

Short Communications

Design of sewing thread tension measuring device

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A sewing thread tension measuring device has been developed and incorporated in the high speed lock stitch sewing machine. The construction of woven and knitted fabrics has tremendous influence on needle thread tension. It is observed that the fabric yield and thickness show high correlation with needle thread tension and less correlation with thread ticket number.

Keywords: Load cell, Microcontroller, Polyester, Seam puckering, Sewing thread tension

The thread tension is one of the important parameters which influences the quality of seam in the garment construction. Unbalanced thread tension leads to seam puckering resulting in sewing defects in the garments. Presently, the tension adjustment is carried out manually by trial and error method by the sewing operators. There is no proper unit to measure the tension of the needle thread while sewing. The thread tension at the beginning of seaming operation is manually adjusted and this tension is not quantified. Hence, in the present work, a needle thread tension measuring device has been designed to measure the needle thread tension in high speed lock stitch machine.

The device will measure the tension of sewing threads in a suitable unit. As a result the trial and error method of tension adjustment can be avoided and the exact tension can be set for the needle thread while sewing to avoid seam puckering, since puckering is related to the seam quality¹.

The drop feed is the simplest sewing feed mechanism². The single needle lock stitch sewing machine of drop feed mechanism is chosen for the

installation of needle thread tension measuring device. Since the spun polyester sewing thread is used for many of the garment constructions³ the seam is constructed in the spun polyester thread. For the evaluation purpose, fabric yield for woven sample is taken in the range of 120-220 gsm and constructed in the 60 and 80 thread ticket numbers. Similarly, for the knitted fabric the fabric yield is taken in the range of 155-273 gsm and constructed in the 60, 120 and 130 ticket numbers.

The principle of yarn tension measuring devices was studied and a load cell of 10 kg capacity was used. The load cell device converts force or weight into electrical signal⁴. Microcontroller 89C52, power supply unit and LED display unit were assembled in order to make sewing thread tension measuring device. A specific stand was designed to place the tension measuring device in the machine without affecting the basic working system of the lock stitch sewing machine. The tension measuring device was installed in the lock stitch sewing machine and final tension evaluation was carried out for various combinations of sewing thread, ticket number and fabric types. The complete evaluation of needle thread tension was made, noted in an observation table and recorded in cyber shot camera for better clarification. The observed tension was analyzed and presented in the form of graph. The correlation between thread tension and the fabric geometry was determined using Microsoft Excel 2007 software.

The sewing thread tension measuring device was installed in high speed lock stitch sewing machine. The thread was allowed to pass through the guides of measuring device and then to the needle bar. The sewing thread tension measuring device along with the microcontroller and circuit board are shown in the Figs 1a and b. Figure 2 shows the working of tension measuring device. Signals obtained from the load cell are amplified and given as input to the analog-to-digital controller (ADC), and then fed to microcontroller. The microcontroller was programmed to display the values of the tension in grams in a display unit. The purpose of selecting microcontroller is to make the device as an online measuring instrument and the same can be used for data acquisition systems⁴.

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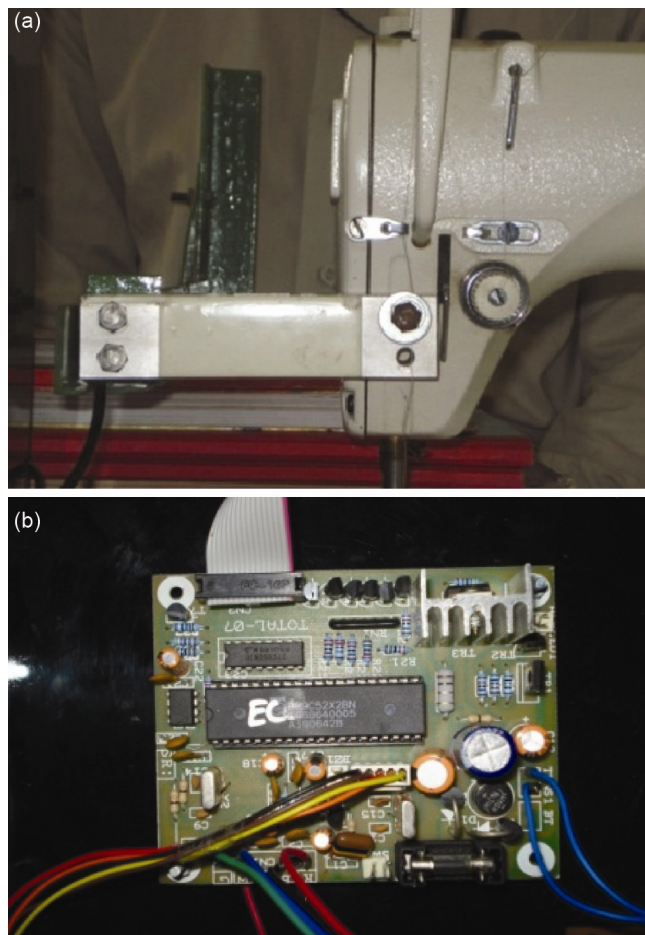


Fig. 1—(a) Load cell in sewing machine and (b) microcontroller and circuit board

The tension measuring device was positioned exactly 10 cm above the bed surface of the lock stitch sewing machine as shown in the Fig. 3. The sewing thread tension was observed by varying the sewing thread ticket number from 60 to 130. The woven and knitted fabrics of different weights were used for determining the thread tension.

Tables 1 and 2 show the fabric geometry and needle thread tension values for different woven and knitted fabrics. The thickness of the fabric significantly influences the needle thread tension. The increase in fabric GSM also directly influences the thread tension. Higher fabric GSM requires more thread tension for better seaming in high speed sewing machine. It is interesting to observe that the fabric construction has tremendous influence on the thread tension for woven and knitted fabrics of the same yield. Needle thread tension is observed from LED display device. The coefficient of correlation value is shown in Tables 3 and 4. It is found that the

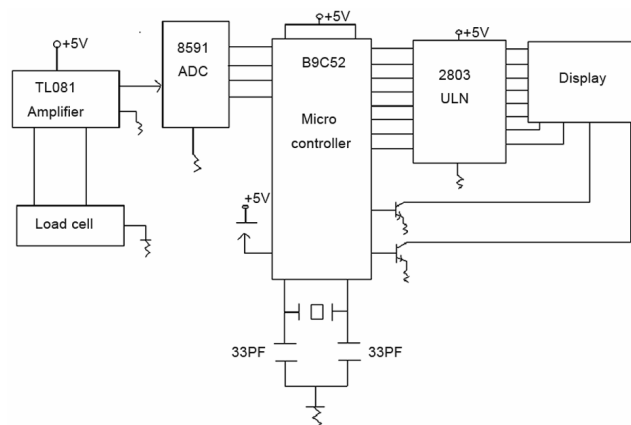


Fig. 2—Block diagram of tension measuring device

Table 1—Needle thread tension measurement for woven fabrics

Fabric	EPI	PPI	Thickness mm	Fabric yield g/m ²	Ticket No.	Sewing thread tension, g
Denim	112	60	0.585	220	60	35
Plain printed	68	46	0.585	220	60	35
Polypropylene	36	28	0.292	133	80	17
Polyester	42	28	0.272	150	80	17
Viscose	54	28	0.282	153	80	17
Plain (grey)	70	64	0.182	120	80	16

Table 2—Needle thread tension measurement for knitted fabrics

Fabric	Courses/ inch	Wales/ inch	Thickness mm	Fabric yield g/m ²	Ticket No.	Sewing thread tension, g
Single jersey	40	48	0.272	155	130	20
Single jersey	38	44	0.312	168	130	23
Single jersey	35	46	0.322	175	130	33
Two thread fleece	34	42	0.412	238	60	36
Two thread fleece	32	48	0.632	273	60	39
Terry	26	30	0.232	250	120	16

needle thread tension has high correlation values with GSM and thickness of the woven and knitted fabrics.

The newly developed sewing thread tension measuring device gives the promising results for assessing the thread tension. It is apparent that the fabric construction of woven and knitted fabrics has tremendous influence on needle thread tension. Improvement in productivity is very important in supply chain of garment manufacture; development of online measuring device will eventually improve the overall efficiency in sewing department. Designing the device in a miniature form will suit for all types of sewing machine. Further work may be carried out on

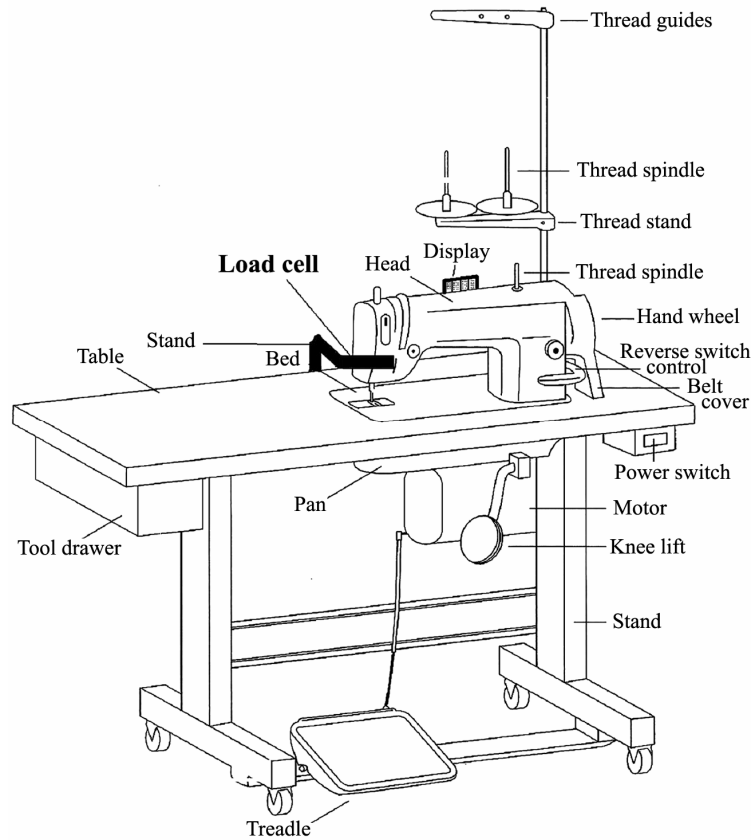


Fig. 3—Location of tension measuring device in high speed lock stitch sewing machine

Table 3—Correlation value of woven fabric geometry and needle thread tension

Parameter	Thickness	Fabric yield	Thread ticket number	Needle thread tension
Thickness	1			
Fabric yield	0.982464199	1		
Thread ticket number	-0.9719488	0.961530169	1	
Needle thread tension	0.982519987	0.969980365	-0.999156632	1

data acquisition and processing of results using intelligent automation for better productivity. The seam quality will be improved and garment rejection level will decrease in inspection.

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Table 4—Correlation value of knitted fabric geometry and needle thread tension

Parameter	Thickness	Fabric yield	Thread ticket number	Needle thread tension
Thickness	1			
Fabric yield	0.1129359	1		
Thread ticket number	-0.7550827	-0.637321634	1	
Needle thread tension	0.133973885	0.886815997	-0.488592858	1

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