CONVERSION OF CONVENTIONAL SILK TWISTING SPINDLE IN TO TFO SPINDLE

A PROJECT REPORT

Submitted by

K.N.VEERASENAN

Register No: 0710202045

in partial fulfillment for the award of the degree

of

BACHELOR OF TECHNOLOGY

in

TEXTILE TECHNOLOGY

KUMARAGURU COLLEGE OF TECHNOLOGY

COIMBATORE – 641 049

(An Autonomous Institution Affiliated to Anna University: Coimbatore)

APRIL 2011

BONAFIDE CERTIFICATE

Certified that this project report "**CONVERSION OF CONVENTIONAL SILK TWISTING SPINDLE IN TO TFO SPINDLE**" is the bonafide work of **K.N.VEERSENAN** (Reg. No. **0710202045**) who carried out this project work under my supervision during the year 2010- 2011.

SIGNATURE

Dr.K.THANGAMANI

PROFESSOR AND HEAD

Department of Textile Technology

Kumaraguru College of Technology

Coimbatore - 641 049

SIGNATURE

Mr.S.SUNDARESAN

SUPERVISOR

Assistant professor

Department of Textile Technology

Kumaraguru College of Technology

Coimbatore - 641 049

Submitted for the Project Viva- Voce examination held on 18/4/11

Internal Examiner

External Examiner

ACKNOWLEDGEMENT

I express my sincere gratitude to our beloved Co-Chairman. Dr. **B.K. Krishnaraj Vanavarayar**, Dr. **J. Shanmugan**, Director, Kumaraguru College of Technology and Dr. S. Ramachandran, Principal for their support and allowing to use the facilities of the institution.

I express my whole hearted thanks to Dr. **K.Thangamani**, Head of Department, Kumaraguru College of Technology, for having been a source of encouragement and for instilling the vigor to do the project.

It gives me great pleasure to express my deep sense of gratitude for my supervisor, Mr. **S.Sundaresan**, Assistant Professor, Department of Textile Technology, Kumaraguru College of Technology, for her innovative guidance, expert suggestions and constant encouragement at every step for the study.

I thank all the teaching and non-teaching staff for their help during this project. Words fail to express my thanks to my beloved parents, and friends who are my sounding board and pillar of strength.

ABSTRACT

Silk industry face many problem due to lack of up gradation in technology in all sector particularly in yarn manufacturing sector. In cotton yarn manufacturing process TWO-FOR-ONE twister pay the way for better production and quality.

In silk yarn manufacturing unit less production, labor shortage, waste% ,twist variation are the major problems affect the future process like dyeing, weaving.

This project deals with study on conventional silk twisting method and TWO-FOR-ONE twisting principle and fabricate TFO spindle for silk then produce yarn from it then compare the properties of yarn produced from both conventional and newly developed spindle .

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.INTRODUCTION

CHAPTER 1

1. INTRODUCTION:

The process of twisting is an indispensable means of improving certain yarn properties and satisfying textile requirements that cannot be fulfilled by the single yarns. The method of twisting two or more single yarns is called doubling or folding or ply twisting. Such yarns are designated as doubled yarn, folded yarn or plied yarn and the machines intended for the purpose are called doublers, ply-twisters or two-for-one (TFO) twisters.

INDIA is 2nd and next to CHINA in the production of SILK but we do not produce even half of what CHINA produces. We Import silk from China,. How Silk Imported from China is Cheaper than ours.due to Over the past 50 years the traditional silk twisting has undergone considerable change and development. the main object has been to improve yarn quality rather than the more common aim of reducing costs.

TWO-FOR-ONE twisting is an older technique used in cotton and man made yarn manufacturing process due to some properties of silk filament like strength, structure but by altering that it is possible for silk twisting also

1. 1 OBJECTIVE OF THE PROJECT

The present study aims at the following objectives;

- To generate data on the properties of silk filament
- To test the silk yarn in various stages for strength, structure using Instron tester ,digital microscope ,evenness and prepare a statistical report for the existing process.
- To study the TFO mechanism
- To produce silk yarn by using tfo mechanism
- To compare the properties of silk yarn from both conventional and newly developed TFO spindle

2.LITERATURE REVIEW

CHAPTER 2

2. LITERATURE REVIEW

2.1 Silk

Silk has set the standard in luxury fabrics for several millennia. The origins of silk date back to Ancient China. Legend has it that a Chinese princess was sipping tea in her garden when a cocoon fell into her cup, and the hot tea loosened the long strand of silk. Ancient literature, however, attributes the popularization of silk to the Chinese Empress Si-Ling, to around 2600 b.c. Called the Goddess of the Silkworm, Si-Ling apparently raised silkworms and designed a loom for making silk fabrics.

The Chinese used silk fabrics for arts and decorations as well as for clothing. Silk became an integral part of the Chinese economy and an important means of exchange for trading with neighboring countries. Caravans traded the prized silk fabrics along the famed Silk Road into the Near East. By the fourth century b.c., Alexander the Great is said to have introduced silk to Europe. The popularity of silk was influenced by Christian prelates who donned the rich fabrics and adorned their altars with them. Gradually the nobility began to have their own clothing fashioned from silk fabrics as well.

Initially, the Chinese were highly protective of their secret to making silk. Indeed, the reigning powers decreed death by torture to anyone who divulged the secret of the silk-worm. Eventually, the mystery of the silk-making process was smuggled into neighboring regions, reaching Japan about a.d. 300 and India around a.d. 400. By the eighth century, Spain began producing silk, and 400 years later Italy became quite successful at making silk, with several towns giving their names to particular types of silk.

The first country to apply scientific techniques to raising silkworms was Japan, which produces some of the world's finest silk fabrics. Other countries that also produce quality silks are China, Italy, India, Spain, and France. China was the largest exporter of raw silk in the early 1990s, accounting for about 85% of the world's raw silk, worth about $800 million. Exports of China's finished silk products were about half of the world's total at about $3 billion.

Silk is highly valued because it possesses many excellent properties. Not only does it look lustrous and feel luxurious, but it is also lightweight, resilient, and extremely strong—one filament of silk is stronger then a comparable filament of steel! Although fabric manufacturers have created less costly alternatives to silk, such as nylon and polyester, silk is still in a class by itself.

2.2 Raw Materials

The secret to silk production is the tiny creature known as the silkworm, which is the caterpillar of the silk moth *Bombyx mori.* It feeds solely on the leaves of mulberry trees. Only one other species of moth, the *Antheraea mylitta,* also produces silk fiber. This is a wild creature, and its silk filament is about three times heavier than that of the cultivated silkworm. Its coarser fiber is called *tussah.*

The life cycle of the *Bombyx mori* begins with eggs laid by the adult moth. The larvae emerge from the eggs and feed on mulberry leaves. In the larval stage, the Bombyx is the caterpillar known as the silkworm. The silkworm spins a protective cocoon around itself so it can safely transform into a chrysalis. In nature, the chrysalis breaks through the cocoon and emerges as a moth. The moths mate and the female lays 300 to 400 eggs. A few days after emerging from the cocoon, the moths die and the life cycle continues.

The cultivation of silkworms for the purpose of producing silk is called sericulture. Over the centuries, sericulture has been developed and refined to a precise science. Sericulture involves raising healthy eggs through the chrysalis stage when the worm is encased in its silky cocoon. The chrysalis inside is destroyed before it can break out of the cocoon so that the precious silk filament remains intact. The healthiest moths are selected for breeding, and they are allowed to reach maturity, mate, and produce more eggs.

Generally, one cocoon produces between 1,000 and 2,000 feet of silk filament, made essentially of two elements. The fiber, called fibroin, makes up between 75 and 90%, and sericin, the gum secreted by the caterpillar to glue the fiber into a cocoon, comprises about 10-25% of silk. Other elements include fats, salts, and wax. To make one yard of silk material, about 3,000 cocoons are used.

2.3 Wild silk

A variety of wild silks, produced by caterpillars other than the mulberry silkworm have been known and used in China, South Asia, and Europe since ancient times. However, the scale of production was always far smaller than that of cultivated silks. They differ from the domesticated varieties in color and texture, and cocoons gathered in the wild usually have been damaged by the emerging moth before the cocoons are gathered, so the silk thread that makes up the cocoon has been torn into shorter lengths. Commercially reared silkworm pupae are killed by dipping them in boiling water before the adult moths emerge, or by piercing them with a needle, allowing the whole cocoon to be unraveled as one continuous thread. This permits a much stronger cloth to be woven from the silk. Wild silks also tend to be more difficult to dye than silk from the cultivated silkworm.

2.4 China

Silk fabric was first developed in ancient China,[1] with some of the earliest examples found as early as 3500 BC.[2] Legend gives credit for developing silk to a Chinese empress, Lei Zu (Hsi-Ling-Shih, Lei-Tzu). Silks were originally reserved for the Kings of China for their own use and gifts to others, but spread gradually through Chinese culture and trade both geographically and socially, and then to many regions of Asia. Silk rapidly became a popular luxury fabric in the many areas accessible to Chinese merchants because of its texture and luster. Silk was in great demand, and became a staple of pre-industrial international trade. In July 2007, archeologists discovered intricately woven and dyed silk textiles in a tomb in Jiangxi province, dated to the Eastern Zhou Dynasty roughly 2,500 years ago.[3] Although historians have suspected a long history of a formative textile industry in ancient China, this find of silk textiles employing "complicated techniques" of weaving and dyeing provides direct and concrete evidence for silks dating before the Mawangdui-discovery and other silks dating to the Han Dynasty (202 BC-220 AD)

The first evidence of the silk trade is the finding of silk in the hair of an Egyptian mummy of the 21st dynasty, c.1070 BC.[4] Ultimately the silk trade reached as far as the Indian subcontinent, the Middle East, Europe, and North Africa. This trade was so extensive that the major set of trade routes between Europe and Asia has become known as the Silk Road. The highest development was in China.

The Emperors of China strove to keep knowledge of sericulture secret to maintain the Chinese monopoly. Nonetheless sericulture reached Korea around 200 BC, about the first half of the 1st century AD had reached ancient Khotan,[5] and by AD 300 the practice had been established in India.

2.5 India

Silk, known as "Paat" in Eastern India, *Pattu* in southern parts of India and *Resham* in Hindi/Urdu, has a long history in India. Recent archaeological discoveries in Harappa and Chanhu-daro suggest that sericulture, employing wild silk threads from native silkworm species, existed in South Asia during the time of the Indus Valley Civilization, roughly contemporaneous with the earliest known silk use in China. Silk is widely produced today. India is the second largest producer of silk after China. A majority of the silk in India is produced in Karnataka State, particularly in Mysore and the North Bangalore regions of Muddenahalli, Kanivenarayanapura, and Doddaballapur. India is also the largest consumer of silk in the world. The tradition of wearing silk sarees in marriages by the brides is followed in southern parts of India. Silk is worn by people as a symbol of royalty while attending functions and during festivals. Historically silk was used by the upper classes, while cotton was used by the poorer classes. Today silk is mainly produced in Bhoodhan Pochampally (also known as Silk City), Kanchipuram, Dharmavaram, Mysore, etc. in South India and Banaras in the North for manufacturing garments and sarees. "Murshidabad silk", famous from historical times, is mainly produced in Malda and Murshidabad district of West Bengal and woven with hand looms in Birbhum and Murshidabad district. Another place famous for production of silk is Bhagalpur. The silk from Pochampally is particularly well-known for its classic designs and enduring quality. The silk is traditionally hand-woven and hand-dyed and usually also has silver threads woven into the cloth. Most of this silk is used to make sarees. The sarees usually are very expensive and vibrant in color. In the northeastern state of Assam, three different types of silk are produced, collectively called Assam silk: Muga, Eri and Pat silk. Muga, the golden silk, and Eri are produced by silkworms that are native only to Assam. The heritage of silk rearing and weaving is very old and continues today especially with the production of Muga and Pat *riha* and *mekhela chador*, the three-piece silk sarees woven with traditional motifs. *Mysore Silk Sarees*, which are known for their soft texture, last many years if carefully maintained.

2.6. Cocoon

Silk moths lay eggs on specially prepared paper. The eggs hatch and the caterpillars (silkworms) are fed fresh mulberry leaves. After about 35 days and 4 moltings, the caterpillars are 10,000 times heavier than when hatched and are ready to begin spinning a cocoon. A straw frame is placed over the tray of caterpillars, and each caterpillar begins spinning a cocoon by moving its head in a "figure 8" pattern. Two glands produce liquid silk and force it through openings in the head called spinnerets. Liquid silk is coated in sericin, a water-soluble protective gum, and solidifies on contact with the air. Within 2–3 days, the caterpillar spins about 1 mile of filament and is completely encased in a cocoon. The silk farmers then kill most caterpillars by heat, leaving some to metamorphose into moths to breed the next generation of caterpillars.

Harvested cocoons are then soaked in boiling water to soften the sericin holding the silk fibers together in a cocoon shape. The fibers are then unwound to produce a continuous thread. Since a single thread is too fine and fragile for commercial use, anywhere from three to ten strands are

Fig.2.6.1 Mulberry Silk Cocoon

2.7 Types of silk

Commercially, silk is classified into four types, obtained from different species of silkworms which in turn feed on a number of food plants. Mulberry, Tasar, Muga and Eri are the commercial names says authors

2.7.1 Mulberry silk:

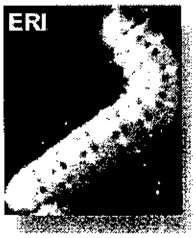
The bulk of the commercial silk produced in the world comes from this variety and often silk generally refers to mulberry silk. Mulberry silk comes from the silkworm, 'Bombyx mori L' which solely feeds on the leaves of mulberry plant. These silkworms are completely domesticated and reared indoors. In India, the major mulberry silk producing states are Karnataka, Andhra Pradesh, West Bengal, Tamil Nadu and Jammu & Kashmir which together accounts for 92 % of country's total mulberry raw silk production.

2.7.2 Tasar silk:

Tasar (Tussah) is copperish colour, coarse silk mainly used for furnishings and interiors. It is less lustrous than mulberry silk, but has its own feel and appeal. Tassar silk is generated by the silkworm, 'Antheraea mylitta' which mainly thrives on the food plants asan and arjun. The rearings are conducted in nature on the trees in the open.

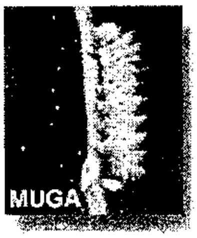
Tasar silk, often referred to as wild silk, comes from the Antheraea moths. These moths live mostly on Terminalia species and Shorea robusta as well as other food plants found in South Asia. The sericulture process of tasar silk is the same as mulberry silk - the cocoons are first dried in the sun to kill the silkworm and then soaked in boiling water to soften the silk before it is reeled.

2.7.3 Eri silk:



Also known as Endi or Errandi, Eri is a multivoltine silk spun from open-ended cocoons, unlike other varieties of silk. Eri silk is the product of the domesticated silkworm, 'Philosamia ricini' that feeds mainly on castor leaves. Eri culture is a household activity practiced mainly for protein rich pupae, a delicacy for the tribal. Recently, the eri cocoons are open-mouthed and are spun. The silk is used indigenously for preparation of chaddars (wraps) for own use by these tribal. In India, this culture is practiced mainly in the north-eastern states and Assam.

2.7.4 Muga silk:



This golden yellow colour silk is prerogative of India and the pride of Assam state. It is obtained from semi-domesticated multivoltine silkworm, 'Antheraea assamensis'. These silkworms feed on the aromatic leaves of Som and Soalu plants and are reared on trees.

Similar to that of tassar, muga culture is specific to the state of Assam and an integral part of the tradition and culture of that state. The muga silk, an high value product is used in products like sarees, mekhalas, chaddars, etc.

2.8 Chemical structure

According to Carty P. (1996), silk polymer is a linear, fibroin polymer. Silk is composed of sixteen different amino acids. Three of these sixteen amino acids, namely alanine, glycine and serine, make up about four-fifths of the silk polymers composition. The silk polymers are not composed of any amino acids containing sulphur. Hence, the polymer system of silk does not contain any disulphide bonds. The silk polymer occurs only in the beta-configuration. It is thought that silk polymer is about as long as (140 nm), or only slightly longer than the wool polymer, and about 0.9 nm thick. Silk may be considered to have the same composition as that of wool except that the silk polymer system contains no disulphide bonds.

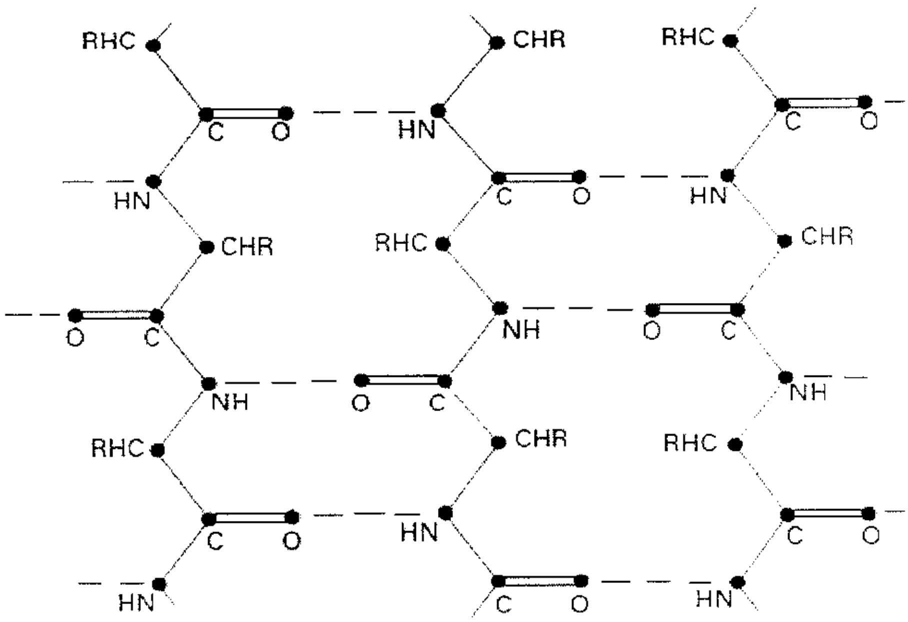


Fig: 2.8.1 Chemical structure of silk

2.9 Properties and characteristics of silk

Warner S (1995) says that the silk filament is strong. This strength is due to its linear, beta-configuration polymers and very crystalline polymer system. These two factors permit many more hydrogen bonds to be formed in a much more regular manner. When wet, silk loses strength. This is due to water molecules hydrolyzing a significant number of hydrogen bonds and in the process weakening the silk polymer.

2.9.1.Microscopic view

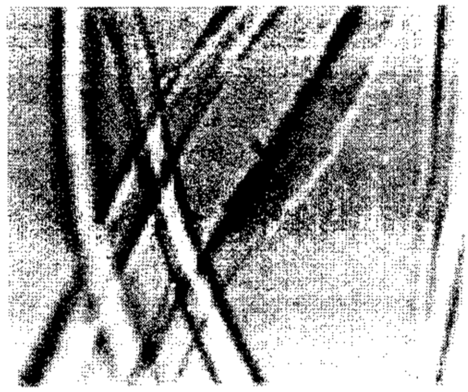


Fig: 2.9.1.1Silk 20 micron bright longitudinal section

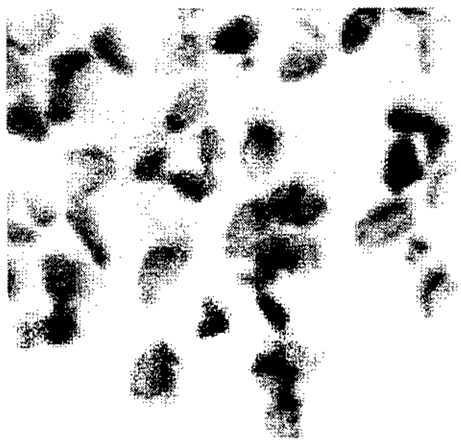


Fig: 2.9.1.2 Silk 20 micron bright cross section

Silk is considered to be more plastic than elastic because its very crystalline polymer system does not permit the amount of polymer movement which could occur in a more amorphous system. Hence, if the silk material is stretched excessively, the silk polymers, which are already in a stretched state (they have a beta-configuration) will slide past each other. The process of stretching ruptures a significant number of hydrogen bonds. When stretching ceases, the polymers do not return to their original position, but remain in their new positions. This disorganises the polymer system of silk, which is seen as a distortion and wrinkling or creasing of the silk textile material. The handle of the silk is described as a medium, and its very crystalline polymer system imparts a certain amount of stiffness to the filaments. This is often misinterpreted, in that the handle is regarded as a soft, because of the smooth, even and regular surface of silk filaments says Carty P. (1996)

According to Gupta V.P. and Kothari V. K. (1997), silk has a very crystalline polymer system, it is less absorbent than wool. The greater crystallinity of silk's polymer system allows fewer water molecules to enter than does the amorphous polymer system of wool. The other hygroscopic properties of silk are rather similar to those of wool.

Silk is more sensitive to heat than wool. This is considered to be partly due to the lack of any covalent cross links in the polymer system of silk, compared with the disulphide bonds which occur in the polymer system of wool. The existing peptide bonds, salt linkages and hydrogen bonds of the silk polymer system tend to break down once the temperature exceeds 100 degree C.

Silk is degraded more readily by acids than is wool. This is because, unlike the wool polymer system with its disulphide bonds, there are no covalent cross-links between silk polymers. Thus perspiration, which is acidic, will cause immediate breakdown of the polymer system of silk. This is usually noticed as a distinct weakning of the silk textile material.

Alkaline solutions cause the silk filament to swell. This is due to partial separation of the silk polymers by the molecules of alkali. Salt linkages, hydrogen bonds and van der Waals' forces hold the polymer system of silk together. Since these inter-polymer forces of attraction are all hydrolysed by the alkali, dissolution of the silk filament occurs readily in the alkaline solution. It is interesting to note that initially this dissolution means only a separation of the silk polymers from each other. However, prolonged exposure would result in peptide bond hydrolysis, resulting in a polymer degradation and complete destruction of the silk polymer, stated Gupta V.P. and Kothari V. K. (1997)

The resistance of silk to the environment is not as good as that of wool. This lower resistance is due mainly to the lack of covalent crosslinks in the polymer system of silk.

2.10 Production of silk yarn

Silk worms are fed on Mulberry leaves and hence, the silk obtained is referred to as mulberry silk. The caterpillars spin themselves into cocoons in circular cane baskets. A span of three months is needed for the eggs to develop to the cocoon stage. Each home within the community manages to produce 100-200 kilograms of silk cocoons at a time. The cocoons are put into a heater so as to prevent moths from hatching and to ensure that the cocoons remain whole and damage free so that it can give out one single continuous filament of silk

A handful of cocoons are taken at a time and are immersed in hot water. The outer portion of the cocoons are removed and kept aside. This waste is utilized elsewhere as lower quality yarn.

The cocoons are then put into cold water. The silk strands gets extracted by hand from each cocoon and is passed through an eyelet on a machine that gets drawn onto a mechanized sectional warping drum that makes hanks of the silk. As the silk being extracted is wet, a coal fire is placed beneath the warping drum so as to dry the silk as it is being wound. It takes 8 cocoons to make a single filament of silk. The natural colour of the silk obtained is a light yellow or Badami as it would be referred to in local terms.

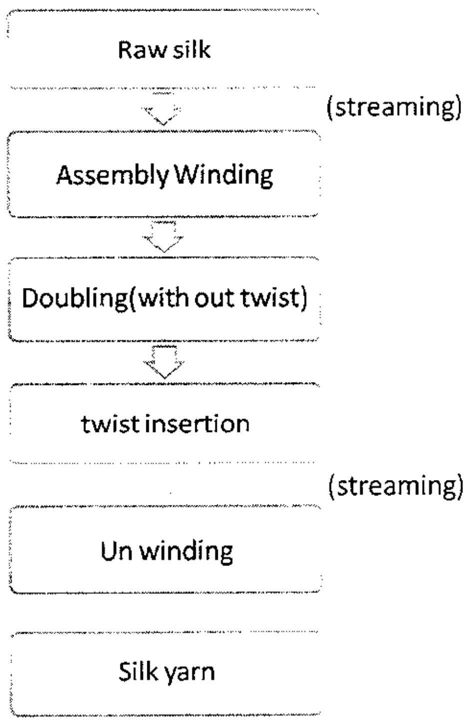
Doubling is the mechanical process of winding of single filament filature yarn onto bobbins. A maximum of 40 bobbins can be wound at a time. Here, 30 bobbins are wound at a time or less depending on the quantity of yarn required.

On the same machine, two/three/four of the single filament raw silk yarns are drawn together and are wound onto bobbins in order to make the yarn ready for plying. To wind four of the single filament yarns onto a bobbin takes 45 minutes whereas, winding of two of the single yarns together would require 11\2 hours. The more the number of yarns to be wound together, the faster will it get wound onto a bobbin and vice-versa. After winding, each bobbin holds a minimum of 35-40 grams of silk. The machines have wheels on one end that control the speed of rotation of the hanks and bobbins and hence one can manually decide on the speed of winding beforehand.

The individual yarns on the bobbins are plied together on a machine in a manner such that it is put into a one up one down lease in order to make it easier to dye the yarn later on. Placing the yarn in lease also prevents knotting. The bobbins are fit between rubber washers on the machine. The washers facilitate tight and even winding of the plied yarn onto bobbins. 100 bobbins are plied at a time although there is scope to wind 200 at a time.

Post plying, the yarn on the bobbins are twisted. The machine reels off yarn from one bobbin to the next while getting rubbed on a wire in a horizontal motion. This rubbing motion is what causes the yarn to form a twist. 30-40 twists per inch are formed depending on a set diameter on the machine that can be changed.

Silk yarn manufacturing process



2.11 WINDING:

The main functions of winding are to put the yarn in a long continuous length to suit later processes and also to eliminate imperfections such as slubs, seak places, dirt and so on.

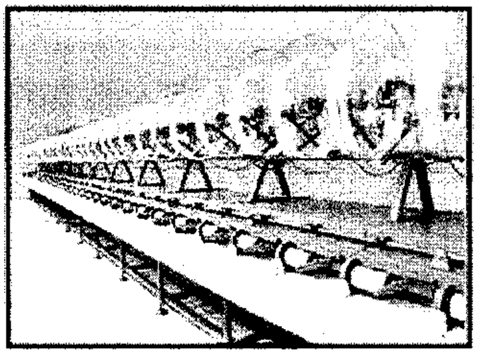


Fig: 2.11.1 Assembly winder

2.12 DOUBLING:

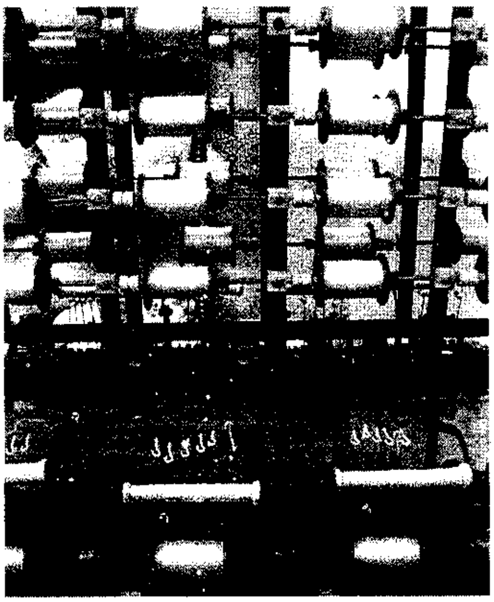


Fig:2.12.1 Doubling Machine

The object of doubling is to double the individual threads. Doubling avoids unevenness and the strength of doubled yarn is correspondingly better than the single thread.

2.13 TWISTING:

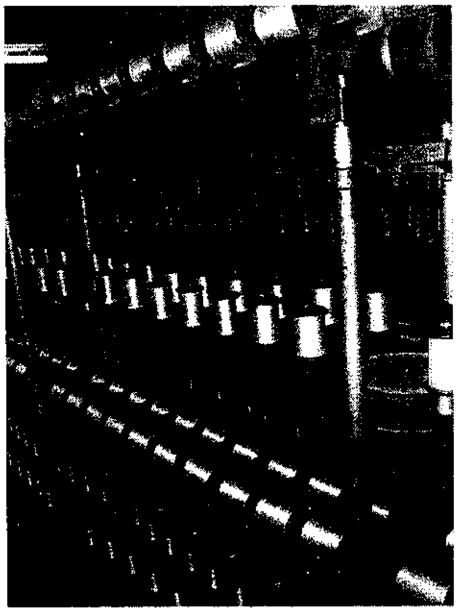


Fig:2.12.2 Up Twister

Silk Twisting machine is of up twister principle. There is a vertical spindle on which doubling bobbin is mounted and yarn from this is wound on to a perforated bobbin mounted horizontally and driven by surface contact. Twist is imparted on account of difference between the speed of the spindle and winding drum.

2.14 RE-WINDING:

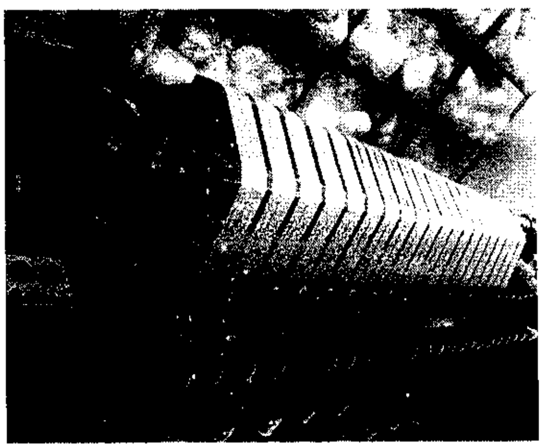


Fig:2.12.3 Re-Windinder

Re-winding machine is practically like winding machine. Its production capacity is more, since normally double yarn is wound on this. If two ply yarn is re-wound, production rate would be more than two times as compared to winding machine.

2.15: Two for one twister origin:

This process was first mentioned in a British patent of 1855.but only during the period 1930-1935 when manmade fibre industry and associated twisting mills experienced a demand for long, knot-free lengths of folded yearns tyre cord production, this process was commercially accepted.

Impact of doubling on yarn quality:

Yarn folding is combing by twisting of two or more straight yarn components to form a composite yarnm of improved or at least modified characteristics .doubling of two or more single yarns together is supposed to result in an overall improvement in yarn quality

2.16 Silk in world markets.

Formerly a luxury trade, the silk industry is at a crossroads. New sandwashed silk brought a wider range of affordable silk brought a wider range of affordable silk products within the reach of millions of consumers during the 1990s. Competition from high-tech synthetics has eaten away market share. Raw silk prices have plummeted by half, to the point that they threaten the sustainability of this industry.

Traditional producers are cutting back on labour-intensive silk production, as urban industries lure farmers from a business in which incomes dropped radically in recent years. Meanwhile, millions of livelihoods are at stake, especially in rural areas, for this traditional and environmentally sustainable product.

In 1988, this magazine published its first article about silk and silk markets. At the time, one could readily encourage newcomers in developing countries to start sericulture and silk production - under certain conditions - in order to get involved in an expanding trade. Ten years later, the market has changed dramatically for the silk sector in developing countries.

In 1988...

* Exclusive, and for women only. Silk was a luxury product for Europe and North America, destined only for those who could afford its exclusivity and high price. No silk products in large quantities were available to customers in medium price brackets. About 90% of silk products available in Western markets were meant for women only.

* Rising silk prices, increasing production. The world market raw silk price was US$ 45 per kilo and would climb to US$ 51 the following year. China was the major producer (about 60% of the total of 67,000 tons). China had been moving steadily towards processed silk products; in 1980, 49% of the exports were raw silk, and in 1988 this had declined to 25%. In terms of sheer production value, China's lead was followed by India, Japan, the USSR, Brazil and the Republic of Korea.

* Consumers. Asian countries - especially Japan, India and Thailand - were also significant silk consumers. Japan was the world's largest consumer.

* No restrictions. No quotas restricted international trade in silk and silk products.

* Some export promotion. Some generic silk promotion activities in Europe were conducted by the European Commission for the Promotion of Silk.

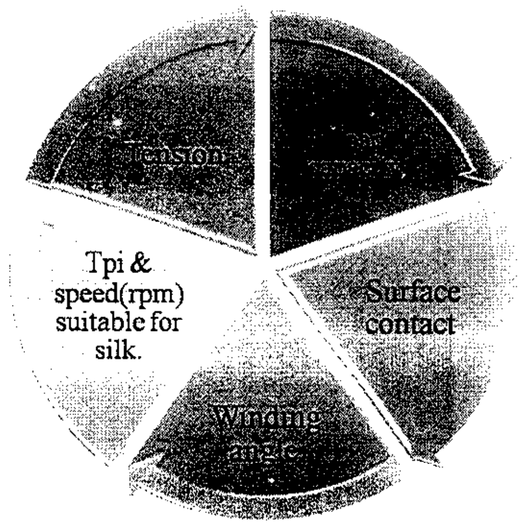
* Silk democratized. Sand-washed silk made its debut in the early 1990s in most Western markets. Silk garments were sold at the height of the boom not only in department stores, but in supermarkets and even in ...

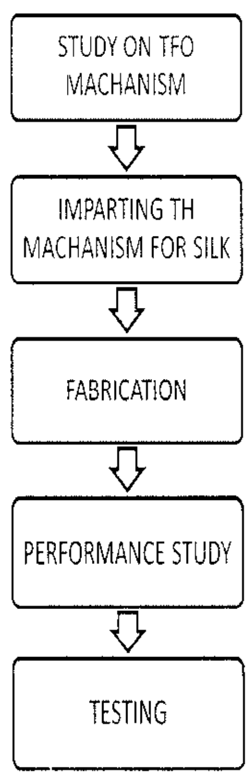
3. MATERIALS AND METHODS

3. MATERIALS AND METHODS

3.1 METHODOLOGY

Altering the Conventional twisting spindle to be compatible for silk considering factors like





3.2 STUDY ON TFO MACHANISM:

TWO FOR ONE twister principle:

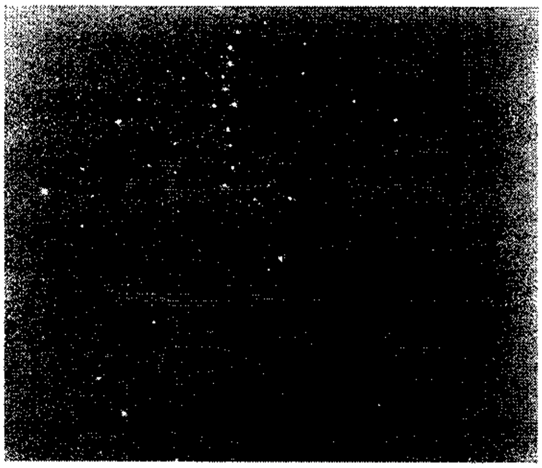


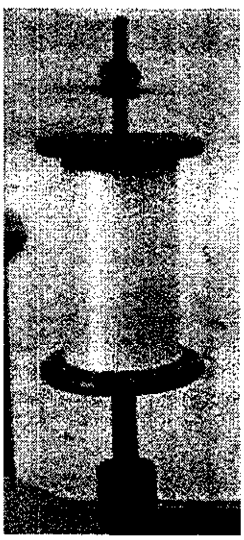
Fig:3.2.1 TFO principle

Fig 1 shows the principle OF TWO FOR ONE twisting. In this technique,both feed and delivery packages are stationary and only a small length of yarn rotates,and while doing so,the feed package.become enclosed by an imagenary envelope produced by rotating yarn balloon.

The yarn balloon encloses the feed package,and one revolution of the spindle inserts two twists into the yarn.the first half of twist is inserted in the hollow shaft of the spimdle between the tensioning unit and the outlet of the rotating disc.the second half of the twist is in principle inserted only when the yarn has returned again from radial to axial movement ,i.e.,at the foot of the balloon.this means that the yarn in the balloon should be half-twisted only careful inspection of practical cases receals,however,that some false twist will be trapped below the balloon eyelet,and the yarn along the balloon trace will show almost full twist a TFO spindle is normally designed in such as way that the feed package is placed inside the rotating yarn balloon ,the delivery package being situated outside it. Nearly all TFO spindles for twisting textile yarns functionally resembles up-twisters.two for one twisting does not involve high speed rotation of either the supply or the delivery package.this result in relatively low power consumption and also permits larger supply packages .since the delivery packages are sufficiently large ,rewinding may not be necessary in most of the case.the general concept that the lower speed maintains the quality of the yarn also holds good in case of two-for-one twisters .high speed maintain the quality of the yarn also holds good in case of TWO FOR ONE twisters .high spindle speeds In the TWO FOR ONE twisters may lead to increases in hairiness and also roughness .in these twisters ,the yarn abrades against the outlet post of the storage disc,the storage disc itself,the rim of the throw-off plate,the balloon eyelet,the pre-take-up roller ,and the winding drum which results in an increases in hairiness.

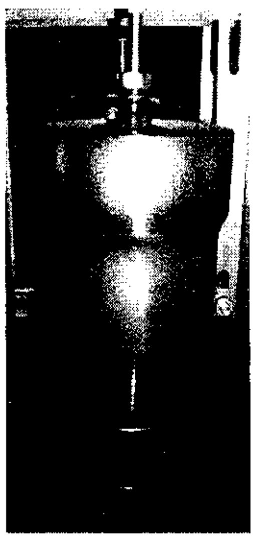
This can be minimized by controlling the yarn speed and reducing the amount of friction during twisting operation ,by making the machine parts from wear-resistent materials ,maintaining them smooth ,without any surface imperfection ,by using special yarn path elements with mirror finish and ceramic coating .in modern TFO twister ,the use of balloon controllers is almost mandatory for medium and coarse yarns on accounts of various advantage which are indispensible. Under identical production conditions, a spindle with balloon controller requires 30% less energy, imposes upto 30%less tensile force, and emits up to 6 db less noise than spindle with free balloon,

In case of machine with balloon controller, the fiber loss due to friction is more. In this case, the loosely held hairs in the yarn are removed as well as new hair are created yarn lubrication plays an important role in controlling hairiness. By application of yarn lubrication, moderate reduction of damage to the yarn by wear and abrasion can be achieved.



Conventional spindle

Fig:3.2.2

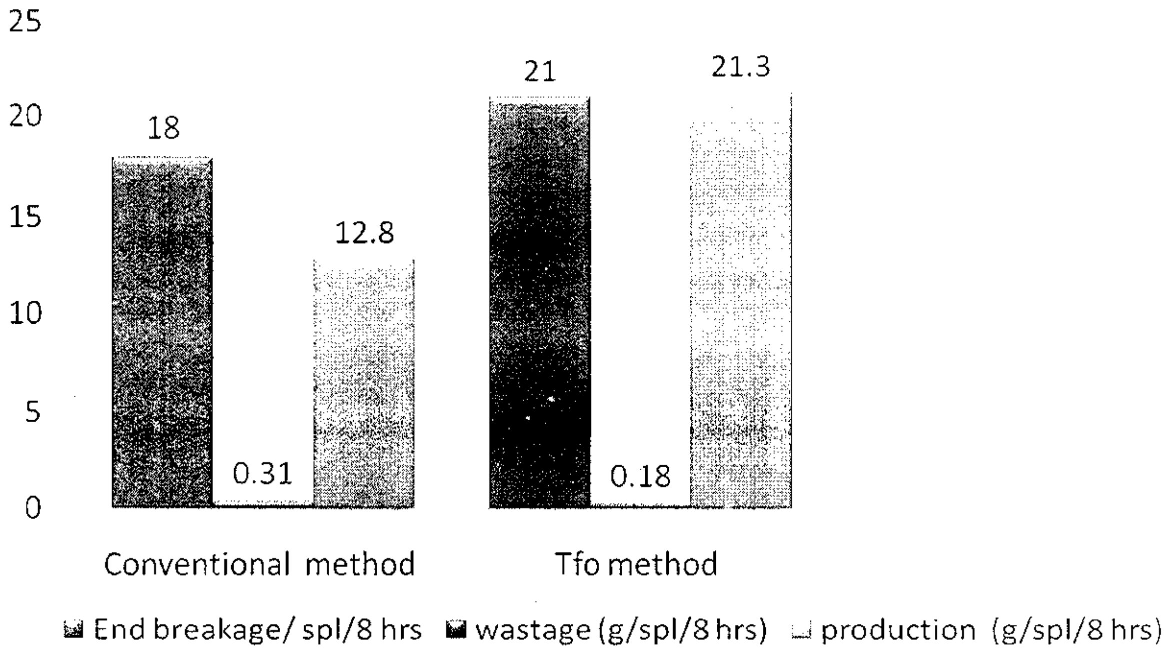


TFO spindle

Fig:3.2.3

Performance study:

	Maximum load(gf)	Extension at maximum load(mm)	Tenacity at maximum load
Conventional method	78.18	20.60	15.64
TFO method	116.56	26.10	23.31



4. Results and Discussion

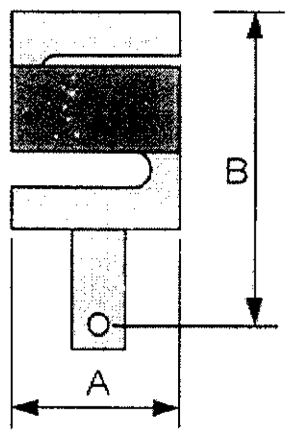
4. Results and Discussion :

4.1 Instron Tensile Tester

Description

Instron load cells are an integral part of a materials testing system. The design, manufacture, and performance verification of Instron load cells is conducted with materials testing applications in mind and the cells are certified in accordance with international standards especially for use in materials testing systems. Interchangeability, along with transducer recognition and single point calibration makes them easy to use in materials testing applications. The cells maintain high alignment and are resistant to offset loading throughout a test, even when large, over sized specimens are being tested. The cells can withstand loads up to 150% or more of their rated capacity. This allows the user to zero out the weight of a fixture that weighs up to 50% of the rated load cell capacity, while still maintaining specified accuracy through the full nominal capacity range of the load cell. Instron load cells are tested for accuracy and repeatability on calibration apparatus that is traceable to international standards, with a measurement uncertainty that does not exceed one third of the permissible error of the load cell.

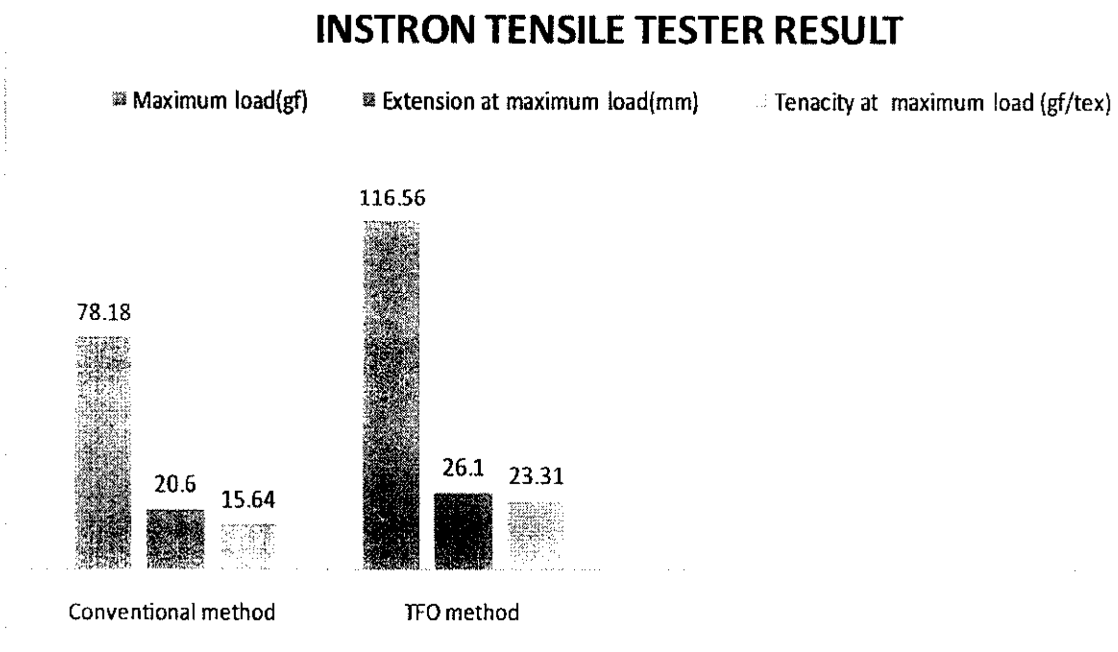
Principle of Operation



Instron load cells are precision force transducers that contain a full bridge of strain gauges bonded to internal load bearing structures. When mechanically stressed the electrical resistance of the strain gauges changes, thus changing the output signal of the bridge. This output signal is then conditioned for display readouts in accordance with international standards. The load cell structure has high axial stiffness, which reduces the stored energy that can be transferred to the specimen at break, thus reducing false values. Increased lateral stiffness reduces measurement errors from off axis loading, commonly found when performing compression and flexural tests or where specimens fail by tearing. The load cells are designed to perform in tension, compression, and reverse stress modes, eliminating the need to change cells frequently

RESULT:

	Maximum load(gf)	Extension at maximum load(mm)	Tenacity at maximum load
Conventional method	78.18	20.60	15.64
TFO method	116.56	26.10	23.31



4.1.2ANOVA table: One-way ANOVA: Tensile Strength versus Process

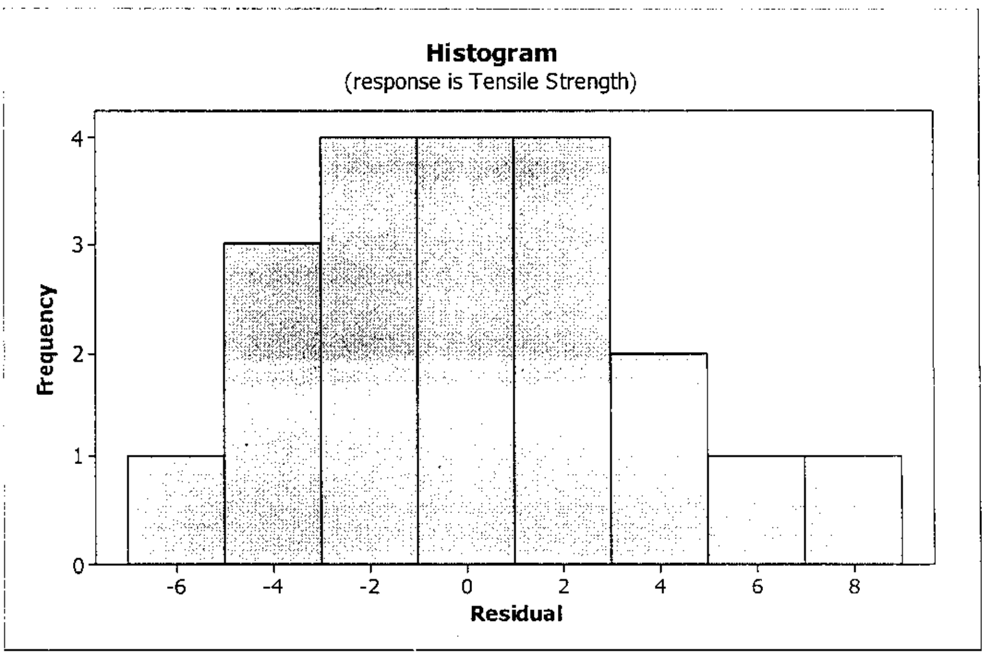
Source	DF	SS	MS	F	P
Process	1	272.8	272.8	**20.16**	0.000
Error	18	243.5	13.5		
Total	19	516.4			

```
S = 3.678   R-Sq = 52.84%   R-Sq(adj) = 50.22%


                                Individual 95% CIs For Mean Based on
                                Pooled StDev
Level   N    Mean  StDev   --+---------+---------+---------+--
-----
1      10  15.636  1.894   (------*------)
2      10  23.023  4.845                      (------*------
)
                           --+---------+---------+---------+--
-----
                            14.0      17.5      21.0      24.5

Pooled StDev = 3.678
```

Residual Histogram for Tensile Strength



INFERENCE

	Degree of Freedom	Value (95% Confidence Level)		Result
		F Table	Calculated	
Between Process	$^{1}V_{18}$	4.4139	20.16	The difference in tensile strength between process is Significant

4.2 MICROSCPOIC EXAMINATION OF SILK YARN BY USING DIGITAL MICROSCOPE:

Microscope & Ends Counting Equipment. 5x,10x,20x,40x & 100x lenses Trinocular biological microscope with fibre cross section kit, high resolution CCD camera and imaging software with measurement facilities. Scope of use cross section of fibre or yarn, analysis of any fibre, yarn and fabric.

Range: 5x, 10x, 20x, 40x & 100x lenses / As per your requirements

Focus: Adjustable
Lights: White, Blue, Yellow Upper & Lower
Supply: 240 Volt AC Supply
Total Size: 200 mm (L) x 160 mm (W) x 550 mm (H)
Weight: 20 Kg

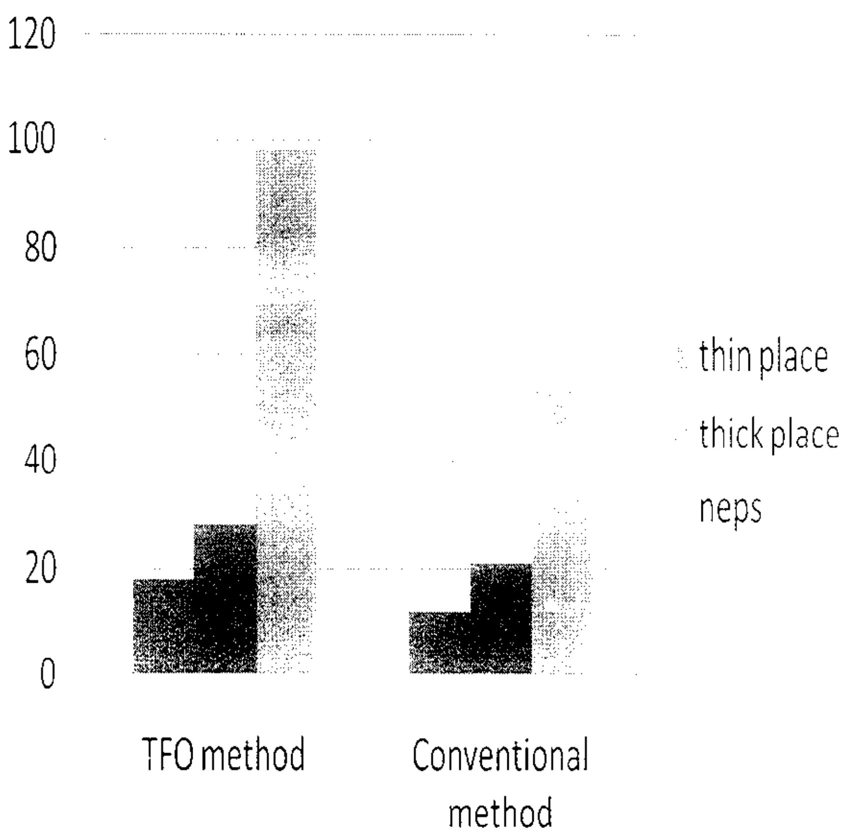
RESULT:

Silk yarn by Conventional method

Silk yarn by TFO method

Fig:4.2.1 silk yarn

S.No	U%	CVm	Thin	Thin	[illegible]	[illegible]	Neps	Neps	Index	Imperfection
1	24.73	30.91	30	18	20	28	98	45	9.22	88
2	23.26	28	22	12	12	21	54	41	8.35	143



4.3 Statex Evenness Tester:

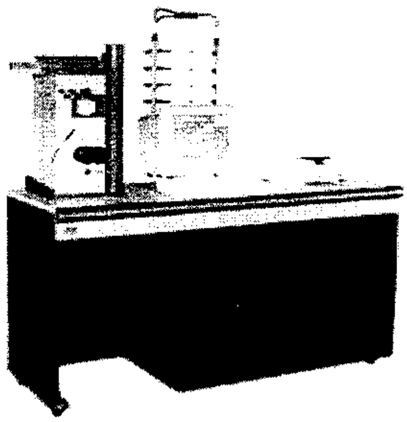


fig:4.3.1

Statex Evenness Tester – 600:

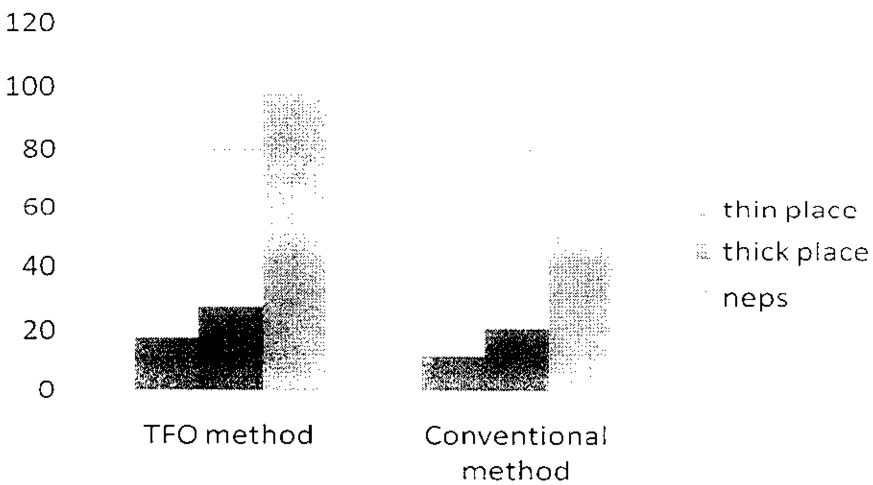
It is a user friendly PC based system for reliable and accurate measurement of mass variation of yarn, roving and sliver. The automatic bobbin changer facilitates to test the preprogrammed number cops without operator influence. Advanced and reliable capacitance based sensor provides measurement of evenness, Imperfections and yarn count.

Numerical reports:

- Imperfections like thick, thin and neps
- Unevenness -U% and CV%
- Cut length variations
- Index irregularity
- Deviation Rate(DR%) **Graphical reports:**
- Spectrogram
- Variance Length curve (VL)
- Histogram
- Normal and cut length diagrams The inbuilt spectrogram analysis software helps in easy identification of fault production process.

RESULT:

S.No.	[illegible]	[illegible]	[illegible] -50%	[illegible] -40%	[illegible] +50%	[illegible] +100%	[illegible] +200 %	[illegible] 400%	[illegible]	Imperfection
1	24.73	30.91	30	18	20	28	98	45	9.22	88
2	23.26	28	22	12	12	21	54	41	8.35	143



4.3.1 ANNOVA TABLE: ONE-WAY ANOVA: IMPERFECTIONS VERSUS PROCESS

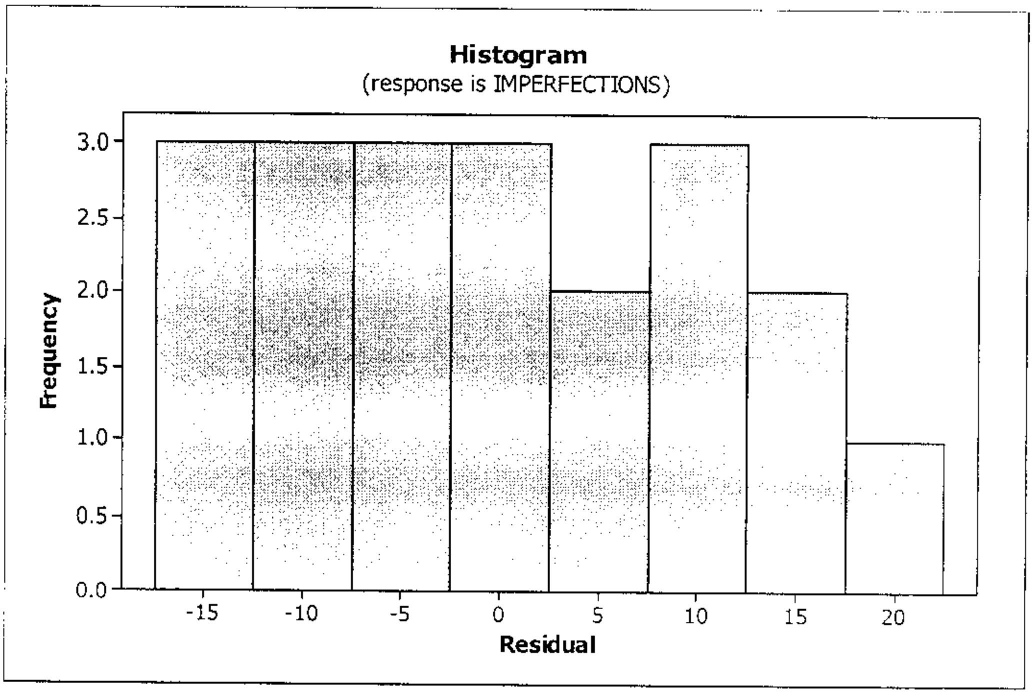
```
Source   DF    SS    MS      F      P
PROCESS   1  5216  5216  40.85  0.000
Error    18  2298   128
Total    19  7515

S = 11.30   R-Sq = 69.41%   R-Sq(adj) = 67.72%


                                 Individual 95% CIs For Mean Based on
                                 Pooled StDev
Level    N    Mean  StDev  ---------+---------+---------+------
---+
1       10   80.40   9.83  (-----*-----)
2       10  112.70  12.60                              (-----*--
---)
                           ---------+---------+---------+------
---+
                                   84        96       108
120

Pooled StDev = 11.30
```

Residual Histogram for IMPERFECTIONS



INFERENCE

	Degree of Freedom	Value (95% Confidence Level)		Result
		F Table	Calculated	
Between Process	$^{1}V_{18}$	4.4139	40.85	The difference in Imperfections between process is Significant

CONCLUSION

CONCLUSION:

From the testing results of instron tensile tester-strength, digital microscope –structure, statex evenness tester-evenness, TFO twisting method have superior quality and also have high production rate than conventional twisting method

REFERENACE

REFERENACE:

1) http://allabouttextiles.blogspot.com/2008/01/silk-properties.html

2) http://allabouttextiles.blogspot.com/2008/01/silk-properties.html

3) http://en.wikipedia.org/wiki/Silk

4) Tensile properties of tassar reeled yarn --- Moon.M.A, Mitra gautam

5) Testing of raw silk for limited characteristics --- hariraj

6) FIBRE SCIENCE --- S.P. Mishra

7) Yarn production --- Lawrence

8) http://central silk board ---www.indiansilk.kar.nic.in

9) Study on TWO-FOR-ONE twister by D. Shanmuganandam