EFFICIENCY OF KNIFELESS GRINDING OF FIBROUS SEMI-FINISHED PRODUCTS

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ЭФФЕКТИВНОСТЬ БЕЗНОЖЕВОГО РАЗМОЛА ВОЛОКНИСТЫХ ПОЛУФАБРИКАТОВ

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ANNOTATION

In this article two knifeless grinders are compared: hydrodynamic acoustic generator and "stream barrier". Operating principles, advantages and shortcomings machines of the are described.

АННОТАЦИЯ

В данной статье сравниваются две установки безножевого размола: гидродинамический акустический генератор и "струя-преграда". Описываются принцип работы, преимущества и недостатки в работе установок.

Keywords*:* Hydrodynamic acoustic generator, "stream barrier", cavitation, knifeless grinding .

Ключевые слова: Гидродинамический акустический генератор, "струя-преграда", кавитация, безножевой размол.

In modern pulp and paper industry the considerable share in production of fibrous semi-finished products is taken by the grinding devices, disk and conic mills. A disadvantage of such devices is shortening of fibers due to the cutting effect. In this regard, devices of knifeless grinding: "stream barrier" machine and the hydrodynamic generator are of special interest for the research.

Intensive sonic and ultrasonic vibrations give the chance to transfer a significant amount of mechanical fluctuations' energy into the interval environment, and the phenomena arising in a cut can be widely used in practice.

As a result of sonic and ultrasonic fields action , excessive pressure and tensile stress rise in the liquid due to high particle velocities and particularly high particle accelerations of the liquid. . At the interface of immiscible liquids and at the interface between liquid and solid bodies in sound and ultrasonic fields there are special phenomena which stimulate processes of dispersion [1].

Based on the data and reasons provided earlier, Dobrovolsky D. S. created the hydrodynamic acoustic oscillation generator for cellulose grinding during the production of paper and cardboard. Such generator works according to the following scheme (fig. 1): the water and fibrous suspension of concentration of 1 — 2% continuously comes from the outside through the pipeline (1) to the tank of the generator (2). In the tank water and fibrous suspension have to occupy all its internal net volume and completely cover the working bodies located there (3).

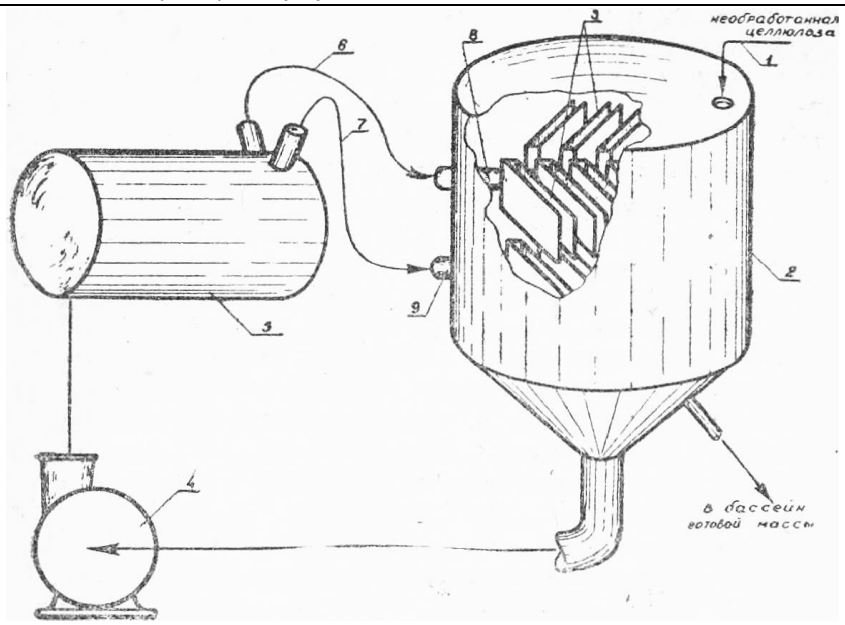

Figure 1. Hydrodynamic acoustic generator
1 – Pipeline; 2 – reception tank; 3 – working body; 4 – pump;
5 – muffler of fluctuations;6, 7 – pipelines; 8, 9 – collectors

From the tank fibrous suspension is continuously pumped (to the muffler of fluctuations (5) by the centrifugal pump (4). All internal volume of the muffler in operating time is filled with the water-fibrous suspension. From the muffler of fluctuations the suspension flows under pressure of 5 — 9 atm. It flows through pipelines (6, 7) to collectors (8, 9), each of which distributes the stream coming to it on branches in the working bodies mounted on the collectors. The water and fibrous suspension coming to working body passes a narrow and long crack of a nozzle of the special device. Length of such crack exceeds 25 mm, height reaches 200 mm, width may vary within certain limits. Empirically was established that optimal operating conditions prevale with a width of crack within 1.0 — 1.5 mm. The nozzle is designed in such a way that the stream of water and fibrous suspension after an outburst from the crack does not deviate and is not twisted without the change of the section as it usually happens. The stream gets fluctuations which frequency and amplitude can be regulated within certain limits . The elastic steel plate put along the axial plane of the movement of a stream at console or two-axial fixing also comes to oscillating motion, synchronous to fluctuations of a stream. It is necessary that own fluctuations of plates correspond to fluctuations of a stream or were it multiple. Then there is a resonance strengthening impact of fluctuations on cellulose. This mechanism is implemented in the discussed device [2].

Advantages of the hydrodynamic generator are simplicity on the device, relatively small overall dimensions, it is the unit of continuous action, it is easy to maintain and is energy efficient. Fibrous mass during the grinding on it is well fibrillated, and at the same time fibers are very little shortened [2].

Disadvantages include a large number of cycles of suspension passing through the machine what leads to heating of the mass by the intake pump, therefore, the additional cooling equipment is necessary. Moreover, based on our observations, low operating pressure of 0.6 - 1.4 MPas it is not enough for grinding of fibrous semi-finished products.

In works of Alashkevich Yu.D., Vasyutin V.G. hypothesis is stated about the cavitational impact on fiber in the place of contact of a stream with a barrier. Experimentally confirmed that as jet strikes a barrier cavitational phenomena emerge. They make effective impact on fiber at higher velocities , than in the known "stream barrier" [3] machines .

Following theoretical researches and the analysis of power impacts on fiber, it became clear that in the presence of a motionless barrier the major power factors of grinding process are: jet strike of fibrous suspension on the motionless barrier and the mechanism of destruction of fiber associated with cavitational effect at contact of a stream of suspension with a barrier [3].

The general view of the stream barrier mechanism is presented in fig. 2. Fibrous suspension in a working cylinder moves from vessel - 5 via the suction valve - 6 due to created discharge of the piston in a working cylinder at reverse motion. At a working piston stroke in a working cylinder suspension under a certain pressure passes consistently through the final valve - 7, the extender and a nozzle - 4 and is thrown out in the form of a jet with a certain speed on the barrier installed in the special camera – 1[4].

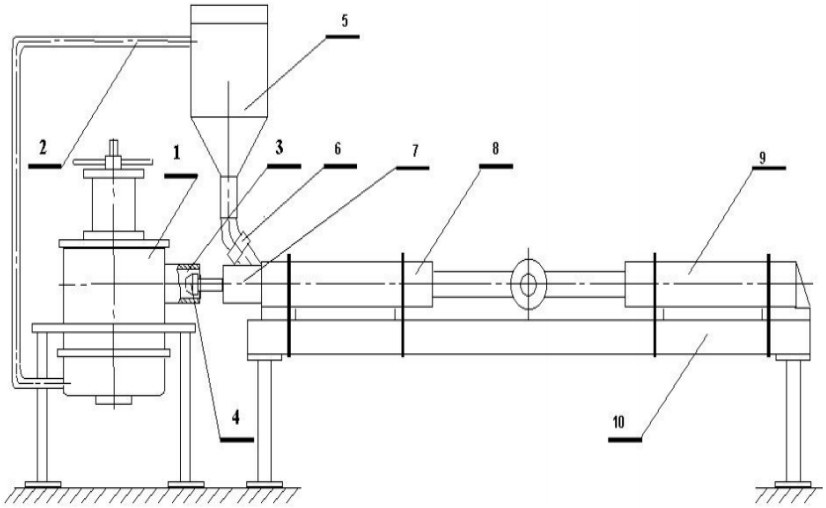

Figure 2. Scheme of the Stream barrier machine
1 – camera of hydrodynamic grind; 2 – return pipeline; 3 – bell; 4 – nozzle; 5 – capacity; 6 – suction valve; 7 – final valve; 8 – working cylinder; 9 – driving cylinder; 10 – frame

The advantage of "stream barrier machine" is the absence of heating of mass as it moves by a hydraulic cylinder and passes through a nozzle, but not through the pump. It reduces construction costs due to the less metal used in the design. Operating pressure in the hydraulic cylinder the grinding of fibrous semi-finished products is 4 - 16 MPas.

Acoustic impact on fiber is not able to provide its breakdown . Nevertheless, if such processing in the existing devices takes place, then it results from action of the indirect effects arising in liquid when passing sound waves, and in particular, ultrasonic cavitation. It is also impossible to exclude fatigue mechanism of destruction of the fiber caused by action of multiple repeating cyclic tension [3].

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РАЗРАБОТКА АВТОМАТИЗИРОВАННОГО СПОСОБА ВОССТАНОВЛЕНИЯ МУЛЬТИПЛЕКСИРОВАННЫХ СПЕКЛ-ГОЛОГРАММ

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DEVELOPMENT OF AN AUTOMATED MULTIPLEXED METHOD FOR THE RECONSTRUCTION OF SPECKLE HOLOGRAMS

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АННОТАЦИЯ

Предложена структурная схема автоматизированного способа восстановления мультиплексированных Фурье - голограмм спекл – полем. В данном способе восстановления происходит следующим образом: оптический предметный луч в области транспаранта прерывается маска с окошкой без транспаранта, а записанная голограмма освещается излучением, прошедшим сквозь матовую пластинку.

Технология автоматизированной восстановлении мультиплексированных голограмм заключается в следующем, маска с окошком при восстановлении первой голограммы стоит в исходном состоянии т. е.