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DESIGN AND DEVELOPMENT OF WEFT HOLDING MECHANISM IN POWER LOOM FOR WEFT IKAT MANUFACTURING

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Abstract

Weft ikat fabrics were produced in powerloom by stopping a loom for each pick and also more manual power were required. In order to overcome this problem, weft holding mechanism is developed in powerloom for Ikat fabric manufacturing which is used for increasing the production. Existing problems reported in weft ikat fabric manufacturing are , for tension adjustment more laborious work taken to vary the yarn tension, chance of design misplace, lower production rate. To increase a production and to reduce physical work of a weaver, weft holding mechanism is developed and fixed to hold the weft during picking and before beat-up. The mechanical attachment is done by using covered steel wire type material based on holding length and loom model. Experiments were done for production of weft ikat fabric using special attachment.

Keywords: weft yarn tension, starting mark, Ikat, loom, covered steel wire.

1. INTRODUCTION

Ikat fabrics have always been popular for their distinct style and unparalleled beauty. It is a loom-woven textile created by a remarkable process. A master weaver first ties bundles of warp threads in precise patterns to prepare for coloured dyes. A more intricate resist-dyeing technique like tie-dyeing, tied patterns must accurately match the planned fabric design. Once the yarns have been suitably dyed and dried, the weaver lines up on the loom to form the pattern. The design takes form as the yarn is woven into cloth. This is an incredibly complicated process, as the weaver has to precisely dye the threads, and place them correctly so it forms the correct pattern when woven. Just to reiterate how hard this is in order to replicate a pattern, the weaver would have to dye the thread in exactly the same place as before and line it up on a loom in exactly the same place and then they would have to weave it exactly the same way.

Double ikat textiles take even more skill to make. For these, the weaver also bundles and dyes the weft thread in patterns. He then weaves the weft and warp to cross precisely so that colours match up and form the planned motif. These ikats are rich in colour. Because of the handcrafted weaving process, Ikat have distinctive feathered edges on the coloured areas.

Fig.1.1-Appearance of Ikat weft tie&dye yarn

Although ikat weaving is a complex technique, it is surprising how the technique is believed to have simultaneously and independently developed in different parts of the world. Ikat was brought to Europe at almost the same time by Dutch traders from South East Asia as the Spanish from South America and explores from the Silk Road. It is interesting to note that every ikat weaving group has its own distinct patterns, styles and choices of colour.

2. MATERIALS AND METHODS

2.1.Material

Two different cotton yarns sourced as Weft and Warp in Pazhani region. The sourced yarns were introduced to warping and pirn winding for the looming process. Table 1 shows the particulars of the sourced yarns.

Table 1 Physical property of Warp and Weft yarn

YARN	COUNT (Ne)	DYEING
WARP	40S	SOLID
WEFT	40S	TIE & DYE

Before looming process, needed to setup the weft holding system and to attach it on the loom. The physical appearance of the weft holding system influenced from the conventional side weft fork stop motion. Covered steel wire, Steel rods, rubber grips, screw, spring and velvet fabrics were purchased from the market and shaped as per the design of weft holding system in the workshop. Table 2 gives the particulars of the weft holding system.,

Table 2 Particulars of the Weft holding system

ITEM	MATERIAL	TYPE	LENGTH in mm	WIDTH in mm
FORK	RUBBER COVERED STEEL WIRE	BENDED/RIGID	100	3
GRIPPER	RUBBER	SERRATED/FLEXIBLE	40	15
GRIPPER ROD	STEEL	RIGID	85	10
SCREW	STEEL	RIGID	40	10
VELVET CLOTH	FABRIC/ADHESIVE BACK	RAISED SOFT SURFACE	40	10

Function of the Fork is to push the weft yarn which newly inserted between the shed for 45mm opposite to the fell of the cloth. Rubber cover over the fork will ensure the smooth surface which will not cut the weft. Gripper provides the holding to the yarn and ensures the yarn couldn't slip or slough off during the beat-up action. Gripper rod hold the Gripper rigid and the end is connected with a steel spring which work as a shock absorber. The velvet cloth attached to the Gripper ensures the soft holding of the weft without damaging. The Screw helps to adjust the Fork to alter the length of the weft which has to be held. Picture 2.1 shows the appearance of Weft holding mechanism.,

Fig.2.1-Appearance of Weft holding mechanism

The weft holding mechanism set in between the shuttle box and the selvedges in both the sides.

2.2. Production of IKAT fabric with Weft holding mechanism

The developed Weft holding mechanism decided to be attached in a Under pick type power loom and plain weave is the weave plan selected. The production trials were divided into 3 methods to compare the efficiency of the mechanism working. Figure 2.2 shows the trial fabric woven with the first method in which no weft holding mechanism were attached and the fabric woven for 500 picks was collected and particulars noted. Figure 2.3 shows the trial fabric woven with the second method in which single side weft holding mechanism were attached and the fabric woven for 500 picks was collected and particulars noted. Figure 2.4 shows the trial fabric woven with the second method in which double side weft holding mechanism were attached and the fabric woven for 500 picks was collected and particulars noted

Fig.2.2-Trial fabric with no Weft holding mechanism

Fig.2.3-Trial fabric with single side Weft holding mechanism

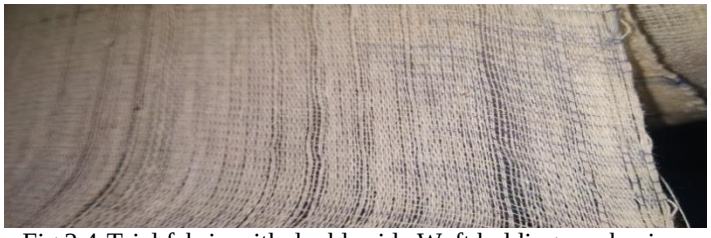

Fig.2.4-Trial fabric with double side Weft holding mechanism

After analysing all the three trial fabrics and particulars, decided to develop the saree design with the methods 1 and 3. In which the actual solid dyed warp and tie and dye weft of an IKAT saree were used. Figure 2.5 shows the Saree design produced without weft holding mechanism. Figure 2.6 shows the Saree design produced with double side mounted weft holding mechanism. Both the fabrics collected for testing.

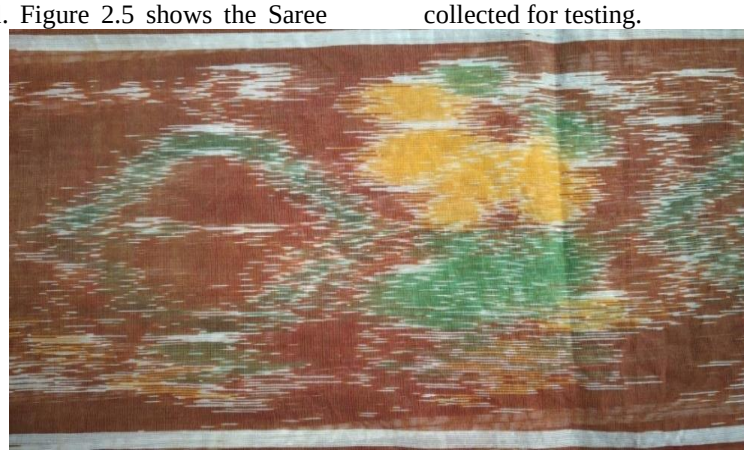

Fig.2.5-Saree fabric with no Weft holding mechanism

Fig.2.5-Saree fabric with double side Weft holding mechanism

2.3. GSM Measurement

ASTM standard D3776 was followed to measure the mass per unit area of woven fabrics. The specimens of size 10 × 10 cm were cut randomly from different places and weighed in electronic balance with an accuracy of 0.01 g and the average of twenty readings was taken.

2.4. Construction per inch (thread per unit length)

PPI and EPI are the most common term in fabric ASTM standard D3775 were followed to identify the results. Pick glass were used for the test.

2.5. Yarn count

Yarn count was calculated by the beesley balance in ASTM D1059/1907 method. In which both the warp and weft yarn counts were determined in English system (Ne)

2.6. Fabric thickness

ASTM D1777-96(2019) were followed to test the fabric thickness in the fabric thickness tester. Multiple results were taken in multiple places of the fabrics and the results were obtained by the average.

3. RESULTS AND DISCUSSIONS

3.1. Visual Evaluation

The main objective of this project is to create IKAT designs without stopping the loom for every pick by using newly developed Weft holding mechanism. So, the visual evaluation of the particular design on the fabric was most important. Table 3 shows the comparison of the visual evaluation of a particular design with and without the addition of Weft holding mechanism

Table 3 Comparison of visual evaluation of Ikat fabric with and without Weft holding mechanism

Fabric woven without Weft holding mechanism	**Fabric woven with single side Weft holding mechanism**	**Fabric woven with double side Weft holding mechanism**
The starting point of each pick varies unequally	The starting point of each pick varies equally	The starting point of pick does not varies.
The difference between each pick's starting point varies in the range of 1.5 to 2 cm	The difference between variation was 2 cm	No variation
Angle of inclination is 10°	Angle of inclination is 6°	No angle of inclination

3.2. Fabric weight

A piece of fabric with 100 sq.cm area was cut from the fabric and weighed. The weight has been multiplied by 100 to arrive the correct GSM value of the fabric. According to ASTM Standard the GSM of the Saree would be 45 to 55 g/sq.m, the resultant GSM of the prepared sample was 48 g/sq.m which can also be used for Saree.

Fig.3.1- GSM Cutter

3.3.Yarn Count

For count identification a template were used to cut the fabric sample and testing carried out according to the procedure by Beesley Balance with respect to the type of yarn used for weaving. The results are Weft – 40s Ne and Warp – 40s Ne.

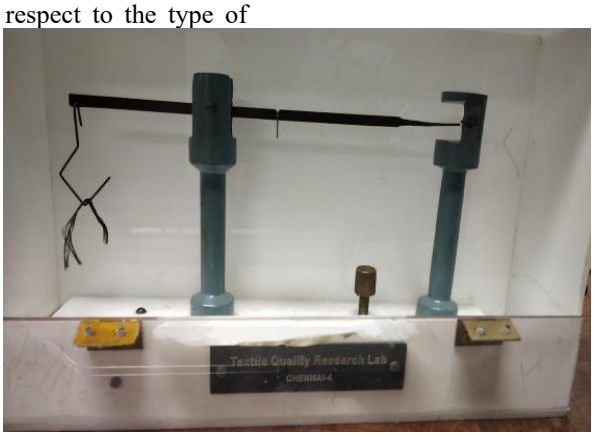

Fig.3.1- Beesley Balance

3.*4. Fabric thickness*

The fabric was placed in-between the two jaws of thickness measuring instrument and thickness was noted. The measured values were multiplied with 0.01 to convert it into mm. The resultant fabric thickness achieved was 0.18mm.

Fig.3.3- Fabric Thickness Tester

3.5. Cover factor

The cover factor of the prepared sample were calculated by using warp cover factor and weft cover factor which can be achieved by theEPI and warp count, PPI and weft count respectively. The result cover factor of the prepared fabric is 19.65 which is calculated from the warp cover factor 13.57 and weft cover factor 11.80.

3.6. Construction per inch (thread per unit length)

The prepared sample were taken for EPI and PPI count by using counting glass and picking needle. Fabric area about 1 inch were selected for the analyzing of EPI and PPI. Results obtained as EPI - 96, PPI - 56.

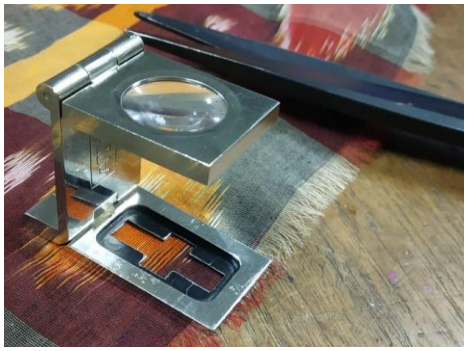

Fig.3.4- Counting Glass

4. CONCLUSION

The new weft holding mechanism for the manufacturing of ikat sari were developed in powerloom. The fabric parameters of the developed samples like GSM (Grams per Square Meter), EPI (Ends per Inch), PPI (Picks per Inch), Thickness, Weft Crimp, Warp crimp, Warp cover factor, Weft cover factor, Cloth cover factor, drape (drape co-efficient – 0.15) and design construction (Plain weave) were tested and analyzed. The starting point of the pick, angle of inclination (adjusted to 1.5°-1° from 6° so there is no angle of inclination), and time consumption (reduced from four seconds to two seconds per pick). A mechanical component designed by the use of elements like covered steel wire (to push the weft yarn to some length), gripper (to hold the weft yarn), velvet paper (to grip the yarn), gripper rod (to hold the gripper) and screw (for adjustable motion). After fixing the component the production rate were compared with current practicing method and the time consumption also carried out by trial running of the loom with the developed mechanism.

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