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ИНТЕНСИФИКАЦИЯ ЭФФЕКТИВНОСТИ РУБИЛЬНЫХ МАШИН ПРИ ПЕРЕРАБОТКЕ ДРЕВЕСИНЫ

INTENSIFICATION INCREASE EFFECTIVENESS CHIPPER AT RECYCLABLE WOOD

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Аннотация:

Рассмотрение и оценка проектных решений, реализованных в механизмах для дробления материалов, в частности, древесины. Анализ ориентирован на выявление ключевых элементов конструкции и их влияния на эффективность и функциональность оборудования. Исследуются различные типы рубильных машин, акцентируя внимание на принципах их работы и применяемых технологиях.

Abstract: Consideration the assessment design of decisions, implemented at mechanisms for crushing materials, at particular, wood. Analysis oriented on revealing key elements constructions the their influences on efficiency the functionality equipment. Are being investigated various types рубильных of cars, emphasizing attention on principles their work the applied technology.

Ключевые слова: топливная щепа, рубильные машины, привод рубильных машин

Keywords: energy plantations, fuel wood chips, chipper, chipper drive, In recent years, the issue of efficient use of forest resources has become increasingly important in the forestry industry. The solution is seen in the introduction of low-waste and non-waste technologies for harvesting and processing wood. One of the key areas of development of the forestry and woodworking industries in this context is the processing of wood production waste and low-grade wood into technological chips. This approach helps to increase the volume of available commercial timber, preserves forest areas, reduces the cost of reforestation and logging, and also increases the yield of wood per unit forest area by 25-30% [1].

chipper drive.

In many countries of the world, energy based on plant and wood biomass is becoming cost-effective and competitive compared to fossil fuel energy. Given the peculiarities of vegetation in our region, this method is particularly promising for the development of bioenergy, due to the presence of significant reserves of industrial forest, flat terrain, developed infrastructure for energy and heat distribution, modern energy and general engineering enterprises, as well as a high level of technical training of the population.

Chopping machines are an important element of the fuel chip production process. There is a wide range of chopping machines that vary significantly in their design. Among the equipment used in the production of fuel chips, the chopping machine is one of the most energy-intensive, complex and expensive units [1].

Depending on the type of working body, chopping machines are classified into several types: disc (with a flat or helical disk and radially arranged knives), drum (with a cylindrical or conical drum and knives on the outer surface), screw (with a conical screw knife) and roller (with two shafts as working bodies). The variety of wood shredder designs is due to the wide range of models used to produce wood chips. Among the equipment involved in the technological chain of chip production, the chopping machine stands out as the most energy-intensive, complex in design and expensive.

The classification of chopping machines is based on the type of working body. Disc grinders are distinguished, where the working body is a flat or profiled disk with radially fixed knives or cutters; drum machines equipped with a drum (cylindrical or conical shape) with knives or cutters located on the outer surface; screw (screw) machines having a conical screw knife as a working body; and roller machines, the working body of which consists of two shafts.

Disk chopping machines are characterized by high productivity and the ability to process wood of various types and diameters. The design of the disc machines makes it possible to obtain chips with sufficiently uniform dimensions, which is important for further use in technological processes, for example, in the pulp and paper industry. The chip size is adjusted by changing the feed rate of the wood and the number of knives on the disc.

Drum chopping machines are used mainly for processing large-sized wood and woodworking waste. The drum design ensures a more stable and uniform supply of material to the knives, which allows for high productivity when processing thick logs. However, drum machines, as a rule, require a more powerful drive by compared to disk drives, which affects energy consumption.

Unlike disk choppers, drum choppers form chips with less stable geometric parameters. This is due to the fact that the cutting tool in drum choppers, as a rule, performs a complex movement that does not lie in the same plane. In addition, the feed of raw materials into the cutting area is often carried out at different angles,

which leads to a change in the angle of the chip cut depending on the size and shape of the processed material.

The instability of the geometric dimensions of wood chips produced on drum chippers can lead to a number of problems in the pulp and paper industry. Firstly, such chips are more difficult to sort, which increases the amount of waste and reduces the yield of finished products. Secondly, the uneven size of the chips can negatively affect the pulp cooking process, leading to a decrease in its quality and an increase in the consumption of chemicals. Thirdly, chips with unstable geometric parameters can create problems during transportation and storage, for example, increase the risk of spontaneous combustion.

Modern developments are aimed at improving the design of drum chopping machines in order to increase the stability of the geometric dimensions of the chips produced [2]. This is achieved by optimizing the trajectory of the cutting tool, improving the feed system for raw materials and introducing automated systems for monitoring and controlling the grinding process.

For a more complete understanding of the advantages of drum choppers, it is necessary to take into account the environmental aspect. Efficient processing of wood waste with their help helps to reduce the amount of waste sent to landfills and reduce the negative impact on the environment. The resulting wood chips can be used as biofuels, for the production of paper, chipboard and other materials, which contributes to sustainable resource management and the transition to a closed-loop economy.

In addition, modern drum chopping machines are characterized by increased operational safety [3]. They are equipped with automatic stop systems in case of emergency situations, protective covers and other elements that prevent injury to personnel. The ergonomic arrangement of controls and controls facilitates the operator's work and reduces the risk of errors.

It is worth noting that the choice between a drum and a disc chopping machine depends on the specific production conditions and requirements for the

final product. If the priority is high uniformity of the chips and strict compliance with the specified dimensions, then disk machines may be preferable.

However, when high productivity, unpretentiousness to raw materials and cost-effectiveness are required, drum machines become the optimal choice.

In the future, the development of drum chippers is associated with the introduction of new materials and technologies aimed at increasing their wear resistance, energy efficiency and automation [3]. The use of modern control and monitoring systems will optimize the grinding process, reduce energy consumption and improve the quality of wood chips. This, in turn, will further expand the field of application of drum chopping machines and increase their competitiveness in the market of wood processing equipment. The size of the chips produced is also an important parameter. It depends on the settings of the chopping mechanism and can vary widely. Large-sized chips are mainly used for the production of chipboard and cellulose, while small-sized chips are used for the production of fuel briquettes and pellets [4].

Screw (screw) chopping machines, by virtue of their design, are used for crushing fine-grained wood and sawmill waste. The conical screw knife provides gradual grinding of the material, which reduces peak loads on the drive. However, the performance of screw machines is usually lower than that of disc or drum counterparts.

Roller chopping machines are specialized equipment designed for crushing bark, twigs and other waste with a high moisture content. Two rotating shafts with knives ensure efficient grinding of the material, while the machine design minimizes clogging of the working body. Roller machines are widely used in woodworking enterprises and in public utilities for the disposal of wood waste.

Depending on the type of cutting tool, chopping machines can be classified into knife and cutter machines. The advantages of cutting machines are manifested in a more uniform distribution of the load on the cutting tool and a reduction in vibration of the equipment. This is achieved through sequential rather than

simultaneous action on wood, which prolongs the life of the knives and reduces wear on bearings and other machine components. In addition, reducing dynamic loads has a positive effect on energy consumption, reducing energy costs.

The design of chiseling machines makes it possible to use woodworking waste more efficiently, since the small size of the cutters and their location ensure better grinding of materials of various shapes and sizes. This is especially important when processing branches, tops and other substandard waste, which can be difficult for knife choppers.

An important aspect is also the safety of operation of cutting machines. The smaller size of the cutting elements and their location reduce the risk of large splinters and waste being released, which reduces the likelihood of injury to maintenance personnel. In addition, the process of replacing and adjusting knives is simplified, which also has a positive effect on work safety [5].

The efficiency of the chopping machine can be significantly improved by using additional equipment such as sorting tables, magnetic separators and chip removal systems. Sorting tables allow you to separate foreign objects from raw materials, such as stones and metal, which can damage the chopping mechanism. Magnetic separators remove metal inclusions from wood chips, which improves their quality. Chip removal systems provide automatic transportation of wood chips from the chopping machine to the place of storage or further processing.

An important aspect of the efficient operation of a chopping machine is the proper organization of the technological process, including the preparation of raw materials, feeding the material into the machine, crushing, removing chips and transporting them to a place of storage or processing. It is also necessary to ensure timely maintenance of the machine and replacement of worn parts.

The correct choice, operation and maintenance of the chopping machine can improve production efficiency, reduce costs and ensure the safety of personnel.

An important aspect of the development is the improvement of cutting elements. The development of new materials and designs of knives with increased

wear resistance and cutting efficiency will increase the productivity of chopping machines and reduce energy consumption. The use of innovative technologies such as laser cutting and surface hardening also helps to increase the durability of cutting elements.

In the field of chip unloading systems, a promising direction is the development of pneumatic systems that ensure fast and efficient transportation of chips over long distances. The use of such systems makes it possible to optimize logistics at the enterprise and reduce the cost of transporting wood chips. In addition, pneumatic systems help to avoid contamination of wood chips with foreign impurities, which is especially important for enterprises producing high-quality wood chips for the pulp and paper industry.

The development of chopping machines is also associated with an increase in their environmental safety. The development of dust collection and noise reduction systems will reduce the negative impact of equipment on the environment and create more comfortable working conditions for staff. The introduction of environmentally friendly technologies, such as the use of biodegradable lubricants, also contributes to improving the environmental safety of chopping machines.

According to mobility, chopping machines are divided into mobile, self-propelled and stationary. The choice of chopping machine depends on many factors, including the type and volume of raw materials being processed, the required productivity, the available budget and operating conditions. Mobile chopping machines with diesel or electric drive are suitable for small amounts of woodworking waste. For large-scale industries processing large volumes of wood, stationary chopping complexes with high productivity and an automated material supply system are used. For mobile shredding machines designed for processing felling residues into felling, the drive of the shredding working body from a hydraulic motor is promising. In this case, dynamic loads are reduced and it becomes possible to recover the braking energy of the working body during stops, which increases the energy efficiency of mobile chopping machines for processing

felling residues in logging areas for biofuels, which contributes to the development of bioenergy in our country.

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