ISSN: 2350-0328

International Journal of AdvancedResearch in Science, Engineering and Technology

Vol. 5, Issue 10,October 2018

DEVELOPMENT OF EFFICIENT CONSTRUCTIVE DIAGRAM AND JUSTIFICATION OF PARAMETERS WHEN SHRINKING KNITTED CLOTHING ON DOUBLE-FUNCTIONAL CIRCULAR MACHINES.

Allamuratova T. K., Djuraev A. D., Mukimov M. M.

Doctoral student of Tashkent Institute of Textile and Light Industry, Uzbekistan.
D.Sc., prof. Tashkent Institute of Textile and Light Industry, Uzbekistan.
D.Sc., prof. Tashkent Institute of Textile and Light Industry, Uzbekistan.

Abstract: The article presents a new efficient design and the principle of operation of the guide for a uniformly stretched knitted fabric on double-loop rotary machines. Formulas for determining the stitches of the loops of the fabric when they are pulled off the upper and lower cylinders on a knitting machine are obtained.

By numerical solution of the problem, graphical dependences of the change in the force of pulling on the knit loops on the system parameters were constructed, the necessary values of the parameters were recommended.

Keywords: knitted fabric, cylinder, tension, guide, ring, uniformity, pulling forces, angle, friction, radius, graphics.

I. INTRODUCTION

The efficiency of knitwear is constantly increasing due to the expansion of the range, improvement of equipment, the use of rational types of raw materials and optimization of knitting patterns. Important factors in the growth of knitwear productivity are an increase in the number of loop-forming systems, the speed of movement of the loop-forming organs, and the reliability of the knitting process [1].

Recently, the level of research in the field of knitting technology in studying the processes accompanying the processing of yarn into knitwear, the behavior of knitted materials in their manufacture and operation has significantly increased [2].

When knitting on one machine, the deviations in the tension of the web are mainly determined by the method of web tension, the construction of the pull mechanism, the shape and dimensions of the spreader. Deviations of the hinge force on the loops around the perimeter of the tubular web lead to a change in the structural characteristics of the web sections: loop density and surface density. For example, on circular knitting two-elastic machines, the deviations of the surface density of the web sections along its perimeter are 43 g / m2 (with an average value of 210 g / m2), i.e. 20% [3].

Double-functional circular knitting machine contains a cylinder and a disk, in the grooves of which there are needles that interact with heels with wedges of knitting systems. The grooves of the cylinder are arranged vertically with a constant step along its generatrix. The upper plane of the cylinder forms its fender plane. The grooves of the disk are located radially in a horizontal plane perpendicular to the grooves of the cylinder. The needle disk is located coaxially with the needle cylinder. The outer diameter of the disk forms a baffle plane.

There is a certain gap between the fender plane of the disk and the surface passing along the bottom of the cylinder slots horizontally. There is also a certain gap between the fender plane of the cylinder and the plane of the bottom of the grooves of the disk vertically. The gap vertically and horizontally between the baffle planes of the cylinder and the disk forms a needle throat, through which the web tied with the needles of the cylinder and disk is drawn inside the machine. When knitting knitted fabrics on a double-knitting circular knitting machine, the force of pulling loops from the needles of the disc relative to their movement along the groove, the newly formed cylinder loops are formed and pulled back more efficiently, clearly, with greater speed than the loops of the disc. This leads to the fact that the dropped loops on the cylinder tighten new disk loops, and the friction forces that arise in this case prevent the formation and delay of disk loops [4].

In [5], a double-functional circular knitting machine is proposed, which contains coaxially arranged needle cylinder and disk, in the grooves of which needles are installed, which interact with heels with wedges of knitting systems.
The machine differs from the known ones in that the disk is equipped with a conical surface on which the needle grooves are radially located, while their longitudinal axis with respect to the longitudinal axis of the cylinder's opposite vertical grooves makes an angle in the range 100^0 - 105^0.
Double-functional circular knitting machine can be used in knitwear production when knitting knitted fabrics of various weaves of various types of yarn [6].
The disadvantage of the proposed double-functional circular knitting machine is that the machine requires large design changes, the knitwear produced on these machines has a low quality.
The known guide for the delay of the knitted fabric in the double-circular circular knitting machines, made in the form of a cylindrical ring, which is rigidly mounted in the cylinder vertically and at an angle of 45^0 to the direction of the loops in the looping zone [7].
The main disadvantage of this design is to obtain an uneven knitted fabric due to the inequality of pull forces from the needles of the disk and the pull forces of the loops from the needles of the cylinder due to different tension forces. In addition, if it is necessary to ensure equality of the tension of the webs for different values of friction with the contacting surfaces, as well as vibrations of the webs, there is no possibility of changing the arrangement of the annular guide.

II. METHODS

Effective design scheme guide knitwear. In order to ensure the smoothness obtained on the double-rotary round-turn machines around the perimeter of the knitted fabric of the looped structure, the design of the guide was perfected by equalizing the tension forces of the pull-away loops along the entire perimeter of the knitted fabric [8].
In fig. 1 shows the guide for the delay of the knitted fabric on the double-ended circular rotating machines.
The design consists of the guide 1 in the form of a ring with curvilinear zones in height, with the difference between the heights of the transition zones of the ring Δ selected within 30 ... 35 mm, and the angle of circumference of the zones α selected within 75 ° ... 80 ° (Fig. 1, and , g, e). The guide is installed inside the lower cylinder 2 horizontally. Guide 1 is rigidly connected (see Fig. 1, c) with three corners 3 (angle between them j = 120 °), in the vertical bases of which there are grooves 11 (see Fig. 1, b, c). The corners 3 are connected to the lower cylinder 2 by means of screws 4 with washers 5. In the loop formation zone, the needles 6 of the lower cylinder 2 form loops 10, and the needles 7 of the upper cylinder 8 form loops 9 (see Fig. 1, a).

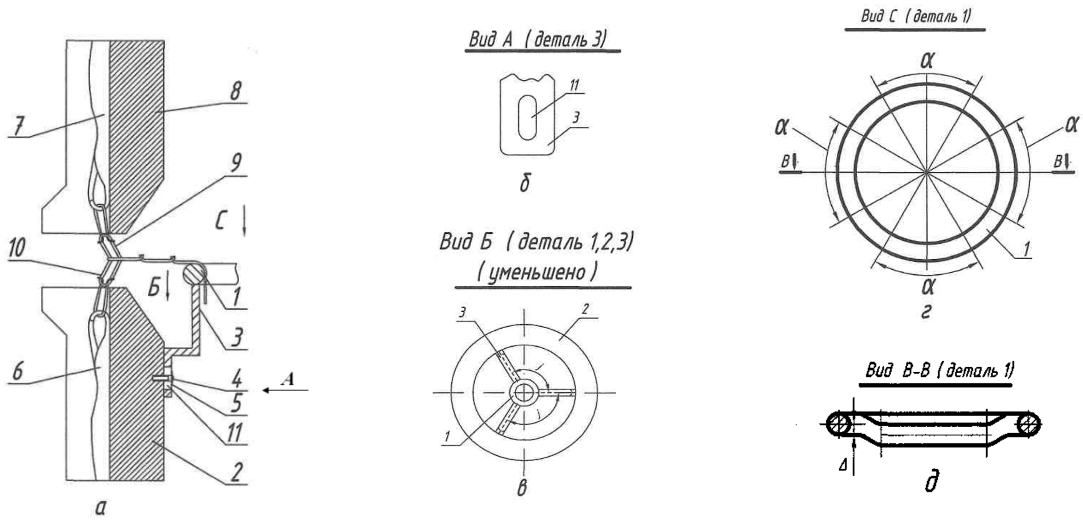
The proposed design works as follows. The needles 6 of the lower cylinder 2 moving in up and down vertically form loops 10, and the needles 7 of the upper cylinder 8 moving back and forth vertically form loops 9. Loops 9 and 10 grabbing the guide 1 at certain angles are pulled down. At the same time due to the oscillations of the loops 9 and 10 and the different values of the friction forces of the loops 9 and 10 with the surfaces of the upper cylinder 8 and the lower cylinder 2, the tension of the loops will be different. By adjusting the vertical installation of the corners 3 of the guide 1 by means of screws 4 and washers 5, it is possible to select the desired position of the ring 1, which ensures that the tensions of the loops 9 and 10 are uneven.
At the same time, the pull-off loops 9 and 10 along the edges of the ring 1 by aligning these zones with a distance Δ (Δ = 30-35 mm) ensure the alignment of the lengths of the web delay along the entire perimeter of the ring 1. It should be noted that the ring can be made of plastic with necessary properties.

The disadvantage of the existing design of the mechanism for pulling double-circular knitting machines is to obtain an uneven looped structure due to the inequality of the forces of loop pulling from the needles of the disk and the pulling forces of the loops from the needles of the cylinder due to different tension forces. As a result of the analysis, it was found that, due to the unequal angles of coverage of the spreader, the difference in the efforts of the tensile hinge columns at the edge and in the center of the swath rollers is approximately 10%.

ISSN: 2350-0328

International Journal of AdvancedResearch in Science, Engineering and Technology

Vol. 5, Issue 10,October 2018



where on and the general scheme of the guide in the zone of looping: 1 - a guide in the form of a ring with curvilinear zones in height, 2 - the lower cylinder, 3 - corners, 4 - screws, 5 - washers, 6,7 - needles of the lower and upper cylinder, 8 - upper cylinder, 9,10 - loops of the lower and upper cylinder;

on b View A in Figure 1, a: 3 - corners, 11 - grooves in the vertical bases of the corners;

on in Type B in Figure 1, a: 1 - a leader in the form of a ring with curvilinear zones in height, 2 - the lower cylinder, 3 - corners, j - the angle between them;

per g View C in fig. 1, a: 1 — a guide in the form of a ring with curved zones in height, α is the angle of grasp of the zones;

on d section bb In Fig.1, g: Δ - the difference between the heights of the transitional zones of the ring

Fig. 1. The guide for the quickdraws of knitted fabric on the double-ended round-turn

The disadvantage of the existing design of the mechanism for pulling double-circular knitting machines is to obtain an uneven looped structure due to the inequality of the forces of loop pulling from the needles of the disk and the pulling forces of the loops from the needles of the cylinder due to different tension forces. As a result of the analysis, it was found that, due to the unequal angles of coverage of the spreader, the difference in the efforts of the tensile hinge columns at the edge and in the center of the swath rollers is approximately 10%.

Based on the analysis of the zone of delay of the loops of the upper and lower cylinders, the mechanism of the delay of double-rotary circular rotary machines has been improved, which makes it possible to obtain a knitted fabric of uniform structure.

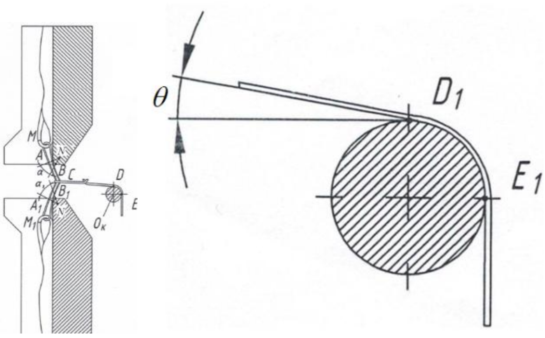
III. ALGORITHMS USED

Determination of the tension of the loops of the canvases when they are being pulled off the upper and lower cylinders on the double-rotary circulating machines. For the analytical solution of the problem of determining the tension of the canvases of the upper and lower cylinders in the double-bottom circular knitting machines using the new effective guide in the form of a ring with varying height of its zones in fig. 2 shows the design scheme.

ISSN: 2350-0328

International Journal of AdvancedResearch in Science, Engineering and Technology

Vol. 5, Issue 10,October 2018



a-in the horizontal direction of the canvases; b-under the inclined directions of the canvases.

Fig. 2. The design diagram of the zone of delay of the canvases of the upper and lower cylinders in a double-rotary circular rotation machine

Entrance tension of a cloth in the top cylinder of the knitting machine:

$$\mathrm{T}_{in} = \mathrm{T}_{av} + \mathrm{T}_0 \sin nt \tag{1}$$

where, T_{av} - the average value of the input tension of the fabric of the upper cylinder; T_0 - the amplitude of the input tension of the upper cylinder;

n is the frequency of change of the input tension of the canvas.

The knitted fabric covered by the needle ring of the upper cylinder of a double-rotary round-turn machine occurs in the region of the angle of wrap angle α, and the tension of the blade after the ring of the needle of the upper cylinder will be determined according to the Euler formula:

$$\mathrm{T}_r = \mathrm{T}_{in} \mathrm{e}^{f(2\pi - j)} \tag{2}$$

where, j - the angle of coverage of the blade ring of the needle of the upper cylinder; f - is the coefficient of friction of the web on the surface of the needle ring of the upper cylinder.

At the same time we have:

$$\mathrm{T}_r = \mathrm{e}^{f(2\pi - j)}[\mathrm{T}_{av} + \mathrm{T}_0 \sin nt] \tag{3}$$

The canvas in the upper cylinder passing the zone NA due to friction between the surface of the cylinder, the tension increases and the expression for its definition looks like:

$$\mathrm{T}_{\mathrm{A}} = F_{fr} + \mathrm{e}^{f(2\pi - j)}[\mathrm{T}_{av} + \mathrm{T}_0 \sin nt] \tag{4}$$

where, F_{fr} - is the friction force between the web and the surface of the upper cylinder in the zone NA.

Knitted fabric in the upper cylinder passes through the rounding of the zone AB, while its tension will be:

$$\mathrm{T}_{\mathrm{AB}} = \mathrm{T}_{\mathrm{A}} \mathrm{e}^{f\alpha} \tag{5}$$

where α is the angle of contact of the web in the zone AB.

Further, the upper web enters from the contact of the upper cylinder and is connected with the web coming out of contact from the lower cylinder of the double-rotary rotary-rotary machine, while the output tension will be:

$$\mathrm{T}_{\mathrm{AB}} = F_{fr} \mathrm{e}^{f\alpha} + \mathrm{e}^{f(2\pi - j + \alpha)}[\mathrm{T}_{av} + \mathrm{T}_{\mathrm{o}} \sin nt] \tag{6}$$

ISSN: 2350-0328

International Journal of AdvancedResearch in Science, Engineering and Technology

Vol. 5, Issue 10,October 2018

Consider the tension of the knitting machine leaving the lower cylinder according to the design scheme shown in fig. 3. Considering that the feeding scheme of the upper and lower web occurs symmetrically, the output tension of the lower web is determined from the expression:

$$\mathrm{T}_{\mathrm{A_1B_1}} = F_{fr_1}\mathrm{e}^{f\alpha_1} + \mathrm{e}^{f(2\pi - j_1 + \alpha_1)}[\mathrm{T}_{av_1} + \mathrm{T}_{0_1}\sin n_1 t] \quad (7)$$

When combining the upper and lower webs, the total tension with α = α_1; j = j_1; n = n_1 will be

$$\mathrm{T}_{com} = \mathrm{e}^{f\alpha}\left(F_{fr} + F_{fr_1}\right) + \mathrm{e}^{f(2\pi - j + \alpha)}[\mathrm{T}_{av} + \mathrm{T}_{av_1} + \sin nt\,(\mathrm{T}_0 + \mathrm{T}_{0_1})\,] \quad (8)$$

It is known that in the design of the web guide when pulling off the generators (length) differ and therefore the guide is made curved along the height of its plane, while the height at the edges of the ring is 30–35 mm greater than the height of the ring zones in the center and each zone covers 75°-80°along its perimeter (see fig. 3.1). Therefore, the installation height of the ring at its edges is provided for in the horizontal plane of the joint webs. At the same time, the output tension of the cloths in the zone of depletion at the edges of the guide ring will be:

$$\mathrm{T}_{out} = \mathrm{T}_{com}\mathrm{e}^{f\beta} \quad (9)$$

where β is the angle of girth of the knitted fabric surface of the ring of the machine guide, β=DO_kE.
In the second position, i.e., when weaving off the webs in the center of the guide ring, the knitted fabrics will be tilted down at a certain angle θ. In this case, the angle of grasping α changes by Δα, and the angle of grasping β of cloths by a ring decreases by Δβ. Then the output tension of the cloths before they will be deflected will be determined from the expression:

$$\mathrm{T}'_{com} = F'_{fr}e^{f(\alpha-\Delta\alpha)} + F'_{fr_1}e^{f(\alpha_1+\Delta\alpha_1)} + [T_{av} + T_{av_1} + (T_0 + T_{0_1})\sin nt](e^{f(2\pi-j+\alpha-\Delta\alpha)} + e^{f(2\pi-j+\alpha_1+\Delta\alpha_1)}) \quad (10)$$

In this case, taking into account the weaving of the webs obliquely at an angle θ to the horizontal axis in the zone centered on the ring of the guide of the knitting machine, the total pull tension is determined from the expression:

$$\mathrm{T}'_{out} = F'_{fr}e^{f(\alpha-\Delta\alpha)} + F'_{fr_1}e^{f(\alpha_1+\Delta\alpha_1)} + [T_{av} + T_{av_1} + (T_0 + T_{0_1})\sin nt](e^{f(2\pi-j+\alpha-\Delta\alpha)} + e^{f(2\pi-j+\alpha_1+\Delta\alpha_1)})(\mathrm{e}^{f\mathrm{C}} + \mathrm{e}^{f\text{Д}}) \quad (11)$$

where, C = 4π-j-β+θ+α-Δα; Д = 2$\boldsymbol{\pi}$-j-$\boldsymbol{\beta}$+θ+α_1+$\Delta\alpha_1$;

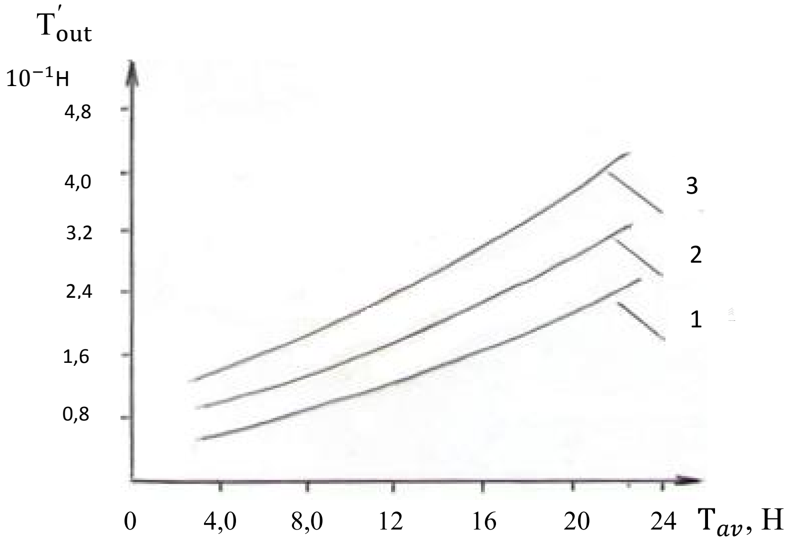
Based on the numerical solution (8), (10) and (11), it is possible to determine the parameters of the guide for obtaining high-quality knitwear.
Numerical solution of the problem and analysis of the results numerical calculations are given taking into account the following values of the system parameters: the diameter of the needle cylinder is 22 inches; class - 10; number of knitting systems - 6; lock block rotation frequency, min^{-1} – 22; performance (coupon length 60 cm), coupons per hour - 18; pull force - 3-20 N; linear density of the yarn 31 texX2; needle thickness - a = 0.5 mm; fender tooth thickness - p = 1.5 mm.
In fig. 3.graphical dependences of the change in the output force of the loops of the loops are presented in the center of the zone of the retractors, that is, at the angle of inclination of the retractable loops θ = 0 with variations in the initial tension force T_{av}.
Analysis of the graphs shows that an increase in the initial tension leads to an increase in the pulling strength of the knitted fabric according to a nonlinear pattern. So with an increase in the initial tension of the loops from 4.0 N to 23.5 N, the force of the loops of the loops along the center of the zone of the delay increases from 6.4 N to 25.2 N with the coefficient of friction of the loops on the surface of the cylinder equal to f = 0.25. With an increase in the friction coefficient to 0.45, the output force of the knitted hinge loops in the center in the zone of the delay in the double-rotary round-turn machine increases from 14.9 N to 42.3 N. less by 35 - 50 mm.

ISSN: 2350-0328

International Journal of AdvancedResearch in Science, Engineering and Technology

Vol. 5, Issue 10,October 2018

Therefore, to align the pull-down forces along both zones, in the recommended design, the guide is made 35-50 mm lower on the edges relative to the center, while the hinge ends are at an angle θ. Therefore, it is important to study the effect of the angle of inclination of the loop θ on the value of the pull force.



1 - at f = 0.25;
2 - at f = 0.35;
3 - at f = 0.45;

Fig 3.Dependence of the change in the pull-off force of the knit loops to the center of the pull-out zone on the change in the average value of the initial tension force of the loop.

In fig. 4. graphical dependences of the change in the force of the delay in the knit loops along the edges of the zone of the delay on the change in the angle of inclination of the loop forming θ for different values of the initial tension of the loops.

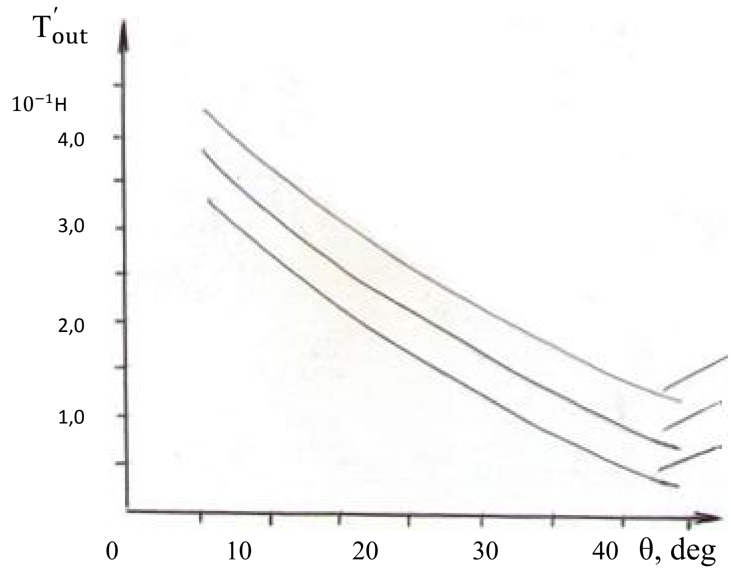
Analysis of the graphs shows that with an increase in the angle of inclination of the knitted loops, not only does the length of the generators increase, but the pulling strength of the knit loops at the edges decreases. In this case, it becomes possible to equalize the pull-down forces of the knit loops both in the center and along the edges of the pull-out zone. With an increase in the angle of inclination of the knit loops from 6^0to38^0, the pull-down force of the knit fabric at the edges of the pull-down zone decreases by nonlinear regularity from 32.7 N to 3.1, N with an average initial tension of 10 N. At the initial tension loops of 20 N, the pull-down force decreases from 42.1 N to 13.4 N with increasing θ to 38^0. Comparing the values of the pull-down force of the knit loops according to fig. 3.and fig. 4. it can be seen that with the initial tension of the loops within (15-20) N the pulling force for both zones (in the center and along the edges) the pulls will be the same within (37-40) N with f = 0.3 and θ = 14^0 - 20^0. Therefore, the given values of T_{av}, f, and θ are recommended for the proposed design of the knit loop guide for a round-turn knitting machine.

The nature and value of the pull force is also influenced by the value of the wire radius and the length of the generator.

ISSN: 2350-0328

International Journal of AdvancedResearch in Science, Engineering and Technology

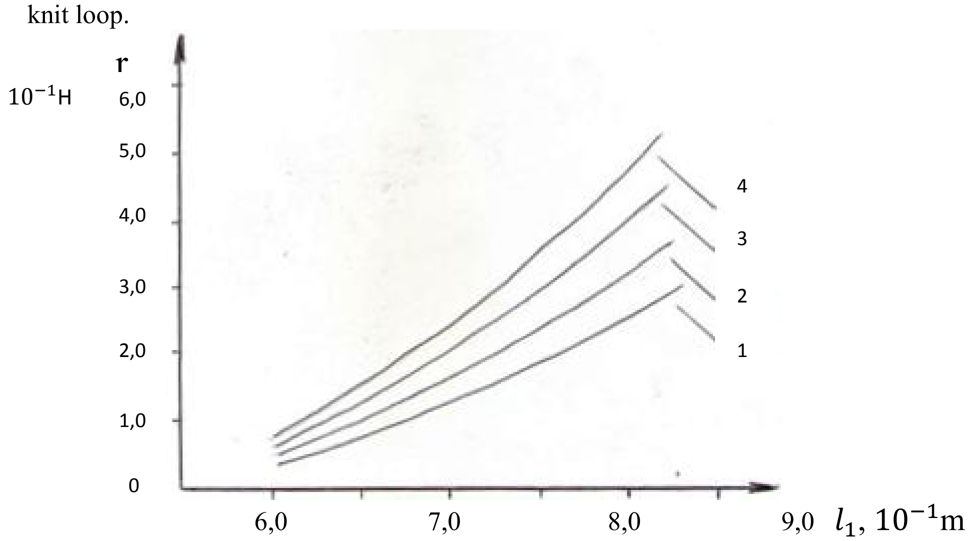
Vol. 5, Issue 10,October 2018



1 - atT_{av} = 20 N;
2 - atT_{av}= 15 N;
3 - atT_{av}= 10 N;

Fig 4. Dependence of the change in the force of the delay in the knit loops at the edges of the zone of the delay on the change in the angle of inclination of the forming loops.

Figure 5.presents the graphical dependences of the change in the radius of the wire of the guide on the length of the loop forming along the edges of the delay zone, taking into account different values of the angle of inclination of the knit loop.



1- at θ = 5^0;
2- at θ = 15^0;
3 - at θ = 25^0;
4 - at θ = 35^0.

Fig 5.Dependence of the change in the wire radius of the knitter loop guide along the edges of the delayed zone on the variation of the length of the knit loop.

ISSN: 2350-0328

International Journal of AdvancedResearch in Science, Engineering and Technology

Vol. 5, Issue 10,October 2018

An analysis of the graphical dependences obtained in Fig. 5 shows that with increasing length of the knitting hinge loops at the edges of the drawbar zone, the radius of the guide wire increases according to a nonlinear pattern So, with increasing l from 0.6 m to 0.87 m, the guide wire's radius increases from $0{,}3X10^{-3}$m to $2{,}95X10^{-3}$ m with $\theta = 5^0$. When the value of the angle of inclination $\theta = 35^0$, the value of the guide wire's radius increases from $0{,}88X10^{-3}$m to $5{,}18X10^{-3}$m with changing l, within (0.6 -0.87) m. Considering the recommended values $\theta = (14^0$-$20^0)$ and l_1 = (0.7-0.85) m from the graphs in Fig. 5. You can select the necessary values for the radius of the guide wire, r = (2, 81-4.48) $X10^{-3}$m, at which the values of the pull force of the knit loops will be the same both at the edges and at the center of the draw line.

In addition, it is important to determine the distance of the location of the center of the wire from the needle surfaces of the upper and lower cylinders of the rotary knitting machine.

IV. RESULTS AND CONCLUSION

1. Developed and recommended new effective designs of guides that allow the alignment of the pull-down forces of the knit loops both in the center and along the edges of the pull-out zone, thereby obtaining high-quality knitwear.
2. Formulas were obtained for calculating the pull-down force of the knit loops in the center and along the edges of the drawstring zone in the round-turn knitting machine, taking into account the influence of the initial loop tension, friction force, and geometrical dimensions of the drawstring zone and the guide.
3. Graphic dependences of the change in the radius of the wire of the guide wire on the length of the loop generators along the edges of the delay zone have been constructed, taking into account different values of the angle of inclination of the knit loop loops. Recommended values are the radius of the wire guide, r = (2.81-4.48) X 10^{-3} m, at which the values of the pull force of the knit loops will be the same both at the edges and at the center of the draw zone.
4. Graphic dependences of the change in the distance from the needle plane to the center of the guide wire at the edges of the delay zone in a two-rotary rotary knitting machine are obtained. Values of the distance from the needle plane to the center of the guide wire, L = (0.52-0.68) m, are justified, at which the pull force at the edges and center will be uniform.

References:

1. Mukimov M.M. vaboskalar. Knitwear production machine.Tashkent teacher 2007.– p. 186-195
2. Galanina, O.D, Prokhorenko, E.G. Technology knitwear. M., Light industry. 1975. - p. 111-114., 129-131.
3. Gorbaruk V.N. Design knitting machines. L., "Mechanical Engineering". 1980. - p. 412-413.
4. Dzhangir Ahmad ogluHajiyev. Scientific basis for the development of resource-saving knitwear production technology.Thesis for the degree of Doctor of Technical Sciences.Ganja; 2008. - p. 34
5. Usmonkulov Sh.K. Ways to improve the quality of double-layer knitwear by improving the mechanism for pushing double-functional circular knitting machines. // Textile problems. No. 2/2016. - with. 30-34.
6. Khazratkulov, H., Sarybaeva, E. Baizhanova, S., M.M. Mukimov. Development of a new range of knitted fabrics for combined weaving. // Problems of textiles. 2009. № 4.
7. Patent No. FAP 01083.A guide for the delay of a knitted fabric on double-circular circular knitting machines.Usmonkulov Sh.K., Mukimov M.M., Allaniyazov G.Sh., Djuraev A.D. Bul. Number 4, 2016.
8. Allamuratova T.K, Mukimov M.M, Djuraev A.D. Routing device for drawing knitted fabrics in double circular weft machines in a circle // Journal "Problems of textiles" Tashkent, 2018 №2, - p. 69-74.

AUTHOR'S BIOGRAPHY

Tamara Kalmuratovna Allamuratova Doctoral student of the Department of "Technology of textile fabrics" Tashkent Institute of Textile and Light Industry, 100100, Uzbekistan, Tashkent, St. Shohzhakhon-5

Anvar Djuraevish Djuraev D.Sc., prof. Department of "Technology of textile fabrics" Tashkent Institute of Textile and Light Industry, 100100, Uzbekistan, Tashkent, St. Shokhzhahon-5

Mirabzal Miraubovich Mukimov D.Sc., prof. Department of "Technology of textile fabrics" Tashkent Institute of Textile and Light Industry, 100100, Uzbekistan, Tashkent, St. Shokhzhahon-5