Annotation. Scientific results of research and development of meat grinders, bowl cutters and emulsifiers are presented. It is noted that in order to find new ways to improve these machines, the corresponding developed concept was used, which is based on the mutual coordination of the processes of raw material supply, its processing and power load of working elements.

Key words: meat grinder, bowl cutter, emulsifier, improvement, increase of productivity, durability, fatigue strength, wear resistance.

Introduction. The main types of grinding equipment for meat processing production were and remain meat grinders, bowl cutters and emulsifiers. Our analysis revealed that the peculiarities of hydrodynamics of raw material in the working areas of these machines significantly reduce their technological parameters, and the specific nature of the raw material movement and its physical and mechanical properties appreciably reduce wear resistance, durability and fatigue strength of working elements.

Main body. The research was based on the concept of systematic coordination of the processes of raw material supply, its processing and power load of working elements. This concept is as follows. Constructive and kinematic parameters of the working elements of machines determine the efficiency of raw material processing. They also determine the hydrodynamics of raw material during processing and after its contact with the working element. In turn, the hydrodynamics of raw material determines its compression, heating and grinding, force loading and wear of working elements. The construction and kinematics of working elements together with their interaction with raw material determines their wear, static, fatigue, vibration, shock strength and corrosion resistance. Significant improvements of meat grinders, bowl cutters and emulsifiers can be achieved by systematically changing each of the above interrelated indicators.
The scientific novelty of the obtained results is as follows: the proposed, substantiated and implemented concept of development of bowl cutters, meat grinders and emulsifiers, which is based on the coordination of raw material hydrodynamics, grinding process and impact on stress-strain state, wear characteristics and fatigue strength (endurance) of machines.

For the first time:
- proposed and substantiated the concept of scientific and inventive binomial as a methodological basis for the development of machines for grinding raw meat;
- it was found that when grinding frozen raw material in a bowl cutter with 6 knives at the initial and middle stages of grinding, all 6 knives of the head take part in the process, at the stage of fine grinding of raw material there are only 2 knives;
- it is established that during high-speed grinding of raw meat, the cutter knife does not come into contact with it by one of its side surfaces, which significantly expands the search for effective ways to increase the strength of the cutter knives;
- regularities of raw material movement in working zones of meat grinders and emulsifiers are established depending on constructive and kinematic parameters of working elements and working zones of these machines and structural-mechanical properties of raw meat;
- it was found that the screw of the meat grinder feeds the raw material at every time within the local sector, the value of which is determined primarily by the approximation of the flight screw to the hole plates of the cutting mechanism;
- the dependence of the limit of fatigue strength (endurance) of the bowl cutter knives at alternating loads on the type of firming processing and on the features of the geometric shape of the knives is established;
- it was found that the knives of modern models of bowl cutters work in the range of oscillatory frequencies close to resonance, which significantly worsens their stress-strain state;
- on the basis of the obtained data concerning the distribution of the temperature field in the raw material during its processing in the bowl cutter it is established that the main heating factor of the raw material during cutting is its intensive friction on the bowl and lid of the cutter knife head due to high speed throwing away of raw material with knives;
- it was found that the axial movement of raw material through the cutting unit is a significant factor of the wear of the cutting edges of knives and the hole plates of the meat grinder;
- it is established that the most tense areas of the perforated hole plates of the emulsifier with the rib stiffeners are the connection points of the rib stiffeners with the outer circle of the hole plate.

Received further development: the idea of the process of removal of raw material from the grinding zone due to the adhesive interaction of knives with raw material; the idea of the intensity of wear of the bowl cutter knives, which work in different cutting planes; provisions on the influence of the main structural and kinematic parameters of the meat grinder and the structural and mechanical properties of the raw material on the productivity of the grinding process.

The following is specified: quantitative values of the axial compression modulus, standard penetration stress and shear stress of the main types of raw meat processed in the meat grinders and emulsifiers; the dependence of the influence of the feed rate of raw material and structural and kinematic parameters of the working elements of the emulsifier on the efficiency of processing raw material in it; the dependence of the forces acting on the blades of the bowl cutter knives on the constructive and kinematic parameters of the knives; the nature and causes of wear of the screw and the working cylinder of the meat grinders.

**Conclusions.** Based on the research, a number of technical solutions for the improvement of meat grinders, bowl cutters and emulsifiers were developed, for
which 8 patents of Ukraine for inventions and 7 utility patents of Ukraine were obtained.

© Batrachenko O.V.