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RESEARCH ANALYSIS RESULTS OF COMPARED PRODUCTION TESTS OF THE MODERNIZED SEWING MACHINE WITH SELECTED TENSIONING DEVICES

Muxamedjanova S.
Bukhara Engineering Technological Institute, Uzbekistan
Email: muxamedjanovasabrina@gmail.com

Abstract– The article presents the results of comparative production tests of a modernized sewing machine with recommended needle and hook thread tensioners. The constructive execution and selected parameters of tensioning devices, which allowed obtaining high-quality stitches in comparison with the existing sewing machine, are substantiated.

Key words– Sewing machine, thread, needle, regulator, tension, platter, rubber shock-absorber, oscillation, rigidity, motion, amplitude, frequency.

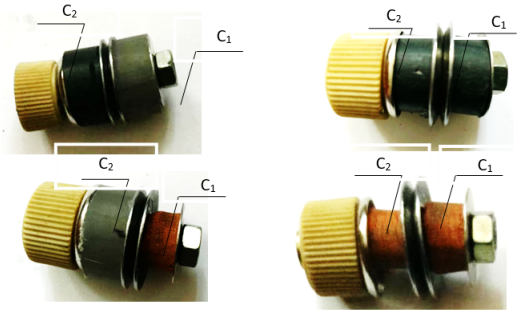
I INTRODUCTION

Based on the results of theoretical and experimental studies, the main parameters of sewing machine thread tensioners were justified [1,2]. Taking into account the recommended parameters of needle and hook thread tensioners, the samples of the developed designs of thread tensioners were made.

Fig.1 shows samples of plate thread tensioners with additional shock absorbers. At the same time, to determine the most acceptable ratios of stiffnesses of shock absorbing and pressure regulating rubber bushings, a number of versions of thread tensioners were produced.

Fig.2 shows the general view of the plate thread tensioner with a rubber shock absorber and a spring pressure elastic element. During the tests different variants of the stiffness ratios C_1 and C_2 of the elastic elements were used (see Fig. 1). In addition, the oscillating version of the tensioning device was considered (see Fig. 2) [3,4].

Tests were conducted on the modernized and serial sewing machine and compared the results. During the tests of the modernized sewing machine with new thread tensioners in obtaining quality stitches in the manufacture of garments, there were no failures, no skipped stitches, no needle breakage, no thread breaks and unraveling of stitches at high speed

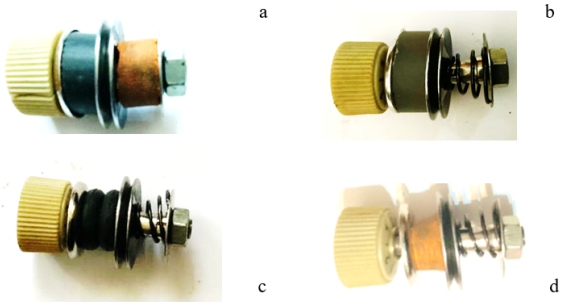


1- at $C_2 > C_1$; 2- at $C_2 = C_1$; 3-at $C_1 = C_2$; - at $C_2 < C_1$;

Fig. 1: General view of disc tensioners with rubber shock absorbers and combirinivon bushings

modes of operation (up to 5000 min^{-1}).

Production tests on the modernized sample sewing machine were conducted at different speed modes and on different brands of denim materials ("Denim", "Gin", "Stretch").



a - with rubber shock absorbers; b - combined version; c - rubber shock absorber with a set of rings; d - rubber shock absorber and spring pressure element;

Fig. 2: General view of the variants of the recommended disc tensioners design

Indicators	In a commercially available sewing machine				In a modernized sewing machine with new thread tensioners			
	1	2	3	average	1	2	3	average
1. Needle breakage	-	-	-	-	-	-	-	-
2. Stitch skip, 10 m	3	2	2	2,3	-	-	1	0,3
3. Thread breakage, 30 m	2	4	3	3	-	-	-	-
4. Tensile strength, 100 m	-	1	2	1	-	-	-	-
5. Deformability in %	26	31	30	30	28	28	29	28,3

TABLE 1: AT A MAIN SHAFT SPEED OF 3500 min^{-1}, THE THICKNESS OF THE OF THE MATERIALS TO BE SEWN IS 3.0 MM (STRETCH MATERIAL).

Indicators	In a commercially available sewing machine				In a modernized sewing machine with new thread tensioners			
	1	2	3	average	1	2	3	average
1. Needle breakage	-	1	-	0,3	-	-	-	-
2. Stitch skip, 10 m	3	2	2	2,3	1	-	-	0,3
3. Thread breakage, 30 m	2	4	3	3	-	-	-	-
4. Tensile strength, 100m	1	1	-	1,7	-	-	-	-
5. Deformability in %	31	30	32	31	33	34	33	33,3

TABLE 2: AT A MAIN SHAFT SPEED OF 4500 min^{-1}, THE THICKNESS OF THE OF THE MATERIALS TO BE SEWN IS 3.0 MM (STRETCH MATERIAL).

Indicators	In a commercially available sewing machine				In a modernized sewing machine with new thread tensioners			
	1	2	3	average	1	2	3	average
1. Needle breakage	1	1	-	1	-	-	-	-
2. Stitch skip, 10 m	4	3	3	3,3	-	-	-	-
3. Thread breakage, 30 m	4	3	4	3,6	-	-	-	-
4. Tensile strength, 100m	2	-	1	1	-	-	-	-
5. Strength of line breaks, n	139	149	142	143	187	196	192	193

TABLE 3: AT A MAIN SHAFT SPEED OF 3500 min^{-1}, THE THICKNESS OF THE MATERIALS TO BE SEWN IS 3.5 MM (DENIM MATERIAL).

The checks showed that the density of the upper and lower threads of the double-layer material corresponds to the norm.

It was found that the quality of the obtained stitches on the recommended sewing machine meets the normative and technological requirements (there were no skipped stitches and folds of materials, breakage of needle and shuttle threads

Indicators	In a commercially available sewing machine				In a modernized sewing machine with new thread tensioners			
	1	2	3	average	1	2	3	average
1. Needle breakage	1	1	1	1	-	-	-	-
2. Stitch skip, 10 m	3	3	3	3	-	-	-	-
3. Thread breakage, 30 m	4	4	3	3,6	-	-	-	-
4. Tensile strength, 100m	1	2	2	1,6	-	-	-	-
5. Strength of line breaks, n	95	98	101	98	116	126	122	123

and there were no needle breakages, as well as there was no dissolution of stitches). Manufactured overalls made of dense denim material "Denim", as well as from deformable denim materials "Stretch" met the regulatory requirements

Technological tests showed that the recommended sewing machine has a number of advantages over existing machines and in the simplicity of design, and in increased productivity, as well as in the quality of stitches and stitches. Technological indicators of the compared sewing machines at different speeds of the main shaft are given in tables $1 \div 3$.

II RESULTS AND DISCUSSION

The results of production tests showed that the use of new disc and plate thread pullers in the modernized sewing machine allowed to increase the quality of sewing denim materials:

- increase the productivity of the sewing machine by 1.2-1.3 times compared to the serial sewing machine;
- virtually no skipped stitches;
- thread breakage is reduced by 8 times;
- no needle breakage;
- there is no unraveling of stitches.

In addition, when using the recommended designs of thread tensioners, the strength of stitches increases to $15 \div 18\%$.

The results of production tests confirmed the performance of the developed sewing machine with a plate thread tensioner needle thread with rubber shock absorbers and plate tensioner with parallel stiffness of shuttle thread in real industrial conditions with high technological performance, and allowed to obtain high-quality special clothing from denim materials with different characteristics [5-7].

III CONCLUSION

On the basis of production tests of the recommended sewing machine with effective needle thread tensioner and, the regulator of shuttle thread tension in comparison with the serial variant. The efficiency of using the recommended designs of thread tensioners is substantiated.

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