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WHAT IS TEXTILE FINISHING

- Finishing is a final process given to a textile material to-

➢ Give a good appearance

➢ Desirable feel

➢ Impart certain durable properties

  - Stiffness
  - Softness
  - Wash and wear finish
  - Water repelling finish
  - Fire retardant finish

➢ To impart certain desirable qualities like- Lusture,Anti static, Crease recovery, Soil repellence

OBJECTS OF TEXTILE FINISHING

- The object of finishing is to improve the attractiveness and/or serviceability of fabric.
- To give desirable qualities to the fabric like-softness, lusture,crease recovery,soil repellency etc.
- To cover faults in the original fabric.
- To set texture and dimensional stability.
- To increase life and durability of textile materials.
- To increase weight.
- To impart new characteristics/properties of textile materials such as flame retardant, water repellent or water proof finishes.

FACTORS ON WHICH TECHNIQUES OF FINISHING DEPENDS

1.NATURE OF THE FABRIC

- CHEMICAL COMPOSITION
- WEAVE

This determine appearance,lusture,weight,whiteness etc.

2.PHYSICAL PROPERTIES OF THE MATERIAL

- STIFFNESS
- ELONGATION
- SOFTNESS
- TENSILE STRENTH
- INSULATION

3.END USE OF MATERIAL

- NON SOILING NATURE
- CREASE RESISTANCE OR CREASE RECOVERY
- RESATANCE TO ABRASION
- STIFFENING
- NON SOILING NATURE

CLASSIFICATION OF FINISHING

1.MECHANICAL FINISHING

a) TEMPORARY

- Drying
- Calendering
- Embossing
- Schreinering
- Stretching
- Glazing

b) PERMANENT

- Milling of wool
- Raising
- Shearing
- Sanforising
- Sueding
- Napping

❑ TEMPORARY FINSHING

Calendering:-

Calendaring is an operation carried out on fabric to improve it's aesthetics. The purpose of calendaring is:

- To impart a smooth silky touch to the fabric.
- To compress the fabric and reduce it's thickness, air permeability by changing it's porosity.
- To impart degree of lustre to the fabric and reduce yarn slippage

Embossing:-

In embossing, any design, that may be engraved on the surface of hard steel bowl, may be transferred onto the fabric as a temporary finish.

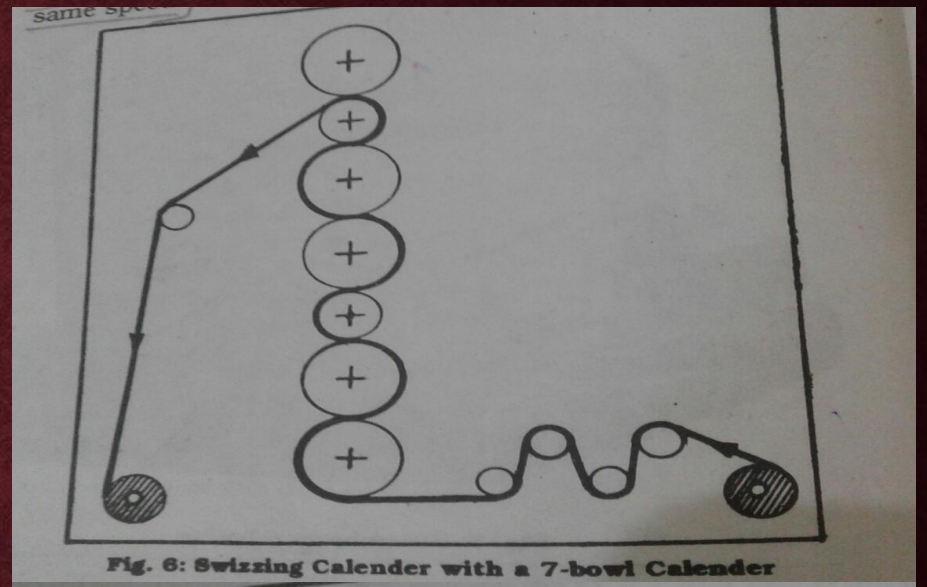


Fig. 6: Swizzing Calender with a 7-bowl Calender

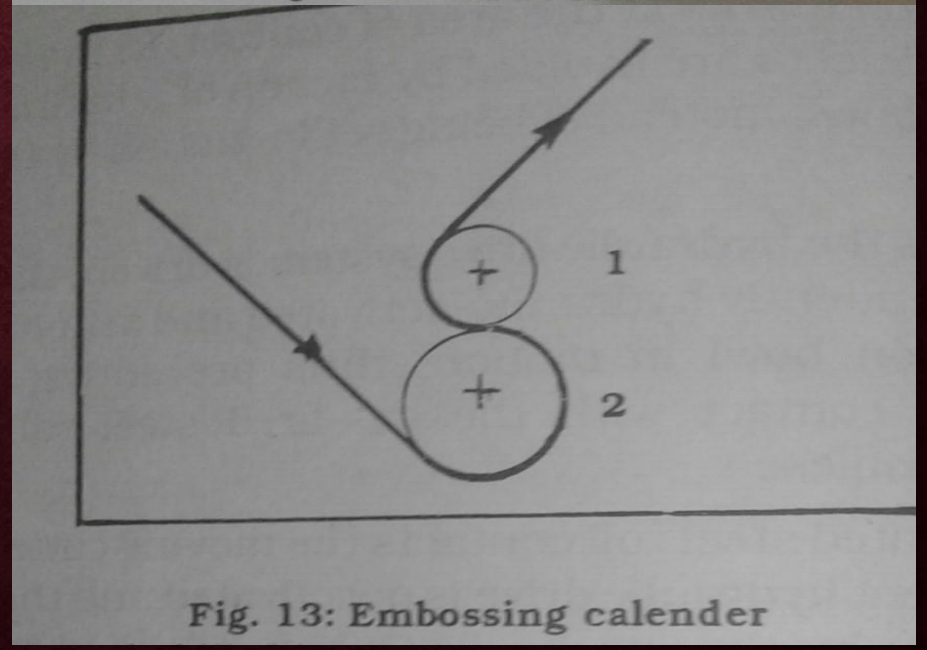


Fig. 13: Embossing calender

❑ SCHREINERING:-

This operation gives a silk-like brilliance to cotton fabrics. This is carried out chiefly on cotton, linens and printed fabrics.

❑ STRETCHING:-

Stretching involve a number of techniques including steam, wetness,

Heat, tension and fixing.

❑ GLAZING:-

Glazing is a highly controllable way of floating colour in betweens layers of finish.

❑ PERMANENT FINISING

- **RAISING-** The object of raising is to produce a pile or nap on the fabric surface by a Teasle-gig machine. Card wire m/c is another raising m/c which is capable of producing a wide range of styles and formerly used for raising cotton fibre.

- Wet cloths are easier to raise than dry cloths.
- Woolen fabrics containing acids or alkalies, are easier to raise than those which are neutral.
- Swelling agents and lubricants facilitate raising.

❑ SHEARING-

✓ -Shearing is used to produce clear, finished spun fibre fabrics. Most of the napped fabrics (except-napped sleepwear, printed cloth) are sheared.

✓ Shearing is done-

i. To clear out the random length fibres and produce a uniform and level pile.

ii. To reduce the pilling

iii. To improve the colour and appearance of the fabric.

✓ The fabric is processed with minimum tension.

❑SUEDING-

Sueding is carried out by means of a roller coated with abrasive material. The fabric has much softer handle and an improved insulating effect to the fibre end pulled out of the fabric surface.

❑ SANFORIZING

- Sanforization is a mechanical finishing process of treating textile fabrics to prevent the normal dimensional alternation of warp and weft. It is also called anti shrinkage finishing process.
- It is method of stretching, shrinking and fixing the woven cloth in both length and width, before cutting and producing to reduce the shrinkage which occur after wash.

❑ NAPPING-

- Napping is a process to develop a pile on the surface of the fabrics.
- As a pre treatment, the fabric should be padded with napping lubricant or softeners to make the fibres in the yarn to slide freely during the napping operation

❑ TRENDS IN TEXTILE FINISHING FOR VALUE ADDITION

- **FRAGRANT TEXTILES-** Encapsulated fragrances can be applied on to textiles to enhance value of a fabric or garments.

➢ "AROMATHERAPY" is a recent addition to create a range of well being finishes through encapsulated vitamin E, alovera, moisturizer could be applied.

- **SMART TEXTILES-** Smart textile are self adjusting, interactive and intelligent.

➢ Garments or fabrics with built-in electronics, which besides monitoring pulse rate, temperature.

- **THERMOREGULATED TEXTILES-** Fibres that contain electric conductive graphite particles can conduct electricity.
- **MOSQUITO REPELLENT TEXTILES-** N,N DIETHYL-M-TOLUEMIDE(DEET) ARE non toxic, non irritant, cosmetically acceptable broad spectrum insect/mosquito repellents.

CHEMICAL FINISHING

- Chemical finishing refers to the use of chemicals to achieve a desired end use property.
- Processes that change the chemical composition of the fibers OR improve the surface characteristics.
- It can be applied in yarn, fabric and garments stages.
- Chemical finish is solution or emulsion of active chemical in water.

Chemical finishes should meet the following requirements:

1.Low-cost product and process
2.Stable during storage and application in terms of pH, temperature and mechanical stress
3.Compatible with other finishes
4.Adaptation to customer requirement and substrate variation
5.Suitable for all kind of fibres and all textile forms such as yarn, woven or knit fabric, garment, nonwovens, etc.
6.Satisfactory stability during washing and dry cleaning
7.Should not hamper important textile qualities
8.On application should be distributed evenly on the fabric and fibre surface
9.No yellowing of white goods or colour change of dyed goods.
10.Easy correction of finishing faults
11.Nontoxic and ecofriendly
12.No release of volatile organic compounds
13.Biodegradable

Several important factors are to be considered before the finalisation of a formulation; a few are as follows:

- The type of textile (fibre composition of the fabric and its construction)
- The performance requirements (extent of effect and durability)
- The economics of the formulation
- Availability of machinery and associated process restrictions
- Procedure requirements
- Environmental consideration
- Compatibility and interactions of finishing components.

CLASSIFICATION OF CHEMICAL FINISHING

TEMPORARY

Softing Agents	Filling Agents
• Oils	Starch
• Fats_	Gum
• Waxes	Salts
• Soaps	China clay
• Polyethylene Emulsion	mineral fillers
• Glucose	MgCl2
•	

PERMANENT

Anticrease

Silicon finish

Reactive softers

Mercerisation

P & N Compounds

Flourochemicals

Permanent setting of wool

Perchmentising

Temporary :

A finish which is not stable and goes off after the first wash is known as temporary finish and these finishes disappears during subsequent washing and usage.

Softening Agents

Softener is a compound of organic polysiloxane and polymer, which is suitable for soft finishing of natural fibers such as cotton, wool, silk, hemp and human hair. Silicone textile finishing auxiliaries have a wide application in textile finishing. The auxiliary can not only deal with natural fabrics, but also deal with polyester, nylon and other synthetic fibers. After treatment, fabric is anti-wrinkle, anti-fouling, anti-static, anti-pilling and plump, soft, elastic and glossy, with a smooth, cool and strong style. Silicone softening finish can also improve the strength of fiber and reduce abrasion. Silicone softener is a promising fabric softener, which is also an important additive to improve product quality and add value in textile dyeing and finishing processing.

Silicone Softeners features

- Soluble in water, aqueous solution is very stable and in good compatibility.
- The fabric feels soft, smooth and full, and has good drape and puffiness.
- Excellent hygroscopicity and good permeability.
- Moisture absorption and antistatic property.
- It has good resilience and wrinkle resistance.
- Stable working fluid, no demulsification, no floating oil.
- Not easy to get yellowing in high temperature.

Silicone Softeners Classification

① Hydroxy silicone oil
② Amino Silicone oil
③ Epoxy silicone softener
④ Hydrophilic silicone softeners

Current situation of silicone softeners

Most of the domestic fabrics use silicone auxiliaries which is hydrophobic, which makes the wearer stuffy and it is difficult to wash. Many fabric products often appear the phenomenon of bleaching oil. The traditional hydrophilic polyether silicone oil has better hydrophilic and water-solubility, but with poor softness and durability.

The effect of different aqueous emulsions of vegetable oils on the wrinkle recovery properties of 100% cotton fabric.

Six vegetable oils (rapeseed oil, olive oil, coconut oil, safflower oil, linseed oil and modified sunflower oil) with different fatty acid were used.

The results prove that the fatty acid profile is an important factor affecting the wrinkle recovery properties of treated cotton fabrics. In general, higher concentrations of the active agent (vegetable oil) provide better wrinkle properties for treated cotton fabrics.

Wax

Wax are used by the textile industry in four main areas:

- Waterproofing of textile substrates.
- Modifying the frictional properties of fibres, yarns and sewing threads to enhance processability.
- Enhancing the performance of finishing compounds such as softeners, silicones and resins.
- Providing superior fabric properties such as improved flex abrasion resistance, tear strength and sewability.

Polyethylene Wax Emulsion

polyethylene wax emulsion is a soft finishing agent with special function in textile processing. Its main components are low molecular weight polyethylene (molecular weight of 1000 ~ 3000), which is also known as polyethylene wax.

Chemical reaction does not occur in the processing, it will not change the color of the dye and hue or affect the color and freshness of the fabric after finishing.

polyethylene wax has a high melting point and the good flexibility of molecule, forming a flexible film on the fiber can effectively improve the tear strength and wear resistance of the fabric.

Having good smoothness, it can significantly reduce the friction coefficient of fiber surface and improve the sewing of various fabrics in high speed sewing.

（2）Application

- It is mainly used as an additive to improve certain properties of fabrics
- It is used as a soft smoothing agent for fabric smoothing finishing agent and high speed sewing thread.

FILLERS

These are applied along with the starches to increase the weight to extend the fibers and close the interstices and produce opacity or covering effect

China Clay or Kaolin:

This is commonest of all fillers. Pure material is white in colour(hydrated aluminium silicates). The densitu of powder is 2.2 gm/cc and posses good covering power.. It forms smooth opaque mass with starch and gives a better and fuller appearance to fabric than starch alone.

MgCl2:

It is available as Hexahydrate $MgCl_2$. $6H_2O$. Both are colourless or white deliquescent crystals. The anhydrous salt has a specific gravity of 2.32 and hexahydrate 1.56.The hydrated salt loses $2H_2O$ at 100°C. Both are soluble in water and alcohol.

French Chalk :

It is naturally occuring hydrated silicate of magnisium. It is white powder having density of 2.5 gm/cc. This isalso known as Talc or Talcum. It is chemically described as a complex of silicate of magnisium $Mg_3Si_4O_{10}(OH)_2$. Thus it is natural hydrous magnisium silicate.

It makes the surface of cloth smoother and more homogeneous tha coarsly ground materials. It's covering power is next to that of China clay.

- **Calcium Sulphate:**

This occures as anhydrite along with limestones or rocksalt or gypsum $CaSO_4$. $2H_2O$, which forms transparent crystals(selenite).

2. Permanent/Durable:

Permanent finishes usually involve a chemical change in fibre structure and will not change or alter throughout the life of a fabric(Mercerizing, Resin, Water proof, Fire proof etc Soil Release).

ANTICREASE FINISHING:

The ability of a fabricto resist the formation of crease or wrinkle when lightly squeezed is termed as crease resistance of fabric. The ability of a fabric to recover to a definite degree is called crease recovery of fabric. Crease Resistant Finishes are applied to cellulose fibres (cotton, linen and rayon) that wrinkle easily. Permanent Press fabrics have crease resistant finishes that resist wrinkling and also help to maintain creases and pleats throughout wearing and cleaning.

These includes Dimethylurea(DMU), polymethylol melamine, dimethylol ethylene urea(DMEU), Dimethylol propylene urea(DMPU), dimethylol alkyl triazone, Dimethylol dihydroxy ethylene urea(DMDHEU) etc.

- **Oil and Water Proofing:**
  Waterproof Finishes allows no water to penetrate, but tend to be uncomfortable because they trap moisture to the body. Recently, fabrics have been developed that are waterproof, yet are also breathable that is more comfortable.For the purpose of cellulose acetate, polyvinyl butyral, polyvinylidene chloride, polyvinyl chloroacetate etc. are used.

Anti-microbial finishes:

With the increasing use synthetic fibbers for carpets and other materials in public places, anti-microbial finishes have assumed importance. Anti microbial finish Eco-friendly anti microbial finishing agent for cotton fabrics & Garments. Useful for eliminating bacterial growth due to sweat.

Water-Repellent Finishes:

Water-repellent finishes resist wetting. If the fabric becomes very wet, water will eventually pass through. Applied to fabrics found in raincoats, all-weather coats, hats, capes, umbrellas and shower curtains.

Mercerization

Mercerization is a finishing treatment of cotton with a strong caustic alkaline solution in order to improve the luster, hard and other properties

Effect of Mercerization:

1.Improve Luster.
2. Increase ability to absorb dye.
3. Improve reaction with a verity of chemicals.
4. Improve stability of form.
5. Improve strength/elongation.
6. Improve smoothness.
7. It has been shown that the increase in the luster occurs because of an effect. The cotton fiber is convoluted. The cross-sectional shape changes beacause of swelling.it becomes circular.

Factors Of Mercirization:-
1.Twaddle
2.Temperature
3.Tension
4.Time

(1) Twaddle (Concentration of NaOH):
If the concentration of NaOH is increased above 56oTw improvement in luster will be attained but if it is decrease below 48o Tw. The quality of luster will begin to be adversely affected

(2)Temprature:
High degree of luster is attained at temperature 18-20oC. As the temperature is increased the quality of luster is adversely affected but on lowering the temperature no improvement in the luster is obtained.

(3) Tension:
For acquiring better luster the material must be stretch to its original dimension (both in warp and weft direction during mercerization). If the material is allowed to shrink during mercerizing then quality of luster will be impaired on the other hand if the material is stretched more no improvement in luster is achieved.

(4) Time:
The optimum time for mercerizing is 30-60 seconds by increasing the duration of time no applicable improvement in the quality of mercerization can be achieved but if the time limit is less than 30 seconds in the quality of mercerization will be improved.

REACTIVE SOFTNER

REACTIVE SOFTNER is a special type of reactive softener which gives smooth, soft feel as well as body to a certain extent to cotton and blended fabrics. It gives water-repellent feel when used with polyvinyl acetate emulsions and other resins. This product can replace costly softeners like silicone emulsions and octadecyl ethylene urea based softener

I. PHYSICAL PROPERTIES :

1. Main component : fatty acid amide and amine derivatives with surfactants.
2. Appearance : Creamish paste
3. Ionic activity : Non- ionic
4. pH (1% aq soln) : 7
5. Solubility : Easily dispersible in hot and cold water.
6. Compatibility : Compatible to hard water, all anionic, cationic and non-ionic finishing agents.

II. FEATURES :

1. REACTIVE SOFTNER imparts full and smooth handle to all kind of fabrics.
2. REACTIVE SOFTNER provides excellent washing fastness properties.
It reacts with cellulose in presence of catalyst and high temperature to impact supple handle and water repellency to the treated fabric.
3. Textile fabrics treated with REACTIVE SOFTNER show improved tear strength and abrasion resistance.
4. Being non-ionic in nature, this softener can be used with other non-ionic and cationic softeners and also with other finishing ingredients like acrylic emulsions, polyvinyl acetate emulsion, etc.

- **Fluorochemical :**

For imarting both oil and water repellency to textiles fluorochemicals sach as Vinyl polymers of acrylic or Methacrylic type copolymers of vinyl esters, vinyl ether, allyl ether and thiomethacrylates.

Vinyl polymers consist of perflouroalkyl group, polymer backbone and a link between two. They are also made by copolymerizing one or more fluorinated monomers with one or more monomers not containg fluorine.

- **Parchmentising:**

Parchmentising is a textile finishing treatment for cellulose fabric, mainly cotton and flax, which stiffens the fabric and imparts a degree of translucency.

PRINCIPLE OF FINISHING OF WOOL

Wool is natural crimped textile fibre obtained from animal hair, mainly from sheep's hair. Wool is possibly the oldest fiber know to humans .finishing of wool can be normally classed into two ways and they are mechanical and chemical finishing .

These two broad streams of wool finishing are inextricably entwined in the finishing of wool to the aesthetic, durability and performance levels demanded by consumer.

Wool Finishing Process-Wool is natural crimped textile fibre obtained from animal hair . Wool is possibly the oldest fibre know to human. Finishing of wool can be normally classed into two ways and they are mechanical and chemical finishing.

These two broad streams of wool finishing of wool are inextricably entwined in the finishing of wool to meet the

THE SEQUENCE OF THE TREATMENT UNDERGOES BY WOOL FIBRE IN VARIOUS FORMS.

- Wool fabrics are of two types ;one woolen and another is worsted .
- Carbonization
- Process used to remove vegetable matter(burr ,seed ,leaf) impurities from wool fabric.
- Objective of carbonization is to remove vegetable impurities.
- Disadvantage is it makes yellowish effect.
- Sulphuric acid solution also contain a wetting agent, usually of the non-ionic surfactants type , to ensure that an even uptake of the acid by the wool occurs.

CRABBING-

- Permanently sets the weave and is essential for some kind of wool cloth ,a exploratory finishing process .
- High level of permanent set are required if the wool fabric is to be scoured and dyed in a rope form.

- Crabbing process-
- Wool fabric is flattened and maintained under some tension and immersed it in boiling water to relieve tensions for 5-10 minutes.
- It is then passed around the heated plate to set the correct dimension.
- Finally ,the wool fabric is cooled by passing the fabric through cold water bath .

MILLING/FULLING-

Controlled felting of woven or knitted is also known as fulling or milling .Fabric consolidates in both warp and weft directions and become thicker ;leading to higher mass per unit area.

It is achieved by intermittent mechanical actin in presence of suitable aqueous liquor.

Properties of Wool

- They have composed of amino acids.
- They have excellent absorbency.
- Moisture regain is high.
- They tend to be warmer than others.
- They have good elasticity and resiliency.
- Poor resistance to alkali but good resistance to acid.

PRINCIPLE OF FINISHING OF COTTON

- Laundering properties of cotton are excellent due to its high
- hot alkaline detergent.
- Strength and durability also enhances properties of cotton.
- It can be made to look attractive in certain weaves and yarn counts, but cotton lacks the natural appeal of silk ,linen and wool.so finishing process attempt to transform natural cotton to look like expensive material.
- This involves stiffening to immediate linen.
- Improvement in lustre to look like silk.
- Imparting crease recovery properties of wool.

DEFECTS IN COTTON -

1- Poor lustre

2-Tendency to shrink

3-Tendency to crease

4- Poor draping quality

Hence, finishing process employed will depend on the properties required in the fabric with respect to its use and its natural properties.

A simple cotton may be divided into 3 steps-

a) Pure finishes

b) Assisted finishes

c) Stiffened finishes

PURE FINISHES

Pure finish gives fabrics an anti- microbial finish in compliance with Oeko Tex standard 100 . It increases hdrophilic function, freshness, and comfort all at the same time . Furthermore, pure finish fabrics have good washability and , can be combined with a No-Iron Finish.

Stiffened finishes

Forming a film on the surface of a fiber influences the touch of the product and has a stiffening effect.

PRINCIPLE OF FINISHING OF JUTE-

Finishing is a textile process used to improve appearance ,impart functionality ,and enhance durability.it should also meet the suitable requirements and secure customer satisfaction.

Textile finishing can be categorized according to purpose or end uses .

JUTE-

Jute is one of the most affordable natural cellulosic fiber and it is a soft ,shiny ,and long vegetable fiber that produced from plants in the genus Corchorus.

The retted jute fibers are generally off-white to brown due to presence of minerals ,and 1-4 m long.

Jute fiber is mainly composed of cellulose ,hemicellulose and lignin.

FUNCTIONAL FINISHING OF JUTE-

Jute has drawback as meshy structure ,poor wrinkle recovery ,high fiber shedding .

To overcome from these drawbacks technologies are developed over years like blending of jute with fine fiber, development of fine yarn from modified spinning.

Functional finishes have been classified into following six groups and then subgroup based on the requirement and end uses.

The diversifications of the jute products in the field other than conventional uses have become a matter of great importance in the jute industry.

SILK- INTRODUCTION

* Silk has remained the “Queen of fibers ” over the years for its elegant textile qualities wear comfort and aesthetic look.

* Silk fiber is defined as a smooth ,lustrous and elastic filament of small diameter ,which is recovered from the cocoons made by the caterpillars for protection during the somnolent period when they are changing into moths . It is the only natural filament that man does not have to spin before it can be used for textile fabrics, but not only to double and twist the long continuous strand.

* Silk is prized for its luster ,sheen and hand . The popularity of this “Queen of fibers ” is mainly because of the finishing it is subjected to.

PROPERTIES OF SILK FABRICS

Silk is one of the popular fabrics for apparel because of its unique properties.

- Silk is most luxurious fabric
- the most comfortable fabric
- the most absorbent of fabrics (equal to wool)
- the best fabric for drape
- the best fabric for color
- capable of the greatest luster
- having the finest "hand" etc.

These are some of the factors which make the fabric more popular. The fabric is cool in summer and warm in winter.

Characteristics of Silk Fabrics

•**Composition**: The silk fibre is chiefly composed of 80% of fibroin, which is protein in nature and 20% of sericin, which is otherwise called as silk gum.

•**Strength** : Silk as a fibre, has good tensile strength, which allows it to withstand great pulling pressure. Silk is the strongest natural fibre and has moderate abrasion resistance. The strength of the thrown yarns is mainly due to the continuous length of the fibre. Spun silk yarn though strong is weaker than thrown silk filaments.

•**Elasticity** : Silk fibre is an elastic fibre and may be stretched from 1/7 to 1/5 of its original length before breaking. It tends to return to its original size but gradually loses little of its elasticity. This would mean that the fabric would be less sagging and less binding resulting in the wearers comfort.

•**Resilience**: Silk fabrics retain their shape and have moderate resistance to wrinkling. Fabrics that are made from short – staple spun silk have less resilience.

•**Drapability:** Silk has a liability and suppleness that, aided by its elasticity and resilience, gives it excellent drapability

•**Heat Conductivity**: Silk is a protein fibre and is a non-conductor of heat similar to that of wool. This makes silk suitable for winter apparel.

•**Absorbency:** Silk fabrics being protein in nature have good absorbency. The absorptive capacity of the silk fabric makes comfortable apparel even for warmer atmosphere. Fabrics made from silk are comfortable in the summer and warm in the winter. Silk fibre can generally absorb about 11 percent of its weight in moisture, but the range varies from 10 percent to as much as 30 percent. This property is also a major factor in silk's ability to be printed and dyed easily.

•**Cleanliness and Washability:** Silk fabric does not attract dirt because of its smooth surface. The dirt, which gathers can be easily removed by washing or dry cleaning. It is often recommended for the silk garments to be dry-cleaned. Silk fabrics should always be washed with a mild soap and strong agitation in washing machine should be avoided.

•**Reaction to Bleaches:** Silk, like wool, is deteriorated with chlorine bleaches like sodium hypochlorite (NaOCl bleaches). However, mild bleach of hydrogen peroxide (H_2O_2) or sodium per borate may be used for silk.

•**Shrinkage:** Silk fabrics are subjected only to normal shrinkage which can be restored by ironing. Crepe effect fabrics shrink considerably in washing, but careful ironing with a moderately hot iron will restore the fabric to its original size.

•**Effect of Heat** Silk is sensitive to heat and begins to decompose at 330° F (165° C). The silk fabrics thus have to be ironed when damp.

Effect of Light: Silk fabric weakens on exposure to sun light. Raw silks are more resistant to light than degummed silk.

- **Resistance to Mildew:** Silks will not mildew unless left for sometime in a damp state or under the extreme conditions of tropical dampness.
- **Resistance to Insects:** Silk may be attacked by the larvae or clothe moths or carpet beetles.

- **Reaction to Alkalis:** Silk is not as sensitive as wool to alkalis, but it can be damaged if the concentration and the temperature are high. A mild soap or detergent in lukewarm water is thus advisable.

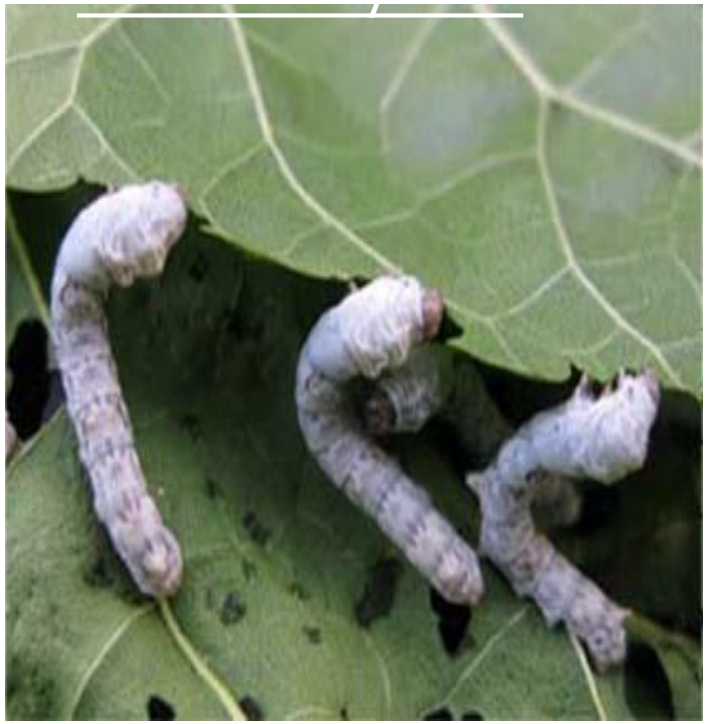
- **Reaction to Acids:** Concentrated mineral acids will dissolve silk faster than wool. Organic acids do not harm silk.

- **Affinity for Dyes:** Silk has good absorbency and thus has good affinity for dyes. Dyed silk is fast to colour under most conditions, but its resistance to light is unsatisfactory.

- **Resistance to Perspiration:** Perspiration and sunlight weakens and yellows silk fabrics. The silk itself deteriorates and the colour is affected causing staining. Garments worn next to the skin should be washed or other wise cleaned after each wearing.

CLASSIFICATION OF SILK

There are four types of natural silk which are commercially known and produced in the world. Among them mulberry silk is the most important and contributes as much as 90 per cent of world production, therefore, the term "silk" in general refers to the silk of the mulberry silkworm. Three other commercially important types fall into the category of non-mulberry silks namely: Eri silk; Tasar silk; and Muga silk. There are also other types of non-mulberry silk, which are mostly wild and exploited in Africa and Asia, are Anaphe silk, Fagara silk, Coan silk, Mussel silk and Spider silk.



Non-Mulberry Silk

Tasar silk

The tasar silkworms belong to the genus Antheraea and they are all wild silkworms. There are many varieties such as the Chinese tasar silkworm Antherae pernyi Guerin which produces the largest quantity of non-mulberry silk in the world

Eri silk

Muga silk

Some other categories of non mulberry silk are:-

- Anaphe silk
- Fagara silk
- Coan silk
- Mussel silk
- Spider silk

FUNDAMENTALS OF SILK FINISHING

- The finish must take into account demand of silky handle and also draping of the material.
- The right combination depending on the article,and the order in which the finishing machines were used were mainly responsible for the final result.
- The wash and wear trend is now becoming more important in the silk , which can be achieved with the use of softeners , elastomers and synthetic resins.
- The drawbacks of the properties of this fibre are rectified and improved by finishing techniques .
- Finishing operations serve the purpose of the functional performance of fabric,
- The most demanded in recent interest is in getting soil –resistant ,flame retardant silk.

Another interesting area in this context is the antimicrobial finishing in order to maintain hygiene and freshness

MECHANICAL FINISHING

Silk can withstand various mechanical finishes which are as follows

1.)CALENDERING

This is a technique used to influence the handle and appearance of the fabric .

* In most of the cases silk is only calendared in the cold stage, which produces a soft handle, With a hot calendaring higher lusture is obtained but it has to be determined in each case in order to prevent negative influence.

* It is mainly used for taffeta like woven with a smooth character and for serge articles (e.g. Pongee twill)

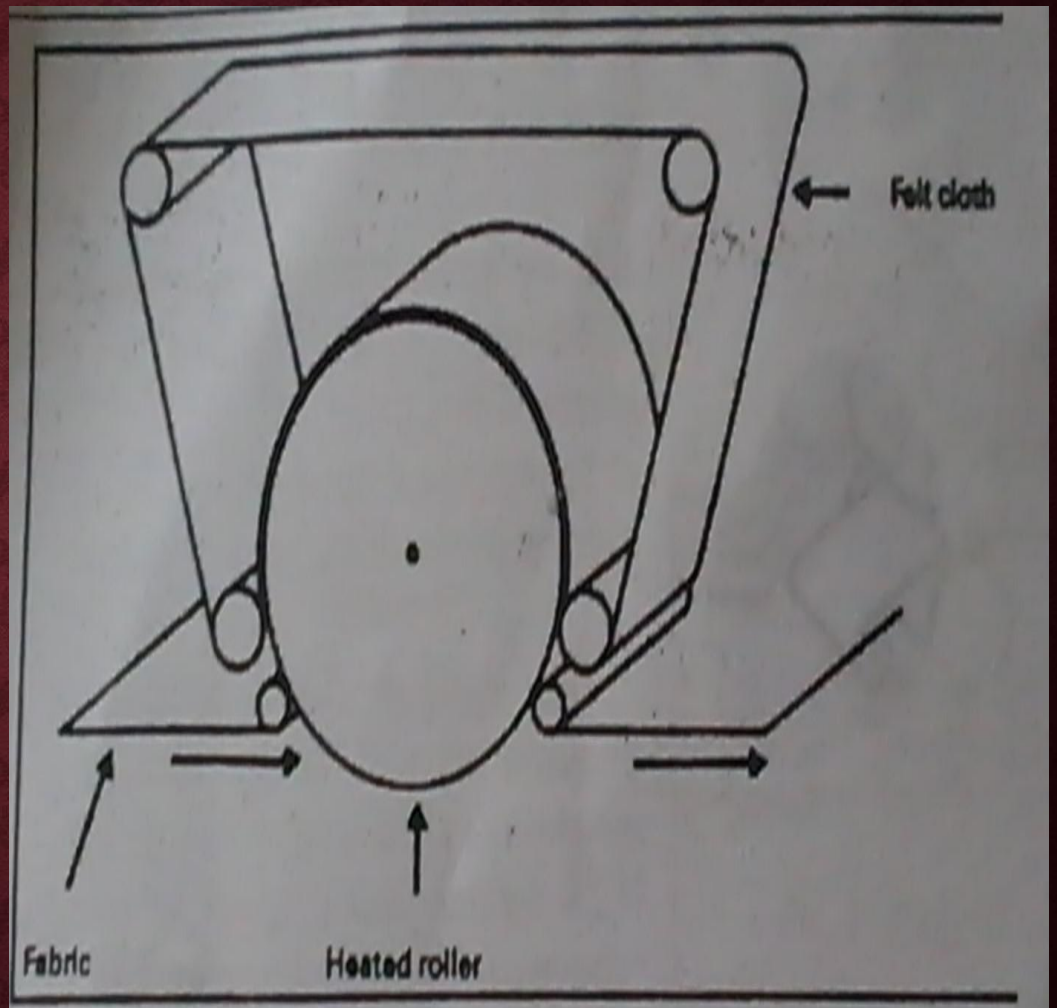
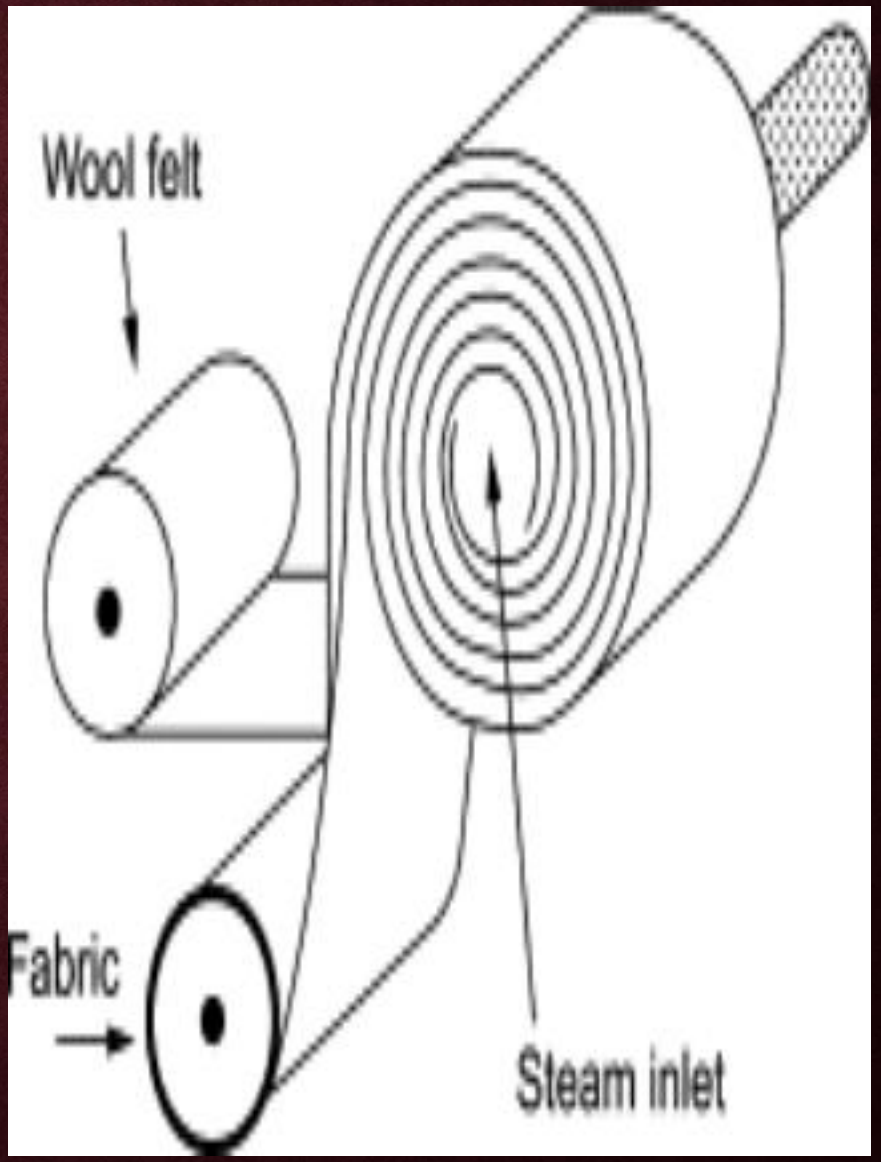


Fig. 1 : Felt calendar

2.) DECATIZING

- Decatizing mainly imparts dimensional stability to the textile fabrics .
- Also creases are removed and the fabric is smoothened .Here the principle involved is controlled relaxation of strains stored in a fabric.
- The fabric along with a felt are rolled in open width on to a perforated cylinder and subjected to super heated steam .Here it is important that the wool felt used should not be so hard that the silk fabric is not pressed flat.
- Discontinuous decatizing machine is more commonly used machine today but continuous decatizing equipment is also found in which felt calendars might be used.



3.) STENTERING

Main objectives of stentering :

a)Drying the goods by means of hot air.

b)Bringing them to desired width.

c)Producing the desired feel in finished goods by the suitable application of heat in conjunction with or without special motions being applied to the cloth.

* The goods are stretched upon a stenter in such a way as to straighten out and produce the necessary width with a minimum of chemical strain. They are then dried by the means of hot air. In this way, the fixing of the dressing occurs while the cloth has a desired width and form.Further by regulation of the temperature and therefore the rate of drying combined with a motion known as “swissing” which is given to the cloth ,the nature of the final “feel” and the elasticity can be controlled.

* Earlier for silk finishing a stenter operating with hot air was sufficient to dry the fabric but nowadays it requires curing frames with temperature upto 150 degree C,since various elastomers and resins are being used.

3.)TAMPONING

Tamponing is a treatment, which leads to improve optical appearance.

* Silk is sensitive to the mechanical friction it is subjected to in the various stages of treatment .Even after taking greatest precautions it is likely that the silk fabric may develop chafe marks.
* The attempt is then made to produce optical improvement on the fabric so that it is acceptable further.

This is achieved by applying extremely fine film of oil evenly on both sides of the fabric .Thus the chafe marks become less visible.

* Earlier only faulty portions of fabric were treated by hand with tamponing cushion.
* Nowadays machines exist which apply evenly to the fabric a fine film of oil homogeneously distributed on several rollers.

4.)BREAKING

Breaking machine is used to impart a particularly soft handle mainly when calendaring is not sufficient .

Two types of machines are available :

* BUTTON : Here the piece is passed several times rapidly to and fro over small rollers studded with brass buttons.
* KNIFE : Here the fabric is drawn over the edges of slanted knives.

The button-breaking machine is older one and recently this is replaced by knife breakers .

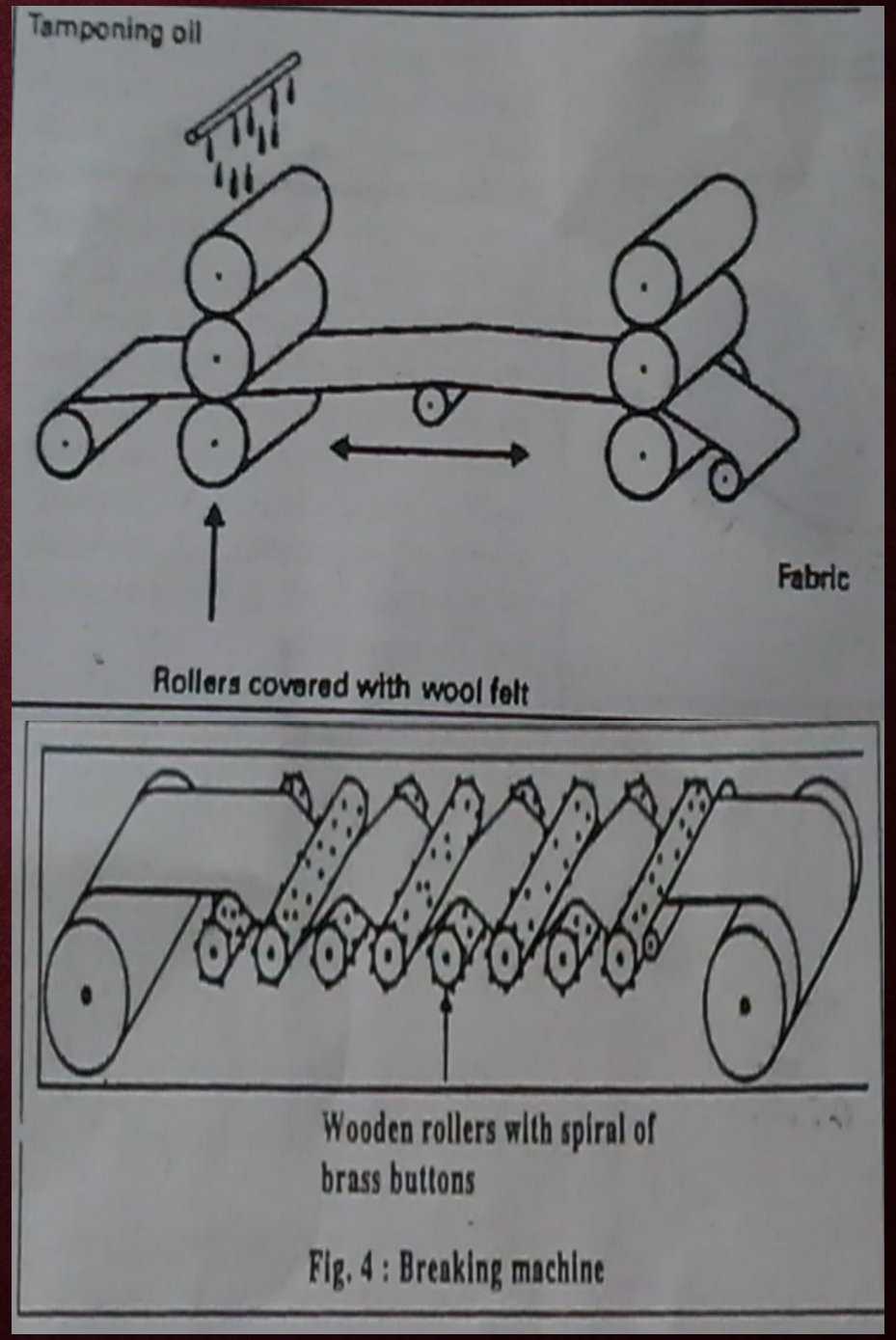


Fig. 4 : Breaking machine

5.)STREAMING OR SHRINKING

For this purpose horizontal screen steamers or shrinking machines are used.

* They produce shrinkage and relaxation of the fabric . Crepe like fabrics often appear too flat .The goods coming from previous treatments are many times in , insufficiently relaxed state.

* In the screen streamer ,the fabric is laid with steam below,on which the fabric can relax.

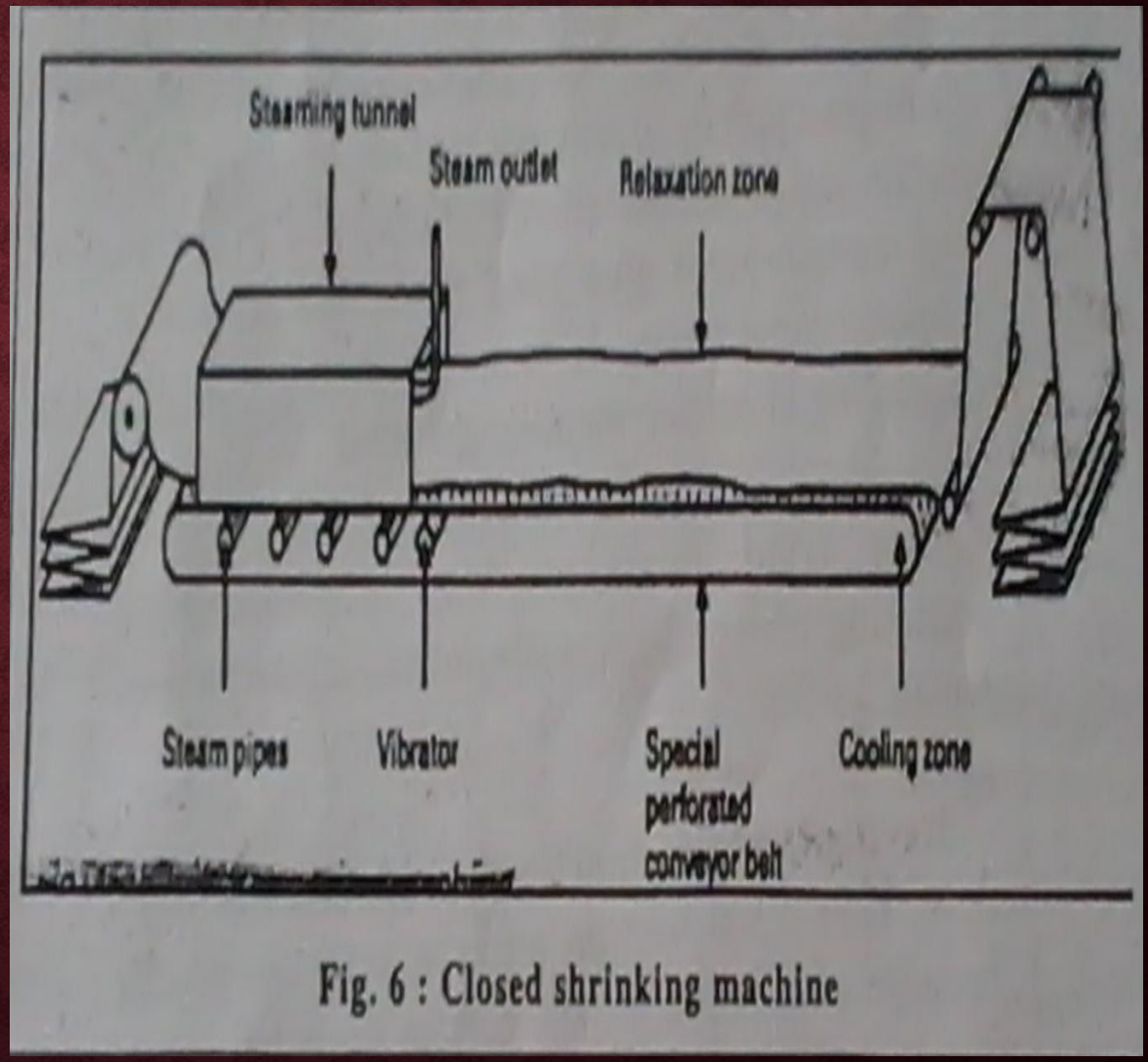


Fig. 6 : Closed shrinking machine

Chemical Finishing

Weighting -

It is well known that silk loses 20 to 25 % weight during degumming because of removal of sericin. Weighting which is also called as charging is carried out by treatment with chemicals.Weighting which is also called as charging is carried out by treatment with chemicals.

a) To compensate for this loss in weight.

b) To impart fuller hand bulk and a greater filling capacity.

c) To Improve drapeability (ability of fabric to hangs gracefully around its own weight).

d) For better wash and wear behaviour.

The various procedures that help in giving weighing as follows :

1. **VEGETABLE WEIGHTING :** This process is hardly used today .It was often combined with colours such as logwood for black.White silk threads were weighted mainly with tannins or special plant extracts (Persian berries)

20 **MINERAL WEIGHTING**: Mineral weighting is still the classic method ,using tin(IV) chloride (Pink salt) Phosphate–Silicate. This is carried out in stages ,which are repeated once , or several times , depending on weight increase desired.

3. **WEIGHING BY GRAFTING (polymer weighting):** Presently polymer "grafting" treatment is becoming popular . With this kind of weighting it has become easy to give the percent content ,calculated on the present weight.

2.)SCROOPY FINISHING

According to the prevailing fashion ,lot of importance is laid on the “scroop” which is represented by the crackling sound produced when the fabric is rubbedor squeezed by hand. The final handle effect of the fabric may be adjusted to harder or softer side, which in turn depends upon the type of the silk article.

While formulating the finishing liquor, it must be taken into account that fibre should always retain ,at least residually ,the classic feel of silk. In some cases ,a scroopy handle finish is given as early as the final rinsing bath at the end of the dyeing or printing process.

The treatment with organic acids, like tartaric acid,oxalic acid, formic acid , acetic acid etc. restores the natural scroopy handle in the finished fabrics. It is assumed that with the influence of acids a reorientation of fibroin molecules takes place at the outermost layer of the fibre .Specialized softeners consisting of the emulsions of fatty alcohals with their sulphated counter parts also impart this desirable effect.

3.)SOFTENING

Silk develops the extra ordinary properties with the application of softeners and also lubricants . These softeners help to improve the following:

a) Hand b) Drape c) Cutting d) Sewability e)Desirable qualities in silk

The softness and stiffness in a fabric are basically a manifestation of inter- fibre and inter –yarn friction .If this friction is reduced the fabric develops a soft handle .However , to achieve good durable softness one may have to focus on to chemical softeners .

In this category organic and silicone based products are common .

Some typical softeners used are :

a)Oil , waxes and fats.

b)Cationics –formulations based on imidazolines , fatty amine ethoxylates .

c)Anionics – sulphates or sulphonates of stearates , oleates,palmitates ,fatty alcohols etc.

d)Non –ionic – polyoxyethylene glycols ,polyethoxylated esters of long chain alcohols ,acids ,glycerides ,oils and waxes.

e)Silicone emulsion –polydimethyl siloxane , polymethyl hydrogen siloxane ,amino silicones etc.

f)Polyethylene emulsion .

The current trend is to use the epoxy derivatives of silicones to get softness coupled with crease and non-yellowing.

All the above softeners can be applied by pad-dry , pad-dry-cure or by exhaust techniques.

4.)ANTISTATIC FINISHING

When silk is grafted with monomers to modify certain properties the problem of static charge arises. Otherwise static charge build upon the silk is moderate .The static charge on styrene grated silk increases with increasing styrene content .This is checked by the antistatic compositions, which are classified as:

a) Statdissipatants

b) Statresistants

The statdissipating agents function by increasing the hygroscopicity of polymer species .In case of silk ,certain water soluble vinyl monomers in treatment with certain acids give good statdissipatant effect .Further, conductivity is found to increase by the depositing of certain metallic particles.

Also ,statdissipatants effect is obtained by rendering, the conducting silk fibre by coating it with metallic silver. The statresistants ,function by reducing the fibre-fibre ,fibre-metal friction and the friction action is mainly because of lubrication .The certain basic lubricants like mineral oil and butyl stearate are used.

5.)WRINKLE FREE FINISHING

The easy-care properties of silk are inadequate as compared to synthetic fabrics,so a good crease recovery finish is desirable for silk .

The objectives are :

a)Easy care finish producing cross-linking agents to avoid crease formation is used .

b)Gives improved dimensional stability.

c)The crease recovery property should withstand repeated laundry washes.

d)Compatible with all finishing chemicals.

These products are such that they either react with one another or cross-link the fibroin backbone to form water insoluble products under the action of heat and catalysts. Urea-formaldehyde precondensates can increase the weigt of silk .Dimethylol dihydroxy ethylene urea,silicone ,acrylate softener and a catalyst give both dry and wet crease recovery on silk ,also there is improvement in tear strength and better abrasion resistance is obtained. The silk-epoxide reaction is found to be mainly with phenolic hydoxy groups of tyrosine residues ,which also results in weight gain of about 15- 20%.Also give dry and wet crease resistant properties.

Apart from these other crease resistant agents,which can be used to improve dry and wet crease resistance ,tearing strength ,elasticity ,weight gains are: Dimethylol ethylene carbamide,Urethane resins with or without addition of modified urea-formaldehyde resins.

The diglycidyl ether of ethylene glycol and the triglycidyl ether of glycerol ; Urea ,thiourea and an aliphatic , alicyclic or aromatic compound ; different types of N-methylol derivatives of nitrogenous compounds ;ethylene urea and glyoxal used with metal salt catalyst and alkyl ethylene urea ; isocyanates are very reactive and can result in neutral medium at room temperature through solvent medium.

All the above chemicals can be applied by padding as well as exhaust techniques.

6.)OIL AND WATER REPELLENT FINISH

As the name suggests this kind of finish generally makes the fabric ,oil as well as water repellent along with imparting stain resistance property without affecting the handle of the fabric.An ideal water repellent should

a) Affect the porosity to air as little as possible.

b) Leave the wet soiling of the cloth unaltered .

c) Be compatible with other finishing agents .

d) Be easy to apply on cloth .

e) And of course impart water repellency,which is fast to washing and dry cleaning .

The principle involved here is to lower the surface energy of the fabric with respect to air to such a low value that it may repel oil or oily stains. Teflon coated appliances are common oil resistant surfaces.

It has been observed that when natural silk was grafted with vapour of hexafluoropropylene ,vinyl chloride, acrulonitrite ,it was found that water repellency , oil repellency ,mineral acid resistance and photostability of natural silk increases.

These repellents are applied by pad-dry-cure process and also by exhaust process .

7.) FLAME RETARDANCY

With the increase in number of accidents caused by fire , the flameproofing finish has acquired considerable importance .A flame-retardant fabric may be defined as one, which does not propagate the flame ,although it may burn or char when subjected to any form of heat. As compared to other fabrics ,wool and silk are relatively self –extinguishing and their "Limiting Oxygen Index" (LOI) values are around 24. But since these fibres cannot safely pass "Vertical Flame Test" ,these fabrics fabrics need to be treated. In western countries it is required by the law to finish children wear especially nightwears by flame-retardants.Yet ,in India such legislation is not there,the awarness in this regard is growing. Such kind of finishes must meet certain requirements: Should give satisfactory effect with an addition of reasonable amount say approx 15-20% of these agents should be durable to laundering ;should not produce appreciable strength loss of the fabric;should not affect light fastness of dyestuff applied on the fabric ; the air- permeability of fabric should not be affected.Silk is self-extinguishing ,but this characteristic is imparted by the Reaction products of polyhalogenated acids having cyclic nucleus such as chlorendic acid and thiourea.Titanium hexachloride ,titanium tetrachloride and zirconyl chloride are found to impart good flame resistancy. Also with treatment of anionic complex of zirconium ,titanium or tungsten ,flame resistance of the fibrous material is increased .Since these treatments are carried out under acidic conditions , could be coupled with dyeing of silk with acid dyes. It has been observed that certain phosphorous containing compounds may be used to impart flame retardancy alongwith resistance to creasing and shrinkage.E.g : N ,N –ethylene bis [PP- bis (azirhidinyl)-N-methyl-phosphinamide]In presence of zinc fluoroborate ,above compounds give good flame resistance alongwith improvement in wash-fastness.

8.)ANTIMICROBIAL /ANTIFUNGAL FINISHING

Antimicrobial is one of the special types of finishing given to the textiles.The main purpose of this is to protect the fibre from microbial attack and to protectthe user against transfer of pathogenic germs.Following are the certain medium where microbes grow :

a) Dirt

b) Warm temperature

c) Moisture and

d) Receptive surfaces

As textiles provide the entire required medium to grow these microbes , it candamage the fabric /garment by several ways .These microbes can be present everywhere ,surrounding us like :On textile and non textile surfaces ; Human body and on particularly all surfaces we contact. This microbial growth results in the following displeasing qualities in human lifestyle like :objectionable odours ; microbial stains ;allergic responses ; disease and infection and product deterioration.

SOME ADVANCED FINISHES

1.)PHOTOSTABILIZATION

Photochemical tendering is one of the biggest drawbacks drawbacks in silk, which is caused by ultra –violet radiations i.e. during exposure to sunlight fabric absorbs UV light .In presence of oxygen and moisture , many free radical reaction are set in motion .Because of this tendering takes place .So there is need of treatment of free radical quenchers, in other words , which are UV absorbers usually called as photostabilizers. Earlier the treatment was given with chemicals like thiourea, ammonium thiocyanate ,tannic acid and formates .But now the trend has been changed because UV absorbers came into picture.

UV absorbers are based on formulations like :

a)Derivates of 2-hydroxy benzophenone (I)

b)Phenylesters and saicylates (III and IV)

c)Derivatives of 2-(2' –hydroxyphenyl)-benzotriazole (II)

d)Substituted cinnamic acid derivatives (V)

Selection of the type and concentration of UV absorbers depend upon:

a)Composition of substrate. b)Thickness of the sample c)Colour requirements d)Processing conditions.

They are generally used at concentration of 1% and can be applied by exhaustion method from dye bath (acid dyes or disperse colours)

FRAGRANCE FINISHES

Finish that prevents the fabric from bad odour after long use,makes the garment as well as the environment fresh. Apart from fragrance also imparts softness to the fabric. Especially suitable for towels , napkins ,casuals etc. Can be applied on cellulose as well as its blends with synthetics.

COOL FINISHES –Snocool

Finishing when applied to the fabric gives a cooling effect to human body .Products imparting this kind of finishing reacts with the body chemistry producing a cool effect to the body .These finishing agents can be manufactured with or without fragrance .Finishing agent with or without fragrance keeps the body fresh too.

THERMAL RESISTANT FINISHES

A finishing agent for producing heat –retaining effect.This type of finishing when applied to the fabric keeps it warm .Produces heat retaining effect due to infrared radiation owing to its porosity.

HYDROPHILLIC FINISHES

Imparts good absorbency along with softness .Can be applied by Pad –dry or exhaust techniques