

Round Steam Machine

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Abstract: The article is devoted to the process of preparing cocoons for unwinding, to soften sericin and weaken the forces of gluing and filling cocoons with water to make it heavier, according to the unwinding method used. The round steamer is designed to perform four main operations: soaking; heating; steaming; filling the internal volume of the cocoon with water.

When steaming, sericin softens excessively, partially dissolving, which reduces the yield of raw silk, and at the same time, the thread has a large number of defects; as well as reduced hardware performance. In the steaming process, it is important that the dissolution of sericin be minimal in order to maintain the adhesive ability of raw silk filaments, which decreases after hydrothermal treatment. For steaming cocoons, many different machines, devices and devices have been developed and used to carry out the process of steaming and unwinding cocoons.

At present, the following types of equipment manufactured in China, Uzbekistan, South Korea, and Japan are mainly installed in the Republic of Uzbekistan. The set of imported production equipment includes steaming machines of the KSS-207, FYIU2000NT models, working on the principle of processing cocoons in an environment with varying temperatures and equipped with an endless chain with 107 baskets. The productivity of the machine reaches 900-1200 kg of dry cocoons per shift, providing cocoons for 4 and 5 cocoon winders KSS-SR-120 and FYIU2000NT. However, in order to establish modes of steaming and filling cocoons for steamers, it is necessary to use small round steamers.

Keywords: Steaming, cocoon, hybrid, circular steamer, Ipakchi1x Ipakchi2.

A steaming machine of a Japanese company was installed in the laboratory of the Silk Technology Department. Designed for steaming cocoons to be unwound. It is used in carrying out laboratory and scientific research and maintenance of small-sized cocoon winding machines for 20-40 NISSAN-type safety gears, FR tupe D-1, D-2 models.

The machine performs four main operations:

- soak;
- heating;
- steaming;
- filling the internal volume of the cocoon with water.

Technical characteristics of the steaming machine.

The method of steaming is vacuum.

Dimensions of the steam tank, mm

Diameter - 750

Height – 450

Weight of cocoons for single steaming, kg - 24

The main parts of the machine are made of stainless steel, copper, brass, which protects the machine from corrosion in water leakage.

To operate a round cocoon steamer, you must have:

- hot (hot) steam with a temperature of 120-1500C and a pressure of 2 atm.;
- a source of cold water with a pressure of 2-3 atm.;
- cocoon winding machine or apparatus for unwinding cocoons;
- one raw material of air-dry cocoons.

The main part of the round steaming machine is a cylindrical steaming tank (bath), made of stainless steel, with a volume of 0.2 m³.

Principle of operation and design.

The process of steaming cocoons consists in treating them with alternating temperatures of steam and hot water, necessary to soften the sericin to a state that allows unwinding the cocoon thread with the least breakage. This process is the most critical step in preparing cocoons for unwinding, since sericin swells and dissolves excessively during overcooking. As a result, the yield of raw silk decreases, the thread turns out to be shaggy, with large defects.

When undercooked, the cocoon unwinds poorly, breaks become more frequent, which reduces the quality of raw silk and labor productivity. Therefore, it is important that the swelling and dissolution of sericin be uniform across the layers of the shell. This is achieved by processing cocoons under pressure or in a vacuum, since under normal conditions water passes through the shell very slowly, mainly due to wettability and diffusion. Increasing the pressure and temperature of the water speeds up this process.

The absorption of water is accelerated by artificially creating a vacuum inside the cocoon, obtained in various ways:

- alternating treatment of cocoons with steam and water at either high or low temperature;
- an increase in water pressure in the chamber where the cocoons are located during steaming;
- mechanical evacuation of air from cocoons, followed by filling them with water using vacuum.

Cocoons are loaded into cassettes (6 pcs) arranged in a circle inside the steaming tank on a large basket, which is driven manually by a rotating mechanism (Fig.).

The basket can be raised using the lever mechanism 16.

The steam tank-6 is equipped with a lid-1, a thermometer-2, an exhaust pipe-3, a drain pipe-7, a water meter-5, steam pipes-13, water pipes-8, a large basket-14 and pressure gauges-15.

The rotating mechanism includes a pair of bevel gears and a flywheel with a handle.

The lever mechanism (16) for lifting the rotating basket includes a pair of levers with a lower pedal.

The lower half of the steam tank is filled with water, the level of which is controlled by a water meter-5.

The steam supply pipe -9 is installed at the top and bottom of the steam tank. Water is heated with steam.

The upper part of the steam tank is used as a steam chamber. In this part, the pipes for supplying steam-6 and water-7 are installed along the perimeter of the tank. Thermometers - 2, installed on the lid of the steam tank and in the lower side part, allow you to control the temperature in the upper and lower parts of the chamber.

A large basket in which 6 cassettes with 11 cocoons are placed moves up and down to alternately treat the raw material with steam and hot water.

1. And its rotational movement contributes to the mixing of hot water and the acceleration of the process of steaming cocoons.
2. Order and mode of operation.
3. Depending on the quality of the cocoons used and the method of unwinding, there are many ways to park the cocoons. The following is an example of one of the methods, which explains how to steam cocoons.
4. Place a certain number of cocoons in cocoon cassettes.
5. Open the valve at the bottom of the brew tank and bring the temperature to approximately 60°C. The cocoons are soaked in hot water and then they are steamed for 3-4 minutes.
6. Close the lid and lift the cocoon cassette in the steam chamber. Using steam, bring the water temperature to 980C for 2-3 minutes. After reaching the set temperature, the cocoons should be in the steaming process in the steaming chamber. In this case, it is necessary to carefully control whether there are floating cocoons or not. The appearance of floating cocoons indicates that there was not enough steam or the steaming time was insufficient.
7. Cassettes with cocoons should be lowered down into hot water and the steam supply should be stopped. Then it is necessary to irrigate cocoons with cold water and move (movement) cassettes with cocoons. Lower the temperature to 900C within 2 minutes.
8. After irrigation (sprinkling) with water for 3 minutes, the temperature drops to 600C. And this completes the process of cocooning.
9. Remove the cassettes with cocoons from the steaming tank and reload the steamed cocoons into a container (bucket, basin) filled with water (about 600C). Steamed cocoons are ready for unwinding.
10. In case of repeated steaming of cocoons several times, pay attention to the transparency of the water so that it is maintained within certain limits.Для определения технологического расчета машины, так как работа циклическая, необходимо знать время процесса запаривания. Затем производят технологический расчет и определяют производительность машины.

The theoretical productivity of the machine in kg/h is determined by the formula:

$$\Pi_T = \frac{a \cdot m \cdot c}{1000}$$

Where: a-number of cassettes, pcs.;

m is the mass of a portion of cocoons in the cassette, g;

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c is the number of cycles per hour, in practice it is 2.

To complete the task of steaming cocoons, it is necessary to prepare a container with water for storing and transferring steamed cocoons to the cocoon winding machine. The container can be a 10-liter bucket or basin.

When working on a round steaming machine, it must be taken into account that this machine has a fixed container, where the entire technological process of locking, steaming and filling cocoons with water takes place using water and steam.

The mode and time of cocoon steaming differ depending on the state of the cocoon shell, its density, degree of humidity, uniformity, according to the method of carrots and drying, one sorting method.

To find the mode of steaming cocoons, you must first make a test cooking. One of the cassettes is filled with a cocoon and the machine is put into the steaming mode according to the trial mode. If the steamed cocoon after test cooking corresponds to a typical technological map, the entire mass of cocoons is allowed to go. If it does not match, then the test samples are re-steamed until the optimal mode is found. The mode is recorded in the journal and further work on the steaming machine is carried out according to the steaming mode found for a given mass of cocoons.

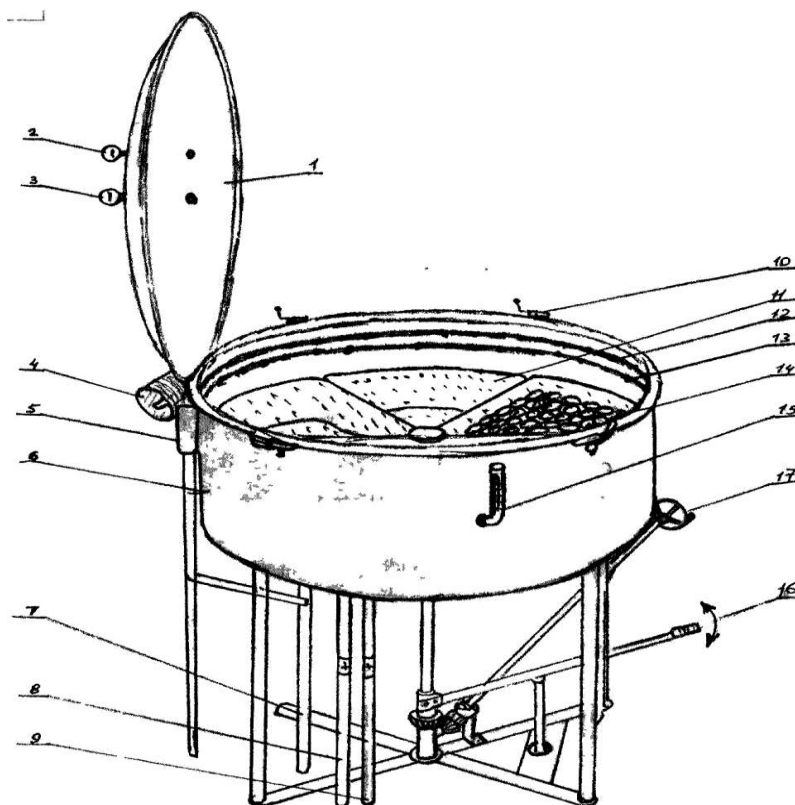
Influence of cocoon steaming on the quality of raw silk and the yield of silk products.

The main task of steaming cocoons is to increase the yield of raw silk, obtain high-quality thread and reduce the formation of waste during cocooning.

Cocoons with a greater degree of steaming of the shell give more rind. Those having a lower degree of steaming affect the increase in breakage during unwinding.

1. Long-term storage of steamed cocoons increases the production of rip and string, while the unwinding of the cocoon worsens.
2. Steamed cocoons require careful handling when looking for the ends of the thread and cleaning from strips and strings. Otherwise, there is an increase in waste in the form of a knot, a rip, a string. Correct working practices must be applied.
3. Uniform steaming of the inner and outer layers of the shell reduces the yield of a film with a high percentage of silkiness.
4. The shell of a cocoon with a high degree of vaporization loses soluble substances in the form of sericin. Reducing the weight of sericin entails an increase in specific consumption. The loss of the high quality of sericin is dangerous because the shell of the cocoon is destroyed with an increase in the yield of rip and string.
5. The amount of dissolved sericin depends on the quality of the cocoon raw materials, the quality of the water and the temperature regimes of steaming.
6. Parking cocoons affects the color of raw silk. Under-steamed cocoons give the white color of raw silk, and over-steamed give raw silk with a yellowish tint.
7. Parking cocoons indirectly affects the uniformity of the raw silk thread. With a large number of breaks, many knots are formed. Thread breaks during unwinding on the degree of steaming of cocoon shells.
8. Overflowing of cocoons is the reason for the formation of defects in raw silk, such as raids, loops, which affects the cohesion of raw silk, which directly depends on the degree of steaming of the cocoon shell.

The strength characteristics of raw silk depend on the degree of steaming of the cocoon shell. The strength and elongation of the thread deteriorate from a large loss of sericin. The uniformity of the strength characteristics of the thread depends on the uniformity of the steaming of the cocoon shell.



Picture. Round steamer

1-Cover; 2-thermometer; 3-Exhaust valve; 4-Counterweight (cargo); 5-water level regulator; 6-steam container (bath); 7-drain pipe; 8-pipe for water supply; 9-pipe for steam supply; 10-fixing lever; 11-cassette; 12-water pipe; 13-steam pipe; 14-cocoons; 15-thermometer (monometer); 16 lever for lifting and lowering the basket with cassettes; 17-handwheel for rotating the basket.

Dependence of swelling (hybrid Ipakchi1x Ipakchi2) of mulberry on water temperature, the duration of the lock and the shell layer

Water temperature, °C	Lock duration, min	mulberry swelling (% of diameter in air-dry state)	
		Top shell	shell inner layer
60	3-4	30,1	20,43
98	2-3	39,08	20,62
90	2	39,7	22,73
60	3	37,69	21,9

Conclusions:

1. The Japanese-made round steamer reduces the consumption of water, electricity, and improves the cocoon steaming process.
2. The operating modes and device of the Japanese-made steaming machine are used in carrying out scientific research and preparing cocoons for unwinding.

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