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IMPROVEMENT OF THE DESIGN OF THE SHUTTLE DRUM IN THE SEWING MACHINE

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Abstract:

Objective. Today, in the process of sewing gauze, the lack of the ability to untie the shuttle thread, to ensure its tension evenly, is considered a disadvantage of this shuttle tube design. our goal is to improve the new construction of the shuttle bobbin in the sewing machine.

Methods. The experiment was carried out on sewing machines of "Shafirkon equatorial" enterprise. the structural scheme and working principles of the component tube with elastic bushing and plastic fingers were studied. a tube winder with a base, frame, guide wheel, tube, hook mechanism, thread tension mechanism and thread trimming mechanism in a sewing machine, along with recommendations for improving productivity.

Results. According to the results, a new effective structure of the component tube was developed. based on theoretical studies, a formula was obtained to determine the friction between the winding thread and plastic fingers.

Conclusion. The article provides a structural diagram and the principle of operation of a composite bobbin with an elastic sleeve and plastic sticks. An analytical method is given for determining the moment of friction between the unwinding thread and the plastic sticks of the rubber bushing in the sewing machine, based on the analysis of the constructed graphical dependencies, the main parameters of the recommended bobbin design in the sewing machine.

Keywords. Sewing machine, bobbin, rubber sleeve, thread, friction, force, moment, plastic stick, radius, coefficient, grooves, pitch, stiffness, deformation, pressure, tension.

Introduction. In double-thread stitch sewing machines, the threads that fall into the sewing zone have a certain margin. At the same time, the bobbin thread is pre-wound on the bobbin [1].

A well-known bobbin design, consisting of two round disks rigidly interconnected by a sleeve [1, 2].

The disadvantage of the known design is the impossibility of providing a uniform tension of the bobbin thread during its unwinding in the process of stitching materials. When unwinding the thread from the bobbin, depending on the location of the current turn of the thread with a change in the radius of its location, a variable unwinding force is required. At the very beginning of the unwinding of the thread, the coil on the bobbin is located at a large radius of the bobbin and therefore a small traction force is required to unwind it, and when the thread is used up at the very end, the radius of the last turns is practically in the bobbin at a radius equal to the outer radius of the bobbin sleeve. At the same time, a large pulling force is required to unwind these last turns of thread from the bobbin.

To ensure the uniformity of the tension of the shuttle thread during their unwinding, that is, when grinding materials, the design of the bobbin winder was improved [2,3].

Bobbin winders for a sewing machine, containing a base, a frame, a wired wheel, a bobbin, a latch mechanism, a thread tension mechanism and a thread cutting mechanism, are not reliable in operation and have low productivity.

A bobbin winder for a sewing machine containing a base, a frame, a wired wheel, a bobbin, a latch mechanism, a thread tension mechanism and a cutting mechanism, while in order to increase productivity, the thread tension mechanism is made in the form of a square, one of the shelves of which has a thread guide slot, and the thread cutting mechanism is made in the form of a slider with a striker coming out and a hole at the end of the bobbin winding [3].

The disadvantage of these bobbin winders for the sewing machine is the complexity of the design and the impossibility of ensuring uniform tension of the bobbin thread when it is unwound during the grinding of materials due to the lack of a means of regulating the tension of the thread in the bobbin with a gradual decrease in the radius of the turns.

In the design of the sewing machine 852 class PMZ [4], the bobbin consists of two side round disks rigidly connected to each other by means of a metal sleeve. The defect of this design is also the impossibility of ensuring the uniformity of the tension of the shuttle thread both during their winding and unwinding.

To ensure the uniform tension of the bobbin thread during its winding and unwinding from the bobbin, allowing a significant reduction in thread breakage and an increase in the productivity of the machine, improving the design of the bobbin equipped with an elastic element. [5].

Methods. Efficient construction of a compound bobbin for a sewing machine. The essence of the design lies in the fact that the bobbin for the sewing machine contains two side round disks rigidly connected to each other by means of a metal sleeve, to which a rubber elastic sleeve is put on. Plastic sticks with a certain pitch are installed on the surface of the rubber bushing. In this case, the stick enters the groove of the rubber bushing for half the thickness, and the rest (the second half of the thickness) protrudes outward from the rubber bushing. This allows, in the process of winding the bobbin thread, uniform tension in the turns over the entire thickness of the wound thread. This is also ensured in the process of unwinding the thread.

The design of the bobbin for the sewing machine consists of two side round disks 1 and 2, rigidly connected to each other by means of a metal sleeve 3. A rubber sleeve 4 is put on the sleeve 3, which has grooves along the outer surface with a certain depth and pitch. Plastic sticks 5 are installed on the grooves of the rubber bushing 4, while part of the sticks 5 protrude from the surface. Along the edges of the rubber sleeve 4 has protruding parts 6 equal in height to the sticks 5. (Figure 1 A)

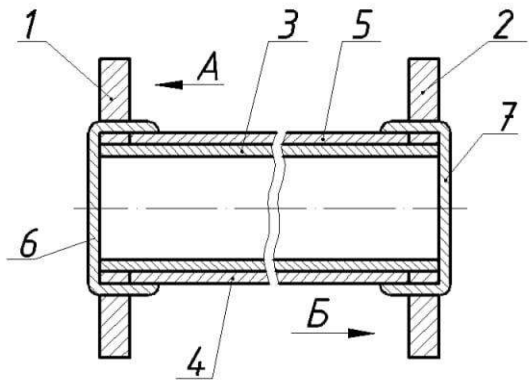


Figure.1 A. The rubber sleeve 4 has protruding parts 6 equal in height to the sticks 5

The design works as follows. The bobbin thread is wound on a rubber bushing 4 with plastic sticks 5. At the same time, due to the tension of the thread, the rubber bushing 4 is deformed. With an increase in the number of screws, the thickness of the wound thread, the deformation of the rubber bushing increases. At the end of the winding of the thread, the rubber sleeve 4 will be in a deformed state. At the same time, with the beginning of the operating mode, the bobbin thread is unwound gradually, cyclically. At the same time, due to the exposing force of the deformed rubber sleeve 4, by means of plastic sticks 5, the thread can be unwound and leads to equalization of its tension. Plastic sticks 5 do not allow the introduction of turns of thread into the rubber sleeve 4. By choosing the appropriate brand of rubber, the parameters of the sticks 5 and the rubber sleeve 4, you can provide the required modes of winding and unwinding the bobbin.

The design of the bobbin for the sewing machine ensures uniform tension of the bobbin thread during its winding and unwinding, leading to a decrease in thread breakage, to an increase in the speed of the machine.

Calculation scheme and method for determining the friction between the unwinding thread and plastic sticks of the rubber bushing of the bobbin. Figure 2 shows the design scheme of the bobbin to determine the moment of friction between the thread and the fingers of the bobbin. According to the design scheme, the circumference of the passage ... through the outer surfaces of the sticks 3 bobbins:

$$2\pi R = ak + tk = k(a + t) \qquad (1)$$

where, a, t- is the width of the plastic stick and the distance between ... sticks, k- is the number of sticks, from (1) we can determine [6,7]:

$$k = \frac{2\pi R}{a+t} \qquad (2)$$

At the same time, the thread pressure force 1 on the outer surfaces of the plastic sticks is composed of the distributed thread pressure force, which depends on the thread tension force, as well as the elastic force of the rubber bushing when winding on the bobbin.

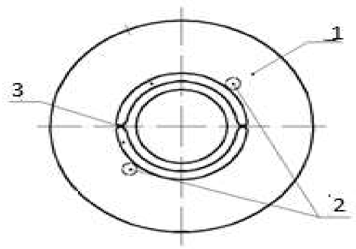


Figure.2. Scheme of the interaction of the thread and plastic sticks

At the same time, due to the relative smallness of the weight of the thread, it can write [8,9]:

$$P = aklq + c\Delta k$$

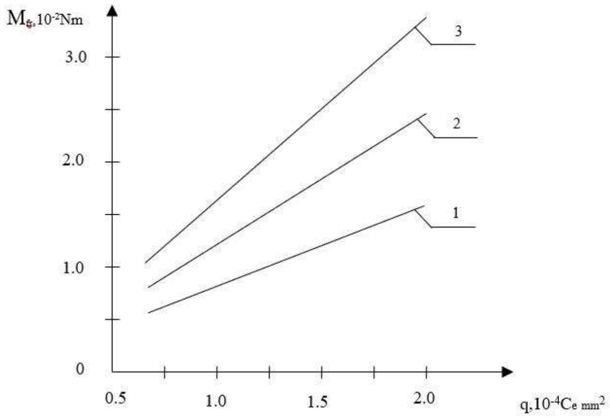
$$F_{tr} = fr;\ M_{fr} = fRP \quad (3)$$

where, R is the radius of the outer circle passing through the outer surfaces of the plastic sticks; C is the stiffness coefficient of the rubber bushing, Δ. is the average value of the deformation of the rubber bushing, is the length of the plastic sticks; q-distributed value of thread pressure 1 on plastic sticks 3; F_{tr} is the force of friction between the thread 1 and the surface of the stick 3; M_{fr} is the moment from the friction force; f is the coefficient of friction between the thread and the plastic surface.

Taking into account (2), (3), we obtain an expression for determining the moment of friction force between thread 1 and plastic sticks 3 in the bobbin in the form [10]:

$$M_{fr} = \frac{6.28\, fR}{a+t}\,(alq + c\Delta) \quad (4)$$

Results. Numerical solution and analysis of results. Based on the solution of the problem, taking into account the given parameters of the composite bobbin of the sewing machine, their graphic dependencies were built. Figure 3 shows the graphical dependences of the change in the moment of friction between the thread and the surfaces of the sticks on elastic bases on the change in the distributed load due to the change in the tension of the thread. An analysis of the graphs in Figure. 3 shows that with an increase in the distributed load, the plastic sticks of the bobbin from the thread wound around them in a nonlinear way naturally increase the moment of friction forces between them. Thus, with increasing load from 7.1 Ce/mm^2 to 21.5 Ce/mm^2 at f=0.08, the value of M_{fr} increases from 1.54·10^{-2}nm to 1.45·10^{-2}nm. When the value of the coefficient of friction between the thread and plastic sticks is 0.15, the value of the moment of friction increases from 0.96·10^{-2} nm to 3.18·10^{-2}nm. It should be noted that the greater the friction moment M_{fr} between the thread and plastic sticks, the more the possibility of unwinding the thread in the bobbin is reduced. In this case, to unwind the thread from the bobbin, some initial thread tension is required.

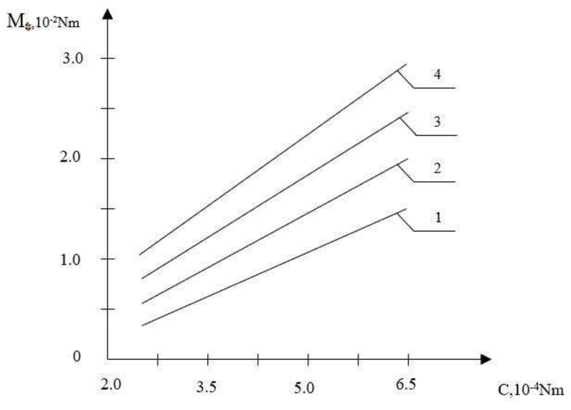


1-f=0.08; 2-f=0.12; 3-f=0.15

Figure.3. Graphic dependences of the change in the moment of friction between the thread and the surfaces of the sticks on elastic bases on the change in the distributed load due to the change in the tension of the thread

This is especially true when stopping and starting the grinding process. With a sharp stop of the grinding process at a small value of the friction moment M_{fr}, self-unwinding of the thread by inertia can occur. Therefore, for linvidation, self-winding of the thread, as well as maintaining the required values of the tension of the shuttle thread in the sewing machine, the recommended load values are $q=(1.8 \div 2.2) \cdot 10$ Ce/mm^2, at which $M_{fr} \geq (1.8 \div 3.1) \cdot 10^{-2}$ nm.

In this case, the stiffness of the rubber base of the bobbin is important. It should be noted that the greater the rigidity of the rubber bushing of the bobbin, the greater the value of M_{fr} between the thread and the plastic sticks. Figure 4 presents. From the analysis of the constructed graphical dependencies in Figure. 4, it was revealed that with an increase in the coefficient



1-q=7.5 Ce/mm^2; 2- q=12 Ce/mm^2; 3- q=15 Ce/mm^2; 4- q=18 Ce/mm^2;

Figure.4. Graphical dependences of the change in the moment of friction between the thread and the surface of the sticks on elastic bases on the change in the stiffness coefficient of the rubber bushing of the composite bobbin

The stiffness of the rubber bushing of the bobbin at q=7.5 Ce/ mm^2, the M_{fr} value increases in linear dimension from $0.35 \cdot 10^{-2}$nm to $1.49 \cdot 10^{-2}$nm.

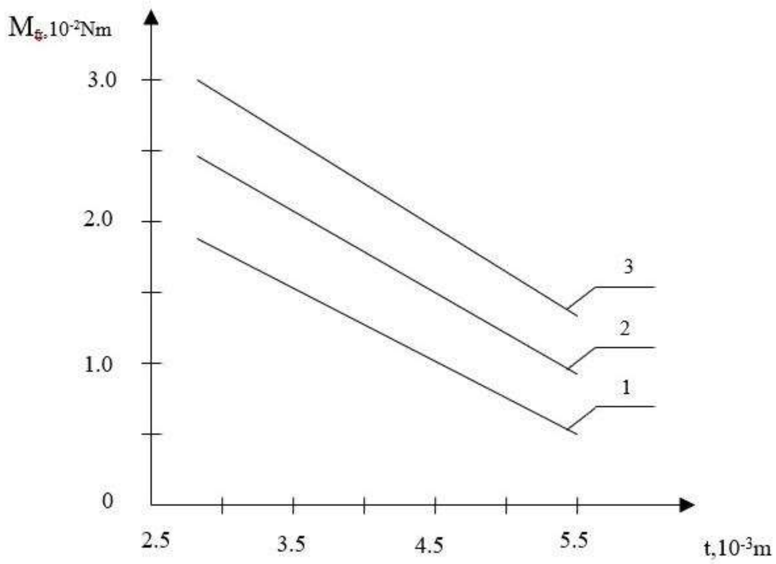
With a load value q=18 Ce/mm^2 with an increasing value of the stiffness coefficient of the rubber bushing from 2.81·10^{-4}nm to 6.5·10^{-4}n/m the friction moment between the thread and the plastic sticks increases linearly from 1.07·10^{-2} nm to 2.87·10^{-2}nm.

To ensure the moment of friction between the wound thread and plastic sticks within the limits of M_{fr} ≥ (1.8÷3.1) ·10^{-2}nm, the recommended values of the stiffness coefficient of the rubber bushing of the bobbin are. C=(5.45÷6.65) ·10^{-4} n/m.

It is known that the larger the contact area of the thread with plastic sticks, the greater the moment from friction forces in this kinematic pair [10,11]. In order to ensure the required area of contact between the thread and plastic sticks, it is considered advisable to increase the number of sticks, the value of the distance between the sticks, or increase the reduction width of the sticks at a certain. Therefore, it is important to consider justified values of the distance "t". Figure 5 shows. Graphic dependences of the change in the moment of friction between the thread and plastic sticks on elastic bases on the change in the distance between adjacent bobbin sticks.

Discussion. The analysis of the constructed graphic dependences in Figure. 5 shows that an increase in the distance between adjacent plastic sticks from 2.85·10^{-3}m to 5.5·10^{-3}m at R=5.5·10^{-3}m also leads to equipping the friction moment along a linear regularities from 1.62·10^{-2}nm to 0.36·10^{-2}nm. This is explained by the fact that with an increase in R values, the number of plastic sticks also decreases, thereby reducing the contact area of the thread with plastic sticks. This leads to a decrease in the values of the friction moment. Radius increase up to 8.5·10^{-3}m, friction moment decreases from 2.26·10^{-2}nm to 0.97·10^{-2}nm. To ensure the required values of the friction torque between the thread and plastic sticks within (1.8÷3.1) ·10^{-2}nm, the recommended values for the distance between adjacent plastic sticks are t≤(3.3÷4.2) ·10^{-3}m.

Conclusion. A new efficient design of the compound bobbin has been developed



1-R=5.5·10^{-3} m; 2-R=7.0·10^{-3}m; 3-R=8.5·10^{-3}m;

Figure.5. Graphic dependences of the change in the moment of friction between the thread and plastic sticks on elastic bases from the change in the distance between adjacent sticks of the bobbin for the bobbin thread in the sewing machine. On the basis of theoretical studies, a formula was obtained for determining the friction between the wound thread and plastic sticks. The parameters of the compound bobbin are substantiated

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PREPARATION OF A NEW STRUCTURE CREATED FOR SORTING OF GINNING SEEDS

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Abstract: This paper researches a pilot copy of a seed sorting device with an improved design. In addition, this article has conducted theoretical and practical studies to determine the effectiveness of seed selection. As a result of these studies, the operating mode of the new construction was determined and the parameters for its effective operation were developed. The geometric parameters of the developed sorting device are recommended for use in the production copy.

Keywords. Seeds, ginning, cotton, cotton fiber, sorting, cleaning, seed fractions, technology, efficiency, spinning, quality, mesh surface.

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