practical importance. This is an issue not only of the corresponding apparatus performance but first of all it concerns the interaction of the sliding mass with the base material.

An attempt to find the brachistochrone equation in a centrifugal field was undertaken in 1982 [2]. The equations in polar coordinates were obtained and the limits of their applicability for practical purposes were determined. In this paper, some refinements are given and a more detailed solution of the problem of brachistochrone in a centrifugal field as well as the research results of this curve properties for various initial parameters are presented.

The conducted studies show that the profile of the accelerating blades of centrifugal devices in the form of brachistochrone can hardly be considered the most rational. The curvature of the blade at the exit from the rotor, although decreasing in comparison with the curvature at the beginning of the motion, leads however to an increase of the normal force and hence also of the frictional forces.

Therefore, the use of blades in centrifugal accelerating devices in the form of brachistochrone or in the form of another curved profile can be justified only in certain cases, for example, in the structures of centrifugal pumps, ventilators or turbines.

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DEVELOPMENT AND RESEARCH OF COUNTERFLOW JET MIXERS OF LIQUID COMPONENTS IN AGRICULTURAL PRODUCTION

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The process of mixing of the liquid components is quite widespread in agricultural production, for example, in the preparation of uterine (working) solutions of pesticides for spraying gardens, seed dressing, fertilizer solutions for plant nutrition, preparation of animal drug solutions, etc.Among the many designs of mixers for liquid components, the most common devices with mixers. The mixing processes in such devices are well studied, the technological processes for their manufacture are developed and their production is established, but these devices have high energy and material consumption. Today, the development and implementation of the production of mixing apparatuses, which will ensure high-quality mixing of liquid components with minimal energy and time, is very relevant. Reducing energy consumption while maintaining or improving the quality of mixing liquids is possible due to the use of counterflow jet mixing. After analyzing the existing designs of jet mixers [1-3], we developed a scheme of the mixing apparatus (Figure 1). The basic theoretical dependencies of the mixing process are determined, the optimal location of nozzles is theoretically determined [4]. The experimental research technique has been developed [5]. The influence of factors on optimization criteria is determined. To conduct experimental studies of the process of mixing the liquid components, an experimental mixing device and an experimental setup were developed and manufactured (Figure 2). The vortex pump 1 creates the necessary supply pressure of the main component. Pressure control is carried out using a pressure gauge 2. Through the supply channel 3, the main component enters the counter-current jet mixer 5. The admixed component enters the mixer from tank 4 through the supply channel 6. After mixing in a counter-current jet mixer, the mixed product is discharged through channel 8. The quality of mixing is controlled using a conductivity meter 7. The mixing process was studied for liquids whose densities differ significantly ($\rho_m \gg \rho_a$) and for liquids whose densities are close ($\rho_m \approx \rho_a$).

To conduct experimental studies as liquids, significantly differing in density, we used GOST 2874-82 tap water with a temperature of 20 ºC (290 ºK) and sugar syrup (sugar content 50%). The content of the mixed component in the mixed product was determined by the density of the resulting solution using an AC-3 hydrometer-sugar meter. To study the process of mixing liquids of similar density, tap water and a weak sugar solution (sugar content 10%) with the addition of citric acid were used. The content of the mixed component in the mixed product was determined by titration of the resulting solution.

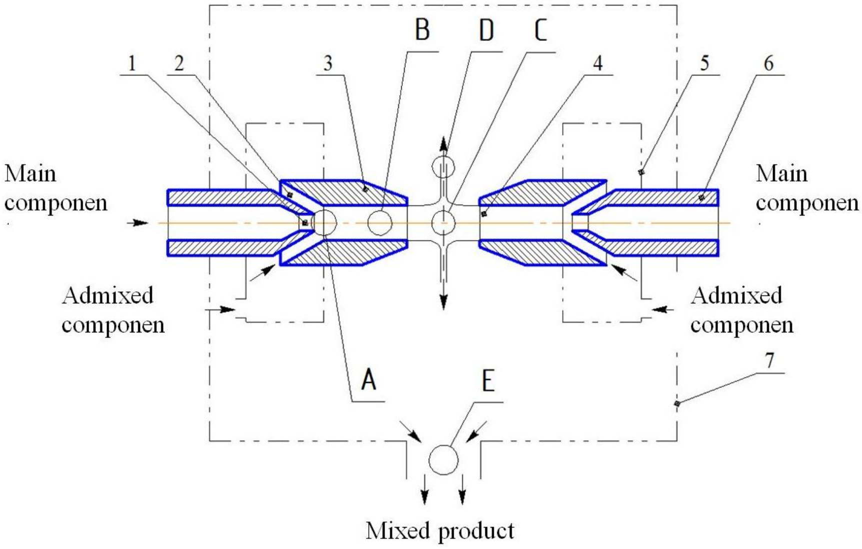

Figure 1 - Diagram of a counter-current jet fluid mixer.
1 - working nozzle; 2 - receiving chamber; 3 - mixing chamber; 4 – nozzle mixing chamber;
5 - feed chamber of the mixed component; 6 - working pipe; 7 - camera fluid collection;
A, B, C, D, E - mixing zones

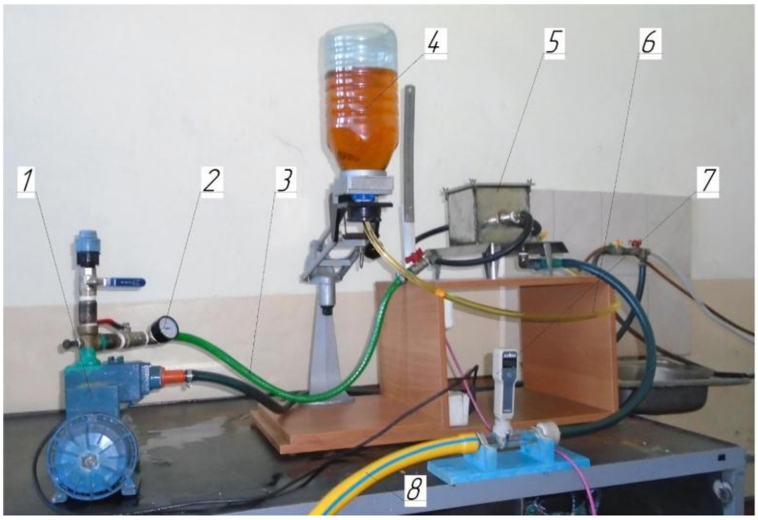

Figure 2 - Experimental setup:
1 - vortex pump; 2 - pressure gauge; 3 - feed channel of the main component;
4 - a container with an admixed component; 5 - feed channel of the admixed component;
6 - counterflow jet mixer; 7 - conductivity meter; 8 - mixed product discharge channel

Based on the research results, the dependences of mixer performance on the distance between nozzle's orifice, the concentration of the mixed component on the supply pressure of the main component at different values of the annular gap in the receiving chamber, and the dependence of the quality of mixing liquids in different modes are constructed.

The results of the analysis of the obtained experimental data indicate that the distance between the nozzle's orifice is the most significant factor influencing the concentration of the mixed component in the mixed product. The least influence is exerted by the feed pressure of the mixed component. A close relationship of such factors as the size of the gap in the receiving chamber and the supply pressure of the main component is also noted. The reason for this is the increase in pressure in the collision zone of the oncoming jets, which leads to a decrease in the pressure drop at the inlet and outlet of the nozzles and, as a result, to a decrease in the injection coefficient.

The quality of mixing increases with increasing speed of collision of the jets, which occurs when the supply pressure of the main component at the inlet to the mixer increases. In general, the results of the study indicate the high promise of this type of mixer, since the specific energy consumption of the process is 3-4 times less than that of classical capacitive mixing devices.

The results can be used to build an analytical model of counterflow jet mixers, dispersants and other hydraulic devices.

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ПРИМЕНЕНИЕ СОВРЕМЕННЫХ КОМПЬЮТЕРНЫХ ТЕХНОЛОГИЙ ПРИ ПРОЕКТИРОВАНИИ КОРМОУБОРОЧНЫХ КОМБАЙНОВ

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В настоящее время в основе разработки высокотехнологичной и конкурентоспособной продукции лежит использование перспективных компьютерных технологий, обеспечивающих информационную интеграцию и системную поддержку жизненного цикла продукции, так называемых CALS технологий. Ядро CALS-технологий составляют CAD/CAE/CAM/PDM – технологии, в которых традиционный последовательный подход к разработке новых изделий заменен принципиально новым интегрированным подходом, получившим название «параллельное проектирование». В основе этой технологии лежит идея совмещенного во времени компьютерного проектирования изделия (CAD), выполнения многовариантных инженерных расчетов (CAE, компьютерный инжиниринг – наукоемкая составляющая CALS-технологий) и технологической подготовки производства (CAM), что позволяет использовать проектные данные, начиная с самих ранних стадий проектирования и инженерного анализа одновременно различными группами специалистов (PDM).

Актуальность применения CAE-технологий в отечественной промышленности предопределена тем, что ведущие фирмы мира три последних десятилетия в своих приоритетных разработках эффективно используют наукоемкие CAE-технологии инженерного анализа. В ОАО "Гомсельмаш" активно внедряются современные компьютерные CAE-технологии: для решения пространственных задач механики деформируемого тела и задач теплопередачи и теплообмена используется интегрированная система прочностного анализа (FEM-система) ИСПА; для решения задач кинематического и динамического моделирования сложных меха-