19.9 Reeling Operations

Reeling is the unwinding of the filament from the cooked and brushed cocoons with the help of reeling machines to obtain raw silk of desired thickness. As the filament of a single cocoon is very thin, filaments from a specified number of cocoons are unwound together as a single thread of desired thickness. Thickness of filament is measured in units called denier. Denier is the weight of 9,000 metres of a single filament. Internationally accepted thickness of quality raw silk is 14 deniers. For weaving silk carpets, filaments of 21–22 deniers are used. For producing silk of 14 denier, filaments from 4–5 bivoltine cocoons and 6–7 multivoltine cocoons are combined together. For producing silk filament of higher denier more number of cocoons are used.

The cocoons to be reeled are placed in a reeling basin containing lukewarm water (47°C). There are two methods of reeling – 1. Direct method of reeling on standard reels and 2. Indirect method involving reeling first on small reels and then re-reeling on standard reels. The following steps are common to both the methods: 1. reeling end formation, 2. twisting, 3. drying and 4. reeling. In the indirect method these are followed by 5. re-reeling and 6. finishing.

19.9.1 Reeling End Formation

According to the denier of the silk to be reeled, the required number of baves from as many cocoons as necessary are collected

and passed through the hole or guide eye of a threader. The warm water in the reeling basin wets the sericin in the bave and this wet sericin serves to bind the baves from different cocoons into a single thread. The cluster of cocoons from which the silk thread is formed is called a **rose** or **rosette**. Each place in the reeling basin where a thread is formed is called an **end**. The conical formation of the filaments from the rosette to the threader is called a **balloon**. Each reeling basin is provided for reeling several ends, from two to four in charkha, four to ten in cottage basin and more than twenty in filatures.

The threader used in charkha is called a **Tharpatti** and consists of a metallic rod with a number of holes in it, the silk thread emerging from one of the holes. In cottage basin and filature units, formerly, **porcelain buttons** differing in their hole size were used as threaders for reeling filaments of different deniers. Nowadays, the porcelain button is replaced by an appliance called **Jettebout** (Fig.19.3). Jettebout is a metallic cylinder formed of two concentric tubes. The inner tube of narrow bore is firmly attached to the jettebout frame whereas the outer tube revolves on the axis of the cylinder. The inner tube has a glass button at the top end and the formed thread comes out through its hole. The outer tube has a circular disc with short slanting arms. In the formation of the reeled thread the free ends of the filaments of the cocoons come in contact with this revolving disc. The

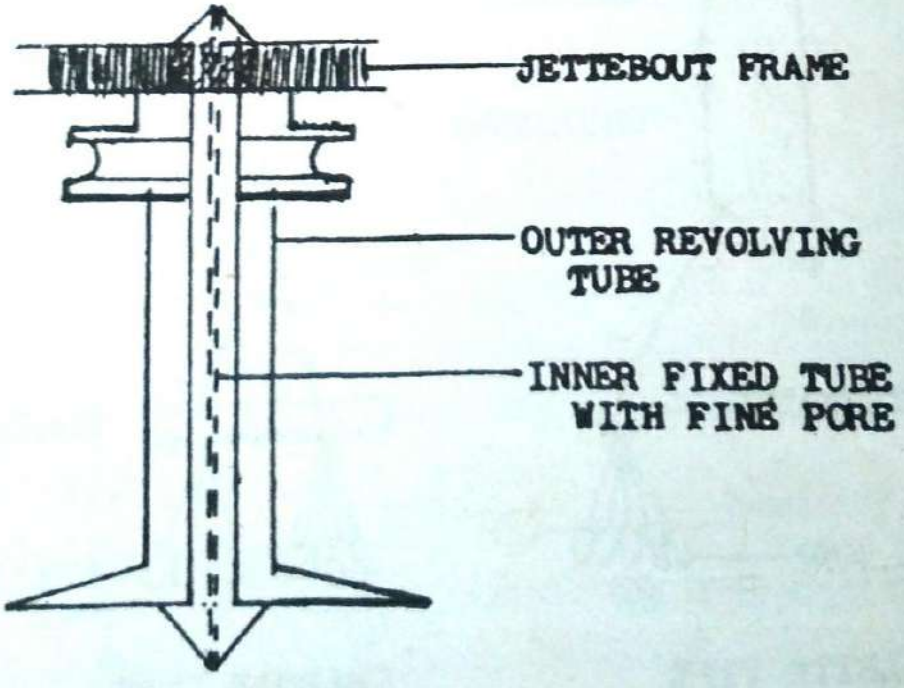

Fig. 19.3 Jettebout

required number of filaments is caught by the disc and passed through the inner tube, while the extra threads are cut by the arms and come away in the hands of the reeler. Hence, the jettebout acts both as a thread guide and a thread catcher.

19.9.2 Intertwining or Twisting

The individual bave of the reeled silk filament must be intertwined or twisted and firmly cemented so that it does not break during the manufacture of fabrics. This twisting and agglutinating is done by a special device called **croissure**. The two purposes served by passing the reeled thread through the croissure before being wound on a reel are – 1. twisting and agglutinating of the individual bave and 2. squeezing out the water from the reeled thread so as to dry the sericin. If the sericin is wet, the threads wound on the reel will stick to each other.

The two types of croissure used in India are – the **chambon** and **tavellette** (Fig. 19.4). The chambon type of croissure, though simple and primitive, is used in domestic reeling units like charkha. Here threads from two reeling ends are intertwined to form a few spirals. The two free ends are taken through the distributor and

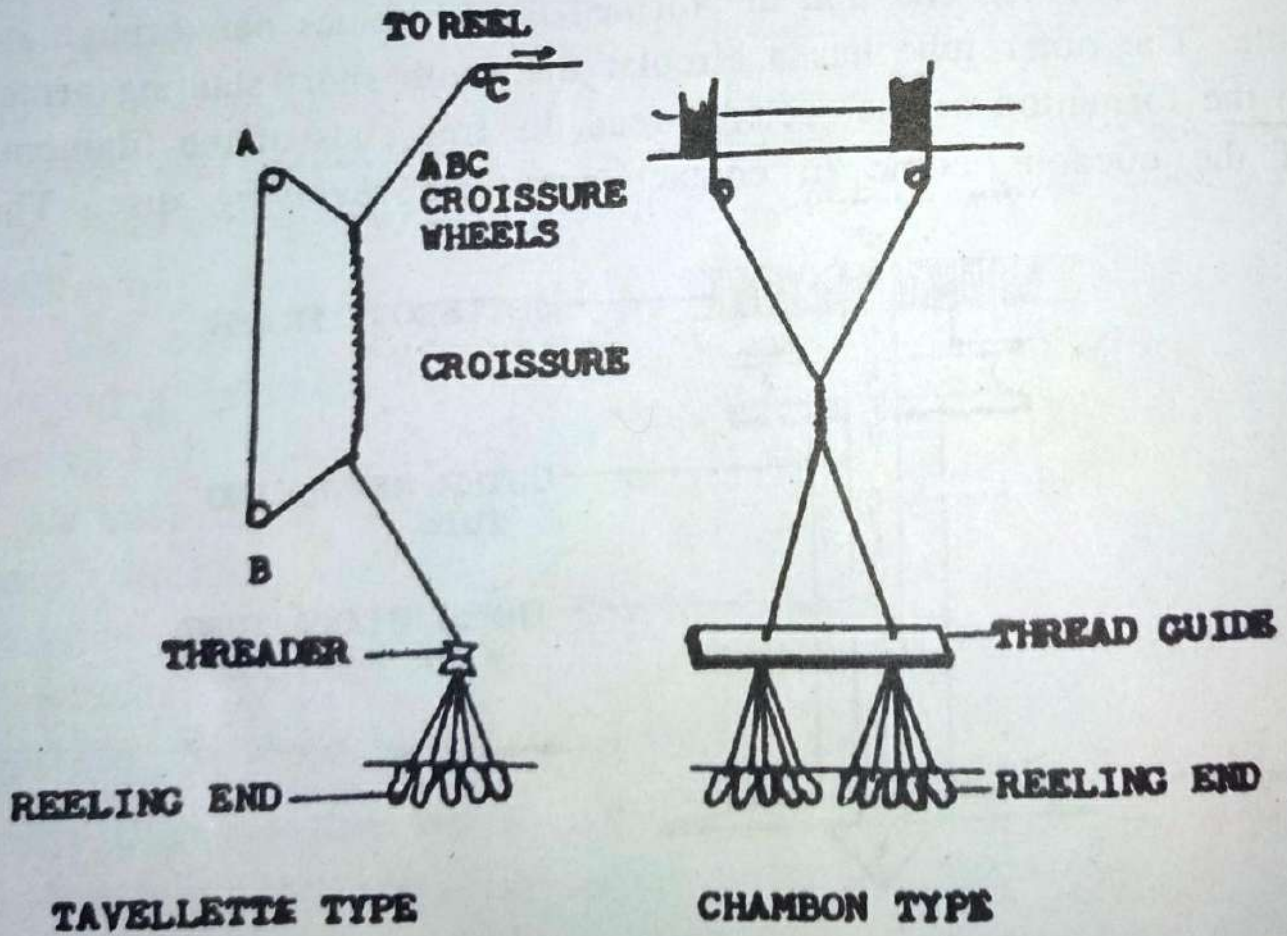

Fig. 19.4 Croissure

wound at two ends on the reel in such a way that the thread from the right reeling end is wound on the left side and that from the left on the right side of the reel. The main advantages of this type of croissure are that its mechanism is simple and it does not require any elaborate arrangement on the reeling machine. The main defects are: 1) there must be at least two reeling ends for the threads to be twisted, 2) formation of double threads is common, 3) there must be two separate ends on the reel also.

Tavellette type of croissure rectifies the defects of the chambon type and is used in cottage basin and filature units. It consists of three pulleys called **croissure wheels** fixed on the **croissure frame**, in such a way that the reeled thread intertwines around itself for producing the croissure effect. The thread coming from the threader is first collected by the middle pulley (A), comes down to the bottom pulley (B) and goes upwards, intertwines around the thread coming from the threader and the free end emerging from the spiral passes through the third pulley (C) before going to the distributor and the reel. The length of the croissure or twisted portion can be adjusted according to the thickness of the silk (denier) of the reeled silk and speed of reeling. While reeling fine thread of low denier the twisted portion is small and the reeling speed is slow and for high denier silk, the twisted portion is large and the speed of reeling is fast as the coarse filament can withstand a higher reeling tension.

19.9.3 Drying and Distribution of the Thread on the Reels

Even after being squeezed by the croissure, the reeled thread retains considerable moisture and the sericin is soft and sticky and, if wound directly on the reel, defects of ribbing and plastering occur commonly. The winding is also poor. To avoid these defects the thread emerging from the croissure is dried completely before going on to the reel. At the same time the thread should be evenly distributed on the reel. The appliance used for this purpose is called **Traverse** or **Distributor**. The traverse is a hot rod with pulley-like devices on it situated beteen the croissure and the reel, and the heat dries the silk as it passes on the traverse before reaching the reel. In the distributor, there are additional pulleys through which silk passes forwards and backwards and is squeezed.

Silk Re-reeling Technology

Silk re-reeling is to wind the yarn reeled on small reels of reeling machines further on to a larger reel to make a hank of standard size and weight, such that it can be transferred to the weaver in the form a bundle (book).

The objectives of re-reeling are:

i) To make raw silk skeins of standard size and weight.
ii) To eliminate the weak portion in the yarn due to reduced denier and gum spots caused due to plastering of the wet yarn.
iii) To tie up broken ends and to make the yarn continuous.
iv) To lay the yarn in a more criss–cross manner, such that it can be easily unwound from the skiens.
v) To pack the silk into bundles (books) for better handling.

The process of silk re-reeling has three operations.

a) Reel soaking or permeation.
b) Winding the silk on to the standard size reels.
c) Finishing the skein for easier and better handling during subsequent operations.

6.1 REEL PERMEATION

The silk wound on to the small reels of the reeling machine is tightly packed and dried which will be difficult to unwind without breakage. In order to smoothly unwind the yarn from the reels, the small reels are wetted with water. Wetting of silk on the reels are generally done by three methods: (i) Soaking method (ii) Patting method and (iii) Vacuum permeation method.

6.1.1 Soaking Method

The small reels are immersed in water for 10 to 15 minutes allowing the silk to absorb water in all the layers of the reel. However, due to tight packing of the silk, water permeation is not proper and complete, due to which the winding ability of the yarn is reduced during re-reeling. If the yarn breaks during re-reeling, the reels are once again immersed in water for further wetting.

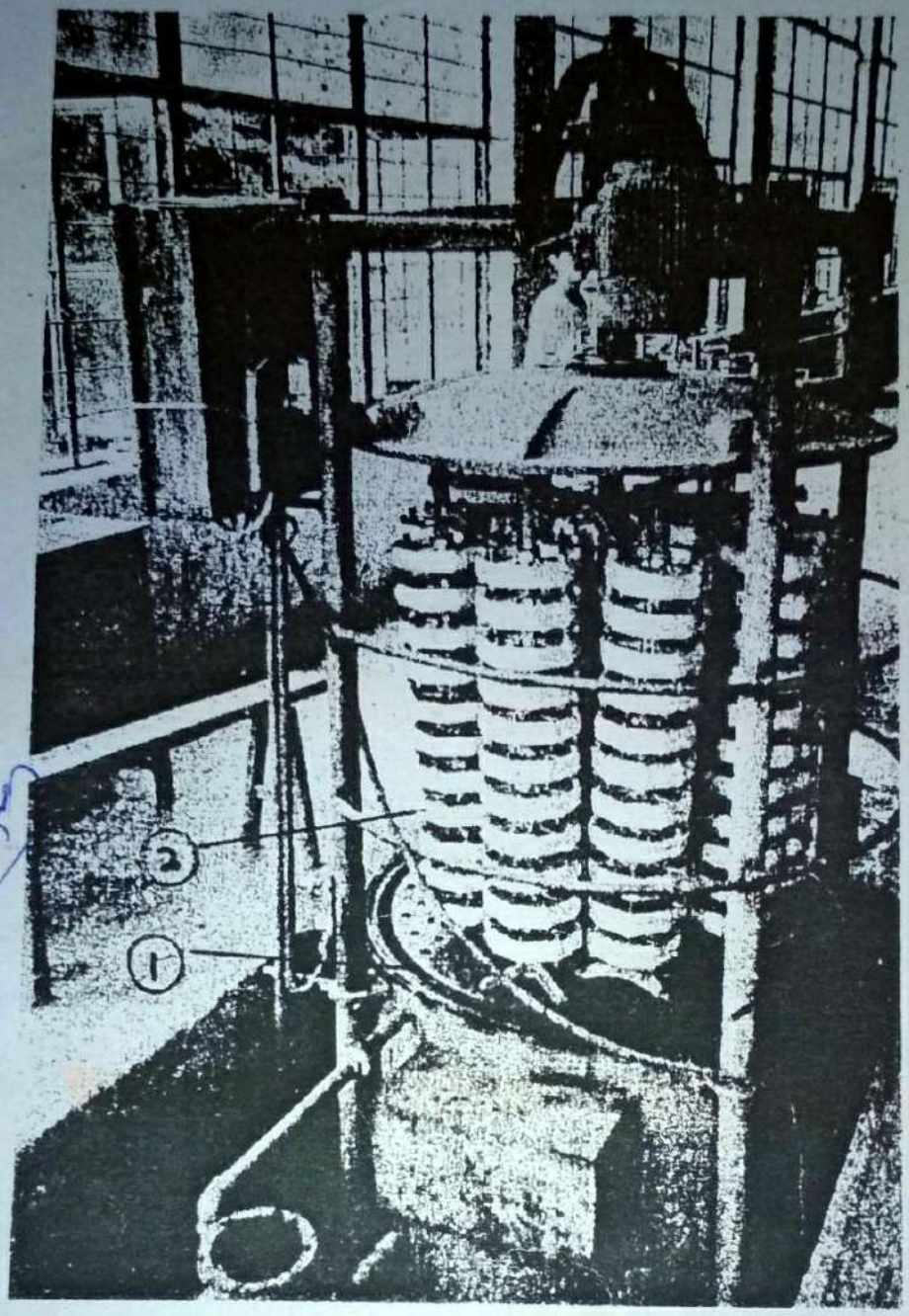

Fig. 6.1 Vacuum reel permeation 1. Permeation bath, 2. Reels

This type of soaking treatment is common in Indian silk reeling industry.

6.1.2 Patting Method

Water is patted on to the silk to be absorbed. This method is not effcient and it is not being followed.

6.1.3 Vacuum Permeation

This is a better method of soaking the silk. Small reels are stacked on a stand and placed in a cylindrical metal tank with a lid and filled with water, so as

STRUCTURE OF RE-REELING MACHINE

The mechine is constructed with Iron & wooden compartments & is double sided Except in very small reeling units where the Conventional type of re-reeling machine with one side is common e.g cottage basin reeling units.

14 Tuesday

PARTS OF RE-REELING MACHINE

(i) LARGE REEL:

made of either wood or iron. the reel shaft is fitted a set of six spokes placed in hexagonal form on other end the shaft Ball bearings are fixed on either end of the reel shaft for smooth rotation. A wooden friction wheel is fixed on the shaft for driving its

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motion by frictional contact with the drum wheel of the main driving shaft. A bevel gear made of nylon or iron is fixed on the other side of the shaft for driving the traverse mechanism (Fig. 6.2).

(ii) *Traverse Mechanism*

The traverse mechanism is an important feature in a re-reeling machine. The criss–cross winding of the yarn on to the hank to form a diamond pattern is important. (Fig. 6.3).

The traverse rod gets its to and fro motion from the reel shaft through bevel gears and the eccentric wheel which converts the rotary motion of the reel shaft into a to and fro motion of the traverse rod. The traverse rod makes a traverse of 7 to 7.5 cms.

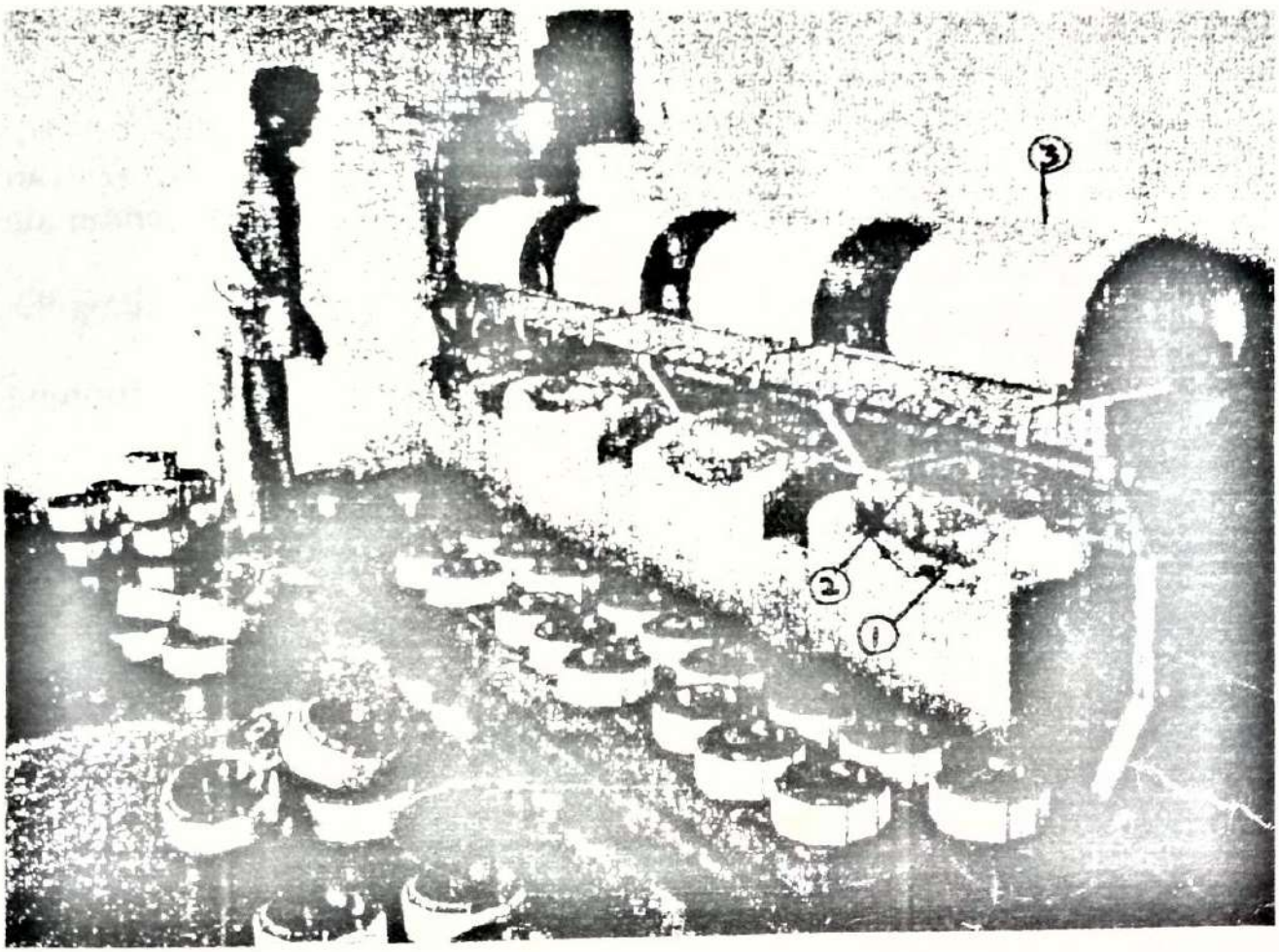

Fig. 6.2 Traditional Re-reeling machine
1. Burning charcoal, 2. Wire mesh, 3. Reel

A specific gear ratio of reel shaft bevel gear and traverse rod bevel gear is maintained. Generally the gear ratio is 13 : 24, 16 : 25 or 17 : 26 depending on the number of diamond patterns required on the surface of the hank. Commonly used gear ratio are 16 : 25 to bring about 13 diamond patterns. Five or six pigtail thread guides are fixed on the traverse rod.

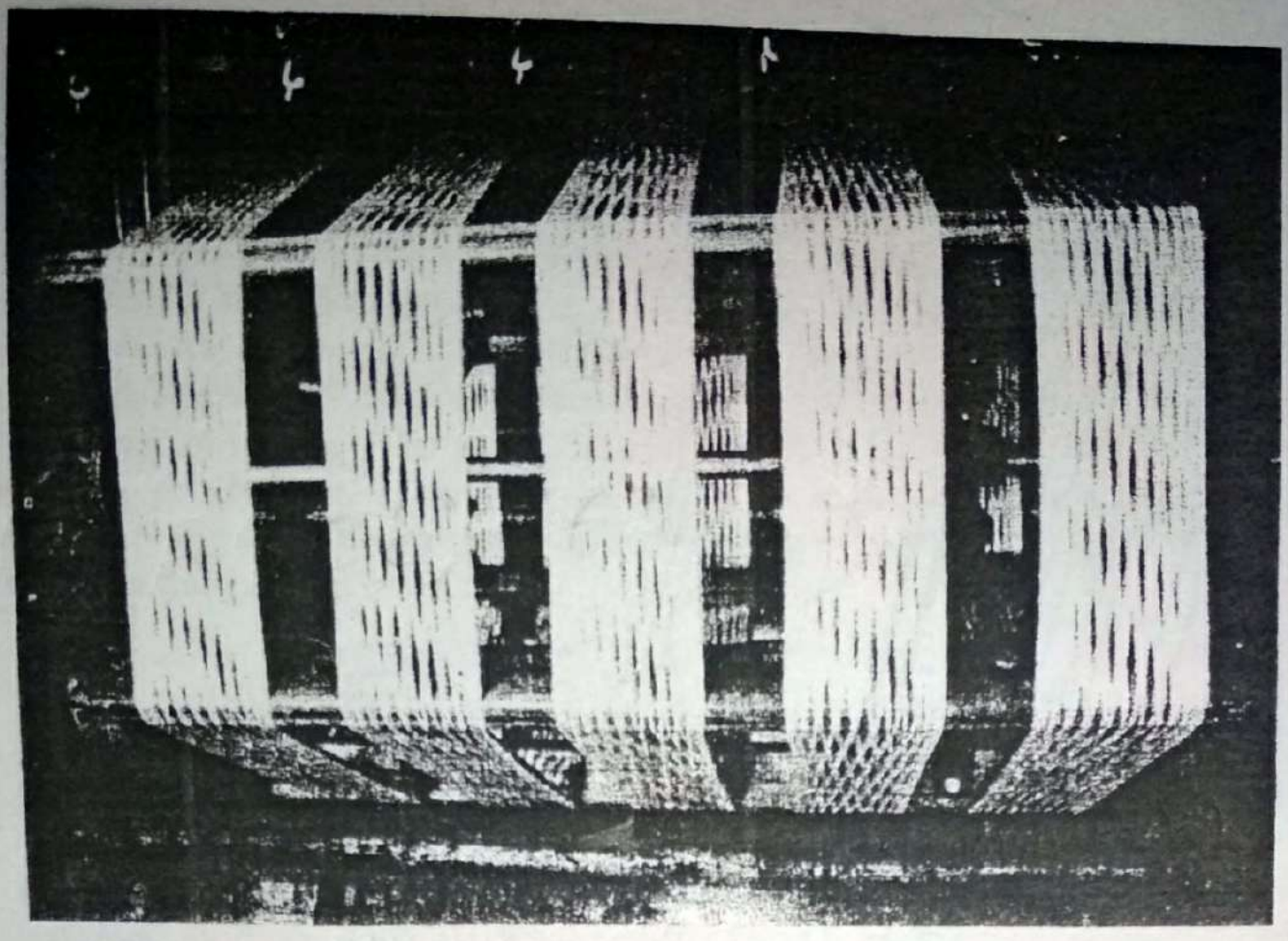

Fig. 6.3 'Diamond' pattern formation in silk hank.

(iii) Main Drive

The reel gets its drive from the main drive head situated at one end of the machine with two main shafts running all along the machine length (for a two sided machine). A drum wheel is fixed on these shafts at regular intervals, such that the wooden wheel on the reel shaft rests on the drum wheel. The reel shaft gets its rotation by the frictional contact between the drum wheel and the wooden wheel. Variable speed pulley or step pulley is provided for varying the speed of the reel. Reel brakes are provided to each reel such that the wooden wheel is disengaged from the drum wheel.

(iv) Silk Drying Arrangements

Unwinding of silk yarn on the small reels is done in moistened conditions for unwinding easily. If the moisture is not eliminated, it leads to plastering (adherence) of the threads, especially at the reel batons and yarn contact points causing gumspots which is a defect leading to yarn breakages during winding of the skeins on to the bobbins. Hence the silk has to be dried during the hank formation.

In the traditional method of re-reeling [(Fig. 6.2 (1)] burning charcoal embers are kept below the rotating reel and the heat generated by the embers dry the

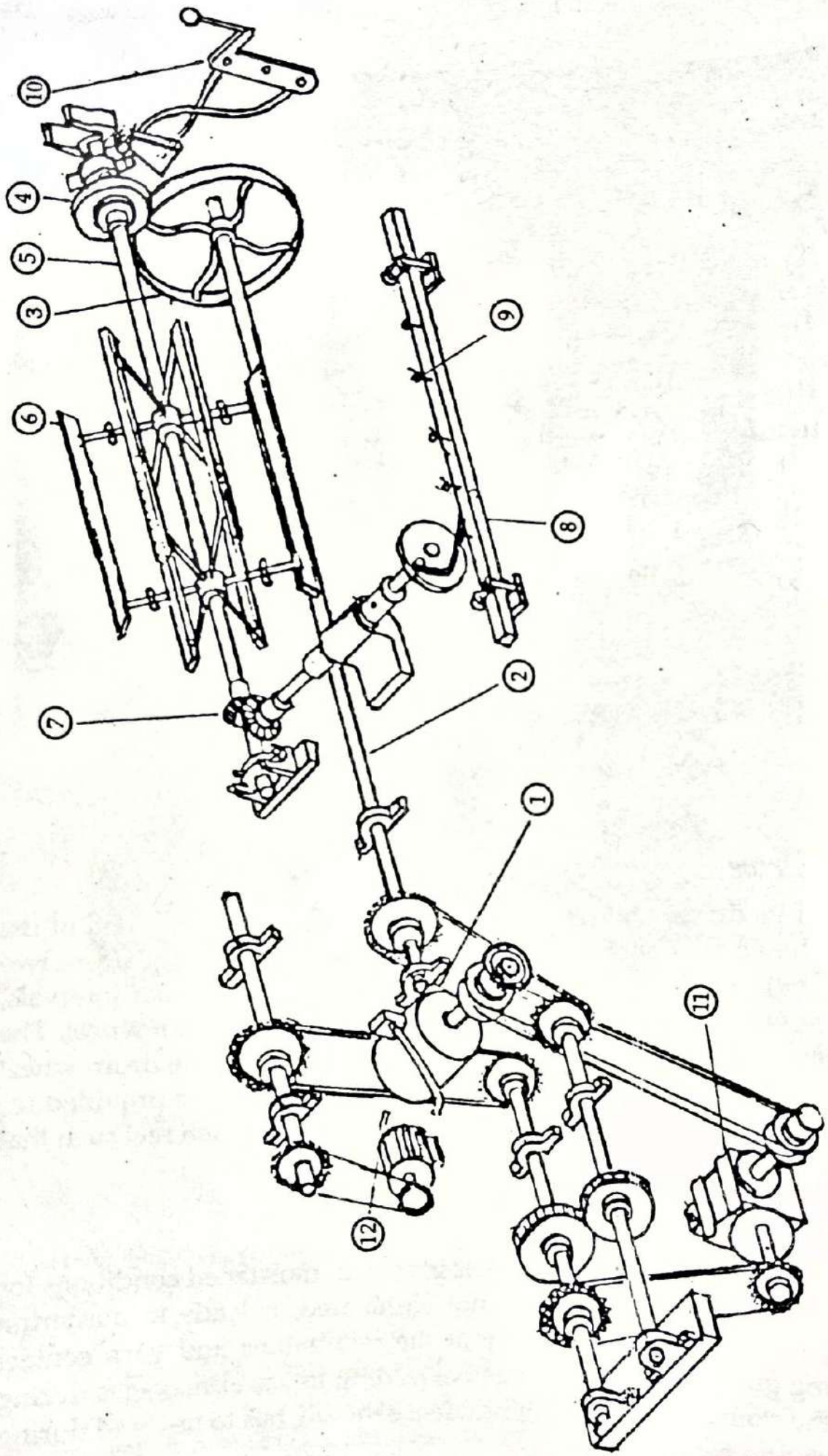

Fig. 6.4 Improved Re-reeling machine - Gear diagram

1. Motor, 2. Main shaft, 3. Drum wheel, 4. Compressed wood or Friction wheel, 5. Reel shaft, 6. Reel, 7. Bevel gears, 8. Traverse rod, 9. Traverse guide, 10. Break lever, 11. Gear box, 12. Tacho generator

silk yarn. A fine wire mesh [Fig 6.2 (2)] is provided in between the reel and the fire tray to avoid fire sparks from the embers coming in contact with the yarn.

The disadvantages of this type of re-reeling are that

—there is no uniformity in drying the silk
—heat loss is high, as the space in and around the re-reel is open
—no control over the temperature for drying
—over drying makes silk yarn rough and low drying results in gum spots.

v) Balloon Rings

Balloon rings are provided in front of the machine to avoid formation of double yarn caused by the broken yarn joining with its neighbouring end and being wound into the hank. Separating plates are also provided in some models.

6.3.2 Improved Re-reeling Machine

With the basic construction remaining the same, improvements were made in the re-reeling machine for smoother operation and drying of silk yarn (Fig 6.4).

1) In the improved version, the large reel is covered in a metal sheet enclosure. The silk passage area and the skien handling area is covered with an acrylic hood. Air vents are provided on top of the machine to eliminate humid air.
2) The brake system is modified for smooth operation and for breaking the inertia.
3) Silk is dried by the heat radiated from 5 cm diameter steam pipes running all along the length of the machine below and behind the reels. The temperature for drying can be maintained at 40 to 45°C by regulating the steam pressure.
4) Nylon bevel gears are provided for the traverse mechanism which does not require lubrication.
5) Step pulleys or variable speed pulleys are provided to change the speed of the reels.
6) The driving head is enclosed in a metal sheet at one side of the machine.

6.3.3 Re-reeling Process

The small reels with watersoaked silk is placed in front of the re-reeling machine on a stand provided for this purpose or on the floor. The ends are picked up and passed through the balloon breaker and over a smooth tension rod (usually steel rod) and through the thread guide and knotted to one of the spokes of the large reel (Fig. 6.5).

The small reels are placed on a slightly inclined platform as shown in the line sketch. In some models, stands are provided for each reel. This is to facilitate a clear unwinding of yarn without any obstruction. If not, the yarn

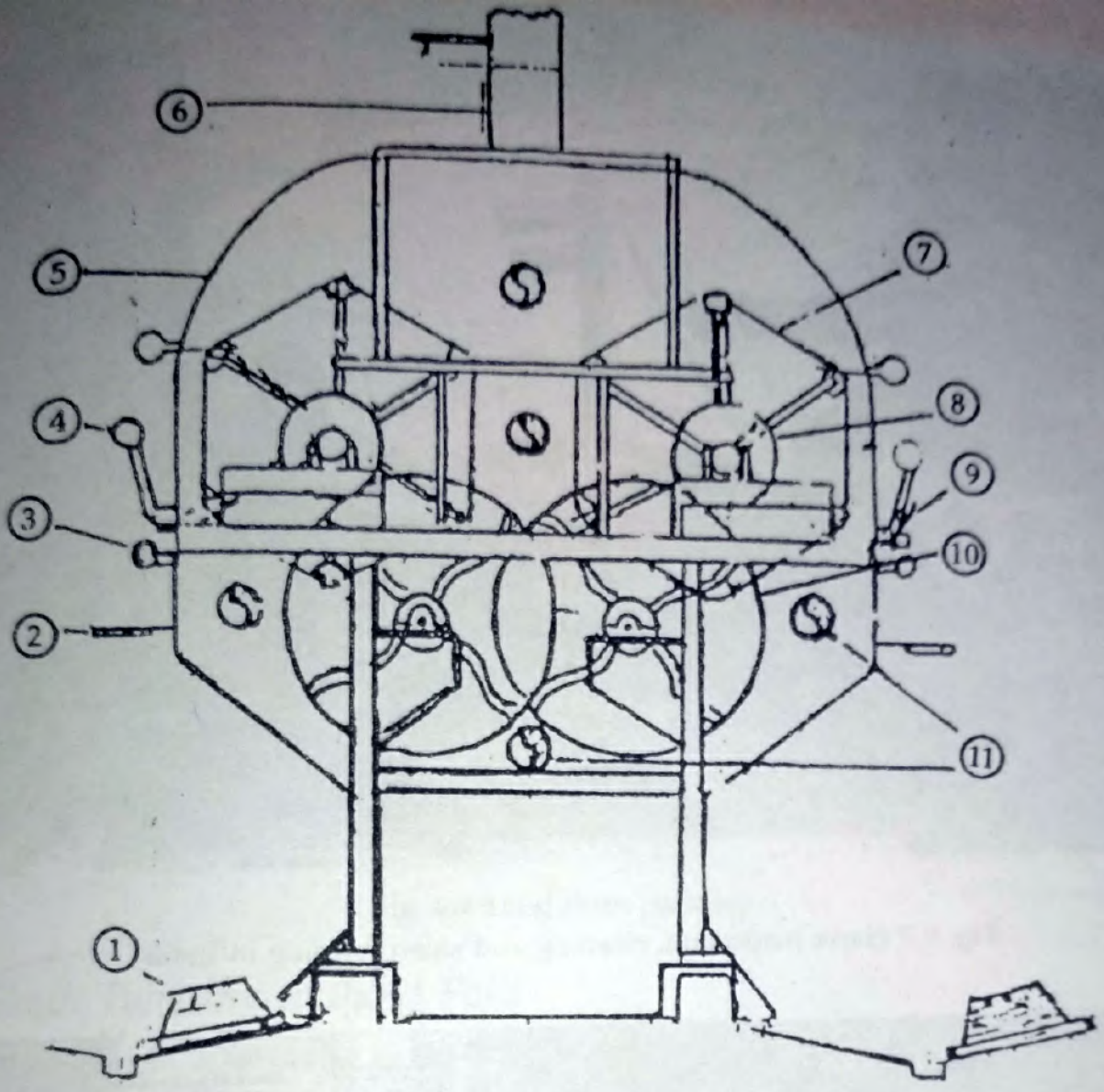

Fig. 6.5 Improved Re-reeling machine (side view)
1. Small reel, 2. Balloon ring, 3. Tension rod, 4. Brake lever, 5. Arcylic hood, 6. Vent, 7. Large reel, 8. Compressed wood wheel, 9. Traverse guide, 10. Drum wheel, 11. Steam pipe

may touch the outer side of the small reel ribs and break, thus reducing the re-reeling efficiency.

If the soaking of the small reel is not proper the yarn breaks during re-reeling. To avoid the breakages, water is sprayed on the small reel occasionally, to wet the silk.

The speed of re-reeling is also an important factor for proper drying of the silk hanks. Generally a winding speed of 200 to 225 mts per minute is found to give good results.

Temperature and humidity are important in the re-reeling chamber for drying the silk yarn. If the humidity is kept very low, the silk gets over dried, in other words, the moisture regain in the raw silk yarn decrease leading to brittleness, the yarn fray out from the hank body and it is difficult to handle such problem during finishing.

If the humidity is high in the re-reeling chamber the silk retains more moisture. Hence, the colour of the yarn become dull and lustre is reduced.

Matting or plastering of the yarns to the skiens takes place leading to hard gum spots which is a serious defect in the winding process. If silk with high moisture regain is stored, the chances of fungus infection are high.

To overcome these problems, the moisture regain of silk at re-reeling has to be maintained between 8 to 9%. In order to maintain this level of moisture regain in silk it is necessary to vary the humidity during re-reeling according to the atmospheric humidity conditions, which vary in different seasons. However action should be taken accordingly to maintain humidity in the re-reeling chamber at about 40 to 45% by varying the size of vent in the exhaust tube.

During re-reeling it is very important to knot the broken ends without wasting much time, otherwise it is difficult to obtain skeins of uniform weight. Knotting of broken threads is important to maintain continuity and to improve the general hank finish.

6.4 SKIEN FINISHING AND PACKING

6.4.1 Lacing the Skeins

After winding the determined quantity of raw silk in the hank form on to the large reel, both the ends of the hank surface and the bottom are collected and joined together and laced using a 40s count coloured cotton thread. This is done for easy identification of the end of the yarn in the hank during the subsequent process. The lacing is done across the hank width with the lacing yarn piercing the hank at 4 to 6 places at equal distance with the help of a crochet needle (Fig 6.6). Lacing is also done in between the large reel ribs using a white cotton thread. This is done in order to maintain the width of the hank intact and silk yarn from fraying out loosely and getting entangled. Care has to be taken to avoid the needle hook damaging the yarn.

After inspecting for any loose or broken ends, the hank is removed from the large reel by loosening the collapsible spokes and removing the reel from the bracket, and the hank is slid out of the reel. Care is taken to see that the hank does not come in contact with parts of the reel, to avoid staining and pulling out of the yarn.

6.4.2 Skien Conditioning, Inspection and Packing

The skien thus removed from the reels are collected in a container and taken to the inspection room.

The inspection room also serves as the conditioning, weighing and packing room. The temperature and humidity of this room is also important as the silk weighed and packed in standard atmospheric conditions of 25+ -2°C and 65+ -2% pH, so as to achieve the standard moisture regain of 11%.

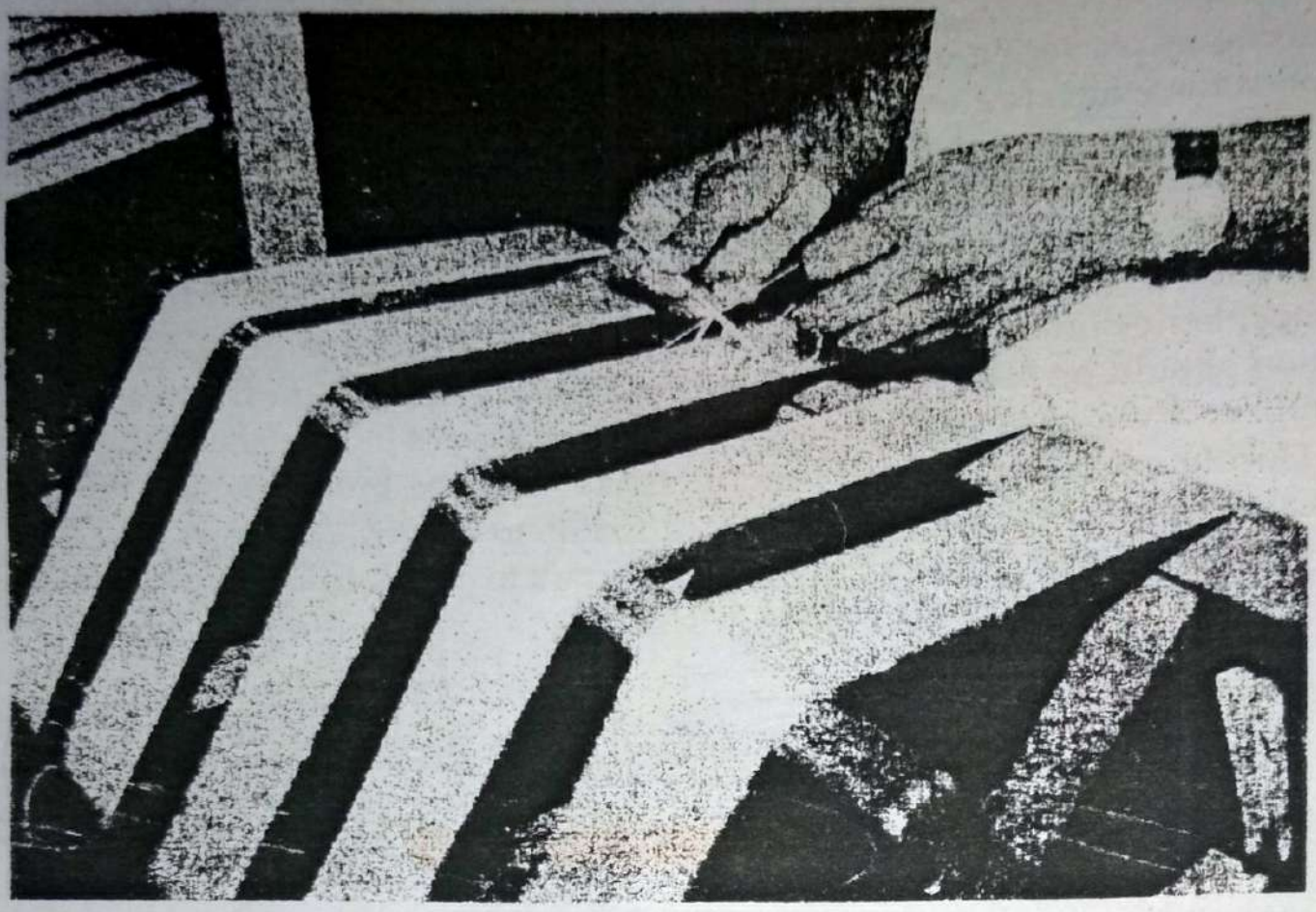

Fig. 6.6 Lacing of hank

The skiens are stored in this room for about 24 hours, for silk to regain the official moisture level.

The individual hanks are taken for inspection on a hank stand for any gum spots which are to be eliminated by gently squeezing or tweezing the hard portion and separating the threads. Such hard spots are not found if the skien is properly dried during re-reeling at a temperature of about 45°C. The loose ends and broken ends if any, must be clipped off as close as possible to the lacing.

After inspection, the skeins are given a twist before it is packed into books. This is done in order to bind all the threads together in the hank. Two types of hank packing are common.

(a) Twisting and Folding Method

The hank is twisted tight like a rope with a skeining hook folding it at the centre. The twist is allowed to untwist in the opposite direction. The two ends passed through the loop of the skein are either tied with a cotton thread or one end is passed through the loop of the other end.

The number of twists in the skein depend on the weight of the silk forming the skein. For a 140 gms of skein, 4 twists in the full length form and 2 twists in the reverse twist form after the fold is given. Whereas for a 70 gms silk

skein, 6 twists in full length form and 3 twists in the folded form are given. This method of skeining is commonly followed in India.

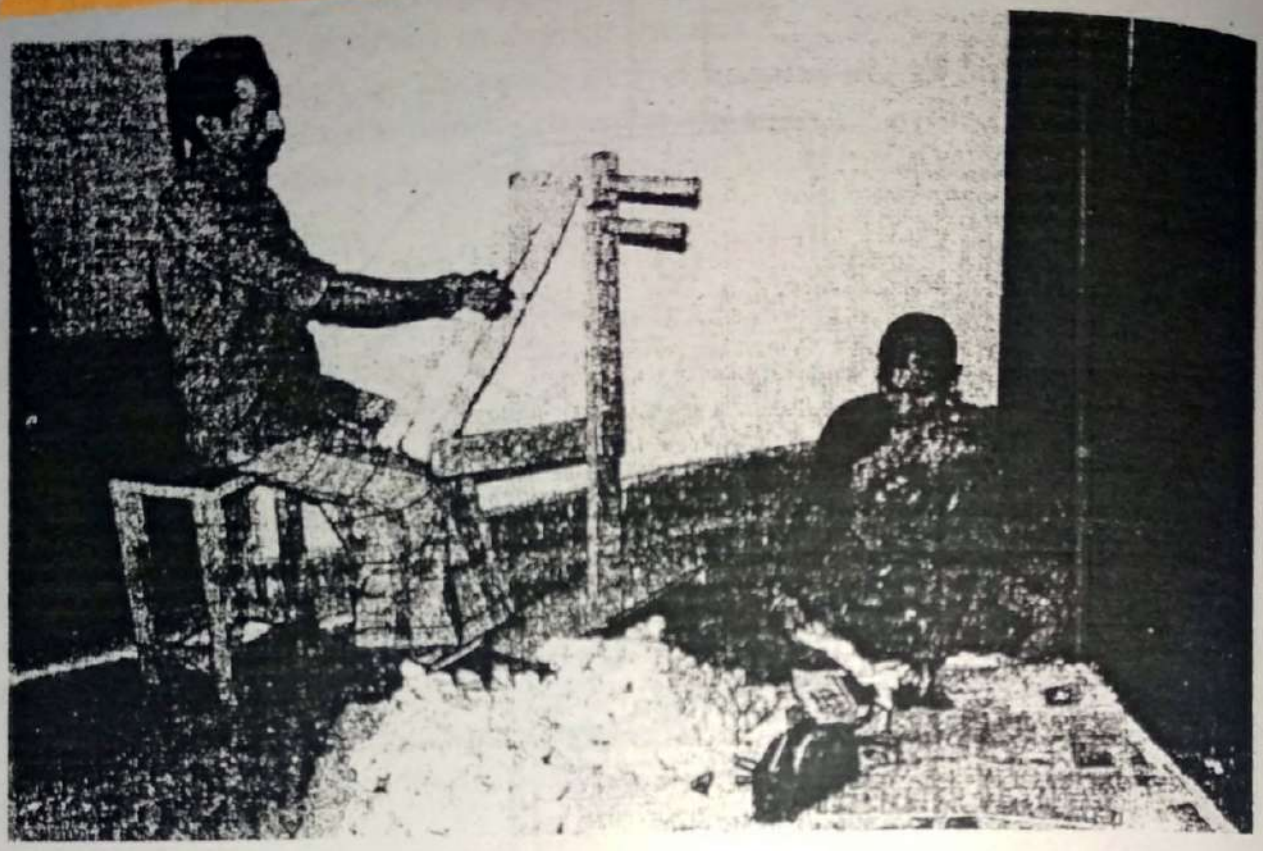

Fig. 6.7 Hank Inspection, cleaning and skien forming in India

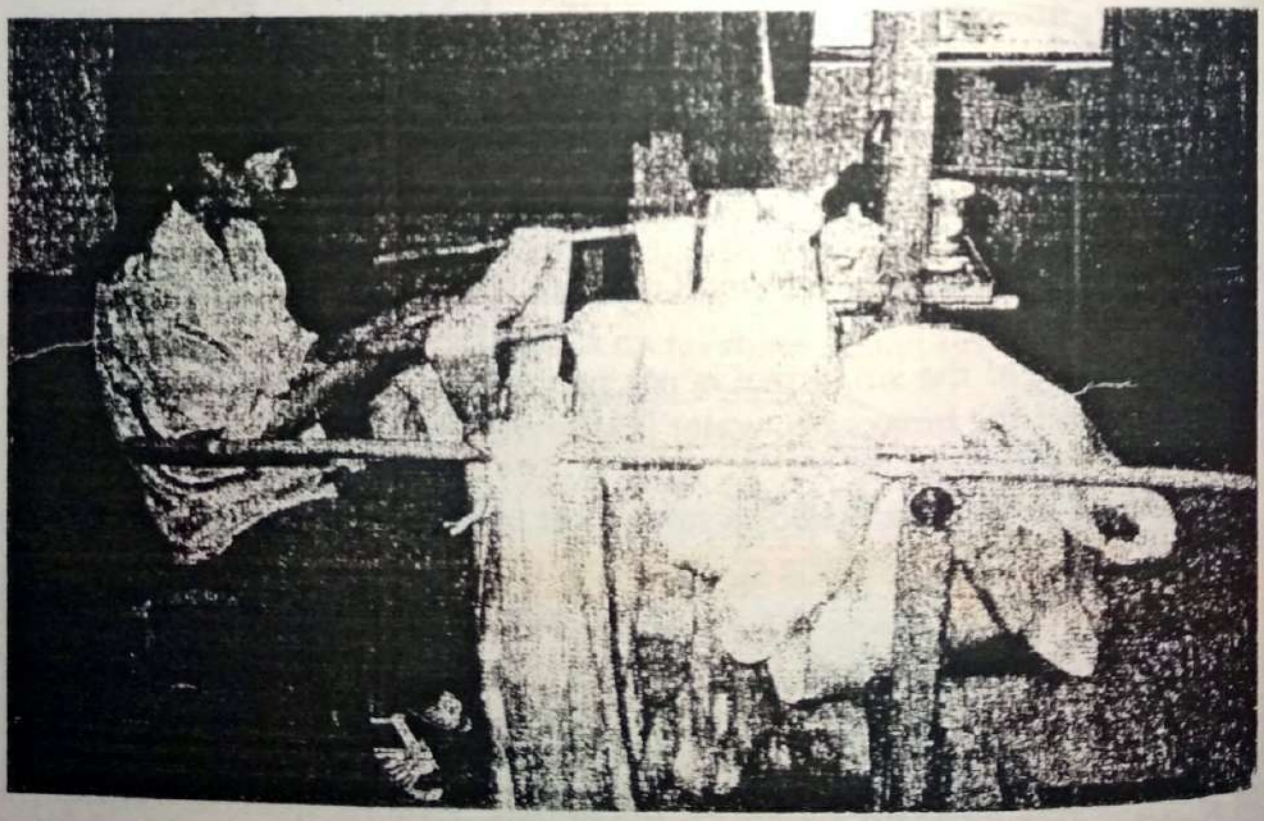

Fig. 6.8 Hank Inspection, and cleaning in China

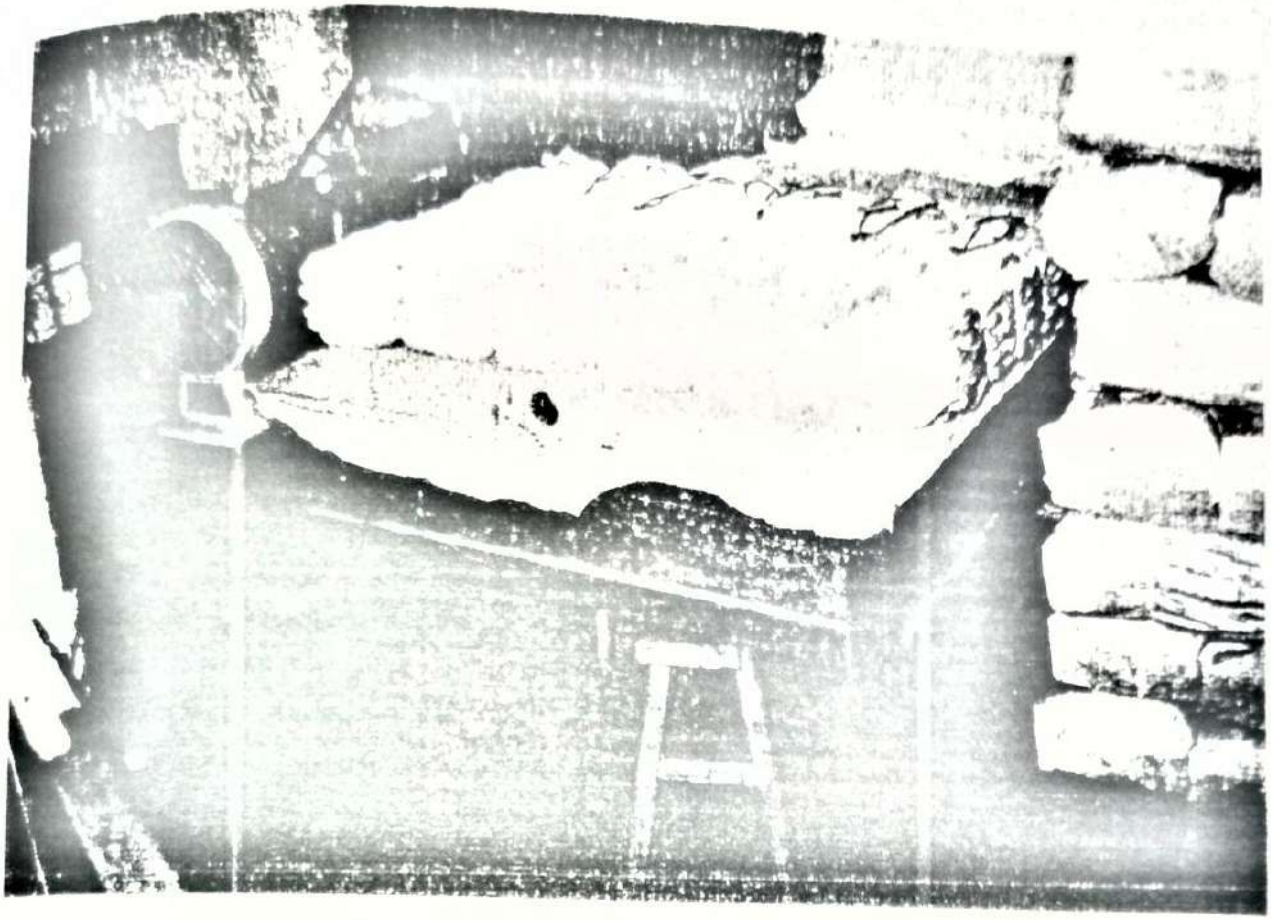

Fig. 6.9 Long skien packing

(b) Skein Twisting without Fold

Raw silk skeins are made into a long bundle. Here the hank is given 4 to 6 twists on a skein twisting stand using a smooth metal rod. After twisting both the top and the bottom, the holding rod is removed along with the silk in the silk stand and placed in a wooden book press, one beside the other to be pressed into a book.

Books of raw silk yarn is easy to transport. For packing, 16 to 20 twisted skeins are placed one beside the other horizontally in a row and columnwise set up neatly in a book-press and pressed in the booking equipment. In the compressed state, the skiens are tied with a cotton cord at four places, such that the bundle retains its compressed condition. Such books are covered with polythene sheets and covered with paper to avoid moisture, damages by insects, etc. during storage and transportation. Each book will weigh about 2 kgs (Fig. 6.9).

The books are packed in cotton or jute bags to form a bale. About 30 books are packed in a bale as per convenience for transporting. After sealing the bale, the details of the silk is pasted onto the bag.

Internationally accepted weight per bale is 60 kgs.

7.3 STANDARDS AND CLASSIFICATION OF WATER FOR REELING

As discussed earlier, depending on the concentration of characteristics of water influencing solubility of sericin in opposite directions and the requirement of the industry, standards have been formulated by the sericulturally

advanced countries. Standards applied in Japan, China and South Korea (standards given by Dr BH Kim) to water having permanent hardness are shown in Table 7.2.

Table 7.2 Norms for reeling water from Japan, South Korea and China.

	Japan		South Korea (as given by BH Kim)		China	
	Standard concent-ration	Permissible range	Standard concent-ration	Permissible range	Standard concen-tration	Permissible range
1. pH a) Original	7.0	6.8-7.4	6.9	6.6-7.2	7.0	6.8-7.4
b) Boiling	8.6-9.0	8.4-9.4	8.3	7.9-8.6	8.4	8.6-9.0
2. M—alkalinity (as $CaCO_3$ ppm)	25-30	20-60	30	20-40	25-30	20-60
3. Total Hardness (as $CaCO_3$ ppm)	30-43	9-89	50	30-70	—	—
4. Electro-conductivity (µmhos/cm)	100	30-300	100	40-300	100	30-300
5. Total residue on evaporation (ppm)	85-90	30-300	85	50-200	35-90	30-300
6. $KMnO_4$ demand (ppm)	0-2	10 or less	—	10 or less	0-2	10 or less
7. Iron (ppm)	0.1 or less	0.2 or less	—	0.3 or less	0.1 or less	0.2 or less
8. Manganese (ppm)	nil	0.1 or less	nil	0.3 or less	nil	0.1 or less

These standards are suitable for industries which use process line 3 and 4 (Refer chapter 3). Norms are used in decision making so as to decide on the location of the industry, to determine a proper treatment method etc. Since process lines 1 and 2 use different machinery and process parameters 'norms' for reeling water have to be different. Though reeling water conforming to the standards given in Table 7.2 can be used to produce a quality silk for the process lines 1 and 2 , a different set of norms are needed to be prescribed to avoid over treatment of water when it does not conform to the standards. Keeping this in view, the research institutes in India where these process lines are predominantly used, have formulated suitable standards for important characteristics. One of these is the set of norms proposed by Karnataka State sericulture Research and Development Institute. Table 7.3 shows the norms for the process lines 1 and 2.

It can be observed from Table 7.3 that total hardness is 'boot strapped' to total alkalinity so that it is always within 30 ppm of total alkalinity. It is due to the fact that both the characteristics have opposite influence on the softening of sericin. Standard concentration of hardness of water will retard the rate of softening to the desired level so that there will be sufficient time for the hot water in open pan cooking system to enter the cocoons. This would help in better and uniform cooking of cocoons. Other elements such as iron, manga-

Table 7.3 Norms for reeling water for process lines 1 and 2.

Water characteristics	Concentration
1. pH	6.5-7.5
2. Conductivity (μmhos/cm at 25°C)	100-500
3. Total alkalinity (as $CaCO_3$, ppm)	50-150
4. Difference between total alkalinity and total hardness (both expressed as $CaCO_3$, ppm)	Less than or equal to 30

nese, copper ion concentrations are to be considered to be the same as listed in Table 7.2.

7.4 CLASSIFICATION OF REELING WATER

The concentration of dissolved solids and in particular, hardness, pH and total alkalinity play an important role while determining methods for reeling water treatment. Since the concentration of these individual characteristics vary from one water to the other, classification of water becomes necessary for better understanding of their collective influence in reeling. Further, classification helps in determining a proper treatment method.

Various methods have been formulated for classification in sericulturally advanced countries.

In filature water classification by Okawa from Japan, four types are defined namely convergence, moderation, dissolution and coarseness type (Table 7.4). In the convergence type, the water is characterized by low pH and pH is increased slowly after heating. This makes cooking difficult and sericin is converged within a short time after cooking. In the moderation type, the cocoons are cooked suitably and sericin is converged properly after cooking. This type of water is suitable for reeling. High pH in original water and very high pH after heating with comparitively low hardness are the characteristics of the dissolution type of water. If this water is used, the silk production will be considerably reduced. The cocoons are over cooked and less converged after cooking. In the coarseness type, the water is characterized by large amount of carbon dioxide and M-alkalinity. This water can cook the cocoons but excessive convergence may be observed after cooking.

Table 7.4 Filature water types

Type	Influence in reeling processes
1. Convergence	Cooking is slow and converges fast
2. Moderation	Cooks properly and suitably converged
3. Coarseness	Cooks properly but over converges
4. Dissolution	Overcooks and converges less

7.6.2 Quality of Water

Management of water quality refers to adequate supply of consistent and suitable quality of water for reeling. If the consistency in the quality of water is not maintained, there will be deviations in production and raw silk quality from the expected values, even when a suitable treatment method is adopted. Therefore, quality of water is regarded as an integral part of water management. While a treatment method emphasizes the procedure for changing quality of raw water to make it suitable for reeling, a treatment system stresses on the proper implementation of the treatment method suggested by the laboratory in a filature. The two main treatment systems that can be used in a filature are batch system and continuous system. Though both systems can be used for any treatment method, the batch system is most suitable when the quantity of water required is less than 5000 litres of treated water per shift of 8 hours and in addition, it is useful in treatment methods such as the sequestering method, the lime soda method, the acid treatment method etc. Likewise the continuous system is preferred for a large filature where a large quantity of water is required and also when mixing of raw and treated water is involved. Batch system can be further divided into three types namely monotank system, dual tank system and multitank system. Figures 7.4, 7.5 and 7.6 are the examples of these systems respectively.

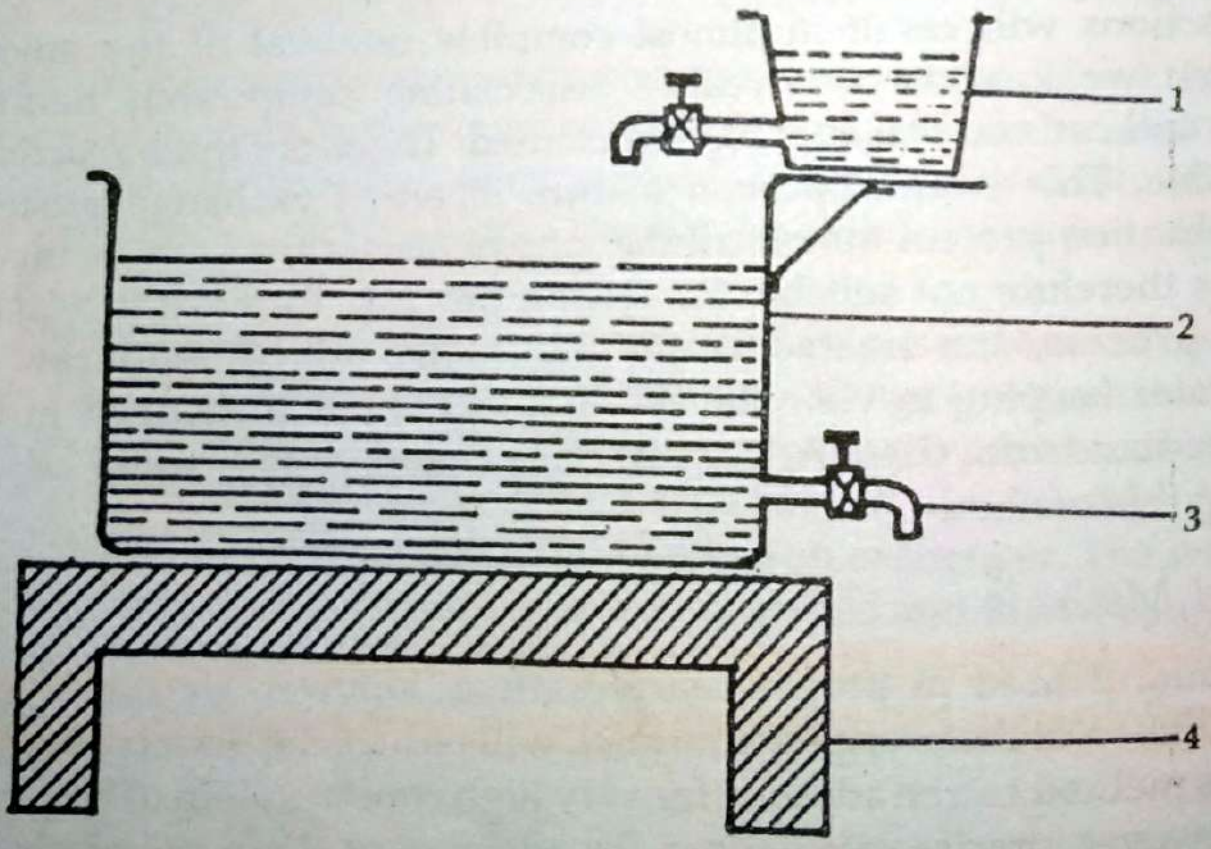

Fig. 7.4 Monotank system

1. Preparation vessel (optional), 2. Tank, 3. Feed water outlet, 4. Stand for placing the tank

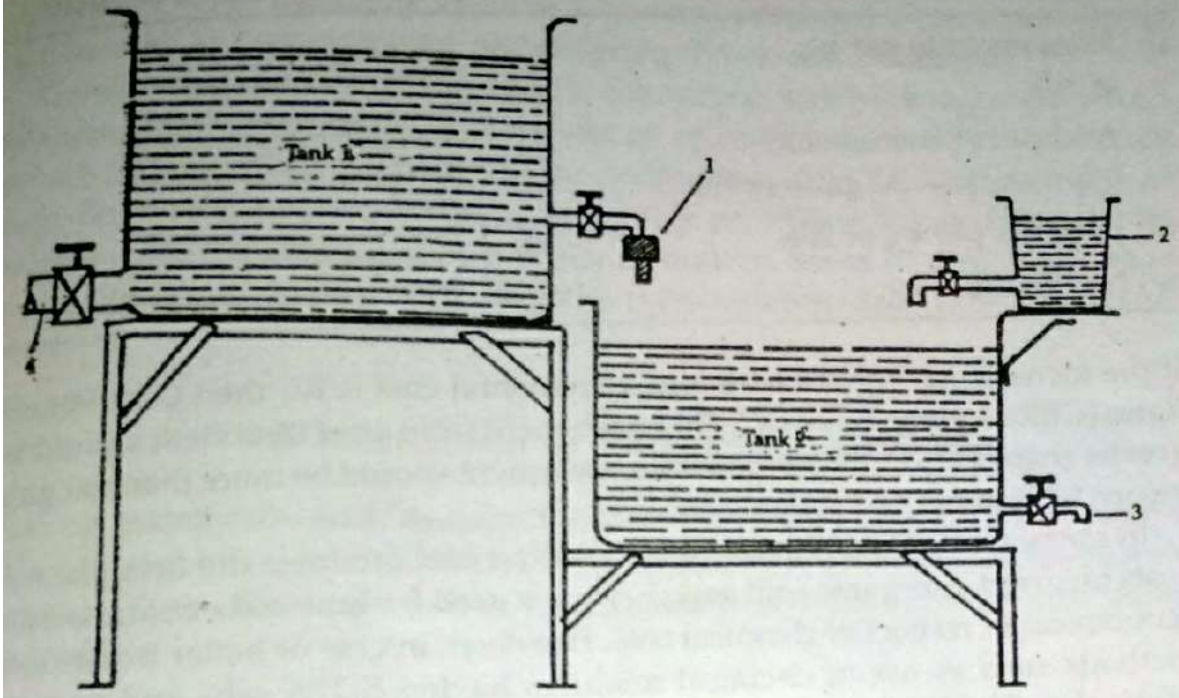

Fig. 7.5 Dual tank system
1. Treated water from first tank, 2. Preparation vessel,
3. Outlet for removing precipitate or sludge, 4. Treated water outlet.

The monotank system can also be used for the ion exchange method of treatment. In this case, the raw water is first filled to a predetermined level and then it is mixed with the treated water from ion exchangers.

The main disadvantage of the monotank system is that it requires a comparitively large sized tank even for a small size filature, as at least half a shift's water requirement needs to be treated at a time. The dual tank system can be used when requirment of water exceeds 3000 ltres/day. In this system

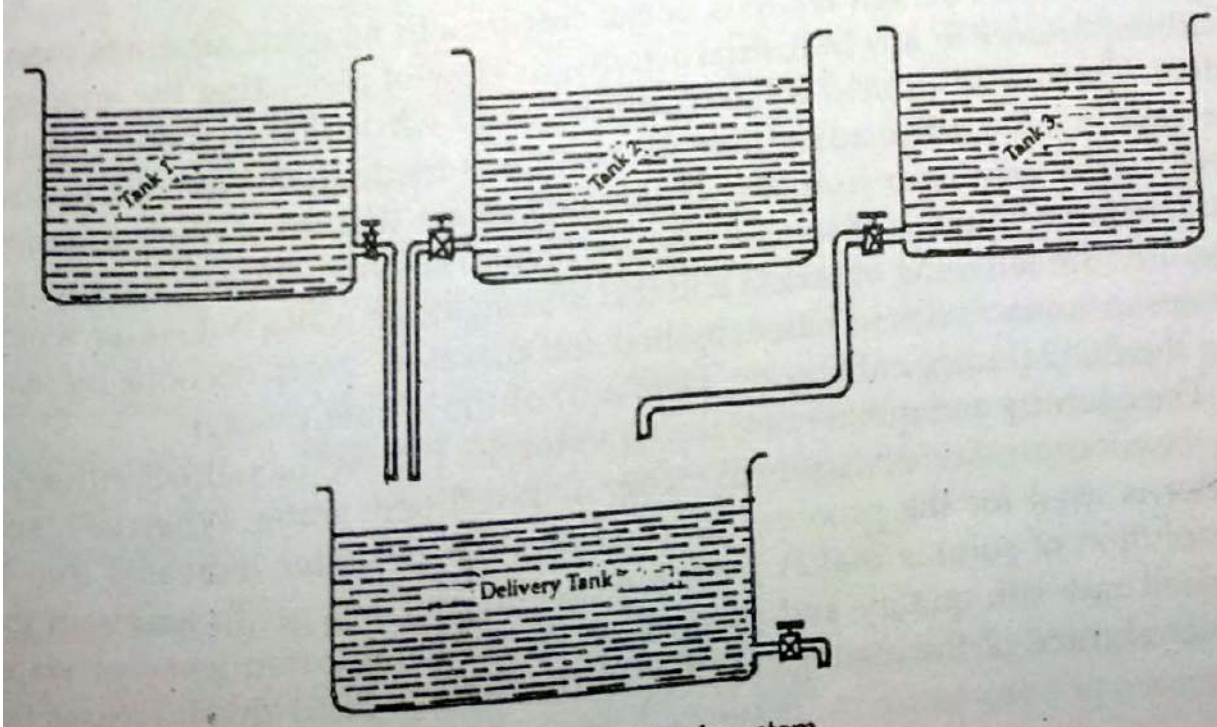

Fig. 7.6 Multitank system.

one of the tanks is used as a treatment tank and the other as a delivery tank. If the tank sizes are properly determined this system provides constant supply of treated water throughout the day and treatment can be made in small batches. Dual tank system can be used for lime soda treatment. In this case, lime soda treatment is given in tank 1 and alkalinity and pH corrections are made in tank 2. The multitank system is suitable for filatures requiring a large quantity of water. This system can be used as a substitute for the continuous system when sequestering or acid treatment method is required. Tanks 1, 2 and 3 are comparitively smaller in size and are used as treatment tanks. Figures 7.7 and 7.8 depict examples for the continuous system.

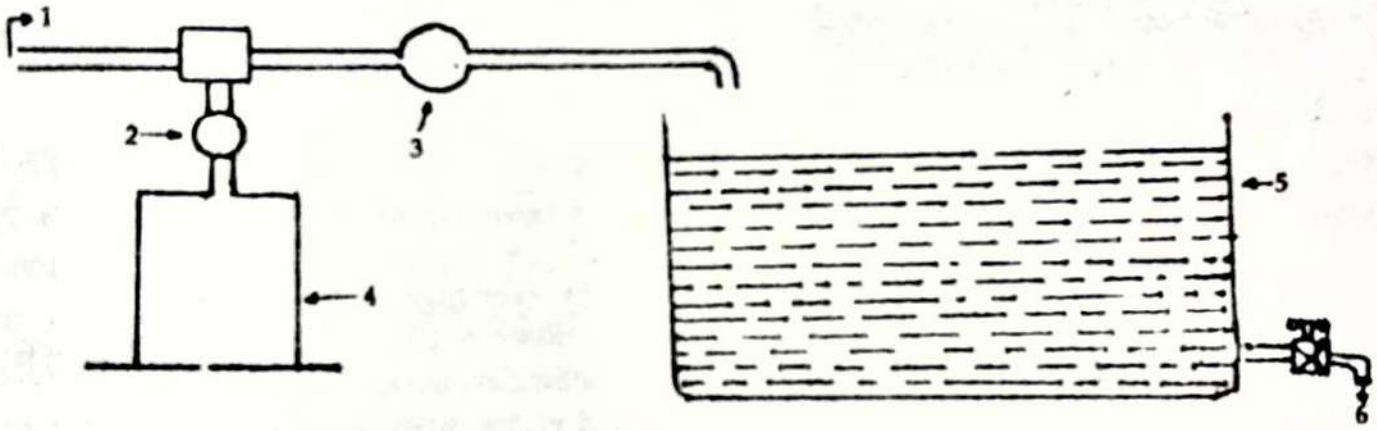

Fig. 7.7 Continuous sytem using sequestering method
1. Raw water inlet, 2. Dosing adjustment, 3. Flow meter, 4. Doser, 5. Delivery tank, 6. Outlet

Figure 7.7 shows the application of the sequestering method of treatment using a continuous system and Fig 7.8 shows the use of ion-exchange method and the mixing of water in this system. Sometimes a combination of batch and continuous systems may be required. This type of blended system is useful when a group of reelers in a place want to use treated water from a common source. In such instances, the treatment plant has to be installed at a common place using a continuous system and individual reelers can feed this water to tanks in their respective filatures and further treat the water for finer corrections suitable to their material and machines by adopting the batch system.

EFFECTS OF WATER QUALITY

7.4.2 Influence of each Class of Water in Reeling [as per KSSRDI classification]

i) Effect of Class A and Class D Water

As observed from Table 7.7, total hardness is more than total alkalinity in these types of water. Therefore, the effect of total hardness is predominant in such kinds of water. When class A or class D water is used for charaka reeling poor reelability and low raw silk production will result. The intensity is more when the difference between total hardness and total alkalinity increases. Since class D water has more ionic concentration, the silk becomes rough. When these types of water are used for the process line 2, it will result in increased duration of cooking, low brushing efficiency, poor reelability, higher wastage, less raw silk production, uneven yarn, etc. For class D water, silk becomes rough and less lustrous. If the difference between the characteristics is less many of the problems listed will be minimized.

ii) Effect of Class B and Class E Water

In these classes of water both the characteristics namely total hardness and total alkalinity are near to each other and therefore problems during cooking and reeling are comparitively less. However, class E poses more problems due to higher concentration of dissolved substances. The water belonging to these classes can be treated by ion exchange method and mixed to produce standard water for reeling.

iii) Effect of Class C and Class F Water

These types of water are characterized by high alkalinity and correspondingly lower hardness. The original water pH may also be slightly higher when compared to other types of water. In these types of water, effect of alkalinity is more prominent than the other characteristics of water. When these types of water are used in charaka where cooking and reeling are done in the same bath and at higher temperature, there will be a greater loss of sericin. In process line 2, less cooking time, high incidence of slubs, split ends, etc. are the few observations that can be made. However, this type of water is more suited to reeling of melted cocoons since the dissolved matter from

the cocoons are acidic in nature. In class F water, as there is a chance of higher difference between the characteristics, the intensity of the problem may increase correspondingly.

iv) Effect of Class G Water

This type of water is characterized by very high concentration of dissolved solids. High concentration of salts in water will lead to low reelability, more wastage, reduced raw silk (%), production of uneven yarn, etc.