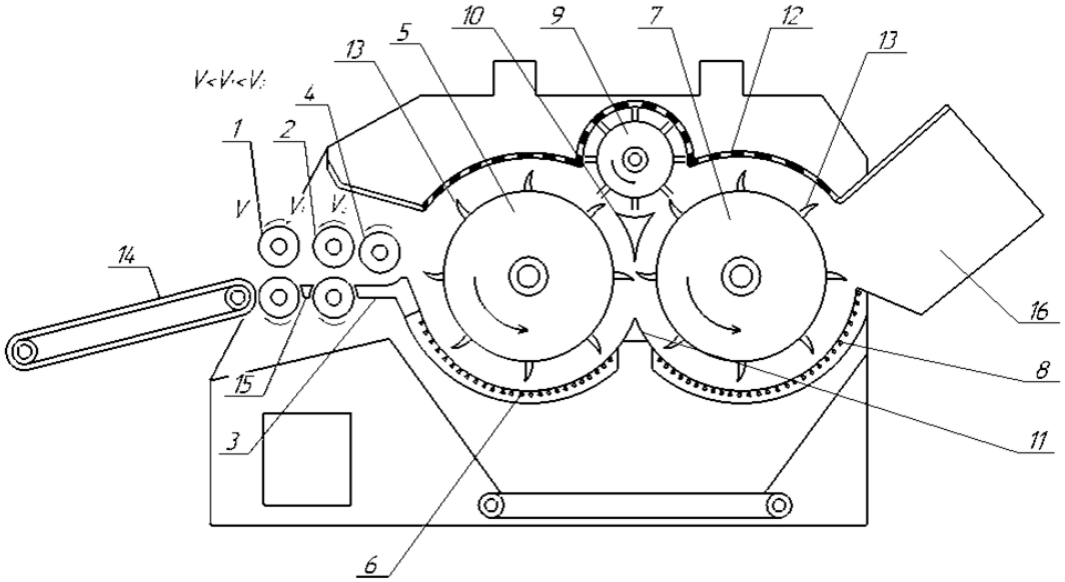


Figure 6. New Loosening Machine.

Achieving a reduction in the thickness of the wool fiber layer in corrugated rolls, forced transfer of the processed material from one drum to another, increases the parallelization of fibers and the degree of purification of wool from foreign impurities [7].

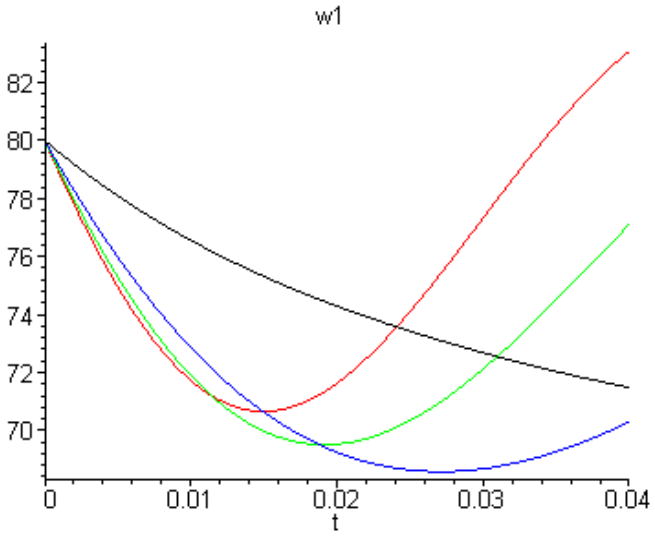


Figure 7. Shred speed dependencies: $\dot{\theta} = w1$ (sec^{-1})on the lattice surface from time at different values of the natural oscillation frequency $\omega_* = \sqrt{k/m}$:black $\omega_{,б} = 40sec^{-1}$,blue $\omega_{,б} = 60sec^{-1}$, green $\omega_{,б} = 80sec^{-1}$, red $\omega_{,б} = 100sec^{-1}$.

Figure7 shows the curves of the dependence of the angular velocity of the shred at different frequency values ω_*, the comparison of which with k with the curves presented shows their practical coincidence at large values of the rotation speed of the grate. Thus, to construct the law of motion of a piece θ(t) the analytical dependence can be sufficiently used on the surface of the bell grating (3.4).

The effectiveness of fluttering is assessed by the degree of loosening of wool, a decrease in the mass of shreds, losses when cleaning wool from weed impurities and the degree of shortening of fibers.

To determine these indicators, comparative experimental studies were conducted using the methodology developed in the work.

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ИНФОРМАЦИЯ ОБ АВТОРАХ / INFORMATION ABOUT THE AUTHORS

Исмойилов Ф.Б., Бухарский инженерно-технологический институт, Бухара, Узбекистан
e-mail: ismoyilov.furqat@mail.ru

Ismoyilov F.B., Bukhara Engineering Technological Institute, Bukhara, Uzbekistan
e-mail: ismoyilov.furqat@mail.ru

Гаппарова М.Х., Бухарский инженерно-технологический институт, Бухара, Узбекистан

Кучкелдиев И.Ж., Бухарский инженерно-технологический институт, Бухара, Узбекистан

Gapparova M.H., Bukhara Engineering Technological Institute, Bukhara, Uzbekistan

Kuchkeldiev I.J., Bukhara Engineering Technological Institute, Bukhara, Uzbekistan

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