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IMPACT OF MODIFIED FEED MECHANISM ON SEAM QUALITY OF GARMENTS

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Abstract: *A few distinct feed mechanisms can be found in sewing machines. The mechanism that feeds the material into the machine differs in each machine. In lock stitch sewing machines, the mechanism known as the drop feed is the one that is utilized the majority of the time. Its construction includes one presser foot, one throat plate, and one feed dog. Different types of feed dogs can be used in the drop feed mechanism to achieve the desired level of customization. In this study, modification-1, modification-2, and modification-3 were created in an industrial lock stitch machine using feed dogs with 18, 21, and 30 teeth, respectively. These numbers correspond to the number of teeth on the feed dogs. The quality of the seams, such as the seams on garments, was analyzed after each modification of the feed mechanism performed on seams made of the same fabric (Denim fabric). We took measurements of the seam's strength and efficiency as well as its puckering and slippage. It was discovered that the seam quality of garments constructed using modification-1 (one) is superior to that of garments constructed using the other two modifications using the same fabric. Therefore, to finish a specific garment accurately, it is necessary to select the appropriate sewing machine and ensure that it has the ideal feed mechanism.*

Keywords: *Feed mechanism, Feed dog, Seam quality, Garment*

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1. INTRODUCTION

The sewing machine's feed mechanism controls the movement of the sewn material, making it the most critical component. Each cycle of needle motion must involve a different part of the material being sewn, which means that the material being sewn must move. This motion is referred to as the feed mechanism [1]. Fabrics are fed into the stitch formation zone by feed mechanisms, which then take the stitched fabrics out of the stitch formation zone. Frictional forces between the feed dog and the bottom fabric and several layers of fabric on the same machine, are what propel fabrics ahead. The presser foot's pressure, which is a littlesmallonsiderable quantity, also produces a force that opposes the movement of the cloth. As a result of this opposing force, the top cloth lengthens somewhat, and there may be some displacement between the top and bottom textiles. This

indicates that two separate lengths of cloth are striving to match up along the seam, giving the seam the impression of being puckered [2].

It is vital to consider both the dynamic properties of the pressure-feed system and the properties of the fabric to effectively function of the feed mechanism of a periodical action [3]. The performance of a garment's seams is determined by the fabric's structural and mechanical characteristics. The appearance and performance of seams are determined by the types of stitches and seams used, their parameters, seam defects, and seam damages [4]. Presser-foot force may be adjusted to lessen issues, including uneven stitches, distortions, and material deterioration. Because it is a fixed-force system, constant-force control does not provide for the best force setting at all speeds. Closed-loop control enables more exact force adaptation to each stitching specificity's needs. Some sewing characteristics, including those more directly connected to the material feedings process, such as the force applied to the presser foot and the vertical displacement of the presser foot, were occasionally measured by researchers using instrumented sewing machines. The theory that contacts losses between the presser foot and the feed dogs increase with sewing speed and decrease when the presser foot pre-tension is increased was supported by the development of a mathematical model for the movement of the presser foot in a sewing machine as well as experiments [5].

During textile materials' stitching, parameters should be set for optimal reinforcing results in the manufactured composite. The damages of the sewing thread and the reinforcing textile should be minimized. For optimal results, measurement devices were developed to watch the relevant parameters (presser foot distance, needle thread tension) during the stitching process [6]. Additionally, a "maglev" presser-foot controller and an electromagnetic actuator were combined to create the "auto damp" presser-foot active actuation system [7]. This system maintained a consistent force between the presser-foot and the fabric. The effectiveness of the feeding system was assessed by detecting vertical presser-foot displacement using a contactless setup using a Hall-effect sensor [8]. Additionally, to comprehend the root causes of sewing issues, the link between presser-foot force, displacement, sewing speed, and material qualities was examined [9].

In the making of garments, it is seen that all kinds of fabrics are added with the same sewing machine. Every sewing machine has a specific feed mechanism different from other sewing machines. Despite the exact feed mechanism of the same sewing machine used for light, medium, and heavy fabrics, noticeable differences are observed between the feed dog teeth. Feed dogs can have thin or thick teeth where the number of teeth is higher if the teeth are thin and the number of teeth is less if the teeth are thick. Therefore, it has been examined if the number of feed dog teeth on the same machine's drop feed mechanism has to be raised or decreased. Here, it has also been studied to see if the number of teeth on the feed dog makes any difference in the quality of the seams on the clothing.

2. EXPERIMENTAL

2.1 Materials and Methods

The denim fabric (Figure1) with EPI-137, PPI-73, Areal Density-8.36 Oz/yd^2, Warp yarn count-20 Ne and Weft yarn count-4.08 Denier composed of Polyester & Spandex was used to produce superimposed seam.

Fig 1. Denim fabric

The sewing thread was 100% spun polyester containing count of 50/2 Nm. This thread was used to make superimposed seams by an industrial single-needle lock stitch machine (Figure 2). Then universal strength tester (Titan of James Heal Co.) was used to measure the seam strength and seam slippage. Other equipment (measuring scale, balance, GSM cutter) was also used as supporting equipment. In this study, the stitch was performed, keeping all other sewing parameters constant. The following standards (Table1) were followed for the measurement of fabric areal density, fabric strength (warp & weft direction), seam strength (warp & weft direction), seam slippage, and seam puckering for three modified feed mechanisms (Table2) separately.

Fig 2. Lock stitch sewing machine

Table 1. Testing standards and measuring purposes

Testing Standard	Measuring Properties
ASTM D 3776:2013	Areal Density
ASTM D1683-11a (Strip Test)	Fabric Strength
ASTM D1683-11a (Strip Test)	Seam Strength
ISO 13936- 1 & 2	Seam Slippage
AATCC standard 88B	Seam Pucker

Table 2. Modifications in the drop feed mechanism using feed dogs of various teeth

Modification No.	Modified Feed Mechanism
Modification-1	Throat Plate - Presser Foot - Feed Dog (18 Teeth)
Modification-2	Throat Plate - Presser Foot - Feed Dog (21 Teeth)
Modification-3	Throat Plate - Presser Foot - Feed Dog (30 Teeth)

The feed dogs included in the three modifications are illustrated belowFigure3). Here, denim fabric was used, and superimposed seams were produced. It is also mentionable that other machine and process parameters remained constant. After that, all the produced seams for three modified feed mechanisms were tested to identify the seam properties. Finally, it was tried to see the relationship between the modification in feed dog and the seam quality of garments.

18 Teeth 21 Teeth 30 Teeth

Fig 3. Different feed dogs for three modifications in feed mechanisms

3. RESULTS AND DISCUSSION

3.1. Seam strength analysis

The seam strength in the warp and weft direction is indicated in Table 3.

Table 3. Seam strength (Warp wise and Weft wise)

Modification in Feed Mechanism	Seam Strength (N) in Warp direction	Seam Strength (N) in Weft direction
Modification-1	156.56	178.54
Modification-2	154.47	166.87
Modification-3	153.07	165.14

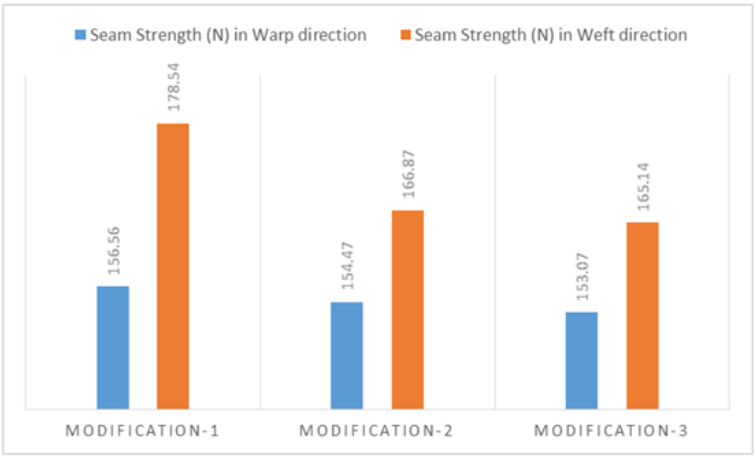

Fig 4. Seam Strength (Warp and Weft wise)

In figure 4, it is clearly shown that the seam strength is the highest for both warp and weft direction in case the case of modification-1, i.e., lower no. of teeth of feed dog gives the better result than higher no. of teeth as the higher no. of teeth of feed dog may damage the fabric during sewing for having more fabric contact.

3.2 Seam Efficiency Analysis

The seam efficiency in the warp and weft direction is indicated in Table 4.

Table 4. Seam Efficiency (Warp wise and Weft wise)

Modification in Feed Mechanism	Seam Efficiency (%) in warp direction	Seam Efficiency (%) in weft direction
Modification-1	20.15	22.39
Modification-2	19.88	21.21
Modification-3	19.74	20.08

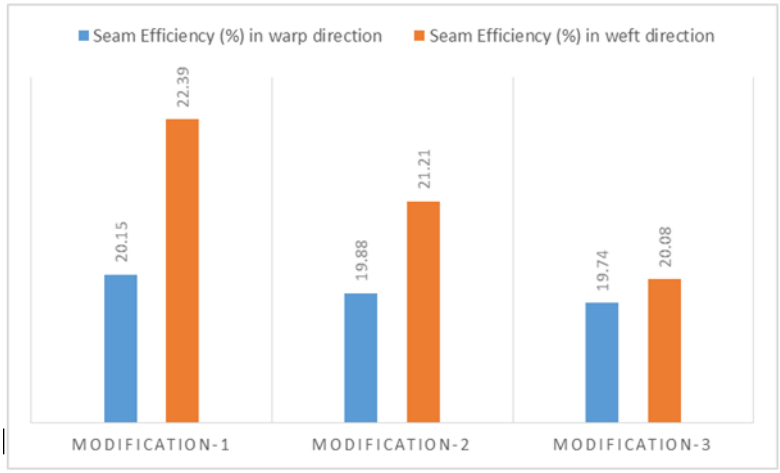

Fig 5. Seam Efficiency (Warp and Weft wise)

Figure 5, shows that the seam efficiency is the highest for both warp and weft direction in the case of modification-1 i.e. lower no. of teeth of feed dog gives a better result than a higher no. of teeth as the higher no. of teeth of feed dog may damage the fabric during sewing for having more fabric contact.

3.3 Seam Slippage Analysis

The seam slippage in both warp and weft directions is given in Table 5.

Table 5. Seam Slippage (Warp way and Weft way)

Modification in Feed Mechanism	Seam Slippage (mm) in warp direction	Seam Slippage (mm) in weft direction
Modification-1	3	5.3
Modification-2	5	6
Modification-3	5	6.33

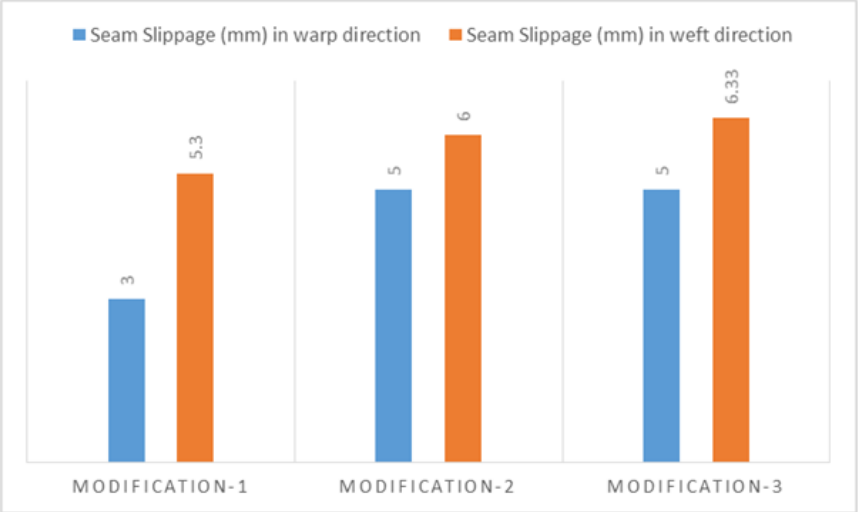

Fig 6. Seam Slippage (Warp wise and Weft wise)

In figure 6, it is clear that the seam slippage is the lowest (good) for both warp and weft direction in the case of modification-1, whereas seam slippage is the highest in the case of modification-2 due to the improper feeding of fabric by the feed dog of higher teeth during sewing.

3.4 Seam pucker analysis

The seam pucker in both warp and weft directions is given in Table 6.

Table 6. Seam Pucker (Warp wise and Weft wise)

Modification in Feed Mechanism	Seam Pucker in warp direction	Seam Pucker in weft direction
Modification-1	4	4
Modification-2	4	4
Modification-3	4	4

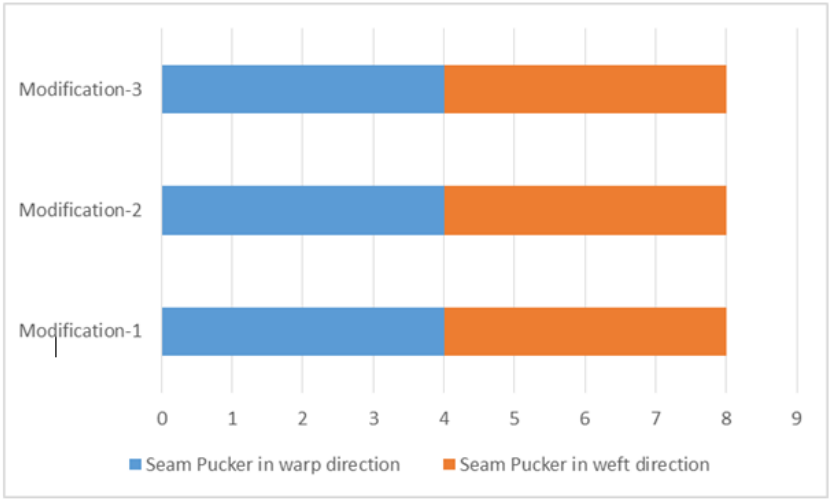

Fig 7. Seam Pucker (Warp wise and Weft wise)

Figure 7 represents that the seam pucker is the same for both warp and weft direction in case of all modifications (1, 2 & 3).

4. CONCLUSIONS

The results of this study make it easy to confirm that the same machine (lock stitch sewing machine) and the exact feed mechanism (drop feed mechanism) cannot be used for sewing all kinds of fabrics (light, medium, and heavy) and will also change the quality of the garment seam. So, choosing the proper sewing machine with the perfect feed mechanism is necessary to complete a specific garment correctly.

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