Automatic Reeling Machine

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Outline of research in automatic reeling machine

The history of the research concerning automatic reeling machine is old. Italy and France initiated the research as far back as 1878 and in Japan, about 1899. However, because in those days the quality of cocoon was poor and labor cost was very cheap the research did not reach the stage of practical application.

From around the 1930's, research on automatic reeling machine was intensified because of the popularization of artificial silk (rayon), resulting in the development of the Yuasa system and the Marui system automatic reeling machines. Each system has been installed in the respective plant but due to the fact that it was not possible to produce a good quality raw silk the operation terminated in a short time.

On account of the emergence of artificial fibre after the end of the last World War, the use of raw silk has been shifted to textile use from women's stockings. And at the same time as a sharp hike in labor cost caused a great difficulty in silk manufacturing the automation of reeling machine became inevitable for which the Japanese Government granted the subsidy for research. Thus, the research on automatic reeling machine has made a rapid progress and the birth of a practical machine has been realized.

This automatic reeling machine at the initial stage of its emergence was not so good because the silk yield was low, with poor quality raw silk and inferior efficiency of the machine. However, the performance has greatly been improved since then and today, practically all Japanese raw silk is being produced by this machine.

Process toward the practical use of automatic reeling machine

Early stage of automatic reeling machine

1) Katakura system of automatic reeling machine

Katakura Kogyo Company carried out two kinds of research: Friction Applied System and Elongation Applied System to detect the size of raw silk in the reeling process and developed a practical use of silk-size detector for each respective system. The Friction Applied System is characterized by winding a wire in spirally and when a raw silk thread runs through it the size is to be detected by the degree of friction. This was called the Denierer which adopted the form in which the cocoon feeder rotates around the reeling machine. This reeling machine was named the K-8 type and was installed at Katakura's five plants from 1952.

On the other hand, in the Elongation Applied System two pulleys with a different diameter rotate simultaneously and as the raw silk is wound up through the same, the raw silk elongates the difference in circumference of the pulleys so the size is detected by the difference in stress at that time. By using this

detector, the automatic reeling machine was called the K-8 B type and was installed at three plants. However, both were found to be defective in various ways and were not used for a long time.

2) Keinan system automatic reeling machine

Keinan Sangyo Company developed a detector of automatic reeling machine by using the dropped-end cocoon. This detector is equipped first with a rotating fork in the lower part (inside the water) of the cocoon during the reeling and creates the cocoon feeding motion by supplementing the dropped-end cocoon which sinks from the upper part. The system was discovered to be defective in that the waste of silk filaments coils around the rotating fork. Consequently, the fork was modified into the reciprocating motion system. The cocoon feeder was, at first, so devised to have the wire coil around and by rotating the same the cocoon is discharged one by one, but it was modified into the box type. This automatic reeling machine sold 62 sets.

3) Cosmos system automatic reeling machine

The Cosmos Kogyo Company developed a reeling machine in which warm water is discharged constantly from the warm water tank constructed in the upper part of the reeling bath to the reeling bath of the lower part thereby creating the flow of warm water at fixed direction in reeling bath so that in case the dropped-end cocoon breaks out during the reeling it is discharged outside of the reeling bath. Then the electric current is charged by the fork pushed by the said cocoon; thus, the motion of cocoon feeding is carried out. This machine has been employed at several plants but it is not being used now.

4) Tama system automatic reeling machine

The Tama Motor Company, the predecessor of the Nissan Motor Company, developed a system in which a hook which catches the co-coon filament in reeling one by one is installed at a fixed number of the reeling cocoon so that the hook stands upright during the reeling by the tension of the cocoon filament. But it falls forward upon the severance of the cocoon filament and touches the cocoon feeding lever, thereby initiates the cocoon feeding motion.

The reel was installed radially and this reeling machine was called the Circular Automatic Reeling Machine but later the arrangement of the reel was changed to the parallel type and the cocoon feeder was modified into a type in which the cocoon feeder rotates around the reeling machine. And a system to detect the dropped-end cocoon by hook was modified into a system to catch the dropped-end cocoon which subsides. This reeling machine was called the Type 10 Automatic Reeling Machine and 121 sets were installed in Japan and abroad.

The completion of automatic reeling machine by set size detector

In 1957 the invention of the size detector by Sadao Ōki of the Sericultural Experiment Station of the Ministry of Agriculture and Forestry was made public. This detector holds a thin plate of fixed thickness between two round-shape glass plates as shown in Fig. 1
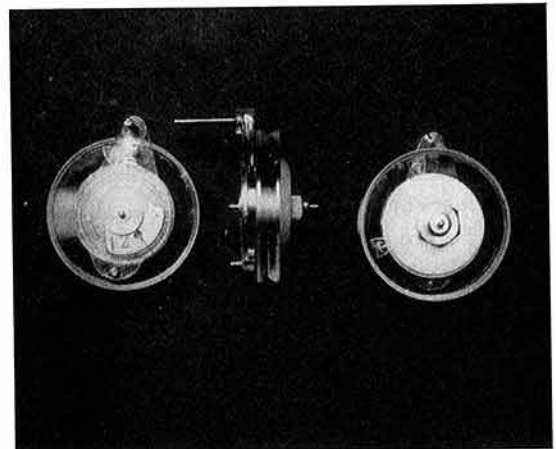

Fig. 1. Size detector of the Sericultural Experiment Station system.
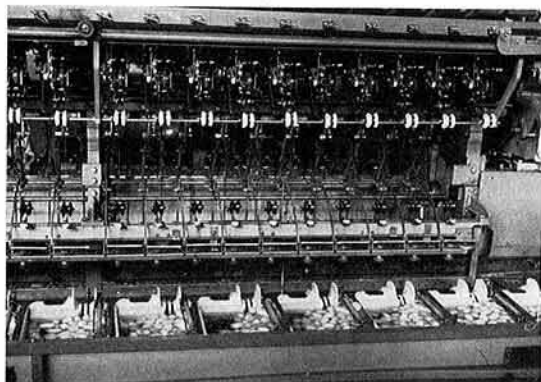
Fig. 2. Principal mechanism of an automatic reeling machine.

and on the outside the odd indicator lever is attached and fastened by nut and bolt.

This detector utilizes the friction of running thread. That is, when the raw silk is wound upward through two plate glasses and in case the size of a thread is larger than the intended size, the detector points upward by friction and in case it is smaller, points downward. And it is so devised that cocoon feeding motion is initiated by having a stick attached to the tip of indicator lever blocks the shuttle movement of sounder. This detector is advantageous in that the detection of size is correct notwithstanding its simple structure. The emergence of this detector has brought about a far reaching impact in the development of the automatic reeling machine so that it can be assumed that the automatic reeling machine has finally reached the completion stage. Hereinafter, brief explanations shall be made on the automatic reeling machine now being used.

1) Nissan system automatic reeling machine by set size detector

The Prince Motor Company, the predecessor of the Nissan Motor Company, manufactured the automatic reeling machine by using the size detector invented by Sadao Oki and experimented its practical application. However due to the fact that the material used for the thin plate of detector was not appropriate, the production resulted in poor quality raw silk with a large size deviation. Since then by

changing the thin plate from aluminum to plastic plate the defect has been eliminated and there is a fair prospect of a large extension.
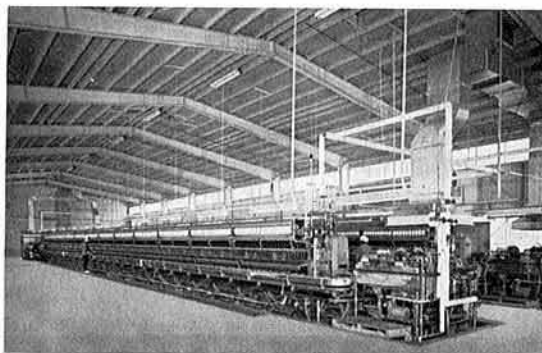

Fig. 3. Nissan system automatic reeling machine.

The raw silk produced by this reeling machine was so superior in quality that this reeling plant put a label 'Specially Reeled by Automatic Reeling Machine of Size Control System', and exported it abroad under a large premium. Since then this reeling machine has been improved by changing the quality of machine parts to withstand the impact of high-speed reeling and by attaching a simultaneous adjustment devise to the size detector, the machine enjoyed good sales under the title, RM type. The Prince Motor Co. also developed the SR type of half-sunk reeling, HR type in which the feeding-end bar and cocoon feeding apparatus are separated and the CT type for cocoon testing.

2) Keinan size controlled system automatic reeling machine

In view of the fact that the Nissan automatic reeling machine has been so favorably approved, the Keinan Sangyo Company has also changed its size detection method to the size detection method of the Sericultural Experiment Station. The company manufactured further developed a new H type and SH type improving the gropping-ends apparatus and cocoon dealer system and extended the same to the groupoperating filature and domestic filature plants.

3) Gunze size-controlled system automatic reeling machine

The Gunze Reeling Company invented a size detector of the X type and manufactured automatic reeling machine by using the same and installed it at its plant and several other plants. This size detector is so assembled as to have two plates cross each other in X shape and raw silk thread is passed through the space of intersecting parts in order to detect the change in size of a thread.

4) Others

The Cosmos Kogyo Company and the Fukushima Seisaku-sho Co. also developed their own special automatic reeling machines by using the size detector of the Sericultural Experiment Station but both did not fare so well.

Extension condition of automatic reeling machine

The total number of reeling machines used in Japan in 1954 was 40,057. The breakdown shows: multi-ends reeling machine, 34,204, accounting for 85.4%; setting system reeling machine, 3,846 (9.6%) and automatic machine numbered 2,007, accounting for only 5%. But in 1969 (January to August) of the total number of 13,124, automatic machine numbered 13,041, accounting for 99.4%, multi-ends reeling machine 52 (0.4%) and setting system reeling machine, 31 (0.2%). And according to the statistics as of December 1968 on the ratio of automatic machines installed by different systems, Nissan occupied by far the largest with 82.2%, Keinan 7.6%, Gunze 10.1% and others 0.1%.

Problems confronting automatic reeling machine

The improvement in labor productivity of the reeling industry has made a far reaching achievement in comparison to other industries. Cocoon drying, cocoon cooking, the transportation of cooked cocoon and the disposal of by-products do not practically require manpower, making possible a manless operation, but, notwithstanding the fact that in the reeling sector great progress has been achieved in comparison to the pre-war period, to ensure a manless operation of this sector there still remains many problems. And some of the major problems are as follows.

1) Problem in degradation of cocoon for filature

The shortage in rural labor force in Japan is a grave issue and the trend is expected to accelerate. As the result thereof, sericulture is expected to become less cared so the quality of cocoon will become non-uniform. Such a poor grade cocoon should be reeled as soon as possible after cooking, and research on improvement of the automatic reeling machine should be intensified on this point.

2) Problem against labor shortage

In Japan to produce 60 kg of raw silk in 1960, 73.6 men labor were required. In 1969 the required labor has drastically been reduced to 17.9 men. But the shortage of young girl labor is a very serious problem confronting the industry, particularly in such a labor where warm water is constantly used, the recruitment of young girls is becoming an acute problem as they seek employment in other industries. And as a countermeasure therefor the development of complete automatic reeling machine is a matter requiring immediate attention.