CHAPTER 1

FINISHING AND SOME FINISHING AGENTS

FINISHING

Finishing is one of the essential processes of a processing mill where all bleached, dyed and printed material are subjected before they are put on the market.

The aim of the textile finishing is to render textile goods fit for their end uses.

Finishing gives the following advantages :

1. Improved appearance - Lustre, Whiteness etc.,

2. Improved Feel which depends on the handle of the fabric and its Softness, Suppleness, Fullness etc.,

3. It improves the wearing qualities - Non soiling, Anticrease.

4. It gives special properties required for particular uses - Water proofing, Flame proofing etc.,

5. It covers the faults of the original cloth.

6. It increases the weight of the fabric.

7. It increases the sale value of the material.

8. It improves the natural attractiveness of the fabric.

9. It improves the serviceability of the fabric.

Hence, Finishing is essential for a textile good before they are put on the market.

TYPES OF FINISH

Finishing mainly falls into three groups;

1. Temporary Finish
2. Permanent Finish
3. Semi-Permanent Finish.

TEMPORARY FINISH

A finish which is not stable and goes off after the first wash is known as TEMPORARY FINISH.

If the finishing effect in the fabric disappears during subsequent washing and usage then it is called TEMPORARY FINISH.

Eg., Mechanical: Calendering, Embossing etc.,

Chemical : Starching, Softening (Except Reactive softeners)

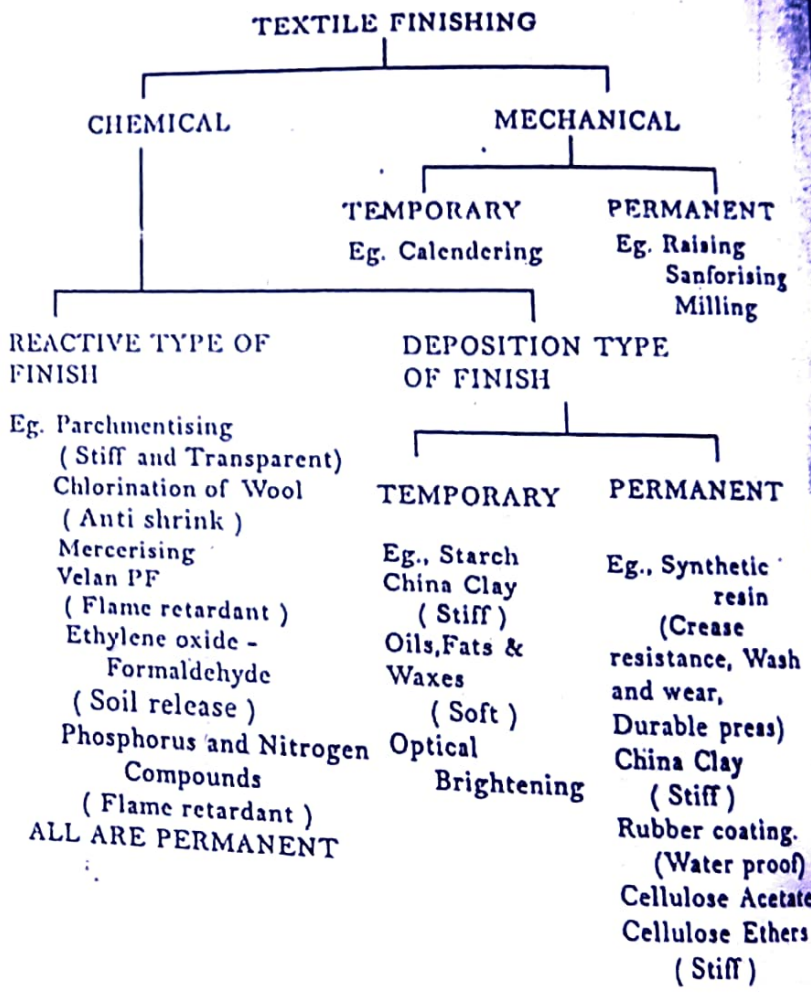
PERMANENT FINISH

If the finishing effect in the fabric does not disappear and remains unaffected through all the conditions of wear and washing treatments, then the finish is said to be a PERMANENT FINISH.

Eg., Mechanical : Sanforising, Mechanical milling of Wool etc.,

Chemical : Resin Finishing, Water proof, Flame proof finish etc.,

CLASSIFICATION OF FINISHES



SEMI-PERMANENT FINISH

A finishing on the fabric is said to be SEMI-PERMANENT FINISH if it is stable to more than 5 to 10 washes and not afterwards.

Eg., Mechanical: Schreiner Calendering.

Chemical : Buckram Finish.

STIFF FINISH

To achieve the fabric stiffening using various stiffening agents is known as STIFF FINISH.

OBJECTIVES

1. To give stiffness to the fabric.
2. To increase the weight of the fabric.

The most commonly used ingredients in stiff finishing are:

STIFFENING AGENTS - Starches, Polyvinyl Alcohol (PVA), Carboxy Methyl Cellulose(CMC) etc.,

SOFTENING AGENTS - Glycerine, Turkey RedOil(TRO), Cationic, Non-ionic, An-ionic, Reactive softeners , PE Emulsion, Silicone Emulsion etc.,

WEIGHTING MATERIALS - Gypsum, Sulphate of Ca and Mg , lead, Zn, Chlorides of Mg, Ba, Zn, China clay etc.,

ANTISEPTIC AGENTS - Alum, Boric acid, Phenol, Borax etc.,

STARCHES: (CHARACTERISTICS AND APPLICATION)

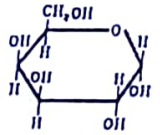
Starches are generally used for stiff finish.

Various starches are available for this purpose.

CHEMICAL NATURE

Chemically starch is similar to cellulose but not exactly equal. Both the starch and cellulose consist of Glucose units and the difference is, starch contains α Glucose and cellulose contains β Glucose.

The structure of α Glucose is given below:



The Glucose chain consists of AMYLOSE linear chain molecules and AMYLOPECTIN branched chain molecules. The combination of Amylose and Amylopectin are not soluble in water. However, if both are separated from each other, both are soluble. The amylopectin is responsible for the paste forming property in starches.

The empirical formula for starch is $(C_6H_{10}O_5)_n$.

PROPERTIES OF STARCHES

Starch is not soluble in water.

Starches swell in water.

For textile application as stiffener, we should convert it into a form of paste.

To get a paste out of starch, it has to be heated in water at or slightly higher its Gelatinisation temperature

Gelatinisation Temperature is the temperature at which the starch becomes a 'GEL' which is suitable for application. On heating with water the starch granules swell and burst at this temperature.

All the starches do not have the same Gelatinisation Temperature.

STARCH	TEMPERATURE
1. Potato	65 - 68°C
2. Tapioca	70 - 74°C
3. Maize	75 - 77°C
4. Rice	80 - 83°C
5. Wheat	80 - 85°C

At 150°C, Starch dissolves in water.

Factors affecting the starch cooking are;

1. Temperature: As the temperature increases viscosity of paste decreases.

2. Stirring: By good stirring, we will get a homogeneous paste. However, prolonged stirring will reduce the viscosity of the paste.

3. Time : Time of boiling varies depending on the type of starch.However, in general as the time of boiling increases viscosity of paste increases.

Hence, the viscosity of the paste is governed by two factors:

1. The size of the granules, 2. The ratio between Amylose and Amylopectin, 3. Stirring and 4. Time of boiling.

STABILITY OF THE VISCOSITY OF THE STARCH PASTE

Though most of the starches are used at their na... pH, the stability of the viscosity of the paste is good a... which varies again with the type of starch.

STARCH	STABLE pH
Sago	7 - 8
Farina	5
Maize	4.5 - 6.5
Corn	4.5 - 6.5

The following factors are to be considered whi... selecting a starch for stiff finish

1. The stickiness during ironing and drying.
2. Ease of penetration into the fabric.
3. Transparency of the starch film.
4. Effect of crushing the starched fabric.
5. The stiffness of starched fabric
6. The smoothness of the starched fabric.

The quantity of the starch to be taken for stiff finish depends on:

1. Weight of the material.
2. Type of weave.
3. Thickness of the fabric.

METHOD OF APPLICATION

Pad - Dry - Calender

DIFFERENT STARCHES

WHEAT STARCH

It is the best starch used for finishing.

It is mostly used for sizing than finishing.

It's gelatinisation temp. 80° - 85°C.

It is rarely used for finishing white goods as it affects the color of the material and also susceptible to mildew formation.

It has a high ability to retain weighting materials such as China clay, Barium sulphate etc., This power of holding weighting materials is attributed to the presence of gluten in the flour. The gluten is nothing but the outer layer of wheat which is a nitrogeneous material.

Gluten may be destroyed by Fermentation.

PREPARATION OF STARCH

Wheat - Destruction of Gluten - Wash - Sedimentation - Separate - Dry - Pack.

POTATO STARCH OR FARINA

It is obtained from TUBERS.

The property of the starch depends on the Maturity of potato.

A matured potato will give a soft and flexible finish with a great Glossy effect when used in conjection with Borax or Wax.

It has a good binding power but its viscosity falls rapidly with stirring.

Generally it is used as mixture with Maize or Sago starch.

It's Gelatinisation temperature is 65° - 68°C.

PREPARATION OF STARCH

Potato - Shave the skin - Crush in water - Wash - Sedimentation - Separate - Dry - Pack.

MAIZE STARCH

It gives a viscous paste and is relatively stable.

This starch is much suitable for finishing.

This has a high ash content even upto 1%.

It is difficult to remove the gluten. The removal of gluten is carried out using 0.3 - 3% SO_2 at a temperature of 40° - 60°C for 30 - 40 hours.

It is often used in conjunction with Farina.

It's Gelatinous temperature : 75° - 77°C.

It gives a crisp effect in finishing.

PREPARATION OF STARCH

Maize - Remove Gluten - Crush - Wash - Sedimentation - Separate - Dry - Pack.

RICE STARCH

This starch penetrates better and gives a harder finish with fullness and firmness regarded as 'Boardy'.

It's Gelatinisation temperature is 80° - 85°C.

It is used for producing a high degree of Lustre on Friction Calender.

It offers difficulties in its preparation as its granules are very small and take a long time to settle.For this reason, Centrifugal separation is preferred for sedimentation.

The grains are steeped in Alkaline solutions till they soften.

PREPARATION OF STARCH

Grinding of rice into powder form - Centrifuge - Wash - Separate - Dry - Pack.

BACK- FILLING FINISH

'Back-Filling' is the descriptive term applied to the process in which thick paste is pressed into ONLY ONE SIDE OF THE FABRIC and the excess is scrapped away later.

OBJECTIVES

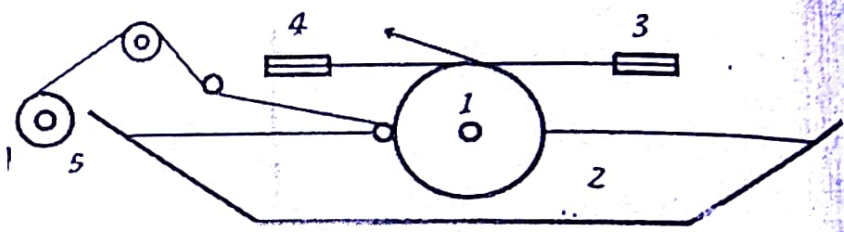
To cover the gaps between the warp and weft treads by a thick paste.

To fill the interstices of the cloth to improve the appearance and solidity of the fabric.

To increase the weight of the fabric by keeping the face of the fabric in good condition.

This is usually given to lower quality and loose constructed fabrics such as Long cloth, Book Binding cloth etc.,

TOMMY - DODD BACK FILLING MACHINE



1 - *Cotton Bowl*
2 - *Finishing Chemical Bath*
3 - *Brass doctor*
4 - *Rubber doctor*
5 - *Fabric to be finished*

The Tommy-Dodd is the most common Back-Fillin machine.

The single Cotton Bowl is semi-immersed in t trough of thick starch paste and the fabric is pressuris around the roller.

The trough contains not only the starch but also so Weighting Agents like China Clay and French Chalk a some preservatives to prevent mildew growth on the fab during subsequent storage.

In this manner the face of the cloth is not impregnat but the paste is applied to the back side of the fabric fr which the excess is scrapped by the Doctor knife as fabric emerges from the trough.

A thick mixing is essential here otherwise a thin paste would penetrate the fabric and give an unwelcomed appearance to the fabric.

RECIPE

(Wheat) Starch	-	100 gpl
Wetting agent	-	0.5 gpl
China Clay	-	50 gpl
Borax	-	1 gpl
Colour	-	As required.

FUNCTION

Starch	-	for stiffening
Wetting agent	-	for softening
China clay	-	weighting material
Borax	-	antiseptic agent

The above starch is applied on the fabric by the above mentioned machine and drying is done on the cylinder with special guide rollers in order to dry the side which has not been starched.

PROCESS SEQUENCE

Pad - Dry - Calender .

RECIPE FOR BOOK BINDING CLOTH

In 100 gallons of water

Potato starch	-	18 lbs
Maize starch	-	80 lbs
Dextrin	-	32 lbs
TRO	-	43 lbs
China clay	-	12 gallons
Ultra marine	-	4 ozs

PROCESS SEQUENCE

Pad - Dry - Calender.

BUCKRAM FINISH

Buckram finish is the name given to the normal stiff finish meant for certain end uses.

This is also one type of Back-filling stiffening finish. This type of finish is mostly used for Collar cloth. This is a very high stiff finish and it produces more stiffening effect. This is also applied using Back-Starching Mangles. It is also called Temporary Collar Stiff Finish.

For this type of finish mostly Farina or Potato starch is used. The Pad Bath contains 10kg of farina in 100 litres of water and is applied by Two Bowl Mangle followed by drying.

Pre-coatings are generally given to get the effect. After drying, it is stentered and calendered.

RECIPE

NON-DURABLE FINISH

Starch(farina)	-	10 - 120 gpl
Wetting agent	-	0.5 gpl
Borax	-	1 gpl
Blueing agent	-	as required

Cheap finish and non-durable.

Pad - Dry - Stenter - Calender.

SEMI DURABLE FINISH

Starch (farina)	-	100 - 120 gpl
Wetting agent	-	0.5 gpl
Borax	-	1 gpl
Tinopal	-	1 - 2 gpl
Blueing agent	-	as required
Resin	-	50 - 60 gpl
$MgCl_2.6H_2O$	-	5 - 6 gpl

Pad - Dry - Stenter - Calender.

PERMANENT FINISH

Poly vinyl Acetate	-	100 - 120 gpl
Borax	-	1 gpl
Tinopal	-	1 - 2 gpl
Blueing agent	-	as required

If the solution is not clear, hot or warm water is added.

PROCESS SEQUENCE

Pad using back filling starch mangle - Dry - Cure at 130°C for 5min - Stenter - Calender.

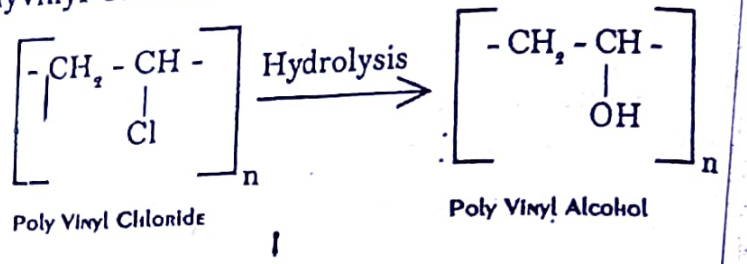
POLY VINYL ALCOHOL

Poly vinyl alcohol is a synthetic stiffener. It is available in yellow or white powder. It is also available in 15% concentration in paste form. It is available in both soluble and insoluble form.

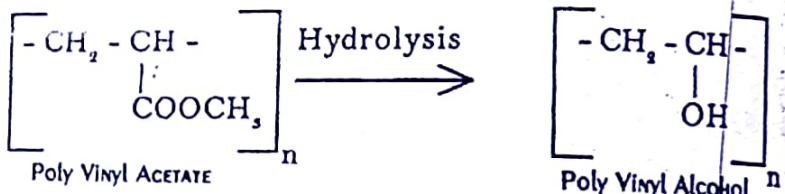
Soluble	-	For textile application.
Insoluble	-	For manufacturing of PVA fibres.

MANUFACTURE

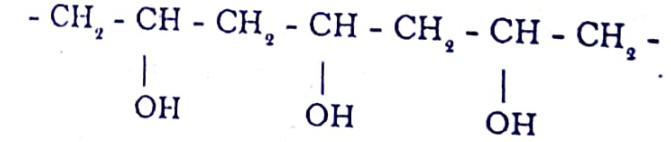
It is manufactured from Vinyl Polymers such as Polyvinyl Chloride.



On hydrolysis of Poly Vinyl Acetate, PVA is obtained.



STRUCTURE OF PVA



USES OF PVA

It is widely used in the textile industries.

Mixture of aqueous solutions of PVA and Ammonium dichromate are photosensitive in nature and are used in Screen exposing. It is also used as a stiffening agent and for sizing of synthetic yarns.

It has film forming, solvent resistance and adhesive binding properties.

It is used as a finishing additive. In finishing it improves the Pilling resistance.

The finishing is permanent and fast to washing if PVA is fixed by chemical reaction with some resins.

Slippage of fabric can be minimised in case of synthetics. It gives body to the fabric.

PROBLEMS WITH PVA

The finish is not permanent because of the solubility of PVA if it is not given along with a resin. But permanent finish can be obtained when used along with Resin.

The main draw back when used on dyed / printed materials is some sort of dulling of shade takes place.

RECIPES USING PVA

DURABLE FINISH

Resin (DMDHEU)	-	70 gpl
$MgCl_2.6H_2O$	-	7 gpl
PVA	-	10 gpl
Poly Ethylene Emulsion	-	15 gpl
Poly Vinyl Acetate Emulsion	-	15 gpl
Silicone	-	20 gpl
Acetic acid	-	1 gpl

PROCESS SEQUENCE

Pad - Dry - Cure at 140° - 150°C for 4-5 mins.

NON DURABLE FINISH

PVA	-	20 - 25 gpl
Borax	-	1 gpl
Tinopal	-	1 - 2 gpl
Blueing agent	-	as required

PROCESS SEQUENCE

Pad - Dry - Stenter - Calender.

POLYVINYL ACETATE

PROPERTIES

It is also a synthetic stiffener.

It is available in paste form.

It is not soluble in water. But with hot water, it gives an emulsion which looks like it's soluble.

They are sold as off white paste in the form of an emulsion.

It is stable under acidic conditions.

It should be applied in acidic pH of 5-6 with the help of acetic acid.

It is supplied in the Vinyl Acetate Monomer form and after application, it has to be polymerised to form a film.

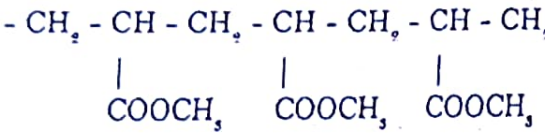
The polymerisation takes place only in the acidic pH.

MANUFACTURE

It is produced by the Acetylation of Vinyl Chloride.

Polyvinyl chloride — Polyvinyl acetate

STRUCTURE OF POLYVINYL ACETATE



USES

It is used as a stiffening agent.

It gives Body, Weight and Drape to the fabric.

It gives a Durable Stiff finish with good Dimensional stability.

It reduces the Pilling of the fabric.

It can also be used to produce Anti-Crease Finish but a higher amount of resin has to be used.

It improves the Crease Recovery Angle of fabric.

It is used for Lamination purposes.

PROBLEM

Polyvinyl acetate is not compatible with Cationic nature auxillaries.

RECIPE

NORMAL STIFF FINISH

PVAcetate	-	20 - 25 gpl
Softener	-	15 gpl
Borax	-	1 gpl
Tinopal	-	1 - 2 gpl
Blueing agent	-	as required

BUCKRAM FINISH

PVAcetate	-	200 - 500 gpl
Borax	-	1 gpl
Tinopal	-	1 - 2 gpl
Blueing agent	-	as required

FOR RESIN FINISH

Resin (DMDHEU)	-	70 gpl
$MgCl_2.6H_2O$	-	7 gpl
Polyvinyl alcohol	-	10 gpl
P.E. emulsion	-	15 gpl
PVAcetate emulsion	-	15 gpl
Silicone	-	20 gpl
Acetic acid	-	1 gpl

PROCESS SEQUENCE

Pad - Dry - Cure.

CELLULOSE ACETATE

PROPERTIES

Cellulose acetate is the best known Ester of Cellulose and an Organic acid.

It is usually sold in the form of White Flakes.

For textile applications, Cellulose Acetate is mixed with various Plasticizers and dissolved in suitable solvent.

It is sometimes customary to add resins of Phenol-Formaldehyde types for special purposes.

Cellulose acetate melts at 200°C and becomes quite plastic in nature.

This is used for several applications in textile industries.

USES

STIFFENING FINISH

In this finish, the fabric should consist of Acetate rayon and Cotton yarn or other Non-thermoplastic threads.

The acetate yarn is distributed in both the directions of warp and weft in between the cotton threads.

When the fabric is subjected to heat, cellulose acetate being thermoplastic, melts and on cooling this produces stiffening effect on the unmelted cotton material.

LAMINATED CLOTH

In this,several layers of cloth are adhered one over the other till cellulose acetate dissolves in suitable solvents like Triacetine, Acetone etc.,

Thick solution of cellulose acetate is used between two layers of cloth, dried and then subjected to heat, with cellulose acetate being thermoplastic, melts and binds the layers of cloth.

TRUBENISING

This is also a process of binding several layers of cloth by placing layers of acetate rayon or thin acetate fabrics specially made for this work.

On subjecting to heat and pressure ,cellulose acetate melts and on cooling, binds the layers of cloth.

The Plasticizers which are combined with the cellulose acetate,is also responsible for the binding purpose. This method is used for making collars and cuffs

LACE EFFECTS

Various types of Lace effects can be produced using cellulose acetate and its solvents.

A mixture of cotton and acetate fibre is printed with resist agents like glue which will prevent the solvent action on acetate.Then the cloth is passed through solvents for the acetate like Acetone, Butyl acetate etc.,

The portion printed with the glue will remain intact, but the unprinted portions will dissolve thus leaving a Lace like appearance. The solvent will dissolve the acetate portion of the mixed fabric and not the other.

It is also used to produce Immunised cotton.However, when immunised cotton is produced the fibre loses its dyeing properties .It is also used to produce Stiff finishing and Collar finishing.

RECIPE

Cellulose acetate	-	10 parts
Acetone	-	49 parts
Methyl cellulose	-	11 parts
Toluol	-	10 parts
Methyl phthanyl Ethyl glycolate	-	20 parts

FUNCTION

Cellulose acetate	- finishing agent
Acetone	- solvent for cellulose acetate
Toluol	- for binding purpose
Methyl phthanyl Ethyl glycolate	- plasticizer

METHOD OF APPLICATION

Pad - Dry - Trubenise.

CONDITIONS FOR TRUBENISING

Temperature	-	100° - 180°C
Pressure	-	300 - 600 lb/inch²

Oil heated cylinders are used for trubenising process.

CARBOXY METHYL CELLULOSE (CMC)

It is available in clear viscous solution.

It penetrates into fibres evenly and rapidly.

It gives a durable stiff finish.

It increases the strength and abrasion resistance the fabric.

$$\underset{\text{Cellulose}}{\text{Cell - OH}} + \underset{\text{Sodium Hydroxide}}{\text{NaOH}} \rightarrow \underset{\text{Soda cellulose}}{\text{Cell - O - Na}}$$

$$\text{Cell - O - Na} + \underset{\text{Sodium mono chloro acetate}}{\text{Cl - CH}_2\text{ - COONa}} \rightarrow$$

$$\underset{\text{CMC}}{\text{Cell - O - CH}_2\text{ - COONa}}$$

PARCHMENTISATION

Parchmentisation is a process carried out on cotton fabric by the action a fairly strong solution of Sulphuric acid(116° - 125°Tw),in the presence of certain additives to produce parchment like effect.

If the fibre moves freely during the treatment Organdie effect is produced.

By this finish we can obtain a transparent and stiff effect.

The fairly strong H_2SO_4 may spoil the cellulosic material also. The addition of glycerine to the sulphuric acid bath controls the degradation action of sulphuric acid on cotton.

Addition of Ammoniun salts reduces the stiffness.

For transparent efffect without making the fabric unpleasently stiff, the following recipe may be chosen;

H_2SO_4	-	69%
Ammonium sulphate	-	5%
Water	-	26%
Temperature	-	10° - 18°C
Time	-	5 -10 secs

We will get the above expected effect.

Addition of Formaldehyde too, modifies the action of strong H_2SO_4 solution.Thus a treatment with a solution containing 77% H_2SO_4, 6.5% HCHO for 20 secs produce a good effect.If we give the same treatment in the absence of HCHO, it damages the cloth.

SOFTENING AGENTS

Softeners are one of the important finishing agents which gives softness to the fabric.

It gives not only softness but also Handle, Drape, Cutting and Sewing qualities to the materials.

BASIC REQUIREMENTS OF A SOFTENER

It should give the required softness.

It should not affect fabric physical properties.

It should be compatible with other finishing chemicals.

It should not give any yellowing problems.

It should not affect the fastness property of the dyed/ printed material.

It should not affect the depth and tone of the shade.

It should not give irritation to the human skin.

They fall into four groups;

Cationic softeners.

Anionic softeners.

Non-ionic softeners.

Reactive softeners.

CATIONIC SOFTENERS

PROPERTIES

They are the widely used softeners for the textile industry.

They are applied only on cellulosic materials.

They have Affinity, Substantivity towards cellulosic fibres.

They are sold in the off white or creamish colour with the pH of 5.6.They are not stable in alkaline pH.

They are fairly soluble in water by virtue of their ionic nature.

Hot water and stirring can be used to make the softener soluble.

Care should be taken to see that alkaline and hard water is not used for finishing since the softeners are not stable in alkaline pH and the cationic salts present in the hard water reacts with the softener forming a precipitate.

It is customary to add acetic acid to water before adding the softener to it to avoid any precipitation.

Being cationic they should not be mixed with anionic products like soaps, TRO,Alkyl benzene sulphonates, fatty alcohol sulphates etc.,

They are chemically Sapamines, Amido amines,Imidazolines and Quaternary ammonium compounds.

PREPARATION OF SOFTENER SOLUTION

X kg softener + X Kg water (70 ° C) - stirred well.

If necessary a little bit of acetic acid may be added.

Then we can add required amount of water to bring the required concentration.

Concentration of softener : 0.2 - 2%

: 20 - 25 gpl

METHOD OF APPLICATION

Pad - Dry - Calender

(or)

Exhaust method (Jigger / Winch)

ADVANTAGES

They are the only softeners which exhibit affi substantivity.

It gives the best soft feel and increases the ha

It also increases the lubricity of yarns when a on it.

It minimises the loss in physical properties on finished fabric.

They give permanent soft finish.

DISADVANTAGES

They are not compatible with other additives.

They get precipitated when used along with anio compounds since it is cationic in nature.

They are stable only at a pH of 5.6 and their usage only limited to soft water.

They give rise to yellowing problem.

They can not be used along with the resins.

USES

They are used to impart a lofty, full soft feel.

They are also used as a softener for yarn.

They are used to modify the handle of resin treated fabric.

They can also be used as an anti-static agent for loose fibres.

ANIONIC SOFTENER

PROPERTIES

They are also widely used softening agent.

They can be applied on cellulose and cellulosic blends apart from synthetic.

They are mainly used to give lubricity to the fabric.

They are pratically having no affinity and substantivity towards cellulosic fibres and hence the softening effect produced by them is not permanent and not fast to repeated washing.

They are sold in off white or creamish paste or Disperse form.

Most textile fibres develop a negative charge in water and it repels the same negative charged ions of anionic softeners. Hence they are only slightly absorbed.

They are soluble in water. They are of four major types

1. Oil, fat and wax emulsions.
2. Soaps.
3. Sulphated and Sulphonated oils.
4. Sulphated fatty alcohol.

It is stable to hard water, dilute acid and dilute alkalis.

Lissapols, Gardinols and Ocenols are some of the popular preparations.

PREPARATION OF SOFTENER SOLUTION

X Kg softener + 20 times hot water - then add required amount of water.

Concentration of softener : 30 - 40 gpl.

METHOD OF APPLICATION

Pad - Dry - Calender

(or)

Exhaust method (Jigger / Winch)

ADVANTAGES

They are compatible with Direct dyes, optical brightening agents, starch, glue, CMC, PVA, blue, gelatin, resins, gums etc.,

They are stable to hard water, dilute acids and dilute alkalis.

DISADVANTAGES

They produce temporary soft finish.

They give yellowing problem.

They give poor softness.

Lot of wastages because of less substantivity.

USES

They are used as a lubricants to cotton fabric prior to raising operation to get dense and soft pile with a lofty handle.

They are used to modify the softness of resin treated fabric.

During Carding and Drawing in spinning, they can be used as a lubricant for the fibres.

NON - IONIC SOFTENERS

PROPERTIES

They are also widely used.

They are applied on Synthetic fibres and their blends rather than cellulosic material.

They have no affinity and substantivity towards cellulosic fibres.

They are sold in the form of Liquids,Pastes and Dispersions.

They are available in Creamy colored paste.

They are fairly soluble in water.

Hot water should not be used for dissolving. Only cold water should be used.

Most of the softeners are emulsions, they do not give clear solutions and it is advisable to add Acetic acid to the cold water before adding the softener.

Chemically they are fatty acid - Ethylene Oxide condensates.

They are made by reacting Poly ethylene glycol with fatty acid.

They will be compatible with other additives.

$$R\text{-}COOH + n\underset{\diagdown\,O\,\diagup}{CH_2\text{-}CH_2} \rightarrow R\text{-}COO(CH_2\text{-}CH_2\text{-}O)_n$$

Fatty acid — Ethylene oxide — Non-ionic softener

They have excellent storage stability.

PREPARATION OF SOFTENER SOLUTION

X gm softener + 10 times its original weight of water

↓

Thorough stirring

A little amount of Acetic acid is also to be added.

Concentration of Softener = 25 - 30 gpl.

METHOD OF APPLICATION

Pad - Dry - Calender

(or)

Exhaust method (Jigger / Winch)

If stripping is required ,then treat the sample with 10 gpl - soda ash at 60° - 80° C for 30 - 60 mins.

ADVANTAGES

They produce best soft feel.

They are compatible with cationic, well as starch, dextrin, glue, resin etc.,

There is no yellowing prolem on co

They can be applied to all types of

DISADVANTAGES

They produce temporary soft feel

They are slightly costlier.

They are not easily soluble.

REACTIVE SOFTENERS

PROPERTIES

They are the most widely used s

They can be applied on all types

Anionic and non-ionic softener affinity and substantivity for cellul the softening effect produced from t and is not fast to repeated washing

Cationic softeners have some aff and produce permanent softness. Ho is their compatibility with other problem.

Reactive softeners react with cellulose and form a Covalent Bon

ADVANTAGES

They produce best soft feel.

They are compatible with cationic, anionic agents as well as starch, dextrin, glue, resin etc.,

There is no yellowing prolem on cotton or synthetics.

They can be applied to all types of fabrics.

DISADVANTAGES

They produce temporary soft feel.

They are slightly costlier.

They are not easily soluble.

REACTIVE SOFTENERS

PROPERTIES

They are the most widely used softeners.

They can be applied on all types of fabrics.

Anionic and non-ionic softeners have practically no affinity and substantivity for cellulosic fibers and hence the softening effect produced from them is not permanent and is not fast to repeated washing treatments.

Cationic softeners have some affinity towards cellulose and produce permanent softness. However their drawback is their compatibility with other agents and yellowing problem.

Reactive softeners react with the '-OH' group of the cellulose and form a Covalent Bond with the fibre.

Therefore, it produces a softening effect which is extremely fast to washing and permanent.

They are sold in the form of liquids.

REACTION

$$\text{Cell-OH} + \text{HO-CH}_2\text{-NH-}\boxed{\text{SOFTENER}}$$

$$\xrightarrow[140 - 150\,^\circ\text{C}]{\text{Acid Catalysts (DAP/MgCl}_2\text{)}} \quad \text{Cell-O-CH}_2\text{-NH-}\boxed{\text{SOFTENER}}$$

They are extremely soluble in water and can be diluted to any extent.

They are made from Pyridinium Chloride and sold under the name Velan FF, Zelan FF etc.,

Due to toxic and unpleasant odour of Pyridinium during the application and during the use, this product is restricted.

The most widely used reactive softeners are made from Octadecyl Methylene Urea and Methylol Stearmide which are nothing but softeners containing N-Methylol reactive group.

They react with cellulose fibres in presence of Acidic catalysts like $MgCl_2$, DAP, DAHP etc., at a curing temperature of 140 - 150 °C.

If the curing is not carried out, they react just like a Non-ionic softener and produce only a temporary soft finish, which is not fast to washing.

Durable softness can be obtained using this softener on Cotton, Viscose, Nylon, P/C, P/V, Rayon etc.,

METHOD OF APPLICATION

Pad - dry at 90°C - Cure at 140°-150°C - Rinse for 4-5 min. - Dry- Calender (if necessary).

Concentration of the softener : 25-30 gpl.

Catalyst : 2-3% on the weight of the softeners.

This treatment is similar to Resin finishing where N-Methylol compounds (DMU, DMEU, DMDHEU, DMPU etc.,) react with the cellulosic fibres under acidic conditions at elevated temperature.

Reactive softeners of this type and resin precondensates can be applied simultaneously so that permanent softening and crease resistance can be imparted to the fabric.

ADVANTAGES

They produce durable softening effect.

They will not give yellowing problem except Pyridine based softner.

They can be applied to all types of fabric.

They decrease the quantity of resin required to impart a high degree of crease recovery.

They minimise the loss in tenstile strength, tear strength and abrasion resistance of the resin finished fabric.

RECIPE USING SOFTENERS

CHEMICAL	C,C/V Voiles	C, P/C, P/V Shirtings	C, P/C, P/V Suitings
Resin (DMU/ DMDHEU)	70 gpl	80 - 100 gpl	150 gpl
$MgCl_2.6H_2O$	7 gpl	8 - 10 gpl	15 gpl
PE Emulsion	20 - 25 gpl	20 gpl	20 gpl
Reactive Softener	20 - 25 gpl	30 gpl	30 gpl

C - COTTON, P/C - POLYESTER COTTON BLENDS
P/V - POLYESTER VISCOSE BLENDS
C/V - COTTON VISCOSE BLENDS

PROCESS

Pad - Dry - Cure - Soap - Rinse - Dry.

Curing has to be done at 140°- 150°C for 3 - 5 minutes and soaping at 60°C.

FOR PERMANENT PRESS FINISH ON P/C, P/V SHIRTINGS

Resin (DMDHEU)	-	125 gpl
$MgCl_2 . 6H_2O$	-	12.5 gpl
PE emulsion	-	20 gpl
Reactive softener	-	25 gpl

The fabric may be padded with an expression of 70%, dried, converted into garments, pressed at 170°C for 4 - 5 minutes on Garment press.

POLY ETHYLENE EMULSION

PE Emulsion (15 - 20 gpl) is used in the resin finishing bath.

It imparts a soft and pliable finish to the fabric.

It reduces the loss in physical properties of the resin treated fabrics.

It lubricates the passage of a sewing needle through the fabric while garmenting.

It can be applied to natural and synthetic fibres.

It gives permanent finish.

USES OF ACRYLIC EMULSION

PROPERTIES

This is one of the stiffening agents.

Many of the finishing assistants used in textile are Highly Inflammable material.

Acrylic emulsion on the contrary, are Not Highly Inflammable.

Hence they are largly used for the application of Flame Retardant finishing.

They have got Stiffening and Binding properties.

Acrylic emulsion may be applied using Padding mangles.

They are transparent and colorless.

They can be used to produce Stiff fabrics. When used in dilute solutions, they can be used to give moderate effects.

They are chemically very stable.

The application of Emulsion polymers are simple and have good adhesive power on textile material.

ADVANTAGES

The ease of preparation.

The simple cleaning of machineries.

DISADVANTAGES

The main disadvantage is that they are costly.

RECIPE FOR DURABLE PRESS FINISH

The addition of Cross Linking agents with this, leads to produce durable press finish.

Resin (DMDHEU)	-	200 gpl
$MgCl_2 . 6H_2O$	-	20 gpl
PE emulsion	-	25 gpl
Acrylic emulsion	-	30 gpl.
Wetting agent	-	3 gpl

PROCESS

Pad - Dry - Cure

Padding	-	80% expression
Drying	-	80° - 90°C
Curing	-	140°-150°C for 4 -5 mins.

WETTING AGENTS

USES OF WETTING AGENTS

In textile processing, all the processes are done using water 'without water we cannot carry out any wet processing.'

Water should be immediately absorbed by the material when it is immersed in water. So, the fabric should have some absorbency to absorb the water.

But unscoured and unbleached material have no absorbency due to Oily and Waxy material present as natural as well as added impurities. So they have less absorbency naturally.

The surface of the fabric should be converted into water loving then only water can easily penetrate inside the material.

When we add wetting agents, it reduces the surface tension and make the surface water loving.

So, wetting agents are largely used for making fabric more absorbent during textile processing.

There are various types of wetting agents avail
Some of them are Anionic in nature and some are
Ionic in nature.

EXAMPLES

Sulphonated Castor Oil (TRO)

Widely used wetting agent.

Anionic in nature.

Compatible with Non-ionic but not with Ca

Sulphonated Fatty Esters

Eg : Methyl or Butyl Oleate.

Aromatic Sulphonates

Eg : Benzene Sulphonate.

APPLICATION

To make the fabric more wettable.

It is used as a Temporary Softening agent.

To make better mixing of different ingredients wh
are used in finishing.

It is used in Water Proofing finish with Rubber Lat
in a concentration of 5% wetting agent on the weight
the rubber.

It is used in Non-Felting finish of wool.

When they are applied as softener, care should be taken to see that there is no change in the color of the fabric after drying.

In dyeing, to make the dyestuff into better dissolution, it is added particularly for Naphthol and Vat.

In mercerising also wetting agents are added to get uniform and even penetration.

CHAPTER 2

SYNTHETIC RESIN FINISHING

RESIN FINISHING AND DIMENSIONAL STABILITY

Cotton is mainly selected for apparel purposes because of their Durability, ability to withstand the rough laundering treatment especially under alkaline conditions, good perspiration absorption characteristics, comfort during wear and ability to take up a wide range of dyestuffs.

But the main headache with the cotton fabric is CREASE formation during washing, laundering and in use.

The formation of crease is an undesirable property to the apparels.

So the material has to be made either Crease Resistant or Crease Recoverable.

The object of this finish is to keep the fabric flat and smooth and free from undesirable creases. So this finish is referred as Anti-crease or Anti-crush or Crease resistant or Crease recovery finish.

It is also called as Resin finishing, since resins are used for this finishing.

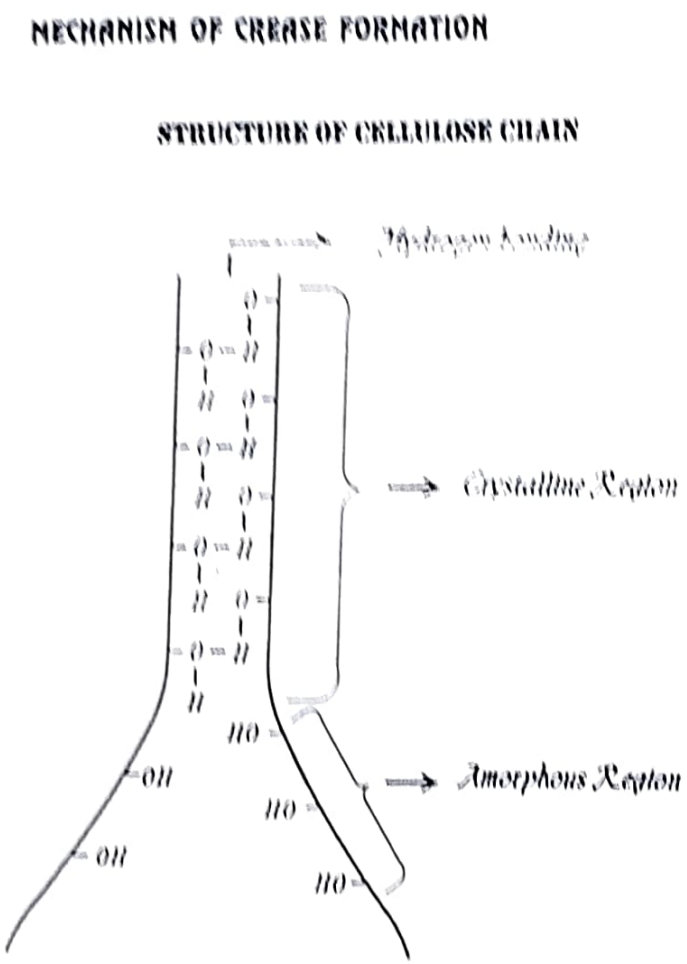
This finish is purely Chemical and Permanent finish.

Usually cotton, linen, viscose and cuprammonium rayon are finished with resin.

'The finishing process by which the cotton fabrics are made not to form crease is known as Crease Resistant Finish'.

MECHANISM OF CREASE FORMATION

STRUCTURE OF CELLULOSE CHAIN



Cotton cellulose chain contains -OH groups i
Amorphous and Crystalline region. There are Hyd
Bonds between the -OH groups of the molecular ch

When a load is applied on to the cotton fabric
cellulosic chain in the fibre bends and this bending re
permanent since the cellulosic chains are In-elastic
bending of the cellulose chains of the fibre under
application of load causes the formation of crease.

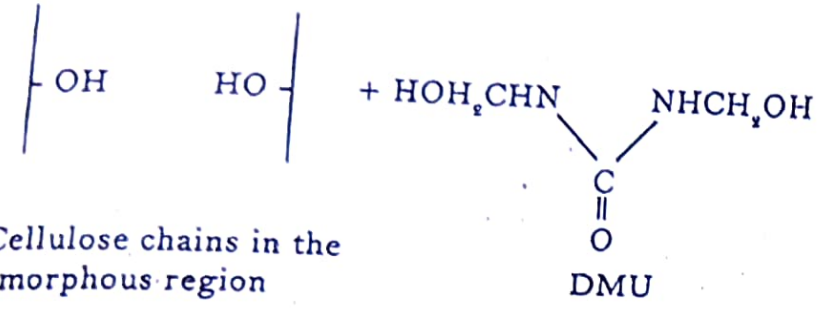
In another theory, the Hydrogen bonds for
between the -OH group of adjacent cellulose chain i
crystalline region are broken (being a weak bond of lo
when a cotton fabric is folded and pressed.

The breakage of the Hydrogen bonds in the crystal
region and the formation of New hydrogen bonds in
amorphous region causes the formation of creases

METHOD TO PREVENT CREASE FORMATION

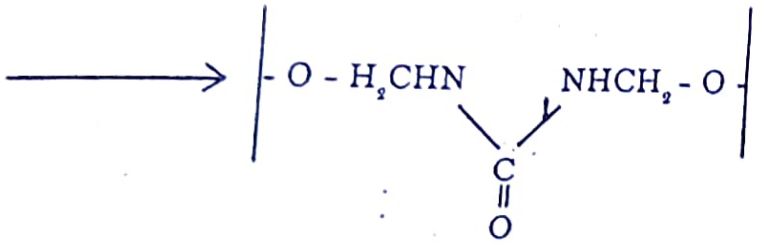
The method of minimising the formation of creas
involes the reaction of the -OH groups of adjacent cellulose
macromolecules with some cross linking agents.

The introduction of cross-links imparts dimensional
stability and elasticity to the fibrous material and make
crease resistant and crease recoverable.



Cellulose chains in the amorphous region

DMU



Cellulose chains cross Linked by DMU

+ $2H_2O$

The most commonly used cross linking agents are nothing but Resins. The resins react with the -OH groups of cellulose forming Cross links which is durable and hence increases the Crease Recovery thereby Dimensional Stability of the fabric.

Resin finishing gives some advantages and some disadvantages to the fibrous material.

ADVANTAGES

It improves the Crease Resistance and Crease Recovery property.

It reduces the shrinkage of the fabric during laundering.

It imparts a smooth and quick drying property.

It improves Resilience, Handle and Draping qualities.

It improves the weight and Dimensional stability.

It increases the strength of rayons in both wet and dry state.

It gives resistance to degradation by light and laundering.

It improves the fastness to Light and Washing of many dyestuffs.

It prevents the Inter molecular Slippage in the fibre core.

It becomes partially water proof and Rot-proof.

DISADVANTAGES

It decreases the Tensile strength and Tear strength.

It decreases the Abrasion resistance.

It gives an Unpleasant odour.

It gives unwanted Harsh and Stiff feel.

It turns the fabric yellow after chlorine bleaching.

Incorporation of proper softener and catalyst in the pad bath can reduce the loss in the above mentioned properties of the fabric.

TYPES OF RESINS

Resins mainly fall into two groups:

Deposition type of resins.

Cross linking type of resins.

DEPOSITION TYPE OF RESIN

As the name indicates, in this finish the resin is deposited on the fabric as Surface Coating.

Here no reaction will take place between the fibre and resin . They include;

Phenol - Formaldehyde Resins.

Alkyd Resins.

Ketone Resins.

Vinyl Resins ie; Acrylates and Methacrylates.

Dimethylol urea.

Among these resins, Vinyl resins are mostly used.

The above mentioned resins are formed by two methods :

Condensation

Polymerisation

Phenol Formaldehyde and Alkyd resins are Condensations products.

Ketone, Vinyl and Dimethylol urea are Polymerisation products.

These are applied in soluble form on the surface the cotton fabric using Padding mangles with an catalyst.

If Dimethylol Urea is padded and dried on cotton it is called Deposition Type of resin but after dry curing is carried out, then it is called Cross Linking of resin.

These types of resins give;

Some extent of crease resistance which is lo than cross linking type.

Stiffness to the fabric.

CROSS-LINKING TYPE OF RESINS

This type of resins chemically react with the fi substance and cross link the fibre molecules.

This type of resin finishing is durable and is mu better than deposition type of resin finishing.

They are also known as N - Methylol compounds the Methylol groups (- CH_2 OH) are attached to nitrogen .

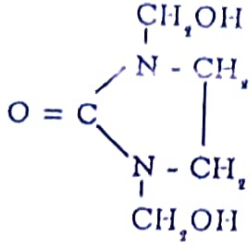
Though these compounds are commonly referred resins,only calling them as resin precondensates is correct The precondensates further polymerise to form resin The resin precondensates are used for this kind of textile finishing and not resins.

The following are some of the Cross Linking type Resins which are mostly used for crease resistant finishi

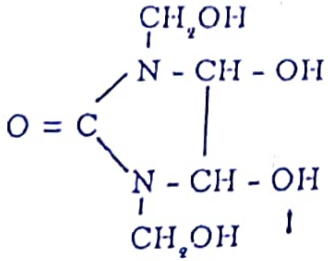
STRUCTURES

DMU (Dimethylol Urea / Urea Formaldehyde)

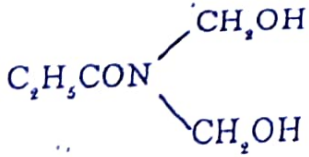
DMEU (Dimethylol Ethylene Urea)



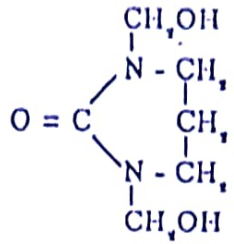
DMDHEU (Dimethylol dihydroxy ethylene urea.)



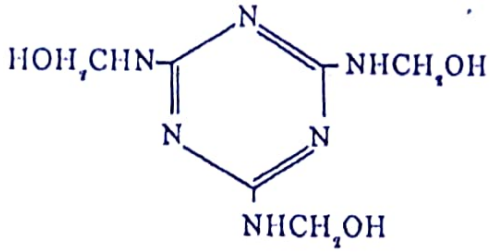
Dimethylol ethyl carbamate



DMPU (Dimethylol Propylene Urea.)



TMM (Trimethylol melamine /Melamine formaldehyde)



PROBLEMS WITH RESIN PRECONDENSATES CONTAINING -NH GROUPS (DMU, TMM)

1) NH groups are susceptible to hypochlorite solution. When resin treated fabrics are taken for laundering with chlorine based agents, chlorine is retained by the crosslink at -NH groups and becomes -NCl and cleaves the cross links and results in loss in crease resistance. It is known as 'chlorine retention'.

2) Chlorine in association with -NH groups forms chloramines which will result in yellowing of fabrics.

3) Excessive crosslinks causes embrittlement and very harsh feel beside giving loss in tear and tensile strength.

PREPARATION OF RESIN PRE-CONDENSATE

Eg. Urea Formaldehyde (DMU)

The preparation of pre-condensate may be effected in either one or two ways.

By allowing the mixture to react at Room Temperature (RT).

By boiling under a Reflex Condenser.

The amount of urea and formaldehyde are to be taken at a ratio of 1: 1.6 which give the optimum effect.

In the first process, Urea is dissolved in Formaldehyde solution (40%) at RT for 4 - 6 hours with periodical stirring and with addition of Ammonia and the temperature should not exceed 35°C.

In other process, the precondensate may be prepared by treating 50 parts of Formalin (40%) solution adjusted to pH by adding NaOH, with 21 parts of pure Urea. The pH of the mixture is raised to 9 with NaOH solution. Equal amount of water is added and the contents are gradually heated to 80°C. The temperature is maintained at 80°C for 15 mins. and cooled rapidly.

STEPS INVOLVED IN RESIN FINISHING

Normally cross linking agents are applied by

Pad - Dry - Cure method.

The application of Urea Formaldehyde resin consi of the following steps:

1) Impregnation of the fabric in the prepared re solution by padding .

2) Drying.

3) Curing at higher temp. by using dry heat polymerise the resin or and cross link the molecular cha

4) Washing and Soaping to remove the unfixed re

5) Drying, softening and drying on stenter.

1) IMPREGNATION OF FABRIC IN PRE-CONDENSATE SOLUTION

Before impregnation, the material should be scour and bleached for better penetration of liquor. Dyed a printed fabrics can be taken directly.

The concentrated solution of resin precondensate diluted depending on the type of fabric and to this ac catalyst and other additives such as Softener and Pe emulsion are added.

Ammonium Salts such as Diammonium Phosphat (DAP), Diammoniun dihydrogen Phosphate (DADH NH_4Cl_2, $(NH_4)_2SO_4$, $MgCl_2.6H_2O$, $Zn(NO_3)_2.6H_2O$ are u as Acid Catalyst with exact amount.

The fabric is padded by using either two or three bowl padding mangle with an expression of about 80% at RT.After padding, the material is dried in stenter with minimum tension at 70°- 80°C.

Higher temperature of drying leads to Migration of finish causing loss in tensile strength and abrasion resistance of fabric.

2) CURING OF IMPREGNATED MATERIAL

After drying, the material is cured at 120°- 150°C for 2 - 5 mins. in a High Temperature Stenter machine.

Cross Linking and Polymerisation take place during curing process.

3) WASHING AND SOAPING

After curing, the material should be washed in open width or rope form in a dilute solution of soap and soda ash.

The purpose of this washing is to neutralise the residual acidity and also to remove any uncombined reagent which causes undesirable effect.

The fabric may be washed with 1 - 2 gpl of anionic wetting agent (TRO) and 2 - 4 gpl of soda ash at 50°- 60°C for 10 mins.

4) SOFTENING AND DRYING

After washing, the material is rinsed in water containing Softening agent.

Then finally it is Stentered in ordinary stenter to dry and to get even width of fabric.

WASH & WEAR AND DURABLE PRESS FINISH

Wash & Wear and durable press (permanent press) finishes are also given using resin precondensates.

Wash & Wear finish (Wash - Dry - Wear and no need for Ironing) imparts crease recovery only and suitable where pressedin creases are not required. This kind of finish is not suitable where pressed in creases are required or where formation of sharp creases are hindered during ironing. Inserted creases on this fabric disappear quickly during wear.

For sharp retention of pressed in creases and freedom from ironing the fabrics, the garments require durable press finish.

DURABLE PRESS FINISHING

This type of finish is generally used in garments making.

DMDHEU is the resin which is used for this finishing.

These finishes are achieved by similar techniques as crease recovery finishes.

The sequence of process of durable press finish is as follows

The cross linking agents are first applied by padding. After padding, the fabric are made into garments or some desired form.Then the Curing treatment is given to the fabric at a high temperature in the form of garments.

This finishing is called as Durable Press finishing.

High concentration of resin and curing at high temperature for a longer time are required for this kind of finish.

This is a further development of Wash and Wear finish.

Urea Formaldehyde and Melamine formaldehyde resins are not suitable for durable press finish because these precondensates cures rapidly and it is difficult to keep them in an uncured state for a long time .

DMEU or Ethyl Carbomates may also be used for durable press finish.

The resin suitable for this process should remain intact within the fabric till the garment is cured and should not become yellow in color.

The resin should be fast to washing and should not affect the Light fastness of certain dyes.

The main disadvantage of this finish is loss in strength and Reduction in Abrasion resistance, because of the combination of high resin content, and prolonged curing at high temperature. Ionic and Non-ionic softeners are therefore added to the resin finishing bath to minimise the loss in strength and abrasion resistance.

Emulsion of polyethylene,polyvinyl chloride,silicones etc; are also added.

PROCESS SEQUENCE

Pad-Dry-Cut and make garments - Insert ... Pleats by hot pressing - Cure - Wash - Hot ... rinse -Dry.

or

Make garments - treat with resin - Hydro... Press and form creases, Pleats with hot iron - D... - Wash - Hot rinse - Cold rinse - Dry.

RECIPE FOR DURABLE PRESS FINISH

DMDHEU	- 200gpl
$MgCl_2.6H_2O$	- 20gpl
PE emulsion	- 25gpl
Acrylic emulsion	- 30gpl
Non-ionic wetting agent	- 3 gpl

POLYSET PROCESS (WET FIXATION PROCESS)

The blended fabrics are better crease resis... 100% cellulosic fabrics. Still ironing is necess... washing to wear in case of blends. So durable pre... is also given for blends but following a differen... sequence.

PROCESS SEQUENCE

Resin solution and additives (without cata... Batch at 70°C for 2 hours - Wash - Dry - Pad with ... - Dry - Stitch garment - Hot press to shape an... creases and pleats - Cure at 160°C for 10 to 15 min ... - Hot rinse - Cold rinse - Dry.

PRECURE, POSTCURE PROCESS

This process involves two major steps such as Polymerising and then Cross linking. The fabrics are cured twice in this process. Different catalysts are used for these two purposes. This method of resin application gives Wash & Wear and Durable press finish to the garments.

PROCESS SEQUENCE

Pad the fabric with a composition [Resin (TMM/ DMEU/DMDHEU) + Polymerising Catalyst (Zirconium acetate / Zn or Cu or Lead acetate) + Wetting agent] - Dry (80°C for 5 min.) - Cure - (160°C for 5 min.) - Wash - Dry/Without Drying go to the next step - Pad with cross linking catalyst (Eg. $MgCl_2.6H_2O$) - Dry (80°C for 5 min.) - Cure (160°C for 3 min.) or Store and latter make garments - form creases and pleats by pressing with hot iron - Cure - Hot rinse - Cold rinse - Dry.

HEAT SETTING

"The process of bringing the dimensional stability to synthetic fabric is known as Heat Setting".

PURPOSE

Fabrics of synthetic fibres and their blends have a tendency to shrink and to form Permanent crease and Wrinkles in boiling water and in hot air.

Most of the treatments for polyester are carried out only at higher temperature above 100°C. However the polyester shrinks heavily therefore, it should be controlled.

2443515

The process of bringing dimensional stabilility in synthetic fibre fabrics is known as heat setting.

OBJECTS

It gives Dimensional Stability to synthetic goods.

It gives Crease Resistance property.

It improves the Resistance to pilling.

It improves some dyeing properties.

TYPES OF HEAT SETTING

Pre setting	-	Before all wet processing.
Intermediate	-	After bleaching and scouring.
Post setting	-	After all wet processes. However, this type will give Dye Migration problem and Dye Sublimation problem.

CONDITIONS FOR HEAT SETTING

The method involves in subjecting the fabric at High Temperature under control (180° - 200°C) for a definite time (30-40 secs). This temperature does not come under normal processing conditions. The fabric is allowed to shrink during heat setting.

The heat set fabric will not shrink in heat unless and until the temperature and time of heat setting is not crossed.

The process of heat setting is normally carried out on Pin stenters or in curing ovens.

The most preferred heat setting conditions are as follows

Texturised polyester and their blends - 180°C for 60 seconds.

Untexturised polyester and their blends - 220-230°C for 30 seconds.

P/C, P/V, P/W blends - 185-190°C for 30 seconds.

Nylon - 190°C for 20 sec.

For texturised PET, 180°C is preferred because texurising is carried out at 183°C and if we carry out heat setting at above 180°C for PET textured filaments, the textured effect will be lost.

When a synthetic fibre like polyester is heat set for obtaining Dimensional stability on a pin stenter under an over feed or 5% - 6% at 185° - 200°C for 30 secs. proper dimensional stability can be obtained.

STAGE IN WHICH IT HAS TO BE CARRIED OUT

It is better to heat set the fabric before dyeing but the operation has to be uniform, otherwise uneven dyeing takes place due to irregular affinity of the dyestuffs.

If it is carried out after dyeing then Migration and Sublimation problems will take place. Some dyestuffs Sublime at that temperature giving patchy dyeing .

Therefore, Heat setting is done preferably before dyeing.

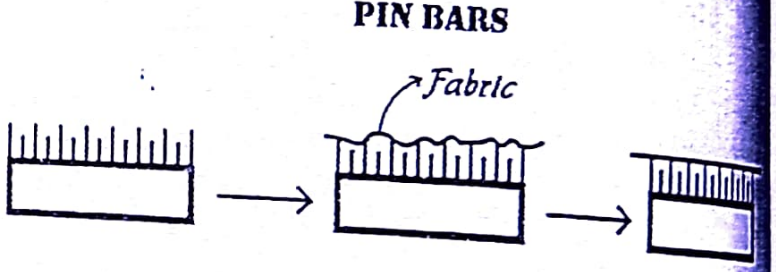
MEDIUM OF HEAT SETTING

Hot air,Saturated steam, High pressure steam Infrared heaters can be used to carry out heat setting.

Pin stenter or curing oven is preferred if the medium is hot air as it controls both warp and weft shrinkage.

If heat setting is done at over 230°C , the fabric gets charred and becomes very harsh.

MECHANISM



Fabric in loop form will shrink..

Over looping is preferred for heat setting.

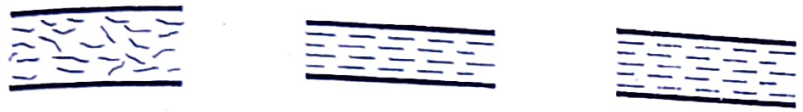
Over feeding 4 - 5% - suitings

3 - 3.5% - shirtings & sarees

Relaxed heat setting gives better results.

Heat setting of the fabric is accompanied by harshening or stiffening of the fabric and it affects the handle and drape.

Heat setting is also carried out using high pressure steam but this method is not recommended because of the degradation of the fibre by hydrolysis.

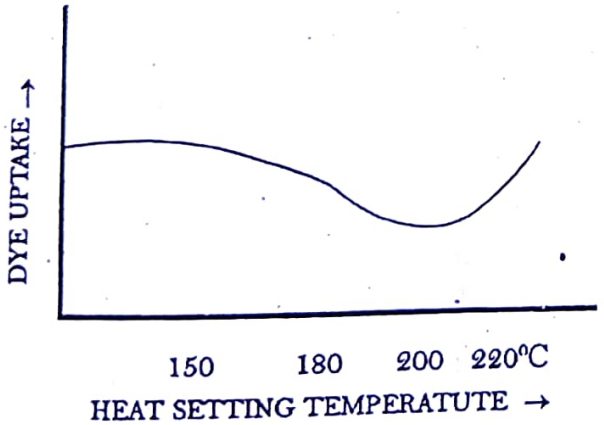


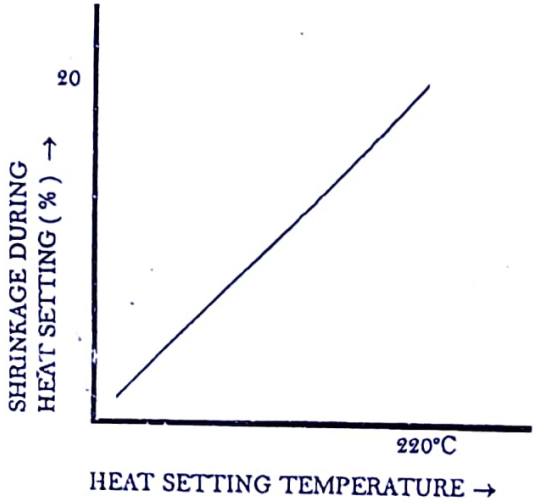
Molecules arranged irregularly after spinning

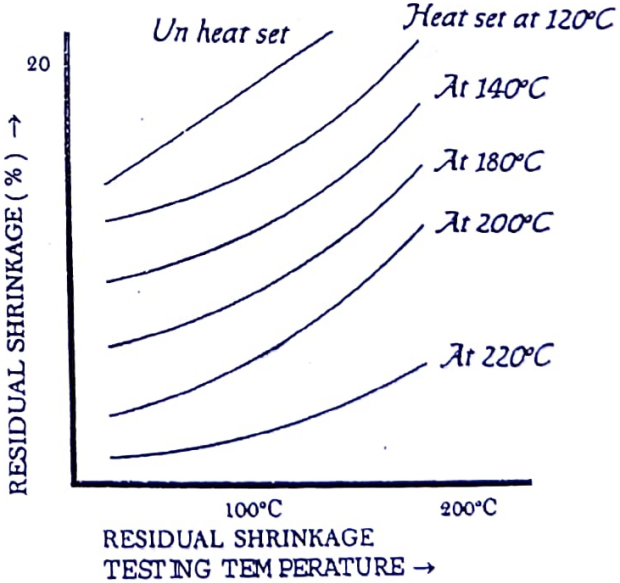
Molecules oriented & parallel after stretching but unstable.

Molecules oriented & parallel after heat setting and stable

EFFECT OF HEAT SETTING TEMPERATURE ON DYEABILITY AND SHRINKAGE







PARAMETERS

Time of heat setting

Temperature of heat setting

Over feeding

Tension of the fabric

Tension during heat setting is also an important factor .It will disturb Diffusion and Fixation process.

ANTI-SHRINK FINISH [sanforization]

SHRINKAGE

Shrinkage is the contraction in the dimension of the fabric due to usage.

Cotton fabric suffers from 2 main disadvantages of creasing and shrinking during subsequent washing.

Creasing is overcome by the Resin finishing whereas the shrinking is prevented by a special finishing known as Sanforising and the machine used for that purpose is known as Zero - Zero Pre Shrinking machine.

HOW COTTON SHRINKS ?

Cotton has the property of swelling in water and this effects Shrinking.

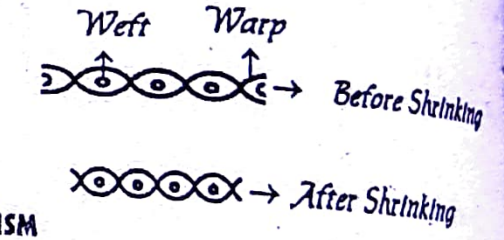
Also the mechanical stress, strain and tension, during spinning and weaving etc., when released causes the fabric to shrink.

The cotton fabric, when put in water, swells. This causes displacement and rearrangement of internal forces. The fibres will become free from tension and fabric will return to the original tensionless state.

These are the reasons for shrinkage.

In case of a fabric, the warp yarns are under more strain due to interlacement than the weft yarns. Hence when a fabric is allowed to shrink, the warp yarn shrinkage will be more than weft yarn.

To overcome this, the fabric is extended in warp direction to some extent in the stenter machine during the finishing process. Then it is subjected to the preshrink process.

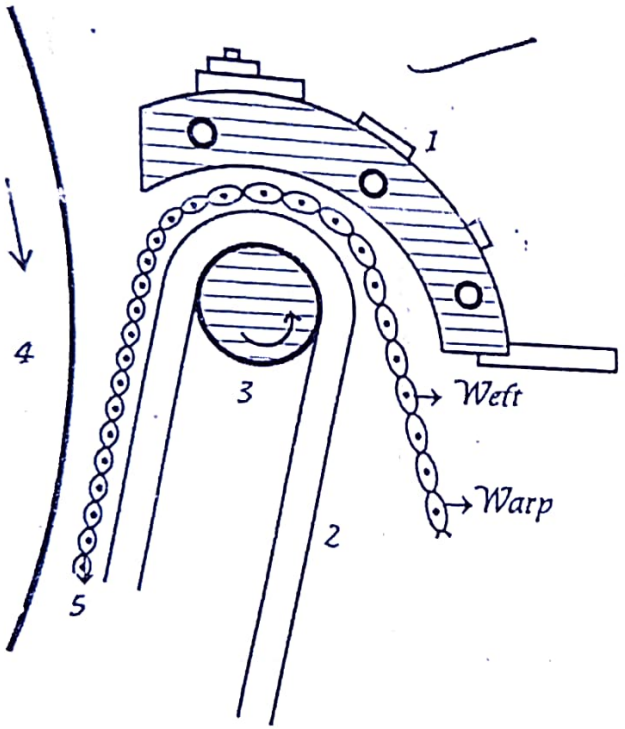


MECHANISM

The mechanism or principle adopted to produce shrinkage is "To place the fabric on the extended rubber surface of a rubber blanket represented by the concave surface.When the tension is released on the blanket it shrinks, The fabric which is in close contact with the rubber blanket at the concave surface has no way other than shrinking along with the blanket."

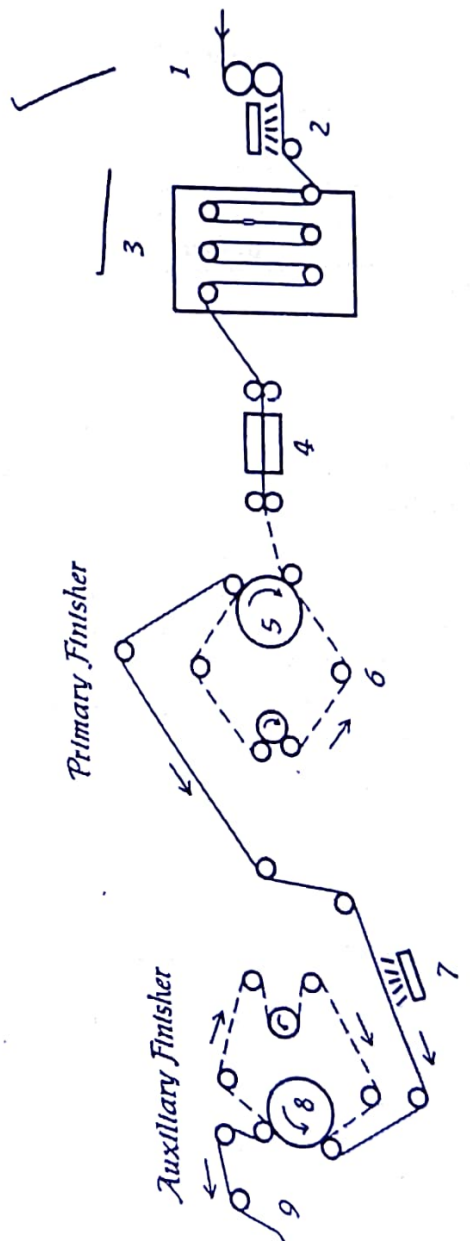
This principle is used to produce pre shrinking finish with the help of a sanforising or Zero -Zero machine.

METHOD OF PRODUCING SHRINKAGE IN SANFORISING



1 - Electrically heated shoe
2 - Felt blanket
3 - Feed roller
4 - Palmer drying cylinder
5 - Place of occuring shrinkage in fabric

SANFORISING MACHINE



1 . Feed Rollers
2 . Sprayer
3 . Steaming Unit
4 . Clip Expander
5 . Cylinder
6 . Felt Blanket
7 . Sprayer
8 . Cylinder
9 . Platter

The amount or % of shrinkage depends on:

1. The tension/stretch on the rubber blanket.
2. Thickness of the rubber blanket.
3. Diameter of the roller.

Generally three sizes are available.

Thickness of Blanket to be used	If Shrinkage of fabric before Sanforising is
0.275"	6 - 8 cm/m
0.4"	8 - 11 cm/m
0.45"	11 - 15 cm/m

The amount of shrinkage also depends on Damping.

The optimum moisture content of cotton and viscose fabric prior to compressive shrinkage treatment in the machine must be 20-25%. At lower moisture content different deformation of the fabric may result. The deformation of the rubber blanket is 6-22% and the fabric shrinkage is 3-7%. If the pressure exerted by the metal shoe is 2-7 atm. the shrinkage obtained is 3-6%. With 3 atm. pressure, the rubber blanket is deformed to 15% while the fabric shrinks 6%.

MACHINE DESCRIPTION

This is a mechanical method of shrinkage control.

The cloth is fed into the machine through the feed rollers of a mangle.

It is used to hold back the cloth and only allow the felt blanket to contract to the required amount. Otherwise overshrinking of the cloth occurs.

From the feed rollers the cloth pass
Sprayers to moisten the cloth thereby maki
soft and plastic so that it can be easily compre
blanket.

The moistening is assisted by a Steaming
Skyer. Then the cloth passed through a Short Cl
to control the width of the cloth.

The cloth is passed to the blanket over the fe
and is placed in firm contact with the streched s
the blanket by Electrically heated shoes.

If cold shoes are used, less shrinkage would r

The cloth in contact with the streched surface
blanket, is passed to the main steam heated cylinder
palmer machine so that when the streched surface o
blanket is contracted by reversal of curvature, the
also is contracted.

The main cylinder of the machine may be either 60
84" in diameter to the material for which it is intende

After passing a round of the drum of the palm
machine, the finished material may be passed on to
auxiliary finisher.

It has an additional palmer unit.

It can be used

1. When both sides of the material are to be finishe
alike or

2. When additional shrikage is required.

If the additional palmer unit is used, the range
called as Duplex otherwise it is called as Simplex.

There is a blanket centering device to keep the blanket in a straight path on the cylinder and also an indicator for giving the tension on the blanket.

The electrically heated shoes are lifted from the blanket automatically when the machine is stopped to eliminate scorching. Before leaving the sanforiser, the fabric should be thoroughly dried otherwise it will elongate.

Proper use of the sanforiser enables shrinkage on laundering (residual shrinkage) to be reduced to 0.75% or less.

After coming out of the felt calendering unit, the fabric is guided to the plaiter which plaits the fabric in to a Trolley.

MAINTENANCE SCHEDULE FOR SANFORISING MACHINE

Name of the machine : ZERO - ZERO MACHINE.

FREQUENCY	JOBS TO BE ATTENDED
DAILY	Cleaning of guide rollers and foxwell guiders,
	Cleaning of various Indicators,
	Cleaning of Flexible steam pipes,
	Dusting off the electrical panels and boards.
	Cleaning of plaiter parts.

BIWEEKLY	General cleaning of guide roll brush bearings of Foxwell guiders.
	Oiling of plaiter revolving parts
WEEKLY	Greasing of ball bearing of guide rollers.
	Oiling of feed roller bearing, oil sump or side shaft for main drive.
	Oiling of differential gear box oil sump, auxiliary motor drive.
	Oiling of driving shaft gear box
FORTNIGHTLY	Greasing of squeezing roller bearings, felt cylinder bearings.
MONTHLY	Checking of Clip openers.
	Checking and cleaning of Damping unit.
	Checking of the surface of rubber blanket and grinding.
HALF YEARLY	Checking of the elasticity and recoverability of the blankets.

CHAPTER 3

SPECIAL FINISHES

WATER PROOFING

"Water proofing is nothing but preventing the passage of both air and water through a fabric"

PURPOSE

For certain uses such as Tarpaulin, Umbrella cloth, Rain coat fabric etc., it is required to give this type of finish as these type of fabrics are generally used against the air and water in the normal life. So they should have some property to prevent both air and water passing through them.

This finish makes the wearer feel uneasy and uncomfortable as the air circulation is not there.

PRINCIPLE

'A film on the surface of the fabric should be formed for the prevention of air and water'.

When a uniform coating of suitable substances such as rubber is produced on the surface of a fabric, the interstices between the warp and weft yarns are blocked by the continuous film or substance and both water and air will not pass through the treated fabrics.

It is a chemical and property giving finish.

REQUIREMENTS

The fabric should not become unnecessarily stiff
the fabic should have soil release or soil repellent prope

The finish should not alter the fastness properties
dyed material, feel, strength etc., of the fabric.

METHOD

By 2 methods, it can be carried out.

1. Methods by which hydrophobic substances are deposited on the cloth.

2. Methods by which the fabric itself becomes hydrophobic.

CHEMICALS USED

1. Vulcanised natural rubber.
2. Oxidised oils of varnishes.
3. Polyvinyl chloro acetate.
4. Polyvinylidine Chloride.
5. Cellulose acetate.
6. Cuprammonium hydroxide solution.

PROCESS

A.) The simplest method of water proofing is the coating of fabric with rubber as a thin film.

DISADVANTAGE

Unwanted stiffness and harshness.

Fabric becomes hard and brittle

B.) The application of Natural oil will also produce this finish.

ADVANTAGE

No cracks or brittleness.

DISADVANTAGE

It is not permanent.

C.) Coating of Water Impermeable substances like Pitch, Asphalt and Molten waxes produce water proofing.

ADVANTAGE

It will give excellent proofing.

DISADVANTAGE

Many desirable properties of the fabric will be destroyed.

D.)Using Synthetic Resins we can produce this finish.

Eg: Polyvinyl chloro acetate
Cellulose acetate
Polyvinylidine chloride

E.) Water proofing with Wax Emulsion.

It can be applied on cotton, linen, wool, silk fabrics.

Aluminium Acetate is used along with the wax emulsion.

There are two steps inolved in producing this finish.

First Step

Wax emulsion - 1 - 3 kg.
Water - 50 litres

Pad the material with the wax emulsion solution.

Second step

In wet condition,

Aluminium acetate - 1 to 3 kg (12°Tw)
Water - 50 litres

Impregnate the fabric and squeeze thoroughly.

Then dry the fabric in a stenter or on a drying range at 110°- 120°C.

PROCESS SEQUENCE

Pad - dry - Calender.

WATER REPELLENT FINISH

'If a fabric allows air but prevents water to pass through itself, it is known as Water Repellent finish'.

REQUIREMENTS

The fabric should not become unnecessarily stiff and harsh.

It is a Chemical and Property giving finish.

The finish should not affect the fastness properties of dyed goods and feel, strength etc. of the fabric.

METHODS

A.) USING METALLIC SALTS

PROCESS

Pad the fabric with metal salts like Aluminium Acetate or Lead Acetate.

Passing the padded fabric through Soap solution like Sodium Stearate.

If necessary a little quantity of wax may be added.

This method is not permanent.

B.) USING SILICONE EMULSION

They impart not only water repellency but also soft handle and improved draping qualities.

PROCESS

Pad - Dry - Cure.

If necessary, Resin may be added in conjunction with silicone.

Catalyst should be added for permanent durable finish.

Eg; for catalyst, Organo Metallic salts.

They are added just before the application.

The pad bath contains Silicone, Resin, Emulsifier and a Catalyst.

C.) THE VELAN PF PROCESS

It imparts water repellency and a soft attractive

It is fast to washing, boiling soap solution, cleaning etc.,

It is a compound of Quaternary Ammonium Salt Pyridine Base and a compound is formed with cellulo the presence of Sodium acetate.

PROCESS

Pad - Dry - Cure - Soaping - Rinse

Padding : 6% Velan PF + 3% Sodium acet at 35°C

Drying : 60° - 70°C

Curing : 120°C for 2 - 3 mins.

Soaping : Soap - 0.2%

Soda - 0.1%

Temp.- 35°C

Time - 1 to 2 min.

Any soap or other detergent left in the materil reduce its apparent Water repellency.

D.) USING WAX EMULSIONS

It gives a soft handle and gloss to the fabric.

PROCESS

Pad - Dry

Preparation of Pad bath:

Take wax emulsion + 3 to 4 times of water

temperature 40° - 50°C

↓

stir

↓

dilute to desired concentration

It can be used along with stiffening or binding agents.

DURABLE WATER REPELLENT FINISH

Stearoxy - Methyl Pyridium Chloride is popularly used for durable water repellent finish.

Methylol Stearamide, Methylated Methylol Melamine can also be used.

A catalyst should also be added.

They chemically react with the fibres and produce durable repellent finish.

PROCESS

Pad - Dry - Cure

For synthetics the following chemicals are added;

Zirconium type pyridinium compounds

Silicones.

Fluro carbons.

MILDEW PROOFING

'The finish that is given to protect fabrics from mildew is known as Mildew Proofing'.

This is a chemical and property giving finish.

PURPOSE

This finish is very important for cellulosic fibre fabrics like cotton, jute, hemp, linen because the Micro organisms consider and utilise them as their food and destroy them.

From the above said cellulosic fibres, Surgical cloth, bedsheets, underwear etc., are made. Therefore they should be protected from mildew.

Temperature - 25° to 35°C and high relative humidity at a pH of 4 - 7 are the favourable conditions for their growth.

So, for the protection from mildew it is essential that mildew proofing is given.

REQUIREMENTS

They should not affect the fastness property of the dyed fabric.

It should not affect the physical properties of the fabric like the strength, feel etc.,

Durable and non-durable finish can be produced.

The finish should be fast to light, wash and dry cleaning.

CHEMICALS

Many antiseptic substances have been used to prevent the growth of mildew in cotton goods.

Phenols, Cresols, Chlorophenols, Phenyl phenols and salts of Zinc, Copper and Mercury have been used extensively.

Salicylanilide which is marketed under the trade name of Shirlan is one of the most suitable antiseptics for cotton goods.

Salicylanilide is not soluble in water.Ammonia is a solvent for it.

0.2% of salicylanilide gives excellent protection against mildew.

Shirlan Extra, Shirlan D, Shirlan A are the three varities of salicylanilide available today.

Some Organic compounds and Organo Metallic compounds can also be used to get this finish.

PROCESS

Pad - Dry - Cure

Concentration of the chemical is 0.5%.

It can also be used on wool and silk.

ROT PROOFING

'Rot Proofing has been defined as the protection from Biological Decay of textiles exposed to moisture with or without contact in soil or other contaminent'.

It is a Chemical and property giving finish.

PURPOSE

This finish is mainly given to cellulosic fibres hemp, flax as they are attacked by Bacteria.

From the cellulosic fibres, bedsheets, underwear are made and have to be protected bacteria.

When the material is exposed to high moisture content or left damp for prolonged period there is chance for the growth of bacteria on it.

The organisms which attack the textile materials of two types:

The moulds or fungi.

The bacteria.

The attack is increased, if the material contains starches, gums, dextrins, flours etc.,

Even the natural impurities present in grey cotton itself serve as food. Therefore the first step to produce proof material would be to Scour all impurities and wax finishes.

REQUIREMENTS

It should not affect the fastness of the dyed fabric.

It should not affect the physical properties of fabric.

The finish should be fast to light, wash and laundering.

CHEMICALS

The chemicals used for rot proofing should

be non-toxic to human being.

should have no objectional odour.

should not discolor the material.

should not affect the handle of the goods.

Compounds of Antimony, Bismuth, Cadmium, Cobalt and Copper have been used as outdoor fungicides. Tellurides of these metals are applied to the fibre by padding method using a binder and emulsifier with water followed by drying.

Copper Naphthanates are particularly more efficient when compared with other copper compounds which are used for rot proofing.

Willesdon Finish uses Cuprammonium solution for applying on Canvas and Tent cloth to make them Rot proof and Water proof.

Emulsions of Zinc or Copper Naphthanate is known as 'Micronil' also confers rot proofing.

0.35% of metallic copper on the weight of the fibre must be present for effective rot proofing.

Zirconium compounds can also be used.

Penta Chloro phenyl Laurate is an effective rot proofing agent but it degrades cotton on exposure to light.

PROCESS SEQUENCE

Pad - Dry - Cure.

Concentration - 0.1%

WILLESDON FINISH

Cold solution of $CuSO_4$ + NaOH (20°C)

↓

Raise the temperature

↓

Black percipitate

↓

Collect the percipitate and dissolve in ammonia we will get Cuprammonium hydroxide solution.

METHOD OF PREPARATION

Copper sulphate	-	60 lbs
Soda ash	-	40 lbs
water	-	as required

We will get a percipitate.

Dissolve this in 85% formic acid.

PROCESS SEQUENCE

Pad - Dry.

FIRE RETARDANT FINISH

'To protect the fibre from easy firing is known as Fire retardant finish'.

It is a Chemical and property giving finish.

PURPOSE

Cotton and Regenerated rayons catch fire and causes fire hazards and fire accidents at home particularly while in cooking.

Children's cloth are susceptible to this hazard.

The men who are working in Fire service Department should wear only this type of fire retarded fabrics to protect catching of fire when they are working.

In defence for tents, ropes, baggages, parachutes., in industry for uniforms in ammunition factories fabrics given flame retardant finish are used.

It is therefore necessary to make the fabric Flame proof for many reasons.

This finish is also essential for Curtain hangings, Decoratives, Furnishing etc.,

REQUIREMENTS

The fabric should not adversely affect the fastness property of the dyed material, shade and tone, feel, handle and should not cause any irritation to the skin.

The finish should be fast to wash, light and laundering.

PROCESS

Mechanism of Flame proofing is

Reducing the oxygen content of fibre and / or

Increasing the moisture content of fibre.

Flame proofing can be done by

Precipitating insoluble metallic compounds or

By depositing soluble metallic salts.

THEORIES AND MECHANISM OF FLAME RETARDANCY

1.COATING THEORY :

Flame retardance is due to formation of a layer of a fusible substance which melts and forms a coating thus excluding the air necessary for the propagation of flame. Carbonates and ammonium salts liberates gases like CO_2, NH_3 and exclude air.

2.GAS THEORY :

The flame retardant decomposes at burning temperature and evolves non combustible gases which obstruct and dilute the combustible gases. Eg. Mixtures of titanium and antimony oxides.

3.THERMAL THEORY :

Heat supplied from the source is conducted from the fibres very rapidly that the fabric never reaches the temperature of combustion.

4.CHEMICAL THEORY :

The flame retardants react with cellulose on burning and forms chemicals such as phosphoric and sulphuric acid which are dehydrating agents, these bring about catalytic dehydration of cellulose which on combustion produces mainly carbon and water.

FLAME RETARDANT FINISH FOR COTTON

FIRST METHOD

By depositing insoluble metallic compounds, the effect of fire proofing obtained is permanent as it does not wash out.

Out of all, Antimony Oxychloride is the best.

It is precipitated on the fibre by the double decomposition of tartaremetic and Stannic Oxychloride, and then washed in running water.

In the same manner, Metallic salts such as Magnesium Borate, Ammonium Sulphate and Magnesium Silicate also produce fire proofing.

SECOND METHOD

Soluble compounds such as Borax, Sodium Phosphate are used. A mixture as given below is found to be effective for this finish.

Borax	-	50 parts
Boric acid	-	35 parts
Sodium Phosphate	-	15 parts

Only 5% solution of the mixture is used.

Most of the fire proofing agents can be fixed by synthetic resins.

Tetrakis Hydroxy Methyl Phosphonium Chloride (THPC) when used with Urea and Methylol Melamine produce good wet fastness flame proofing properties.

The fabric is padded through the solution containing;

THPC	-	15.8%
Methylol melamine	-	9.5%
Tri ethanol amine	-	3 %
Urea	-	9.9%

dried and cured at 140°C for 5 mins and washed.

This process is known as 'Proban' finishing.

PROCESS SEQUENCE

Pad - Dry - Cure.

APO-SILICONE EMULSIONS

APO (1-aziridinyl phosphine oxide) is a resin forming polymer which imparts flame resistance to the fabric. An emulsion containing APO and methyl hydrogen siloxanes imparts durable water repellency, crease resistance, flame resistance and soft handle to cotton fabric without using a catalyst.

FLAME RETARDANT FINISH FOR WOOL

Pyroset CP which is a stable solution containing 50% Cyanamide is found to be an effective flame retardant for cotton, rayon and wool.

To provide a durable flame retardancy to wool 6.5% Pyroset CP and 2.5% phosphoric acid is sufficient as against 20-30% Pyroset CP and 15-25% phosphoric acid required for cotton.

Pad - Dry - Cure (150°C for 10 min.)

FLAME RETARDANT FINISH FOR POLYESTER

Phosphorus compounds, Halogen compounds, Posphorus - Halogen compounds and Nitrogen - Halogen compounds are generally used for flame proofing of polyester.

It is applied by Pad - Dry - Thermofix method.

Some of the commercial products are Flamex MM (Guardian Laboratories , USA), Firemaster LV (Michigan chemicals Corpn., USA), Tanotard PNZ (Chas Tanner Co.,USA).

FLAME RETARDANT FINISH FOR P/C BLENDS

THPC - Urea - (Polyvinyl Bromide - Polyvinyl Chloride copolymer) combinations are generally used for P/C blends. A typical recipe is as follows.

30% THPC - Urea

4% Disodium hydrogen phosphte

6.4% PVB - PVC

2% NaOH (50% Solution) to adjust pH 5.7

Pad - Dry (85°C) - Cure (160°C for 1-3 min.)

Some commercial products are FR 1030 - 190 (Sandoz) Pyrovate 3762 (Ciba Geigy), Taien TPD-V, TPD 100 (Toyobo Co. Ltd), Fyrol 76 (Stauffer chemical Co. Ltd.), Caliban FRP 44 (White chemical Corpn.).

FLAME RETARDANT FINISH FOR NYLON

Halogen containing compounds and organo phosphorus compounds are generally used for flame retardant finishing of nylon.

Some of the important flame retardant additives are halogenated hydro carbons and their derivatives as such or in conjunction with Sb_2O_3, PbO, SnO_2, Sodium Borate.

Phosphorous containing compounds such as ethylene glyco phosphorous trichloride condensate, aliphatic and aromatic phosphorous compounds, Phosphonates etc.,

A typical recipe is given below

18.5% THPC

8.5% TMM (Trimethylol melamine)

8.8% Urea

2.1% Surfactant

Pad - Dry - Cure

FLAME RETARDANT FINISH FOR ACRYLIC

Since flame retardant modacrylic fibres with vinyl chloride as comonomers are easily produced, development of a finish for acrylic textiles is limited to the following chemicals.

Ammonium sulphide, Ammonium Phosphate, Urea, $TiCl_4$ - Sb_2O_3 reaction product, DMU and ammonium bromide, Hydroxylamine salt with TMM etc.,

However, commercial processes have not yet been developed.

In all synthetic fibres it is also possible to produce flame retardant fibres by incorporating certain additives in the polymers even before spinning.

MOTH PROOFING

'Moth proofing is a finishing which is given to prevent the growth of moth'.

It is a chemical and property giving finish.

PURPOSE

It is mainly carried out on wool fabrics as the Keratin molecules are consumed by moths as foods.

Since woollen fabrics are costlier, they have to be protected from moth.

Moth is a small insect that feeds on substances like keratin and fibroin and so animal fibres are more susceptible to the attack of moth.

Woollen and worsted materials are attacked by moth and quickly eaten away and the housewives have to be very careful in preserving such garments.

REQUIREMENTS

The finish should not affect the strength, drape, handle, softness, fastness property of dyed fabric and it should not cause any irritation to the human skin.

The finish should be fast to wash, light and laundering.

PROCESS

Moth proofing can be done in the following ways;

1) By exposing the material to sunlight or Sulphur-di-oxide.

2) Using Naphthalene balls and Para dichloro benzene.

3) Using some substances containing flourine such as Sodium flouride, Aluminium flouride, Potassium flouride and Sodium antimony flouride.

4) Using soluble solvents such as Dichloro Benzene Sulphomethylamide and Dichloro Diphenyl Trichloro ethane.

5) Evlan - BL and Mittin FF also produce moth proofing .These are the best mothicides.

6) A concept has been brought out wherein it is suggested that it is better to change the structure of keratin of the wool by chemical modification.In this case, the Disulphide Linkages (cystine linkages) can be changed.

PROCESS

Pad - Dry - Cure

Concentration - 20% on the weight of the material.

SOIL RELEASE FINISH

Accumulation of soil and dust particles is known as 'Soiling'.

To get rid of this soiling problem , the fabric cannot be made totally soil repellent or soil resistant but a type of finish is given to the fabric, so that during washing, the accumulated soil on the fabric can easily be removed from the fabric.This type of finish is known as 'Soil Release Finish'.

Also, the released soil particles should not get redeposited on the fabric during or after washing.

PURPOSE

This type of finish is mainly given to synthetic fibres.

Blouse pieces and some ladies wear are also soil release finished because of their easy absorption of soil.

The deposition of soil will reduce the appearance and the real color of the fabric. So, it is essential to carry out soil release finish.

This is a chemical and property giving finish.

REQUIREMENTS

It should not affect the fastness properties of dyed material and some other physical properties such as strength , feel, drape etc., It should be fast to light, wash and laundering.

FACTORS GOVERNING SOILING

As the static charge increases, soiling increases.

As the moisture regain increases, soiling decreases.

As the tempertature increases, soiling increases.

As the Size of the soil particles increases, soiling decreases.

As the Smoothness of surface increases, soiling decreases.

As the Denier of the fabric increases, soiling decreases.

As the Twist in the yarn increases, soiling increases.

METHODS OF BRINGING SOIL RELEASE PROPERTY

Mercerisation of cotton fabric .

Using Film forming compounds like CMC, PVA, Starch.

Converting the fibre and making it hydrophilic.

Using metal oxides like silica, alumina, $BaSO_4$, TiO_2

Using Acrylic polymers with PE, PE glycols, PE emulsion etc.,

Using Silicone emulsions.These are widely used today.

PROCESS FOR PET FIBRE

FIRST METHOD

Take polyester and pad with a solution containing Polyethylene glycol and Sodium hydroxide.

Pad - Dry method.

SECOND METHOD

Take 1 - 3% concentration of Cirrasol PT.

Pad - Dry - Cure.

THIRD METHOD

Pad the polyester yarn with 10% of NaOH at 60°C for 10 minutes.

Pad - Dry.

FOURTH METHOD ··

Pad the polyester with H_3PO_4 (Phosphoric acid)

Pad - Dry.

FOR POLYESTER / WOOLLEN BLENDS

Soil Release Agents (SRA) : Migafor 5765 (CGY)

or Nonax (Bohme)

Recipe:

SRA	-	50 parts
$MgCl_2.6H_2O$	-	5 parts
Fluorescent brightener	-	10 - 40 parts

Pad - Dry - Cure.

Padding is done at an expression of 60%, followed by drying at a temperature of 70° - 90°C and then curing at 160° - 210°C for 20 seconds.

FOR NYLON FIBRES

Methoxy Methyl nylon	- 0.5%
Catalyst	- 5%

Pad - Dry - Cure.

ANTISTATIC FINISH

During spinning, weaving and finshing of yarns and fabric, friction will be created by rubbing. Therefore Hydrophobic fibres tend to develop static charge. As the cellulosic fibres are good conductors, they do not produce static charge whereas the synthetic fibres which are not good conductors, develop static charge.

Due to this, shocks are experienced while working on the stenter, zero-zero machines etc., and the fabrics get entangled and soil attraction takes place which is also a problem.

Therefore the synthetic fabrics are given a finish to prevent the static charge generation. This is known as 'Anti static Finish'.

It is a chemical and property giving finish. Both durable and non-durable finishes can be produced.

Anti static property can be brought out:

By reducing the charge

By increasing the surface conduction power.

By making the fibre hydrophilic.

Most of the antistatic finishes are based on the first mechanism ie., by reducing the charge and increasing the surface conduction.

Silicone emulsions, PE emulsions, PE Glycols, Poly Ammonium Quaternary Salts, Acrylic Polymers can be used for this purpose.

In fact the Silicone emulsion when used, produces antistatic property by reducing the friction between the

fibres with added advantages of soil release property, softness and suppleness etc.,

Today 'Antistat PP' is used on polyester fabrics in 5-10 gpl concentration by Pad - Dry - Cure method.

Normally it is added in the finishing bath itself along with other additives. The moisture regain of the fibre plays an important role in static dissipation. The higher the moisture regain lower will be the static accumulation.

FIBRE	MOISTURE RAGAIN %	RESISTANCE
Viscose	12	7 ohms
Cotton	8	7 ohms
Nylon	4	12 ohms
Acrylic	1	14 ohms
Polyester	0.4	16 ohms

There are two methods of application of antistatic agents.

1) By incorporating non-durable antistatic agents into polymer during manufacture of synthetic fibres.

2) By applying either non-durable or durable antistatic agents, on the filament or yarn or fabrics. These are applied either by Exhaust method or by Pad - Dry-Cure method.

Some of the commercial antistatic agents for synthetic fibres are Cirrasol PT (ICI), Ceramine R,ANS (Sandoz), Antista Oil, Antista D,M (Ahura chemical products), Antistatic Oil, Antista D (Hico products Ltd.,), Antistatin C,D and M(BASF).

ANTI-PILLING FINISH

Pilling is the formation of small knots of fibr the surface of the fabric.

This entanglement of fibres spoil the appearan the fabric.

The main reason for this formation of pills is tha fibre has very high Tenacity.

High tenacity fibres like PET , Nylon form pills.

The problem of pilling is mainly in polyester blen

FACTORS INFLUENCING PILLING

1) Fibre characteristics like staple length, denier a cross section

2) Yarn construction.

3) Fabric construction.

ANTIPILLING TREATMENTS

1) Mechanical treatment.

2) Chemical treatment.

MECHANICAL TREATMENT

Cropping, Shearing and Singeing include in thi category.

In cropping and shearing, the fabric is first sheared and then cropped. The process is repeated two or three times .

It is then singed. This is the most important operation for reducing pilling.

During singeing, the protruding fibres are burnt.

They actually soften and melt forming beads on the surface of the fabric.

During dyeing, it will give a Specky appearance.

Hence, singeing is carried out after dyeing.

Heat setting at 150°C for 5 minutes also reduces pilling and is carried out after singeing and before washing off.

CHEMICAL TREATMENTS

In one operation, the fabric is treated with 2 gpl of Caustic soda solution at 60°C for 30 minutes, washed, dried, and heat set.

In another method, the fabric is treated with 3.5% Ammonia solution at 130°C for a few minutes, followed by washing and drying.

The mechanism involved in the above two methods is to reduce the Strength of the fibre resulting in Lower Pilling.

Another simple method of reducing the pilling tendency is to apply a solution of Adhesive or Resin so as to make the fibres cling more strongly to each other in the yarn and fabric. However, that would create a Harsh handle on the fabric.

For this finish, a 2.6% aqueous emulsion of Polyvinyl Chloride is applied by Pad - Dry - Cure method.

FINISHING OF KNITTED GOODS

Knitted goods are commonly used for under garments, sports wear and to a limited extent as casual wear.

One peculiar qaulity of knitted goods is that it can be easily deformed and will lose its shape when streched.

For these fabrics which are meant to be used as under garments and sports wears, the main requirement is that the material should be absorbent so that sweat can be absorbed easily.

A good scouring and bleaching will easily ensure this property.

Knitted goods have a natural ability to recover from creases.

They normally do not retain any creases.

Any extra strength or lustre can be imparted to the material using mercerised yarns for making the knitted material.

After knitting, it is very difficult to mercerise the knitted material.

In the case of casual wears, some amount of creasing is required to enhance the appearance and serviceability of the fabric.

One of the most common finishing is to apply a softening agent to the fabric.

Care should be taken in such a way that the given finish will not destroy the Porous Nature of the fabric.

SOFTENING OF KNITTED GOODS

To soften the knitted goods, softening is done by using softeners .

As and if it is in the tubular form, normally Exhaust method is applied using Winch.

Care should be taken that the machine which is used for this purpose is tenisionless.

If there is tension, the elastic beauty of the knitted good will be spoiled.

Softeners like Anionic, Non-ionic, Cationic and Reactive softeners may be used.

Reactive softeners produce Permanent softeness.

Other softeners will produce Temporary softeness.

Silicone emulsion is also used as softening agent for knitted goods.

CALENDERING AND DIMENSIONAL CONTROL OF KNITTED GOODS

The objective of calendering is to ;

1) To make the knitted goods more lustrous.

2) To impart smoothness.

3) To impart Full Handle.

4) To impart Dimensional Stability.

Calendering and Dimensional control of knitted goods are done using Santex.

It is a combined Calender and Compacting machine.

The machine consists of the following features

Fabric feeding device.

Steaming box

Compacting and pressing device.

Precision plaiter.

The knitted goods are passed into the first steamer through the feeding device.

In the steaming process, the goods are obtained in a more pliable nature.

Then it is passed through Pressing device to get Dimensional control.

Here, heat and pressure are applied with stretching.

Finally it is plaited on the plaiting table and kept for sometime and finally it is dried.

Felt Calender machine can also be used for this calendering purpose where there is no tension on the fabric.

USE OF SILICONE IN FINISHING

INTRODUCTION

Silicones are one of the most versatile Organo Polymers available today.

It is very much used in finishing. Without silicones the fabric finishing is considered incomplete.

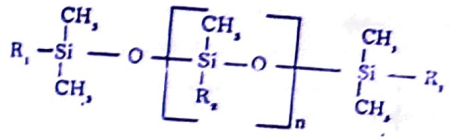
Addition of silicone products to the fibre as well as the fabric enables the manufacturer to improve the quality and the life of the finished fabric and also the value.

CHEMISTRY

Silicones are OrganoPoly Siloxanes having a backbone of Silicone - Oxygen - Silicone atoms.

Since silicone atom is tetravalent, two sites are available on each silicone of the siloxane chain.

These sites are occupied by Organic Substituents and these organic groups give rise to specific functionality of silicones.



R_1 - CH_3 or OH

R_2 - Amine, Epoxy, Carboxy etc.,

DVANTAGES OF USING SILICONES

Silicones give Textiles a unique durable finish which unlike any finish obtained by other organic substances.

They provide Softness, lasting Elasticity, Body, Soft ndle, good Sewing property, Permanency after repeated shing to both natural and manmade fabrics and yarns, well as woven, non woven and knitted fabrics.

It can be applied by any method such as Padding, haustion, Spraying etc.,

They are compatible with other finishing agents like ins, Optical Brighteners, Binders, Catalysts etc.,

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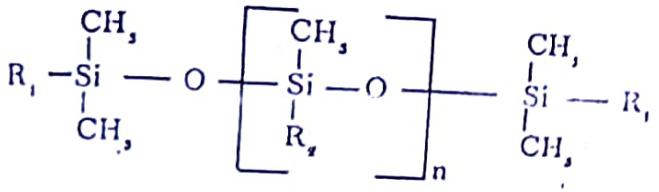

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Silicone finishing agents are normally used in aqueous system in the form of oil in water emulsions and can be either milky or clear transparent micro emulsions.

PROPERTIES

A wide range of silicones are used in the textile industry .Their end use depends on their structure, specifically the functionality.

Some of the organomodified polysiloxanes and their properties are given below;

HYDROPHILIC MODIFIED SILICONES

This kind of silicone acts as a Wetting agent since they decrease the kinetic friction between fibres.

AMINO MODIFIED SILICONES

These silicones are highly Absorptive on fibres.

Fabric material treated with these silicone fluids are imparted with improved Softness and pleasant Feeling of touch.

EPOXY MODIFIED SILICONES

These silicones have chemically active Glycidyl groups.

They provide Water repellency, Durable Softness, Wrinkle Resistance etc.,

CARBOXY MODIFIED SILICONES

These silicones contain Carboxylic groups which improve the feel of Nylon fabric.

These can be used in combination with Amino and Epoxy modified silicones.

USES

They are used as softeners and Finishing agents.

It not only gives Softness but also Hand, Drape, Cutting and Sewing properties.

In case of synthetics, it reduces Static Charge.

It also improves the Antislip properties to control the slippage in tightly woven nylon or PET fabrics.

It is also used as Anti-Foaming agents.

They are also used as Thread and Yarn lubricants.

They are used as Heat-Resistant Release agents.

METHOD OF APPLICATION

Pad - Dry - Cure

Padding liquor consists of

Silicone emulsion	- 10 - 30 gpl
Acetic acid	- 5 gpl
pH	- 5.5

Then the fabric is dried at 100° - 120°C.

Then it is cured at 150°C for 5 minutes. It is important that the Catalyst (1/5 part of silicones) is to be added.

CALENDERING

OBJECTS

To upgrade the fabric handle and to impart a smooth silky touch to the fabric.

To compress the fabric and reduce its thickness.

To improve the the Opacity of the fabric.

To reduce the Air Permeability of the fabric changing its porosity.

To impart different degree of Lustre to the fabric.

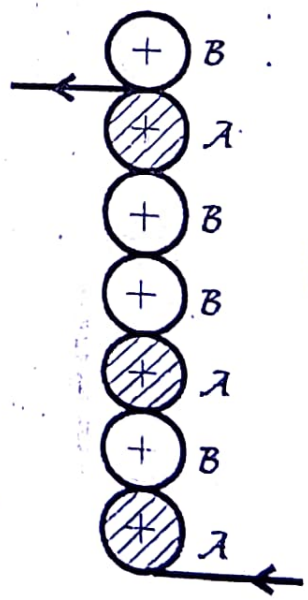
To reduce the Yarn Slippage.

7 BOWL CALENDER

It is one type of calendering machine.

In a typical 7 bowl calender, the arrangement of bowl is shown below;

7 BOWL CALENDER



A - Iron Bowl
B - Compressed Cotton Bowl

The calendering effect produced depends on the ;

1) The moisture content of the fabric.
2) The number of bowls used in the calender.
3) The composition of the bowls.
4) The arrangement of bowls.
5) Temperature.
6) Pressure.
7) Speed of the machine.

Generally the compressed material bowls are made from either Cotton or Wool paper, Linen paper or Flax paper.

The hard bowl is made up of either Chilled Iron or Close Grained Cast Iron or Steel.

Iron bowls are made with highly polished surface and are heated from inside by steam or gas.

The fabric is passed through the machine in between the bowls and as the result Gloss is developed in the calendered fabric.

They run at a speed of 8 mts/min.

In this machine, there are 3 iron bowls and 4 cotton bowls.

In between two metallic bowls, one cotton bowl is arranged.

Care should be taken in such a way that no two iron bowls are arranged together to avoid damage to the fabric.

Sufficient pressure is employed by either weighting the rollers with heavy weights or by spring weighing or by Hydraulic pressure weighing.

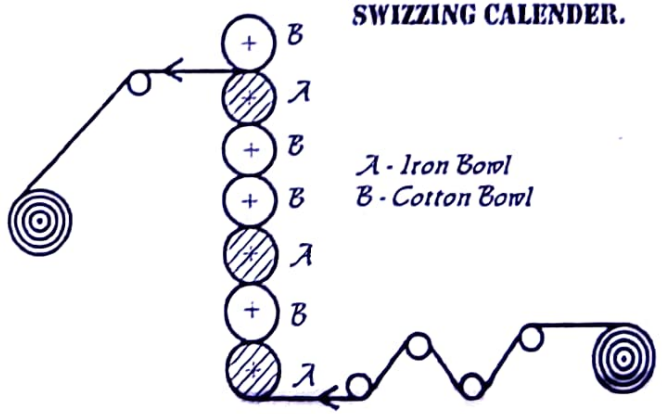
Normal speed is 60 to 80 yards/min.
The normal pressure is 40 to 60 tons.

SWIZZING CALENDER

This is a 7 bowl calender. Swizzing calender effect can be obtained by passing the cloth through the Nips of the calender rollers in which the surface speed of all the rollers is the same.

Depending on the number of calender bowls and composition of the calender bowls, a smooth appearance can be obtained by this swizzing finish.

SWIZZING CALENDER.



This process closes the interstices of the cloth and gives it a smooth appearance.

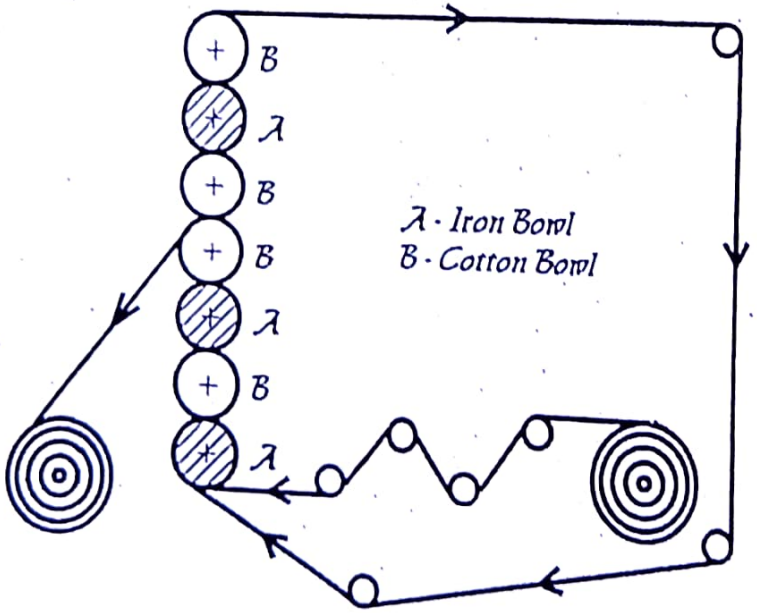
Before calendering, softening and filling agents should be added to produce lustre.

All the bowls in this machine are rotated in the same speed. The normal speed of the machine is 90 yards/min.

CHASING CALENDER

It is also a 7 bowl calender.A chasing calender finish is obtained with all the bowls of the calendering machine running with the same surface speed, and the cotton fabric is passed through the nips of the calender for several times, each layer of the cloth overlapping one another.

CHASING CALENDER



Chasing gives a Thready-Linen appearance and special soft handle to the fabric.

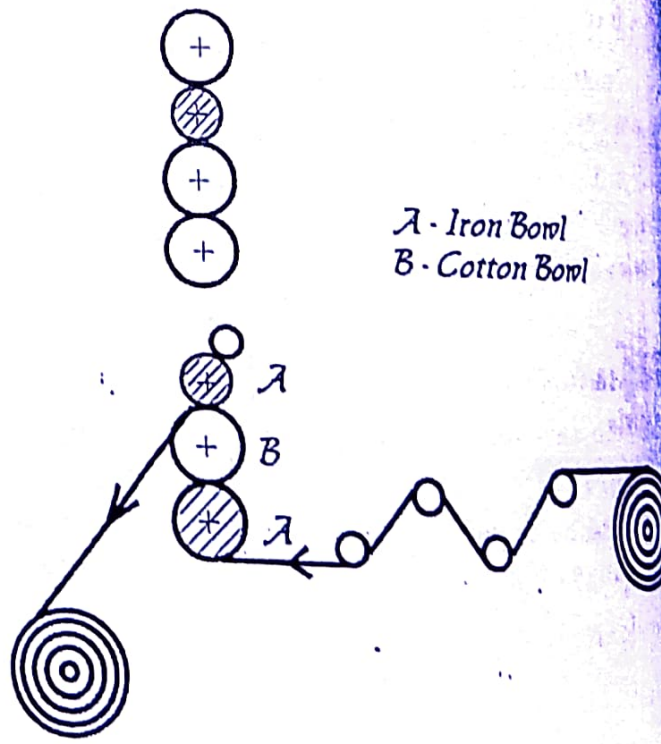
Here, all rollers are run at the same speed.

The fabric is passed through the nips of the rolls for several times.

FRICTION CALENDER

For producing this effect, the top four bowls of bowl calender can be lifted up,disconnecting the cotton between the third and the fourth bowls so as to use three bowls.

FRICTION CALENDER.



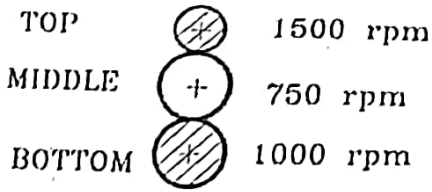
The above diagram is a Friction calender with a 7 bowl calender after disconnecting the top four bowls.

The three bowl calender, one of which is cotton and the other two are of chilled iron.

Friction calendering gives a higher Gloss and greater closing of the yarns, it is produced by bringing the cloth in contact with a heated polished chilled iron bowl which is rotating at a faster speed than the cloth itself.

The polished chilled iron bowl is heated by steam or gas and using gear wheels, the top chilled bowl is rotated at double the speed of the fabric and of the lower two bowls.

As a variation, the top bowl may be run at $1^1/_2$ times the speed of the lowest bowl, with the middle bowl running at an intermediate speed.



The top bowl with its higher surface speed produces the friction effect by polishing the cloth.

This finish is generally imparted to loose construction cloth such as binding cloth, low quality printed cloth etc.,

It is generally run at a speed of 32 mts/min.

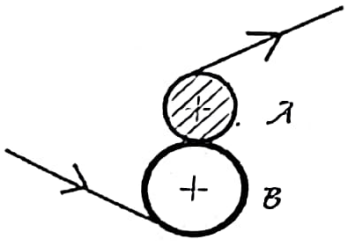
The speed of the calender when used in friction calendering is determined by the amount of finish desired on the fabric and by the number of bowls used.

SCHREINER CALENDER

It is a special calender which produces a beautiful Silk like Lustre in cotton fabric by embossing fine lines on it and is therefore also known as Silk finish.

This is carried out chiefly on cotton lining, Sateens and printed fabrics.

SCHREINER CALENDER



A - Chilled Iron Bowl
B - Cotton Bowl

The usual schreiner calender consists of two bowls, the upper bowl is made up of specially polished steel bowl and the lower bowl is made of compressed cotton.

The top metallic bowl is engraved with parallel lines normally 200 lines/inch^2 at 20° angle.For some special cases it maybe drawn at an angle of 45°.The metallic bowl is heated by gas usually at 150°C.

The two bowls are in contact with each other when the machine is running and are kept seperated when not in use. Otherwise the cotton bowl may get destroyed.

The top bowl is fixed and the lower is movable.

Very high pressure of 100 tons or more is exerted on the fabric as it passes through the nip by hydraulic means.

The lower bowl, in some cases is set at an angle by Skewing arrangement to give enhanced brilliancy.

Mercerised fabric when treated in this calender gives Silk finish.

Like other calender finishes, it is also not permanent. It is destroyed while washing the fabrics. Generally Umbrella cloth and Aniline Black dyed cloth are finished by this calender. Speed is 10 to 25 mts/min

FELT CALENDER

Light weight cotton goods like super fine Dhoties, Sarees, Rolles etc., are finished on this machine.

This is also employed for the finishing of knitted goods.

Blanket drying is a special method of cylinder drying. Here the cylinder is used for both drying and finishing.

The main cylinder is 6 to 8 feet in diameter made up of Tinned Sheet Iron or Stainless steel.

The cylinder is heated by steam and rotates freely.

An endless woollen felt blanket passes around the major part of the cylinder.

The cylinder is rotated along with the endless blanket.

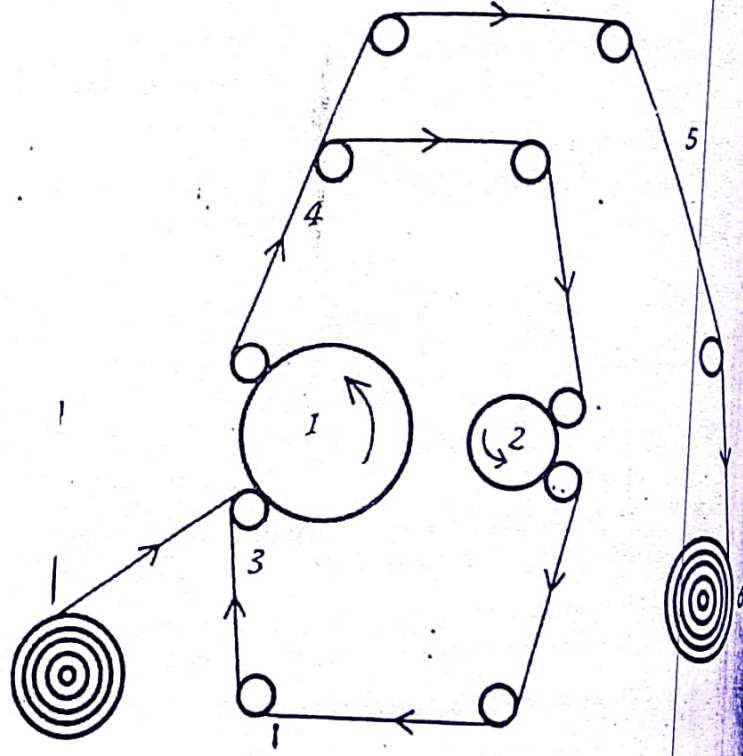
Before feeding the fabric to this machine, the fabric is passed through a padding mangle for applying the finishing mixture and then passed over an expander or a small stenter.

Then the fabric is fed between the blanket and the cylinder and is kept against the hot surface by the pressure of the blanket during drying.

In this manner, there is no undue tension on warp.

In addition to drying, it gives an attractive finish with soft feel and a smooth surface.

FELT CALENDER.



1 . Large Heated Drum 8" dia.
2 . Auxiliary Drum
3 . Thick Woollen or Endless Rubber Blanket
4 . Guide Roller
5 . Cloth
6 . Take up Batch Roller

In another type of felt finish, the fabric is finished on hot air stenter, damped on a damping machine and then passed through felt calender to get required feel.

Speed of this machine is 30 to 40 mts/min.

Fabric width of 1 to 2.5 cm can be reduced by this machine.

DAMPING - PREPROCESS TO CALENDERING

Damping is nothing but moistening or wetting.

Damping operation is carried out as a preprocess to calendering.

Mechanical operation of calendering depends on Pressure, Heat, Friction and Moisture.

Hence, before calendering the fabric is subjected to damping where sufficient amont of moisture is added to the fabric.

As the physical properties of all textile materials vary to a very large extent with the moisture conditions, it is very important that this should receive attention before the fabric is subjected to any mechanical operation.

It is possible to allow fabrics to lie for sometime in a humid conditioning room, or more quickly to spray water directly on to the cloth or blow the steam through the fabric.

The process of spraying water or blowing steam to the fabric, makes the fabric more Flexible and prevent them from causing damage by tearing.

FINISHING OF FLANNELS

Flannels are generally made up of wool.

They are raised fabrics and hence yarns with proper Low twist/inch are used to make the fabric having a suitable design.

The fabric is then treated in a raising machine for 3 or 4 times to raise enough pile of fibres on both surface of the fabric.

They are then brushed and then sheared to give it a neat even pile appearence.

Other wollen finishings are generally not necessary.

In certain cases, a Crabbing treatment may be given to give it better dimensional stability.

MAINTENANCE SCHEDULE FOR 7 BOWL CALENDER

FREQUENCY	JOBS TO BE ATTENDED
DAILY	Cleaning of all guide rollers, expanders and Foxwell rollers.
	Cleaning of plaiter parts.
	Dusting off all indicaters.
	Removing all deposits on the bowls.
BIWEEKLY	Oiling of guide roller bearings and swivel bearings of Foxwell guiders.

CHAPTER 4

FINISHING OF SILK, WOOL, POLYESTER AND NYLON.

MILLING

Milling is an essential process for woollen material.

It is otherwise known as Felting.

The ability to Felt is the characteristic feature of wool.

The felting property is used in the finishing process to alter the appearance, body, elasticity and the strength of the wollen fabric.

Different types of wool vary in their ability to felt and this depends on length, fineness, scaliness, waviness etc.,

The object of Milling is to make the fabric fuller and denser as a result of which the woven pattern becomes more or less obscure.

Both dyed and undyed fabrics are milled.

The milled cloth is suitable for producing a raised finish.

CLASSIFICATION

Milling is classified into two types;

1) Acid milling and
2) Alkaline milling (including soap milling)

Both are carried out in stock or in rotary milling machine.

The three essential requirements for felting to occur are;

1) Moisture,
2) Heat and
3) Pressure.

ALKALINE MILLING

This may be carried out with soap and soda ash or with alkali alone.

For best results, the following conditions may be used.

Sodium Carbonate	-	6 - 7° Tw
pH	-	9 to 11
Temperature	-	38°C

This is suitable for unscoured wool of low quality.

It is not suitable for fine fabrics.

ADVANTAGE

Both scouring and milling is carried out in one operation.There is a 30% saving of cost compared to soap milling.

SOAP MILLING

It is a very widely used method.

For the process, the following conditions may be used;

Soap solution - 8 - 10% strength

2.5 gallons is sufficient for 100kg of cloth.

Temperature - 40°C

After milling, the material is given a short and warm wash to remove all traces of soap.

ADVANTAGE

Softer cloths are milled with less risk of damage.

No previous scouring is necessary.

DISADVANTAGE:

It is a slightly a costlier process.

ACID MILLING:

Sulphuric acid is the best milling agent.

Sulphuric acid - 0.2 - 0.5%

pH - 2

Temperature - 45°C

But the 0.2 - 0.5% sulphuric acid is diluted with 2 lbs of dark oil Vitriol for every 100 lbs of cloth.

After milling, the fabric should be washed thoroughly.

ADVANTAGE

This method is used for even very stronger fabrics.

Always employed for colored woven goods due to less bleeding of color.

This method is useful to mill cross breed wool which is difficult to mill with soap solution.

DISADVANTAGE

It is suitable only for Animal fibres since it dea the cellulosic fibres. It produces unwanted Harshnes

Before milling, it should be thoroughly scour remove any traces of soap, as the soap precipitates th

Normally Rotary Milling machine is prefer milling processes.

CRABBING

OBJECT OF CRABBING

Crabbing is a setting process of wool.

It is carried out to bring Dimensional Stability eliminate the latent strains developed on the fibre du spinning and weaving.

To eliminate the distortions like crocking, crow patterns and uneven shrinkage.

The degree of stress relaxation during crab depends on:

1) The fibre quality.

2) Yarn twist.

3) Cloth construction.

4) Subsequent dyeing and finishing operat

It is important for the finishing of fabric contai

1) Mohair or cross bred wool.

2) Light weight open weave fabric.

3) Highly twisted yarn containing fabrics

METHOD

Essentially, crabbing consists of winding the fabric on a roller under tension on to a beam through Hot or Boiling water containing a Wetting agent and then rotating the loaded beam in the hot or boiling bath for about 10 mins.

The fabric is then wound on another beam and the operation is repeated.

By this method, the fabric is set and does not get distorted during the subsequent processing.

PARAMETERS

The effectiveness of crabbing depends on;

1) The tension.
2) Duration of treatment.
3) Composition of crabbing liquor.
4) Temperature.
5) pH of the crabbing liquor.

The tension should be uniform. Higher tension leads to the production of a Papery Feel in the fabric.

The temperature must be constant. Too low temperature leads to inadequate setting.

The pH of the crabbing liquor should be maintained at 7. Poor setting may take place if the pH becomes acidic.

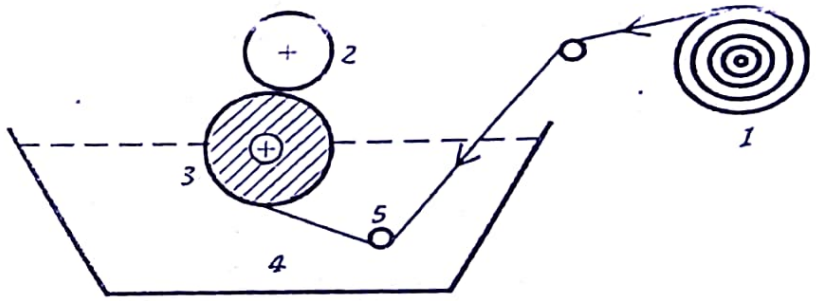
In the composition of the crabbing liquor no alkali should be added. The addition of alkali will damage the cloth.

Prolonged crabbing with alkaline solution discolor the fabric and impart a poor handle.

Care should be taken while winding, as bad winding leads to Listing.

Crease should not be allowed to form while winding, as these creases too will get set during crabbing.

CRABBING MACHINE



1 . Batch Roller
2 . Weighting Roller
3 . Fabric Winding Roller
4 . Crabbing Liquor
5 . Guide Roller

In the simplest crabbing machine, the fabric wound on a roller is unwound, passed around guide rollers into hot or boiling water and wound back on a roller.

A weighting roller on the top ensures that the pressure is applied during the winding onto the lower roller.

The roller is allowed to rotate till the water is cooled at room temperature.

Crabbing of woollen fabrics is based on the combined effect of moisture and heat on the fabrics.

It is repeated for several times to acheive permanent setting of wool.

DECATISING

This is also a finish similar to Felt calendering mostly meant for woollen fabrics.But today all suitings are decatised.

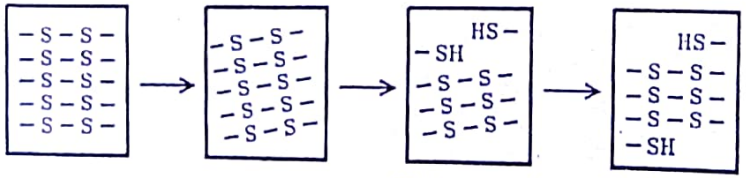
Both batch and continuous methods are available.

Essentially, this is a Stress-Relaxation process.

The function of setting is to relax the various stresses built up in the material during spinning and weaving and to stabilise the fibres in the new and desired construction.

The chemical change takes place during setting of wool is shown below.

THIO - DISULPHIDE EXCHANGE.



Wool fibre contains small quantity of Thiol gro (-SH).

It can be converted into Disulphide bond(-S-S-) reaction of wool with a reducing agent or by the actio hot water, steam or alkalies.

This interchange reaction and hydrogen bo rearrangement are important in wool setting.

MECHANISM

The fabric is compressed between two layers o woollen felt and steam is blown simultaneously.

The fabric acquires Body, Suppleness with ironin effect on both the faces.

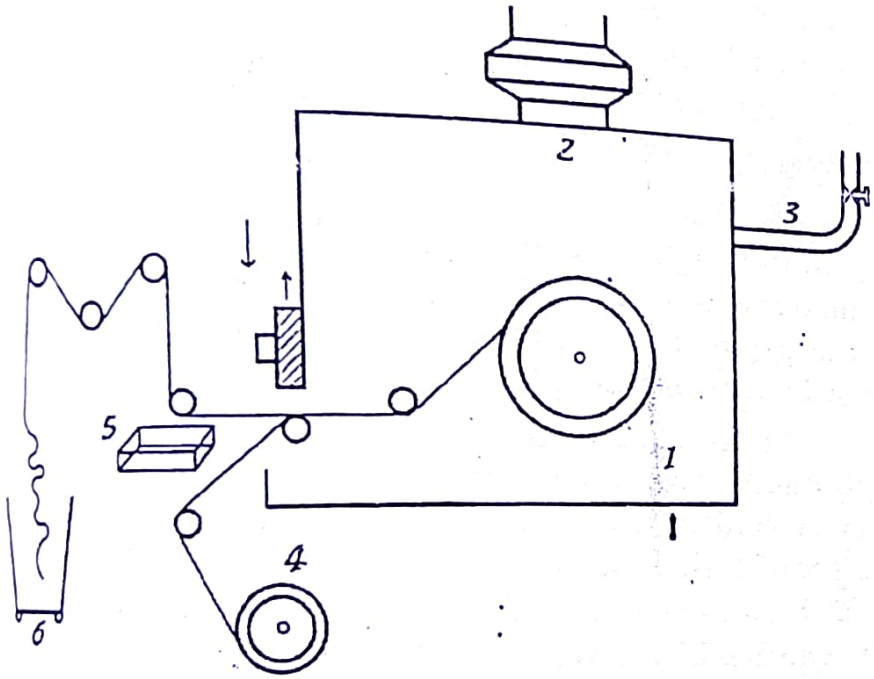
These are due to the swelling of the fibre by steam

PARAMETERS

The effectiveness of decatising depends on

1) Type of fibre.
2) Time of contact.
3) Amount of steam.
4) Tension.
5) Type of finish desired.

DECATISING MACHINE.



1 - *Steam heated Cylinder*
2 - *Exhaust*
3 - *Steam Cine*
4 - *Woollen Felt*
5 - *Table*
6 - *Finished Material*

PROCESS

Without the fabric, felt is run forward and backward for 15 - 30 minutes.

The fabric is fed along with the woollen felt.

The amount of fabric to be fed depends on the length of the woollen blanket.

Normally one piece is fed The piece is cut at the joint.

The chamber door is shut and the steam is opened and maintained at a pressure of 10 -15 PSI.

The felt is run forward and backward with the help of reversible motor for 5 minutes.

After the treatment time, (normally 7 minutes) steam is shut off and the fabric is collected and laid on the table.

CHEMICAL DECATISING

It will give a full soft feel.

Normally Sodium BiSulphide is used at a concentration of 10 - 20 gpl.

Pad - Dry - Steam.

Padding is done at an expression of 50% on a padding mangle.

Steaming is done by winding the material on a perforated beam of a decatising machine and steamed for 3 - 5 minutes followed by the application of vacuum till the fabric cools.

ANTI FELTING

By felting of wool, we can get milled effect which is necessary for all woollen materials.

But for some cases such as knitted wool, felting is a great disadvantage.

Cloth which is intended for printing also needs Anti felting which increases the affinity for dyeing.

Processes are developed to make wool non-felting by modifying the scale structure.

In non-felting of wool either removal of scale takes place or scales become blunt.

The following method is used for non-felting of wool.

CHLORINATION

In earlier days non-felting was done by treating the wool with Chlorine gas or Hypochlorous acid.

Wool when treated with chlorine gas at a pH of 7 or below and then subsequently treated with the acid, the felting property is removed and a lustre is obtained with increased affinity for dyeing.

This treatment also acquires an Anti-shrinking property.

All these new properties are due to the removal of scales or scales becoming blunt enough to undergo anti-felting process.

As wool absorbs very quickly, uneven chlorination takes place hence uneven dyeing results.

In Wet Chlorination process, the material is treated with 2 - 3% of active chlorine (weight Sodium hypochlorite solution for half an hour, then acidified with 6% HCl (30°Tw) and the treatment continued for a further period of 30 minutes.

Finally, an anti-chlor treatment should be given Sodium Sulphite or Sodium bi Sulphite.

DIFFERENT METHODS

Wet Chlorination can also be done using Formic along with Hypochlorite solution (Negafel Process

[0.6 gpl available chlorine Hypo solution, Sodium formate to adjust the pH to 4, T material at 5 - 10°C , after 8 min. add Formic acid the pH to 3 - 4. Treat for 20 min., rinse and antichlor treatment]

In dry chlorination process wool is first conditioned to standard moisture content and placed in autoclave is valcanitilined to protect it from corrosive action chlorine. Air from autoclave is removed by a vacuum and chlorine gas is let in and circulated for one hour the antichlor treatment is given. This process gives uniform results than wet chlorination.

In another process for making wool unshrinkable without causing damage to it, wool is treated with solution of Sulphuryl chloride (SO_2Cl_2)in white spirit one hour at room temperature. Then it is centrifuged washed with a warm solution of Lissapol.

Some Protolytic enzymes like PAPAIN are useful in making wool non-felting [enzyme, 1% of Sodium bisulphite, at 70° C for 15 - 30 min.]

ROTARY PRESS

It is generally applied to woollen materials, especially for woollen blankets.

Just like calendering machine in cotton finishing, Rotary press is used for pressing the blanket cloth giving a sort of shine.

Fluffy blankets are given a light press. Whereas cheap blankets are given a heavy press.

The thickness of the blanket can be adjusted by,

1) The pressure applied and the shine,

2) By the moisture and

3) Heat.

The rotary press consists of a steam heated cylinder which fits into the hollow of a steam heated bed.

The diameter of the cylinder may vary from 15 to 24 inches.

The fabric is carried through the press by the rotation of cylinder and pressure is exerted by pressing the bed against the cylinder to give 500 and 1000 lbs/sq.inch.

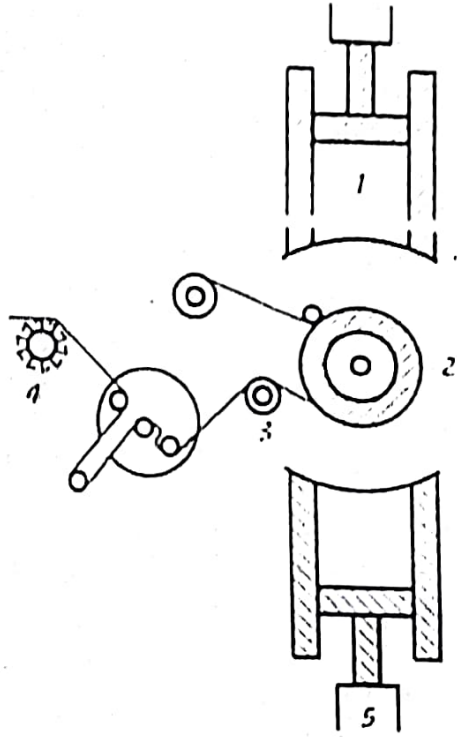
This is a continuous process and the average output is 5 - 10 yards/min.

The rotary press is not used for the highest qualities of fabric, on account of the stretch which is given to the cloth.

The central bowl carries the cloth being highly pressed between the heated bowl and the two curved plates.

Brush roller is provided to remove creases before the cloth enters the press.

ROTARY PRESS MACHINE



1 . *Jacketed Half Curved Polished Brass Plate heated by Steam*
2 . *Central Heated Iron Bowl*
3 . *Expander*
4 . *Brush Roller*
5 . *Hydraulic Pressure*

FINISHING OF ALL WOOL SUITINGS

The sequence of processes of all wool suitings is as follows;

GREY MENDING
DOLLY WASHING
DRYING
MENDING
ROTARY PRESS
SOFTENING
SHEATING
ROTARY PRESS
COOLING AND CONDITIONING
DECATISING

FINISHING OF TERRY WOOL

GREY MENDING
CRABBING
GAS SINGEING
DOLLY WASHING AND DRYING
HEAT SETTING AT 190°C
CRABBING
DOLLY WASHING
MENDING
ROTARY PRESS
SOFTENING AND DRYING
ROTARY PRESS
DECATISING

FINISHING OF WOOLLEN BLANKETS

Woollen fibres are made in the form of blanket known as Woollen Blanket.

Due to scales in the structures there will be shrinkage. Due to shrinkage, the cloth becomes bulky.

The procedure is as follows;

Fibre comes out

Covering the yarn surface

Pressed

Entanglement takes place on blanket surface.

PROCESS SEQUENCE

MILLING
WASHING
SMOOTHENING
WET RAISING
DRYING
ROTARY PRESS

WEIGHTING OF SILK

'The process of increasing the weight of the Silk material is known as Weighting of Silk'.

PURPOSE

After the processing of silk material, it loses about 25% of it's weight particularly after degumming.

PROCESS

PICKING (stannic chloride soaking)

WASHING

PHOSPHATING (sodium phosphate)

ACIDIFYING (H_2SO_4)

Repeat picking and phosphating till sufficient weight is obtained.

Treat with Sodium Silicate.

CHEMISTRY

Stannic chloride+Sodium Phosphate → Tin phosphate

Tin phosphate+Sodium silicate → Tri silicate of Tin

CARBONISING

It is also a special type of finishing of converting of polyester blends to 100% polyester by chemical treatments where 70% Sulphuric acid is used.

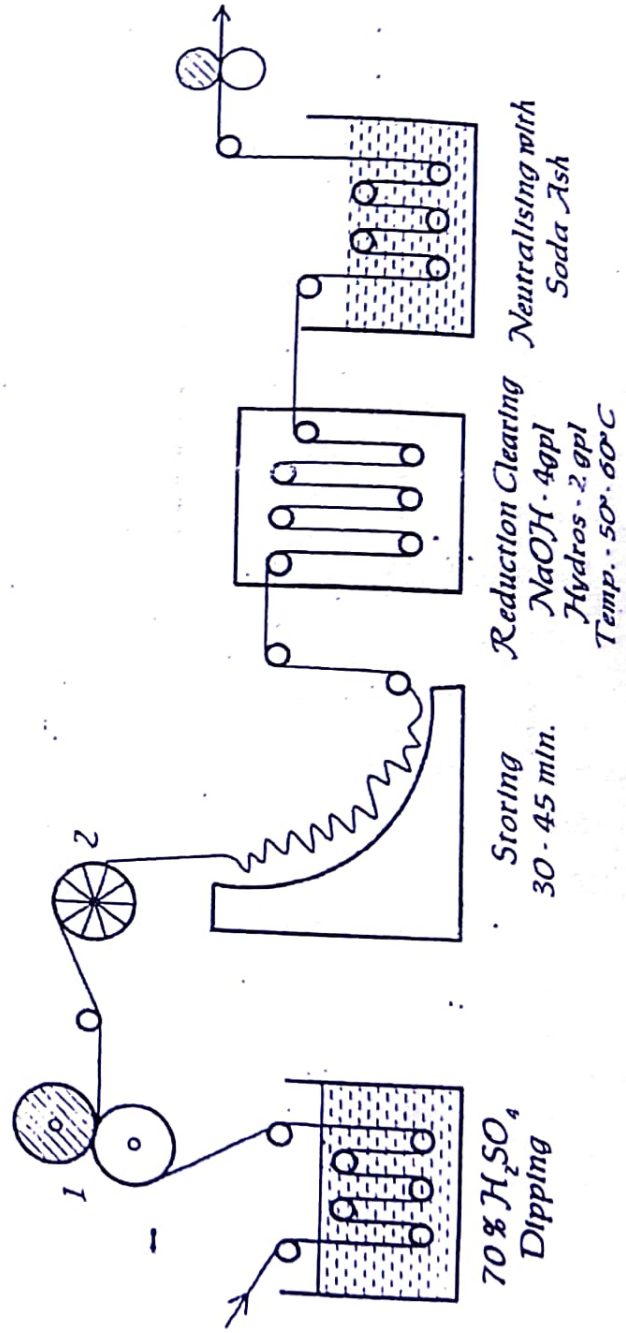
The process of treating P/C blend fabric in 70% H_2SO_4 and converting it to 100% PET is known as Carbonising.

70% H_2SO_4, dissolves cellulose and leaves only the PET portion.

In 50% H_2SO_4, viscose dissolves in case of P/V blends.

The process is done by running through H_2SO_4 like dyeing in a jigger.

LINE DIAGRAM OF CARBONISING UNIT



1. Padding (70% expression)

- Store - Neutralise - Wash

ntains nitrous impurities, which affect the
rse dye on PET dyed material.

nt this Urea can be added.

ıction between cellulose and H_2SO_4 is

ıne heat liberation migration of dyes takes

ıdded to suppress the exothermic reaction and
emperature.

of Urea is sufficient for this process.

mic acid along with urea will give good results
event the migration, mark off of the dye etc.,

urea : 5gpl

sulphomic acid : 5gpl.

ne of treatment that the cellulose gets dissolved
n.

ger, the H_2SO_4 consumption will be more and
roblems will be very severe.

of machine : 30 mts/ min depending on the tray

OPTICAL WHITENING OF POLYESTER GOODS

FLUORESCENT BRIGHTENING AGENT

The most popular method of polyster whitening is done using Optical Brighteners or Fluorescent Brighteners.

The fluorescent brightening agents suitable for application to PET fabrics are insoluble in water and are usually supplied as Greenish Yellow Dispersions or in Liquid form.

They produce a good white effect on PET and have satisfactory wash, light and sublimation fastness.

THE PRODUCTS : Tinopal ERT
Uritex ERN
Palanil white RR
Milka white ATN.

APPLICATION ON POLYESTER

CARRIER METHOD

The bath in the jigger is set with

0.1-0.2% - Fluorescent Brightening Agent(FBA)
X% - Carrier
0.1- 0.5% - Acetic acid to set pH 6.

Enter the material at 40°C

Run for 15-30 min.

↓

Raise the temp. to boil in 30 min and maintain for 30- 60 min.

↓

Rinse with hot water

↓

Dry

The degree of whiteness depends on the Carrier Concentration

HIGH TEMPERATURE METHOD

Machine to be used : HT beam dyeing machine or Jet dyeing machine at 120-130°C

Finishing liquor consists of 0.5-1.5% - FBA

0.5-1% - Dispersing agent

0.5% - Acetic acid pH5-6,

↓

Enter the goods at 40°C

↓

Raise the temperature to 120-130°C in 30 min and maintain for 30 - 45 min.

↓

Raise with hot water

↓

Dry

The temperature of application greatly influences degree of whiteness.

PAD - DRY - THERMOFIX METHOD

It is a continuous method.

Pad the fabric with 5 - 25 gpl of FBA at RT

↓

Dry at 100 - 110°C

↓

Thermo fixation at 180-200°C for 30-60 seconds

↓

Wash

↓

Dry

PAD- STEAM METHOD :

Pad the fabric with FBA dispersion at RT

↓

Steam at 100-101°C for 2-3 hrs under pressure (1-1.5 Kg/cm^2) for 25-30 min.

↓

Thermo fixation at 150- 170°C for 3-5 min

↓

Wash

↓

COMBINED RESIN FINISHING AND OPTICAL BRIGHTENING

Pad liquor consists of

X gpl	-	Resin
X/10 gpl	-	Catalyst
X gpl	-	Softener
5-15 gpl	-	FBA - for PET
1-2 gpl	-	FBA - for Cotton
0-1 gpl	-	Wetting Agent

METHOD

Pad - dry - cure at 140 - 150 °C for 4 - 5 minutes.

POPLIN FINISH

Poplin is a kind of light weight cotton fabric which is mostly used as dress material.

They are either bleached or dyed or printed.

FINISHING OF DYED AND PRINTED POPLIN

FABRIC PARTICULARS

Warp and weft	=	100% Cotton
Count	=	20^{s}
Ends/ inch	=	68
Picks / inch	=	44
Weave	=	plain weave

FINISHING EFFECT DESIRED

Soft handle with lustre.

Easy care properties.

Water resistant.

These fabrics are generally dyed and printed with reactive dyes. So selection of resin is very important.

PROCESS SEQUENCE

Impregnate → Dry up to a residual moisture content of 6 - 9% (100 - 120 °C)
(75 % Pickup)

↓

Emboss calendering at 160 - 200 °C

↓

Curing at 150 - 160 °C for 4 /5 minutes.

FINISHING OF DYED GOODS

FABRIC PARTICULARS

Warp and weft	=	100% Cotton
Count	=	40^{s}
Ends/ inch	=	64
Picks / inch	=	44
Weave	=	plain weave.

FINISHING EFFECT DESIRED

Wash resistance.

Easy care properties.

Soil release property.

Smooth handle.

This effect can be obtained by the combination of several finishing agents and the different finishing effects require a proper selection of resin.

Generally resin finishing imparts abrasion resistance.

The selection of softeners as well as the soil releasing agent is very important

PROCESS SEQUENCE :

Padding (75% pick up)

↓

Curing at 150 °C for 5 minutes.

↓

Sanforising.

FINISHING OF BLEACHED AND PRINTED POPLIN

FABRIC PARTICULARS

Warp and weft	=	100% Cotton
Count	=	60 ^{s}
Ends/ inch	=	120
Picks / inch	=	72
Weave	=	Satin.

FINISHING EFFECT DESIRED

1) Dimensional stability with good wash performance.

2) Soft handle.

3) Resistance to pilling.

PROCESS SEQUENCE

Pad (70% pick up)

↓

Dry

↓

Flash curing at 180 ° C for 10 Seconds.

SHIFFON FINISH

Shiffon finish is known as weight reduction finish.

To make the PET fabric as silk like material this finish is given to PET fabrics.

For this process caustic soda solution is used.

Garments of natural silk are greatly valued for their Softness, Drapy Suppleness, Warm and Sensious feeling and comfort properties.

If polyester fabric is constructed from very fine denier yarn, the feel of the fabric is close to Natural silk.

However, it is uneconomical to weave or knit fabrics from very fine denier yarn.

Therefore, a finish is given to PET fabrics to make them silk like material.

This finishing treatment is based on controlled hydrolysis of polyester with sodium hydroxide.

It gives some loss of weight of the fabric which reduces the denier of the fibre and thus, gives a Thin fabric.

The weight reduction depends on,

1. Alkali concentration.
2. Temperature.
3. Time of the treatment.

There is no notable difference in dye affinity between normal and shiffon finished polyester.

It will also be give a Shiny effect and a Scroopy effect.

PROCESS OF WEIGHT REDUCTION FINISHING

NaOH concentration = 19-20 %

Temperature = 100 °C

Time = 15 min.

Machine to be used = HTHP, Jet dyeing process.

Calendering
↓
Heat setting
↓
Caustic treatment
↓
Souring
↓
Washing. pH = 5-6.

DELUSTRING OF RAYON

INTRODUCTION

Rayon fibres are having a bright metallic lustre.

The high metallic lustre of these fibre is not acceptable by the consumers.

Consumer needs a little lustre approximately to that of natural silk.

In order to make the highly lustred rayons appear like natural silk, it is necessary to reduce the lusture and that is what is known as DELUSTRING.

MECHANISM

To delusture the bright metallic lustrous fibre, it is necessary.

1. To scatter the light from the external surface.
2. To reflect the scattering light in a diffused manner which penetrate into the interior of the fibre.

METHODS

1. Internal delustring.
2. External delustring.

INTERNAL DELUSTRING

In this method the delustring of Rayon is done by adding the delustring agent in the spinning bath during the manufacture of filament itself.

In this method, various substances which have high refractive index (more than 1.5) are added in the spinning solutions of the filament and then the filaments are extruded.

In this method, the filaments are finished before the filament formation itself.

CHEMICAL	REFRACTIVE INDEX	DELUSTRING EFFECTIVENESS
TiO_2	2.5	0.5%
Zinc sulphate	2.37	1%
Barium	1.637	4%

ADVANTAGES OF TiO_2

1. It has a high refractive index of 2.5.
2. It has very small particle size of 0.75 micron and will not block the spinneret.

EXTERNAL DELUSTRING

Here the mechanism is precepitating some insoluble substances on the fibre using various delustering agent.

An after treatment to rayon fabrics is carried out which is known as External Delustring method.

Here, the Refractive Index and Particle size are not important.

There are 2 methods,

1. One bath method.
2. Two bath method.

These methods involve external white pigment coating uniformly on the surface of the fabric.

TWO BATH METHOD

In this method, the fabric is first impregnated with Barium hydroxide.

Chemicals like Stearamide can be added in the bath if higher exhaustion is required.

The impregnated fabric is then impregnated again in a bath containing H_2SO_4.

The H_2SO_4 reacts with $Ba(OH)_2$ to form $BaSO_4$ which is insoluble.

$$Ba(OH)_2 + H_2SO_4 \rightarrow BaSO_4 + 2H_2O.$$

ONE BATH METHOD

Since the two bath method is expensive, one bath method is preferred.

In this method, Matting agents are made in advance and applied in presence of certain additives which brings attachment to the fibre.

In this case, china clay, aluminium oxide, zinc oxide, titanium oxide and barium sulphate are widely used.

Among with the above compounds 5% softener, 15% of resin may be added.

The fabric becomes unnecessarily harsh and stiff by the use of TiO_2.

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PROCESS

Pad - Dry - Cure.

However, the two bath method is the most effective since the surface deposition will be less.

The fabric do not become too harsh and stiff.

DELUSTRING OF ACETATE RAYON

Acetate rayon also exhibits very high metallic lustre due to the peculiar nature of cellulose acetate. So it is also necessary to delustre it to satisfy consumers' demands.

External delustring is not suitable for acetate rayons, However, internal delustring method is mostly used by adding TiO_2 in the spinning bath itself.

The external delustring method is replaced by the PHYSICO-CHEMICAL METHOD.

This method depends on the attraction of the surface fibres by aqueous, liquor phenols of 0.1 N strength applied at 75-90°C.If lower delustring is required 3-10 gpl of phenol can be used.

The widely used process is to treat the acetate rayon with the alkaline soap (2-20 gpl soap + soda ash) at the pH of 10-10.5 at a temperature above 80°C.

The most common method is to use phenol and Alkaline soap together for better result in which case, the fabric is treated at 100°C for 30 min.

CREPING

Creping is a special effect produced mostly on rayon.

The finisher/processor has nothing much to do in the creping process, except treating the fabric in simple soap solution.

MECHANISM

If a Highly twisted yarn made from a fibre which has high swelling properties and which also shrinks very high is subjected to swelling process, the twisted yarn gets untwisted and during the same time shrinks and loop formation takes place.

For a good creping effect, the popular construction of a fabric is a plain warp and a crepe weft.

The weft is generally built of two threads with the twist in one direction followed by two threads with the twist in the reverse direction.When the fabric is wetted untwisting of yarn takes place in opposite direction, but as their ends are fixed at the selvedges, the fabric shrinks in width producing snarling or crepe effect.

To get regular crepe effect, embossing calender is a must.

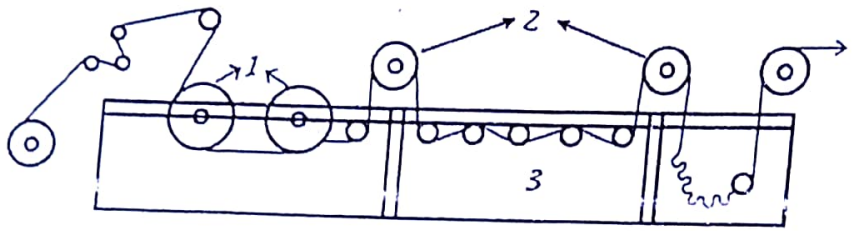
Care should be taken on pressure and temperature while embossing .

To get good and permanent crepe effect, it is necessary to use higher temp. and high pressure during embossing.

Maximum temp. : 50°C

Maximum pressure : 550 psi.

CONTINUOUS CREPING



1 . Carge Drums
2 . Drums Carrying the Fabric
3 . Creping Ciquor

Because of the shorter time, the concentration of the Creping solution will also be higher.

Soap	-	3%
Caustic(4°Tw)	-	1.5%
Wetting agent	-	0.25%
Temperature	-	at boil

CHAPTER 5

FINISHING MACHINES

RAISING MACHINE

RAISING

Raising is a mechanical finishing process carried out on cotton fabrics like Sateen, drill, denims etc.,

In this process, the fibres are raised to a certain level and the fibres are made to protrude from the surface of the fabric uniformly.

MACHINES

Raising machines are generally of two types

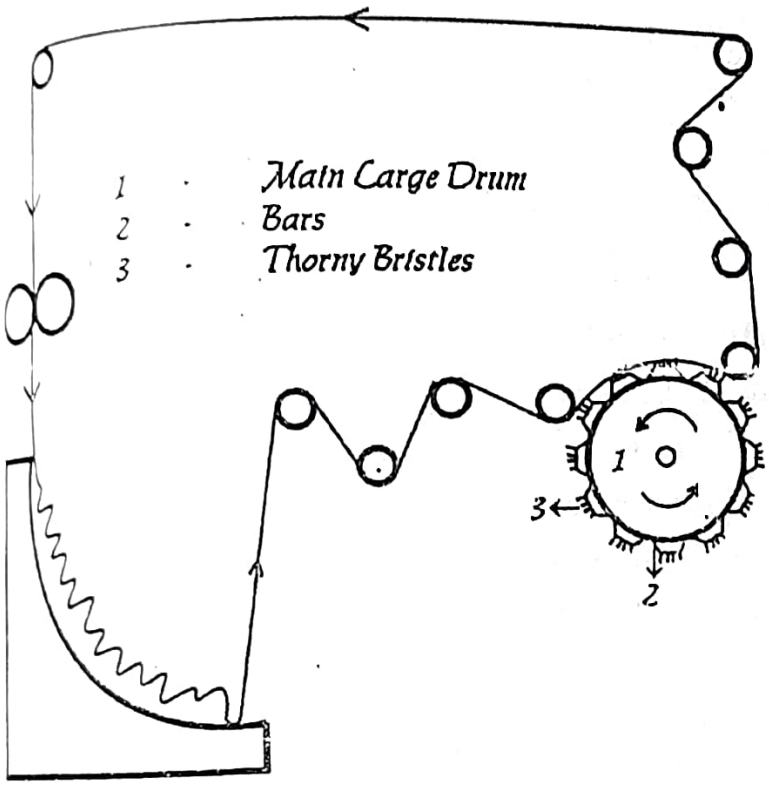
1) Teasel Machine
2) Hard Wire Machine.

TEASEL MACHINE

Teasels are obtained from a particular type of cultivated plant. These are throny bristles which are fitted on bars and such bars are fitted horizontally on a large drum.

The cloth passes in contact with the drum carrying the teasels in the same direction but at a slightly lower speed than the drum, with the result of that the fibres are raised up. It is better to moist slightly the fabric to ensure raising as dry raising has the defect of tearing the fibres.

TEASEL MACHINE.



In this process, the cover or pile is raised in one direction only.

In the moist and wet processing, the swollen fibres are less rigid, and this assists raising. Dry raising is very suitable for fabrics which have not been milled and more spongy effect is produced.

Machines are also available with two cylinders.

The number of runs depends on the nature of material and the effect required.

CARD WIRE RAISING MACHINE

Card wire raising machines are ususally constructed on the basis of a cylinder around which small rollers covered with the wire points are mounted.

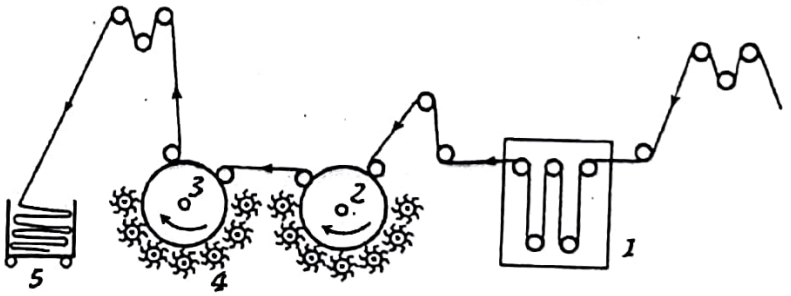
Two main types of machines are available.

1. Single acting.
2. Double acting.

In the single acting machine, the pile is raised in only one direction as the wire-covered rollers rotate in the opposite direction to that of the cylinders.

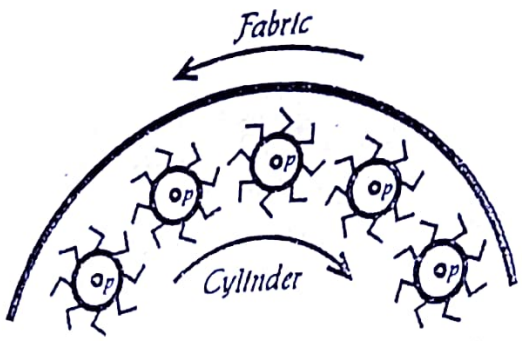
The double acting machine has two sets of rollers termed pile and counter pile rollers, which rotate at the same speed in the same direction; the points of the card-wire are set in opposite direction to each other, and by adjusting the speed of the two types of rollers, more or less raising effect can be produced.

CARD WIRE RAISING MACHINE

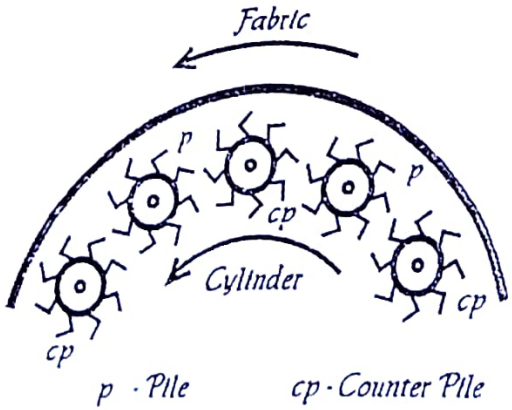


1 . Damping
2 & 3 . Hollow S.S Cylinder
4 . Brush Rollers
5 . Raised Material

SINGLE ACTING RAISING



DOUBLE ACTING RAISING



p - Pile cp - Counter Pile

The number of rollers on the machine varies according to the type, but thirty are common.

The speed of the wire raising machine varies from 12-15 yards per minute, which is 20-30% higher than that of teasel raising.

From the single and double acting machines, produce various effects of raising.

PRECAUTIONS IN RAISING MACHINE

Thickness of the material.

Damping.

Number of teeth/sq. inch.

Gauge of the teeth.

Pressure extended by the teeth.

Tension of the fabric.

Number of teeth rollers.

Speed of the teeth rollers.

Weft threads are mainly subjected to raising process.

The fabric to be raised should have less number of twist in the yarns.

The fabric should run at the very slow speed when compared with the speed of the raising rollers.

DAMPING MACHINES

Mechanical operation of calendering depends on pressure, friction, heat and moisture.

Hence, before calendering, the fabric is passed through a damping machine where sufficient quantity of moisture is added to the fabric.

The damping machines are of two types

1. Brush damping machines.

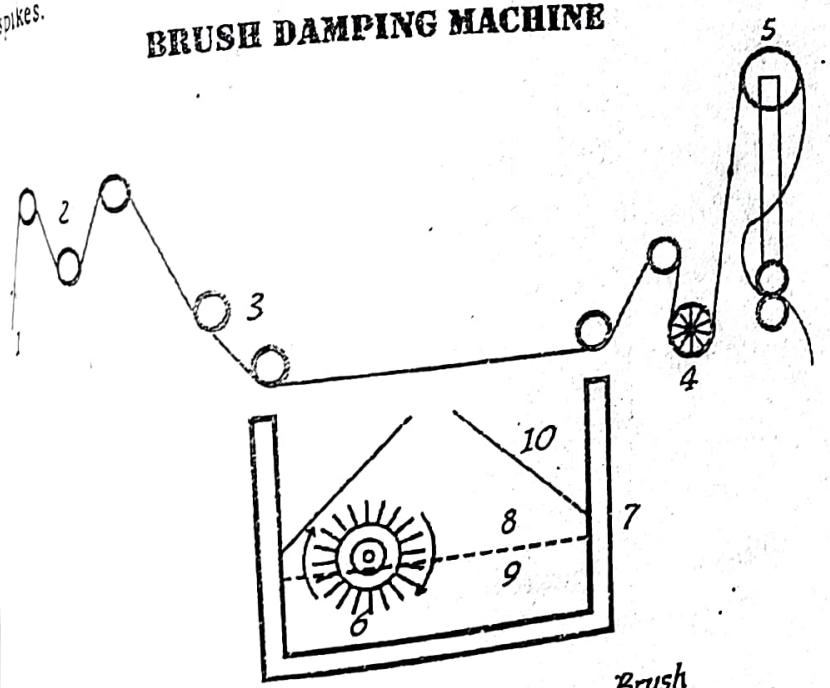
BRUSH DAMPING MACHINES

In this machine, a brush revolving at high speed in contact with water in a tank sprinkles water onto the fabric which passes over it.

This machine consists of a cast iron or mild steel fabricated frame and rectangular wooden water tank with the inclined hinged covers which form the slit.

The brush is made up of fibres, bristles or copper spikes.

BRUSH DAMPING MACHINE



1	.	Fabric	6	.	Brush
2	.	Tension Roller	7	.	Water Tank
3	.	Guide Roller	8	.	Water Level
4	.	Circular Winch	9	.	Water
			10	.	Hinged Lid

Copper sprocketted laminations mounted on a shaft work as a brush. Copper brush is common in use.

The level of water is so maintained that the spikes just touch the water.

The level of the water is kept constant in the tank by over flow pipe.

This is necessary for regulation of damping of the cloth.

Further regulation is effected by adjusting the width of the slit by hinged lids.

The copper brush is made to revolve at the very high speed and sends the water in the form of a fine spray or moist through the narrow slit onto the surface of the cloth.

The speed of the cloth is about 100 mts/min.

SPRAY DAMPING MACHINE

This is an improvement over brush damping machine, as it conditions the cloth more uniformly.

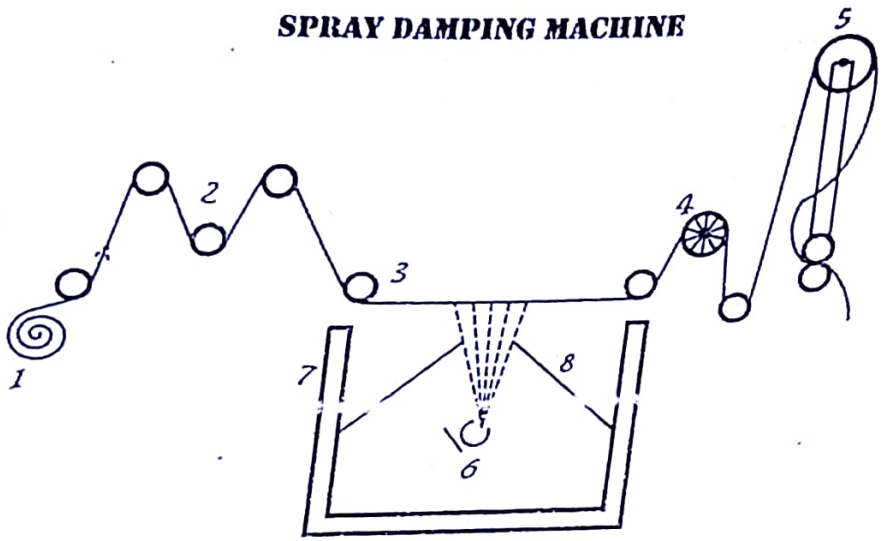
This machine is similar to brush damping machine, but the brushes are replaced by closely spaced nozzles.

Water is atomised by discharging it under pressure onto an inclined disc.

The resulting very fine spray is delivered onto the cloth passing over it.

The nozzles are attached to a common feed pipe, which is supplied with water under pressure from a pump.

SPRAY DAMPING MACHINE



1	-	Fabric	5	-	Platter
2	-	Tension Rollers	6	-	Feed Pipe and Nozzle
3	-	Guide Roller	7	-	Wooden Box
4	-	Circular Winch	8	-	Hinged Slids

Feed pipe and the nozzles are enclosed in a wooden box with adjustable hinged lid which permits the amount of damping to be controlled by hand. An automatic device is provided on some machines whereby the sprays are shut off immediately when the machine stops, so that there is no risk of over damping the fabric.

After damping, the cloth is allowed to stand for about 2 hours so that moisture is uniformly absorbed.

STENTERS

Cotton fabrics, after bleaching process, shrinks widthwise and weft becomes distorted.

The main function of the stenters is to stretch the fabric widthwise and to recover the uniform width.

The stentering machine is also used for the following operations

1. To dry the fabric.
2. To give heat setting to synthetics and blended fabrics.
3. To give curing treatment for some special finishes such as resin finishing, water repellent etc.,
4. To give soft finish to the fabric.
5. To stretch the fabric to required width.

HOT AIR STENTERS

These stenters are one of the important machines in a processing mill.

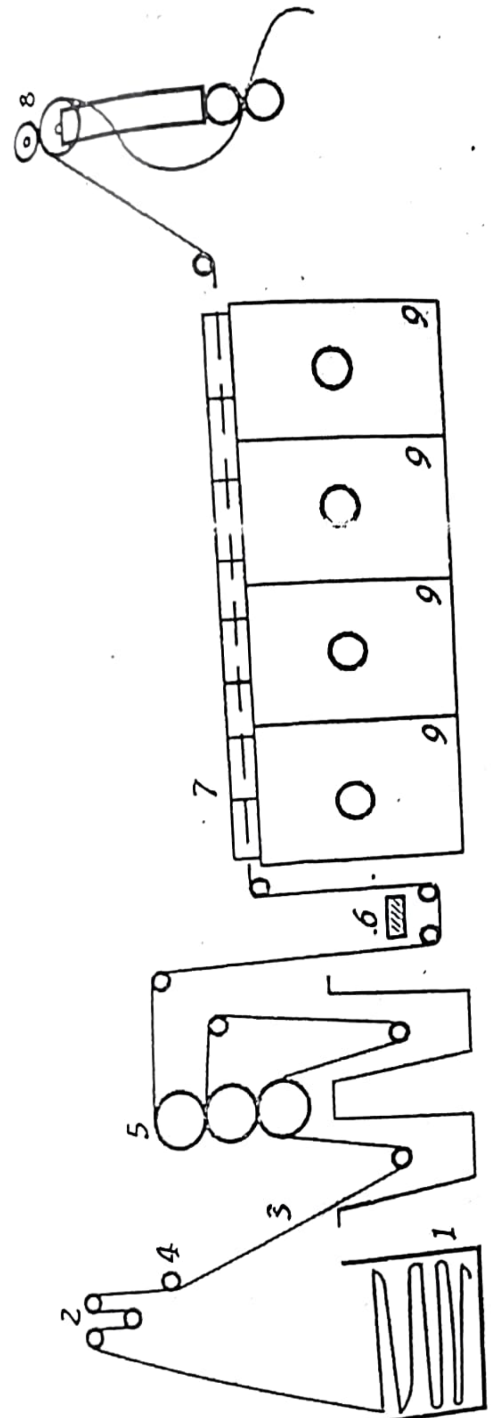
The main object of the machine is

1. To stretch the fabric.
2. To dry the fabric.

Hot air stenter stretches the fabric and also dries it.

The fabric is dried in stretched state free from creases.

HOT AIR STENTER



1 . . Trolley
2 . . Tension Rollers
3 . . Fabric
4 . . Guide Roll
5 . . Padding Mangle
6 . . Platform
7 . . Chain of Clips
8 . . Plaiter
9 . . Sectional Heaters

There is a control over the width and lengthwise stretching also during drying which is not so in cylinder drying.

Generally, all the fabrics are padded with the finishing chemicals in the padding mangle and then dried in hot air stenter to recover the width, straighten and stretching the weft and obtain a peculiar feel which only a hot air stenter can give.

The first section of the hot air stenter range is a 3 bowl padding mangle for applying the finishing chemicals to the fabric.

The padded fabric then passes under a platform to the entering end of the stenter where two attendants remove only curled selvedges and control the feeding in to the clips.

The fabric is gripped between the clips at either selvedges.

The cloth is carried by the clip in stretched condition for a length of about 80 feet.

Hot air is blown on to the fabric by a powerful fan through sheet iron trunking and adjustable nozzles.

A large multitubular heater is used to heat the air.

Steam is used as a heating medium.

The hot air is delivered from the nozzles above and below the cloth or from bottom only.

The nozzles can be adjusted to deliver the hot air towards or against the direction in which the cloth is moving.

The Jigging motion is given to cross rails by crank disc and connecting rod.

The stroke can be varied upto 24" and the speed upto 50 strokes/min.

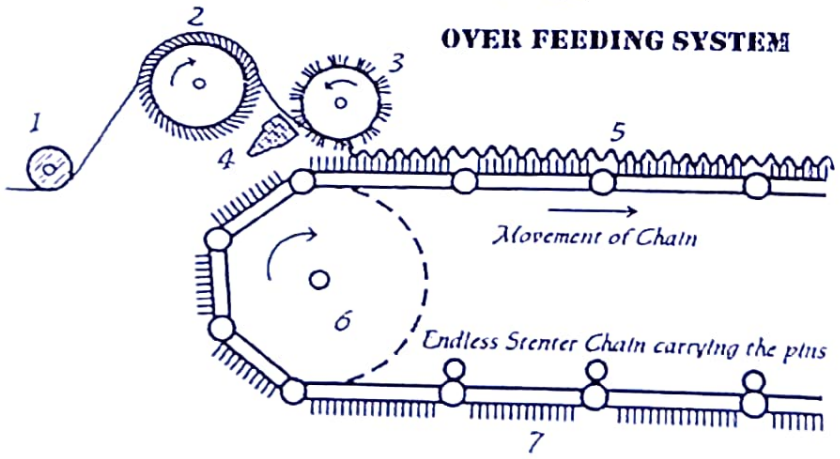
Pin stenters have no Jigging motion.

OVER FEEDING SYSTEM

The over feeding system is useful in producing unshrinkable cloth on a stenter. This is a simple modification of the pin stenter and is still in use.

The wet cloth is fed on to the machine at a higher rate of speed than that of the stenter itself, so that no longitudinal tension is applied when the fabric is gripped by the machine or during the drying process.

OVER FEEDING SYSTEM



1 · Batch Roller
2 · Pin Roller
3 · Brush Roller
4 · Electrically Heated Shoe
5 · Fabric over fed on the Pins
6 · Wheel carrying the Pins
7 · Pin Stenters

At the intake of the stenter, the fabric is fed into the machine in the usual manner near a slide roller, but is then gripped near the edges by two feed rollers.

It is driven by a train of pinions in such a way that the surface speed of these rollers exceeds that of the pin chains by a definite amount which can be varied by altering the gears.

A pressure brush forces the fabric onto the pins or the slower moving pin chain, after which the cloth passes into the drying chamber properly.

During drying the cloth shrinks and the distance between the selvedges is diminished.

It will be noted that tension is released in both directions.

KRANTZ SYSTEM OF AIR CIRCULATION

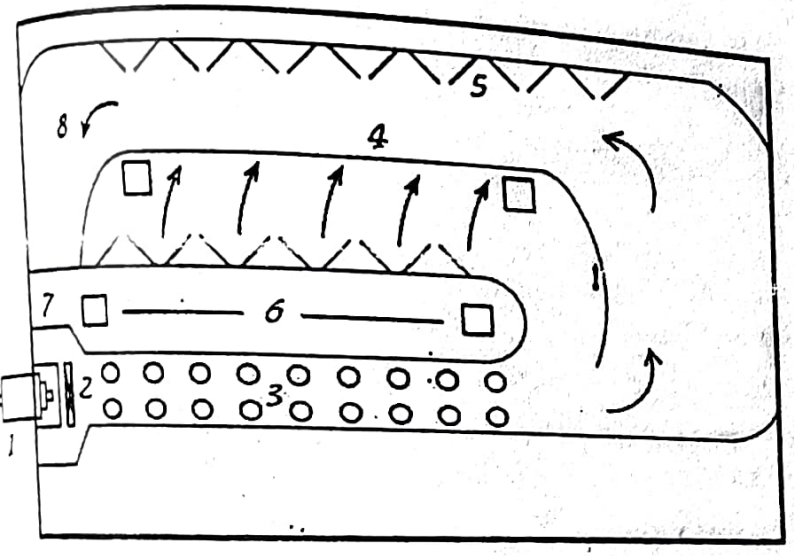
In this system, the air is circulated through a heater, across the fabric, both above and below, at the right angles to the length of the stenter and back to the fans.

The air velocity at the surface of cloth is increased by baffles.

The air is heated by gilled tube radiators with steam in the tubes.

The air is blown over the tubes by a fan or by several fans blowing air at different temperatures, usually the highest at the entering end.

KRANTZ AIR CIRCULATION



1	-	Motor	5	-	Deflectors
2	-	Filter	6	-	Stenter Rails
3	-	Heater	7	-	Filter
4	-	Cloth	8	-	Air Returns to Fan Suction

The stenter is enclosed in a chamber of fibre boards on a metal frame and lined with aspestos sheet for thermal insulation.

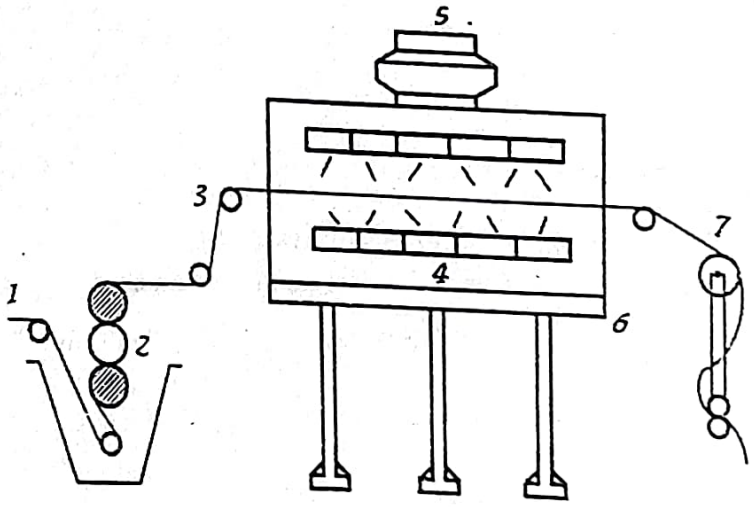
FLOAT DRYER

A float dryer does not have any guide rollers inside the chamber. The fabric passes through the chamber from one side to the otherside without any intermediate support.

Hot air is blown on the fabric through suitable nozzles arranged in series both in top and at the bottom of the cloth passage.

In fact the fabric floats on air while it is inside the chamber and hence the name.

FLOAT DRYER



1	-	Fabric	4	-	Hot Air Blow
2	-	Padding Mangle	5	-	Exhaust
3	-	Guide Roller	6	-	Drying Chamber
			7	-	Platter

It is practically similar to hot flue drier.

For certain types of dyes, it is important that the impregnated fabrics should not initially come in contact with any rollers while drying, otherwise, there will be migration of the dye.

Float dryer overcomes this and dries the fabric uniformly without migrations.

Uniform drying is essential for getting good results in dyeing.

Float drier can also be used in stenters for increased drying capacity and avoiding starch paste or resin sticking on clips or pins.

Float drier is suitable for

1. Pre-intermediate and final drying.
2. Mild drying.
3. Drying of pile and structured fabrics.

THE MAIN DESIGN FEATURES OF FLOAT DRIER

It consists of double walled insulated chamber.

It consists of heat exchange radiators of 100 psi pressure.

It is provided with suitable air boxes, air ducts and motors for driving fans.

An exhaust is provided for exhausting purposes. It eliminates the development of heat pockets in the chamber.

There is individual control of air velocities and temperatures.

It is generally working with a padding mangle.

There is a crease opener fixed on both the sides straightened the creased fabric.

It can also be in conjunction with screen or roller printing machine.

HOT FLUE DRIER

In this machine, the cloth is dried by hot air. The machine consists of a chamber of sheet iron covered with insulating material to minimise the loss of heat.

There are two rows of guide rollers, upper and lower.

Large number of upper guide rollers are driven positively so as to help the fabric to travel forward.

The other guide rollers are rotating freely.

The chamber has four compartments.

Sometimes in the first and second compartments, steam chests are placed between the fold of the fabric.

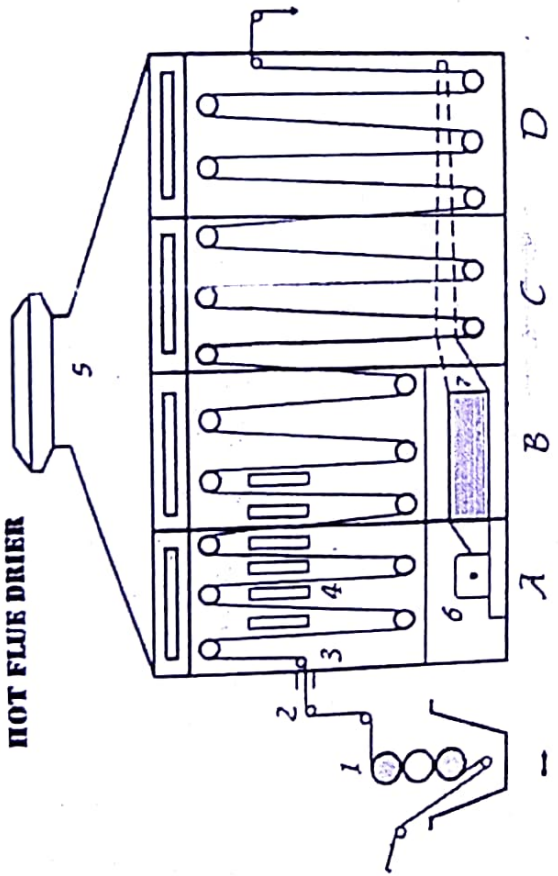
The fabric passes between the steam chests without touching the plates of chests but it is dried by heat radiated from the steam chests.

In the third and fourth compartments hot air is blown.

Steam chests are supplied with low pressure steam at about 5-10 PSI pressure.

Hot air is provided by means of a centrifugal fan and multitubular heater is placed in the base of the chamber.

HOT FLUE DRIER



1 . Padding Mangle
2 . . Fabric
3 . . Guide Roller
4 . . Steam Chests
5 . Exhaust
6 . . Fan
7 . . Multitubular Heaters
A.B.C & D - Compartments

The fan blows air at high velocity over the tubes which are supplied with steam at 100 PSI pressure.

The multitubular heater and the steam chests have usual steam accessaries such as steam valve, pressure gauge, steam trap, safety valve etc.,

The hot air is distributed through channels which run along each side of the chambers, connected by cross pipes between which the folds of the cloth pass.

In these cross pipes, there are slots from which the hot air is distributed.

Thus air is blown in between the vertical folds of cloth at the bottom of the machine and is drawn out by the exhaust fan at the top.

Maximum economy is obtained by recirculating the air. An inlet and an outlet valve is provided to regulate the air flow.

Hinged windows are provided on the sides for ready inspection.

The speed of the machine is governed by the capacity of the chamber to hold the cloth and temperature of air used for drying.The machine runs at the speed of about 60 mts/ min.

DISADVANTAGES

The rate of drying is not so high as cylinder drying.

It is not simple and cheap.

ADVANTAGES

It does not impart harsh papery finish to the cloth.

STENTER - MAINTENANCE SCHEDULE

FREQUENCY	JOBS TO BE ATTENDED
DAILY	Oil checking in the gear box Cleaning of filter Clip lubrication of oil glass Clip chain lubrication Cleaning of trough
BI-WEEKLY	Checking and feeding of eyepot of gear box Checking of oil in main drive gear box Cleaning of padding rollers
WEEKLY	Checking of hot air fan bearing Checking of grease in rubber roller and granite roller Checking of clip opener Tightening of hot air fan belt
MONTHLY	Checking of Plaiter bearing Checking of exhaust fan bearing Arresting the air leakage in side door
YEARLY	Over hauling Clip boiling and cleaning Mangle rubber roller and granite roller grinding. Air cylinder servicing
YEARLY (Cont.)	Changing of Carbon rails and Carbon lungs Checking of hot air fan belt, shaft bearings Changing of V-Pulley Checking of plaiter bearing Checking of entrance clip tension plate washer Cleaning of exhaust doom Changing of main drive gear box open bearing and oil seal Checking of exhaust fan bearing. Checking of width variation gear box and screw rod Arresting of air leakage in side door