6. *Weight of cocoons* : This is an important aspect because the cocoons are sold by weight. The weight of a cocoon is influenced both by its racial character and by the rearing conditions, especially, the quality of food. It decreases from the time of spinning till the emergence of the moth. It is necessary, therefore, to see that the cocoons are sold in the middle pupal period to get optimum returns. Selling the cocoons too early, in an attempt to have a higher weight for the cocoons, is not desirable as this will increase their renditta value and decrease the selling price. Delayed selling will result in lower returns as the weight of the cocoon will be reduced. The weight of Indian Cross Breed multivoltine cocoon is in the range of 1.1 to 1.4 gms and that of the bivoltine commercial hybrids is 1.6 to 1.8 gms.

7. *Shell weight* : Shell weight is more important than cocoon weight because it is the shell that yields the silk. The average shell weight of the commercial multivoltine hybrids is about 0.15 to 0.25 gms and that of bivoltine is 0.30 to 0.50 gms.

8. *Shell ratio* : Though entire cocoons with the pupa inside are marketed, only its shell is used for silk production. Therefore, the cocoon to shell ratio is assessed for fixing the price. The cocoon-shell ratio is expressed in percentage and is calculated by the formula

$$\text{Shell Ratio} = \frac{\text{Weight of the cocoon shell}}{\text{Weight of the cocoon}} \times 100$$

Compared to the shell ratio of 15–25% of Japanese bivoltines, indigenous Indian pure multivoltines have only 10–12%. This has been improved to 13–17% in the newly-evolved hybrid multivoltine races. It is in the range of 18–23% in the commercial bivoltine races.

9. *Length of the filament* : This is measured by reeling silk thread from a single cocoon on a single cocoon reeling machine called

Epprouvette. The average total length of filament in a single cocoon is 300 to 400 m for Indian multivoltine pure races, 400 to 650 m for Indian multivoltine hybrids, 800 to 1,200 m for Indian multivoltine Cross Breed and 1,000 to 1,600 m for Bivoltine cocoons.

10. *Non-Breakable Filament Length* : It represents the average length of the filament from a cocoon that can be unwound without any breaks. It is calculated by the formula

$$\text{NBFL} = \frac{\text{Weight Filament Length}}{1 + \text{Number of Breaks}}$$

11. *Filament Denier* : Denier is the unit used to denote the thickness of silk filament. It is the weight of 9,000 m length of silk expressed in gms. The filament denier decreases from outside to the inside of the cocoon regularly. Wide variations in filament denier are not desirable. The value of denier varies from 1.7 to 2.8 gms. It is calculated by using the formula

$$\text{Denier} = \frac{\text{Weight of the filament (g)}}{\text{Length of the filament (m)}} \times 9{,}000$$

Filament denier is used to estimate the number of cocoons required to reel the silk of a specific denier. Filament denier is measured using an epprouvette and a denier scale.

12. *Floss percentage* : Floss is an entangled loose filament around the cocoon shell and it is unreelable. Generally floss percentage is determined on shell weights. Multivoltines have a higher floss percentage (8 to 12%) as compared to bivoltine cocoons (2 to 5%).

13. *Renditta* : The number of kilograms of cocoons required to obtain 1 kg of reeled silk is called renditta. Multivoltines have a renditta value of 8 to 14 while bivoltines have a value of 6 to 8.

REELABILITY PERCENTAGE :-

The reelability denotes the percentage in ratio of length of non-broken filament to entire length of cocoon filament. This is an important character of cocoon in reeling. It is remarkably different

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in different silkworm races. Temperature and humidity also influence it, particularly humidity provided during mounting.

Cocoon ~~with~~ with good reela-bility require less number of end-fee-ding in a unit time and lesser size deviation in raw silk. Higher quality raw silk can be produced with reduced rendita. Reelability has a major relationship with production and quality. Reelability is usually expressed by the length of non-broken filament length. Generally, longer a non-broken cocoon filament length, higher is the reelability. This indicates that higher the reelab-ility percentage higher is the raw silk quality.

PROPERTIES OF SILK

Physical properties:

1) MICROSCOPIC APPEARANCE OF SILK FIBRES

The cross sectional view of the mulberry silk is the cocoon filament of *Bombyx mori* is roughly elliptical, showing the two triangular brins completely surrounded by sericin, normally facing by each other with the flat side of the triangle. The longitudinal view show a very irregular surface structure mostly in the sericin layer which consists of transverse fissure, creases, wrinkle fold and uneven lump. The longitudinal view of the degummed fiber show a smooth structure less, translucent filament with occasional constriction as well as swelling or lumps.

The Microscopic appearance of the wild TASSAR SILK is very different from that of Bombyx mori. The fiber are broad and show distinct longitudinal striations, also peculiar flattened marking, usually running obliquely across the fiber .The striated appearance of the WILD SILK indicate that structurally the fiber is composed of minute filament often referred to as fibrils or micelles.

2) **HYGROSCOPIC NATURE:** Silk is highly hygroscopic in nature. Silk has a regain of 11% at 65%RH & 27 degree Temp. Degummed silk is somewhat less hygroscopic in nature since sericin has a great power of absorbency moisture than

the fiber proper. The regain of degummed silk is regarded as about 9-25% at standard atmospheric condition. A temp. of 140 degree Celsius or 120 degree C.

Type of fiber	Moisture content
Raw cotton	8.5
Jute	13.75
Sheep wool (washed)	16
Sheep wool (dry)	18.25
Silk (dry)	11
degummed (9-25%)	

3) **TENACITY AND ELONGATION:** Tenacity indicates the quantity of weight a given fiber can support before breaking. The typical tenacity of bave is 3.6 to 4.8g per denier. Degummed silk has a greater tenacity than raw silk.

Types of fiber	Strength kg/mm2	Elongation %age
Raw cotton	37.6	7-9
Silk	44.8	20-25
Sheep wool	10.9	26-33
Jute	41.44	1.3-1.4

ELONGATION;- Define the length to which a fiber may be stretched before breaking. Raw silk has an elongation of 18 to23% of its original length. Excess moisture increases the elongation of silk, but decreases its tenacity.

4) **SPECIFIC GRAVITY:** The bave specific gravity on an average of sericin and fibroin measure from 1.32 to 1.40.Generally, the specific gravity of sericin is slightly higher than that of fibroin (SEE RAW SILK TABLE BELOW).

Type of fiber	Specific gravity
Raw cotton	1.57-1.52
Java cotton	1.4
Sheep wool	1.25-1.35
Silk (natural)	1.30-1.37
Silk (degummed)	1.25-1.36
Jute	1.44-1.48

(5) **ELECTRICAL PROPERTIES:** Silk is a poor conductor of electricity and accumulates a static charge from friction. This trait can render it difficult to handle in the manufacturing process. This static charge can be dissipated by high humidity or by manufacturing at R.H of 65% at 25 degree Celsius. Based on its insulating properties, silk is used as extensively as covering wire in electrical equipment.

Chemical properties

1. **Action of heat** ;-Silk will stand a higher temperature without injury or danger of decomposition .It can be heated to140c.At 170c however it is repeatedly disintegrated ,on burning it liberate an odor similar to the burning of hair.
2. **Action of acid**;-Silk rapidly absorbs dilute acid from solution & in so doing increases in luster & acquire the scroop which is characteristics crackling sound emitted when the fiber is squeezed or pressed. Silk protein like wool, can be decomposed by strong mineral acid conc. Sulphuric acid & Hydrochloric acid dissolve silk and nitric acid color silk yellow.

Acid of alkalies: silk is not sensitive to dilute alkalies as wool but the lusture of the fiber somewhat diminished. When treated with strong hot caustic alkalie the silk

fiber dissolves. Ammonia & soap have no effect on silk beyond dissolving the sericin though on long continued boiling in soap, the fibroin is also attacked

4. **Effect of organic solvent**: cleaning solvent & spot removing agent like carbon tetrachloride, triethanolamine, acetone, etc .don't damage silk.

5. **Effect of sunlight**: sunlight tend to accelerates the oxidation & result in fiber degradation & destruction

6. **Oxidation:** Reports regarding the oxidation of protein are rather meager since the rxns. Are very complex. Oxidizing agent may attack protein in three possible points.

a) *At* the side chains.

b) At the N-terminal residue

c) At the peptic bonds of adjacent amino gps.

Assessment and grading of cocoon

Cocoon assessment :- its not compulsory but ocassineally done. 100 gram fresh cocoon are randomly taken . cocoon are cut individually by simple cutting machine projectd cocoon ends is cut by blade which is fixed to a moveble arm and weight of shell is made for assessing shell percentage.

Grading point:point will given corresponding to filament length and reelability percentage as given below.

The total point obtained from the filament length reelability percentage should be referred to the under mentioned list to be classified for said cocoon.

Grade	super	1st grade	2nd grade	3rd grade	4th grade
points	91.5	91.0 90.5	90.0 89.5 89.0	88.5 88.0	87.5

Generly the pice difference b/w the two grade is in order of 7-8 yr/kg of cocoon.

After testing certificate of grade is given by testing authority. Reeled silk & left at cocoon are returned to concenerd filature personnel. Who is going to purchase the particular cocoon lot and filature pay the cocoon price to the farmer alongwith rest of cocoon transation .

Grading point according to length of filament.

Length of filament	Less than 890	891-960	961-1030	1031-1100	1101-1170
Points	38.0	38.5	39.0	39.5	40.0
Length of filament	1171-1240	1241-1310	1311-1380	1381-1450	Above 1451
points	40.5	41.0	41.5	42.0	42.5

Grading points according to reelability percentage

Reelability %	Less than 39	40-46	47-53	54-60	61-65	66-70	71-76	77-80	80-85	More than 85
points	47.0	47.5	48.0	48.5	49.0	49.5	50.0	50.5	51.0	51.5

Cocoon testing and grading in india/~~and japan~~

Cocoon testing and grading may be accomplished with a compact automatic reeling machine as well as multiend reeling machine which is a typical equipment

in major sericultural countries. Testing and grading method is some what simple in india.

→ The ~~quality~~ quantity of fresh cocoon which are taken out of lot for testing purpose depending upon the actual weight of lot on offer.

The cocoon on offer is divided in to three batch:-

1. Batch weighing upto 1000 kgs.
2. Batch weighing upto 2000 kgs.
3. Batch weighing upto 4000 kgs.

The simple size of fresh cocoon are taken out of each batch for testing as follows:-

1. 1st batch – 2.0 kgs
2. 2nd batch – 4.5 kgs.
3. 3rd batch – 6.0 kgs.

In case of dry cocoon the quantites are taken out for testing from each batch are as follows:-

1. 1st batch up to 400kgs of dyr cocoon – 0.8 kg taken out for testing.
2. 2nd batch up to 800 kgs of dry cocoon – 1.8 kgs taken out for testing.
3. 3rd Batch up to 1600kg and over – 2.4 kg are taken out for testing.

In india there are only one type of test are mainly conduct :-

1. Visual test. (2) Estimated renditta constant. (3) Cocoon price testing or cost of cocoon per Kg.

GRADING OF COCOON FILAMENT LENGTH

Length of filament	Below 920	921-990	991-1060	1061-1130	1131-1200
Mark	33.5	34.5	35.5	36.5	37.5
Length f fli	1201-1340	1341-1410	1411-1480	1481& over	
mark	38.5	39.5	40.5	41.5	

2. Grading of cocoon with reeliability percentage :-

Reelability%					
multiend	Below 39	40-45	46-51	52- 56	57-62
Automatic	Below 34	34-39	40-45	46-51	52-57
mark	43.5	44.5	45.5	46.5	47.5
Reelability%					
multiend	63-68	69-73	74-80	81-86	Over 87
Automatic	58-63	64-69	70-76	77-82	Over 83
mark	48.5	49.5	50.5	51.5	52.5

GRADE

Grade	A	B	C	D	E
Result	Over 90	88-89	86-87	84-85	Below 83

18.1 Transport of Cocoons

The harvested cocoons have to be transported to the centralised marketing centres. While transporting the live cocoons in a heap or in a closed bag or container, the pupae often suffocate, resulting in perspiration. The perspiration, being alkaline in nature, affects the sericin layer of the cocoon filament, which results in poor reelability.

During transportation, if there are too many jolts and if violent changes in climate occur, the pupae inside may die. If the cocoons are packed too compactly they die due to excess pressure. Fluid oozing out of dead pupae will dissolve the sericin of the other cocoons and will stain and harden them and all these result in poor reelability.

Before packing, defective cocoons such as melted and flimsy ones, should be removed, because they are more easily damaged and will spoil the lot.

The container should be so designed as to provide enough aeration, prevent jolting and crushing of the cocoons. Perforated

13. *Renditta :* The number of kilograms of cocoons required to obtain 1 kg of reeled silk is called renditta. Multivoltines have a renditta value of 8 to 14 while bivoltines have a value of 6 to 8.

Yet another aspect of cocoon marketing that needs drastic modification is the method of fixing the floor price. Quality is assessed only on the basis of shell ratio and visual inspection of the lot. Though the elaborate procedures followed for this purpose in Japan and other countries may not be feasible in our country, the simple procedures evolved by CSTRI can be enforced throughout India. They have evolved certain constants that can be used for estimating the renditta from the shell ratio. The constants suggested by them are–

165 for cocoons with shell ratio of 14–16%
150 for cocoons with shell ratio of 17–20%
133 for cocoons with shell ratio of 21–23%

The renditta can be estimated by the formula

$$\text{renditta} = \frac{\text{constant}}{\text{shell ratio}}$$

For example, if the shell ratio of a lot is 15, then its renditta is 165/15 or .11. These constants have to be modified to take into account the number of defective cocoons which will lower the renditta value. Defective cocoons are assessed by taking 100 cocoons from a random sample and counting the number of defective cocoons. If these are less than 5%, the constants can be used directly or after certain modifications. From the renditta value obtained the price is fixed by dividing the kakane cost (the standard cost of cocoons required to reel 1 kg of raw silk) by the renditta. If the kakane cost of a specific race is Rs 800/-, then the price of the above lot will be 800/11 or Rs 72.75/kg. The renditta value is a more dependable guideline for fixing the price than mere shell-ratio.

This way of fixing the floor prices will benefit the reeler by assuring him of the quality of the cocoons and enabling him to go in for better cocoons to produce better quality silk. It will also benefit the rearer who is assured that if his cocoons are of better quality, he will get a better price.

19.10 Reeling Appliances

Though three types of reeling appliances, namely charkha, cottage basin and filature basin are used in India, nearly 50% of raw silk production is of charkha origin, 40% comes from cottage basins and only 10% from modern reeling units. This clearly shows that in India reeling is a predominantly rural activity though sophisticated multi-end reeling machines and automatic reeling machines have been introduced in the public sector. This is also one of the reasons for the poor quality of raw silk as judged by international standards. For export purposes, the raw silk should be in the grade of 2A, A, B or C, but Indian silk is below the grade of H. The focus of attention at present is on improving the raw silk to a gradable quality.

19.10.1 Country Charkha (Traditional Charkha)

Charkha reeling system is a floating system of reeling similar to Italian systems. It is suitable for reeling inferior quality cocoons and most of the defective cocoons encountered in Indian markets. But the silk reeled by this system is of poor quality.

This manually operated simple and cheap reeling machine is traditionally home-made, using material available locally in the village with the help of the village carpenter and blacksmith. This is generally installed in the backyard of houses or in simple sheds. Generally, each reeling unit has 5 or 6 charkhas. Each charkha consists of three parts, namely, a mud platform, a distributor and a reel.

The mud platform is rectangular in shape (60 × 120 × 90 cms), and has a built-in fireplace on which a mud pot or a copper vessel (45–50 cms dia) is buried up to its brim. This vessel is used both as the reeling and the cooking basin. Water in the vessel is heated by burning firewood, paddy husk, peanut shells or dry twigs. The fireplace has a chimney for the escape of smoke.

Securely fixed at the end of a thin, long stick, leaning against the front edge of the mud platform, is the thread guide called **tharpatti** with many apertures for the reeled silk to pass through. It rests just above the basin. **The distributor is a wheel which revolves on its vertical axis.** A cord belt connects the wheel to the reel. The wheel is operated by a second person called turner. **The revolution of the distributor makes a wooden rod called traverse to move** backward and forward. The traverse rod is placed parallel to the front edge of the platform and about 20–25 cms above it. Small wire loops, placed at regular intervals along the length of the tranverse rod, serve as guides for the reeled threads passing to the reel. When reeling is in progress, the traverse rod moves briskly to and fro in front of the reel and distributes the silk on it evenly after making the cross-winding to effect the chambon type of croissure.

Each reel can accommodate about four ends. The reeler takes a handful of cocoons and puts them in the water kept at boiling point in the basin for cooking. After cooking, he removes the floss with the help of a stick and collects the ends of all the cocoons. He holds them in a bunch in one hand and takes the filaments from the required number of cocoons and passes them through the aperture in the tharpatti as a single thread. After the thread passes through the tharpatti, two threads emerging from two apertures are intertwined in the form of a croissure and fed to the charkha reel through two distributor guides. The thread so formed is attached to the reel and the reel is rotated manually by a separate turner.

Disadvantages in Using Country Charkha: This is suitable for reeling only limited amounts of cocoon as there are not special storage facilities. The reeled silk is coarse and of poor quality because there are no devices for maintaining uniform denier. It is not re-reeled to remove defects like loose end. It shows poor evenness, cleanness, cohesion and winding qualities. Reeling is done in water of high temperature and harms the reeler. Charkhas of different regions are different and the silk reeled from them are also different and so there is no uniformity in charkha silk. Smoke and dust from the chimney fall on the cocoons and the silk and

spoil their lustre. As the same basin is used for cooking and reeling, the water in it gets turbid quickly and affects the quality of the silk reeled.

Main Reasons for the Popularity of Charkha Reeling : It is the traditional method of reeling passed on from generation to generation. No special training is needed. The charkha is cheap, occupies less space and can be made by the reeler himself. The per unit cost of production in charkha is very low (only Rs 15/kg compared to Rs 20–25/kg in cottage basin reeling and Rs 50–80/kg in filature units). Amount of silk reeled per reeler is higher (up to 1 kg/reeler compared to 800 g/reeler in the other appliances). Defective and inferior cocoons including urinated cocoons can be reeled economically only by this appliance. The raw silk produced has a ready market in the handloom sector. The rearer himself generally reels the silk from his cocoons without going to the market and this also reduces the cost of production. Only two persons are needed for the reeling operation.

In view of the popularity of this appliance and also taking into consideration the fact that some of Indian cocoons are of inferior quality which can be reeled only on charkha, CSTRI has introduced a number of new improvisations to the traditional charkha and have released improved models like: 1. Single unit CSR&TI-improved reeling machine with economic oven. 2. Double unit model and 3. Four unit model. The institute has also introduced an improved economic oven which saves fuel and eliminates dust and smoke.

Features of the Improved Charkha : Cooking and reeling basins have been separated in the new model so that the water in the cooking basin can be kept at boiling point and that in the reeling basin at 47°C. This enables reeling to be done more efficiently and easily. The oven in the new model, based on the popular Karnataka model, Astra Ole, is smoke-free (high chimney), ash-free (lid with handle for oven) and saves fuel (air ventilation). Replacement of the crude Tharpatti by a simple slub catcher enables efficient casting and piecing of the thread so that slubs (abruptly thickened places in the yarn) and wastes are avoided in

the reeled silk. All the four threads can be reeled independently of each other due to the installation of Tavellette type of croissure in place of the simple chambon croissure. This ensures better twisting and formation of the thread in a more compact form and more efficient removal of water from the thread. Passage of the thread over longer distance before reaching the swift in this new model allows better driage which is further improved by the hot charcoal/ wood fire kept in a covered perforated metal plate below the swift. Easy rotation of reeling wheel is made possible by the chain type of driving system. Improved collapsible swift of 1.5 m periphery with traverse system as the distributor wheel enables better coiling of the reeled thread in the hank.

With the improved charkha the quality of raw silk is considerably improved at the same production rate and yield as the country charkha. The cost of the improved charkha is also affordable

19.10.2 Domestic Basin

These reeling units, common in Karnataka, are designed for direct reeling on Italian type of swift with one and a half metre periphery. Superior cocoons like the bivoltines can be reeled on domestic basins to obtain quality raw silk. Each domestic basin consists of sets of two reeling basins and one cooking basin fixed on a platform of convenient height. The single pan cooking basin is fixed exactly in front of the two reeling basin units to facilitate transferring of the cooked cocoons to them. Separation of cooking and reeling basins, better croissure system and use of a single cooking basin for supplying two reeling basins are improvements over the charkha system of reeling.

19.10.3 Cottage Basin

This reeling device is indigenously designed on the principle of the Japanese multi-end reeling machine with a better reeling performance than the charkha. Cooking is done independently on a three-pan system. The reeling unit consists of 4-6 reeling basins fixed on a table. The reeling basin is made of copper sheet and the dimensions generally are 45 × 25 × 7.5 cms. Reeling is done in a hot water. Hot water for the reeling basin is supplied through a tap from a

water drum fitted in the cooking unit. In each basin six ends are reeled. A button or jettebout is used as the thread guide and this helps better attachment of the threads and removal of slubs and waste. Each basin has its independent croissure frame designed for application of the tavellette croissure. This enables twists to be imparted on the same thread itself and also better removal of water and gum spots on the reeled thread. The croissure frame and the drive wheels on the transmission shaft are made of either wood or iron. The reel frame consists of an angle of iron or wooden frame fitted about one metre away and parallel to the reel bench. The reel bench is at a convenient height (150–170 cms) for the easy working of the reeler sitting on a stool. The reels are driven by drive wheels fitted on a common transmission shaft. The traverse mechanism at the end of the transmission shaft has the required gears and a cam for imparting a to and fro movement to the traverse bar to impart diamond formation in the reeled silk. At the other end of the transmission shaft a handle is fitted for rotating the reels. The thread wound on small reels are re-reeled to make standard sized hanks on a re-reeling machine.

Cottage basin units may be hand-driven or power-driven. Normally each establishment has a minimum of 10 basins and large establishments have up to 40 basins. In some large establishments steam generated in a boiler is used for heating the water in cooking and reeling basins and also to stifle the cocoons. Production of silk per day per basin is about 800 g. Most cottage basins are under private management.

19.10.4 Filatures

These are large government-owned establishments suited for reeling large quantities of quality silk because of the many in-built control mechanisms. But they require best quality cocoons for optimum production. Indian multivoltine cocoons which are loosely constructed are not suitable for reeling on these modern devices. There are two types of filature units, the older Italian model direct reeling type suited for high speed reeling at a high temperature and the modern Japanese model multi-end indirect reeling types suited for slow speed reeling at a lower temperature. The second type is popular in India.

d) Multi-end Reeling Machine: This is based on the concept of reeling on multi ends at slow speed with minimum of thread breaks and has brought about a radical change in the design and operational technique of reeling.

The multi-end units have an automatic cooking unit suitable for cooking the cocoons to suit this particular system of reeling. The reeling unit consists of two parallel rows of reeling basins with a set of overhead small reels. The reel bench is of convenient height to enable the worker to sit on a stool and reel.

The rectangular (10–12 cms deep), copper reeling basin which is tinned inside and with the outer edges well rounded is provided with a built-in overflow drain. Each basin has as many jettebouts and reeling ends as there are reels with provision for the application of tavellette type of croissure. The reels of the multi-end machine are of a small size with a circumference of 60 to 75 cms. Each reel has, on one side, a rim of round stainless steel or brass encircling the reel bars. The reels are slipped over a common carrier shaft-driven by connecting gears from the main shaft. The shalft is provided with a mechanical brake to stop the whole series of reels on it whenever it is necessary. Each reel can be stopped by a stop button device provided for each reel which works automatically on the appearance of large slugs and waste in the raw silk thread being reeled. It is designed to wind upon itself only one hank. The machine is provided with speed regulators and is made free from vibration to ensure better durability. The multi-end machine ensures increased productivity, superior quality of reeled silk and reduces waste. The silk reeled has to be re-reeled on standard reels of the re-reeling machine. Re-reeling is easier and there is less waste. Raw silk production per day per basin is varying from 600 to 800 g but the quality of the silk is superior.

The multi-end filature units are generallly public sector undertakings. Of the bigger units, 6 are in Karnataka (200 basins each), 2 in Jammu & Kashmir (one in Jammu with 150 basins and the other at Srinagar with 600 basins) and one in Malda (100

basins). Of the smaller units with 20–40 basins, there are three in Uttar Pradesh, forty in Andhra Pradesh, one in Himachal Pradesh, one in Madhya Pradesh and three in Tamil Nadu.

These are either imported machines or fabricated indigenously and are almost not suitable for reeling superior quality silk from Indian cocoons. CSTRI has now designed small multiend reeling units with ten basins suited for reeling Indian cocoons and have installed them in some of their Demonstration-cum-Training Centres.

b) Automatic Reeling Machines : These sunken system reeling units are used extensively in Japan for reeling uni- and bivoltine cocoons. It has pressurised cocoon boiling machine, automatic cocoon feeder and a mechanical brushing unit. It is also equipped with automatic denier control device which ensures minimum size deviation. In automatic reeling machine, the collected cocoon filaments are initially drawn through Jettebout, slub catcher or button on the top croissure pulley, guide pulley, indicator device, lower croissure pulley, croissure, guide pulley, tension pulley, brake lever and finally on to the reel through the ring attached to the traverse bar.

The mechanism of feeding the end of the cocoon filament is of two types. In the type called rotary type, the apparatus for feeding the ends circulates around the reeling parts and in the other called fixed type, the apparatus is fixed in position and called the automatic end picking apparatus. In both types, on an indication by the size detector, the cocoons are supplied one by one, precisely and quickly, till the desired size is arrived at.

c) Semi-automatic Reeling : The process is the same as in the case of automatic reeling machine except that the cocoons are supplied manually for reeling.