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RESEARCH OF THE INFLUENCE OF IMPROVED DRAFTING SYSTEM DESIGN ON RING YARN QUALITY

ИССЛЕДОВАНИЕ ВЛИЯНИЯ УЛУЧШЕННОЙ КОНСТРУКЦИИ ВЫТЯЖНОГО ПРИБОРА НА КАЧЕСТВО ПРЯЖИ КОЛЬЦЕВОГО СПОСОБА ПРЯДЕНИЯ

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ABSTRACT

RING SPINNING MACHINE, DRAFTING SYSTEM, DELIVERY CYLINDER, YARN, PHYSICAL AND MECHANICAL PROPERTIES

The article presents the research results of setting parameters influence of draft system to quadratic unevenness of yarn over the cross-section, specific breakage load and quadratic unevenness on breakage load. The use of a modernized drafting system at the optimum settings will improve the yarn quality due to better control over the movement of fibers. The stability of the drafting is ensured by the preservation of the continuous clamping line and the constancy of the friction forces.

АННОТАЦИЯ

КОЛЬЦЕПРЯДИЛЬНАЯ МАШИНА, ВЫТЯЖНОЙ ПРИБОР, ВЫПУСКНОЙ ЦИЛИНДР, ПРЯЖА, ФИЗИКО-МЕХАНИЧЕСКИЕ СВОЙСТВА

В статье приводятся результаты исследования влияния параметров настройки вытяжного прибора на квадратическую неровноту пряжи по сечению, удельную разрывную нагрузку и квадратическую неровноту по разрывной нагрузке. Использование модернизированного вытяжного прибора при оптимальных параметрах настройки позволяет улучшить качество пряжи за счет лучшего контроля за движением волокон. Стабильность вытягивания обеспечивается сохранением непрерывной линии зажима и постоянства сил трения.

Drawing is one of the most important processes in spinning technology. Drawing is carried out in a drafting system which construction implements the basic provisions of the theory of drawing.

One of the reasons that increases the irregularity of the yarn when drawing the product in the drafting system is the unsatisfactory straightening of the fibers, leading to a decrease in the proportion of controlled fibers during the stretching process, increasing their irregular shifts, creating fiber grouping that reduces the strength and irregularity in the strength of the yarn. Straightening of the fibers occurs mainly during the drawing process between the draft pairs. The efficiency of the straightening of the fibers also depends on the magnitude of the stresses of the friction forces. Consequently, increasing the load on the rollers and improving the quality of their coating will lead to an increase in the straightness of the fibers and a decrease in the irregularity of the outgoing product.

To create the necessary frictional forces in the drawing field and ensure a reliable clamping of the fibers, the cylinders surface is made grooved. The rollers of the drafting system, pressed to the grooved cylinders, rotate under the action of frictional forces. The stratification of the drawn product and the appearance of irregularities are observed because of the lag of the roller from the cylinder and the uneven rotation of the roller. The elastic coating of the rollers when worn with the flutes wears out, and with a small width of the flutes, even a partial damage of the fibers occurs.

To eliminate these drawbacks, it was suggested to improve the drafting system by replacing the grooved part of the draft cylinders with elastic coating bushings [1]. In this case, the contact strip of the draft pair is doubled, which ensures a reliable clamping of the fibers; the frictional field force remains constant along the length of the top roller, thereby stretching the process with high stability. The use of bushings with an elastic coating allows the processing of a twisted roving with increased load on the rollers and at a high speed without damaging the fibers.

Optimal settings for the modernized drafting system were selected to ensure high yarn quality [2].

After solving the problem of optimizing parameters settings of the modernized drafting system, a comparative assessment of the quality indicators of the yarn of linear density 20 tex, produced with the use of a conventional drafting system (control version) and with the use of a modernized drafting system (experimental version) was carried out.

After solving the problems of optimizing the settings of the modernized drafting system, a comparative assessment of the quality indicators of the yarn with the linear density 20 tex, made using a conventional drafting system with a fluted part

of the delivery cylinder (control version) and in the process of using an upgraded exhaust accessory, part of the delivery cylinder was replaced with elastic-coated bushings (experimental version).

The yarn quality indicators of the compared variants are shown in Figure 1–2.

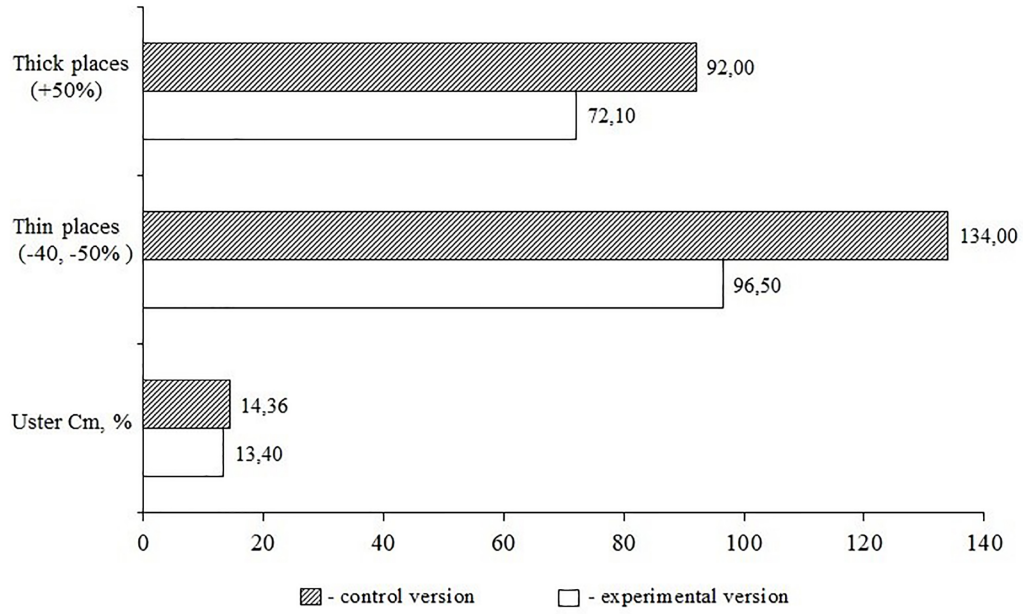

Figure 1 – Irregularity of the yarn in the cross-section

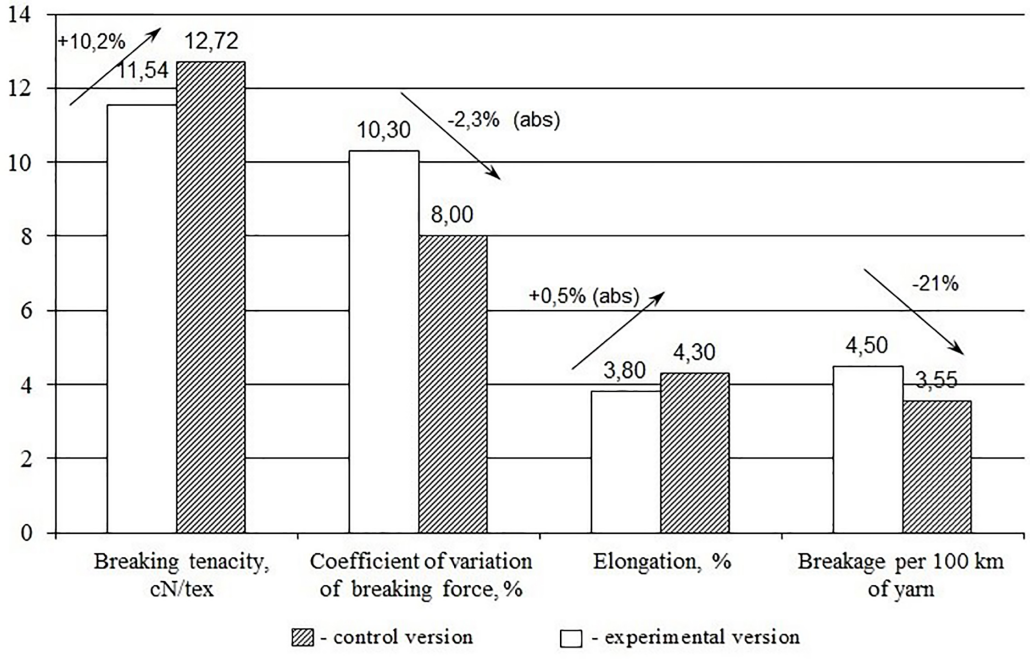

Figure 2 – Main indicators of physical and mechanical properties of the yarn

From Figures 1–2 it is seen that the use of a modernized drafting system with the optimal parameters of its settings allows to improve the quality of the yarn by better controlling the movement of fibers in the drafting system and the stability of the drafting process. The internal irregularity of the yarn is reduced from 14.36 % to 13.4 % by reducing the number of thin places by 28 %, thick places by 21.6 %, which indicates the preservation of a continuous clamping line and constant friction forces. Reducing the internal irregularity allows to increase the breaking tenacity to 12.72 sN/tex, against 11.54 sN/tex in the control (factory) version. The coefficient of variation in breaking force is reduced by 2.3 % (abs), and the elongation of the yarn is increased by 0.5 % (from 3.8 % to 4.3 %).

Yarn quality: breaking load, unevenness in breaking load, internal irregularity at the cross-section, influence on spinning stability and breakage. Breakage occurs in the cross-section of the product, in which the breaking load is less than the tension. The breaking load in the yarn break section is reduced when the number of fibers in the section decreases to 0.6n – 0.8n. An increase in the internal irregularity of the yarn leads to an increase in the number of broken sections. Comparative control and experimental versions, we see the number of thin places (-40 %, -50 %) in the yarn cross-section in the experimental version decreases by 28 %, the quadratic irregularity in the cross-section decreased from 14.36 to 13.4 %, and the breaking load increased by 1.18 sN/tex, while the uniformity of the breaking load increased (the coefficient of variation decreased from 10.3 % to 8 %).

The improvement in the yarn quality indicators made it possible to reduce the breakage from 54 to 43 breaks per 1000 spindles per hour, i.e. by 20.4 %.

Tests in production conditions have shown that when the yarn is spun on a ring spinning machine with a modernized drafting system, the stability of the spinning process improves the quality of yarn.

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