INTERIM REPORT ON THE PERFORMANCE OF THE "SHIZUOKA" ELECTRIC SEPARATOR.

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This machine, which was introduced recently into Ceylon for separating stalk from tea, has, since its first appearance, aroused considerable interest amongst all connected with the tea industry. Claims were made that by its use the long and tedious process of hand picking would be eliminated.

The feature of this new approach to the problem of extracting stalk is the employment of the basic principle of electrostatic separation, which has proved successful in the mining and metallurgical industry. In adopting this principle in the case of tea, the manufacturers of the machine have recognized the existence of a difference in the electric susceptibility between particles of tea and stalk, brought about partly by a difference in moisture content and partly by a difference in the general structure. In consequence, when a mixture of stalk and tea is subject to the effect of a strong electric field, the electric charge induced on the particles will vary according to the difference in surface conductivity. It is this characteristic difference which is utilized by this machine for the removal of stalk.

In the 'Shizuoka' machine the electrostatic field is provided by an insulated roller charged to a high potential from a high tension system, and by another roller, which is earthed. The strength of the field is controlled by the gap between the two rollers and also by the high voltage source. Both rollers rotate, and the tea to be treated is conveyed by means of a moving belt on to the earthed roller, from where it passes through the electrified gap. The more highly charged particles are pulled towards the other roller, whilst the rest follow the natural trajectory. These two fractions are then separated by an adjustable plate.

In brief, the machine consists of five essential parts:—

(i) The feeder.

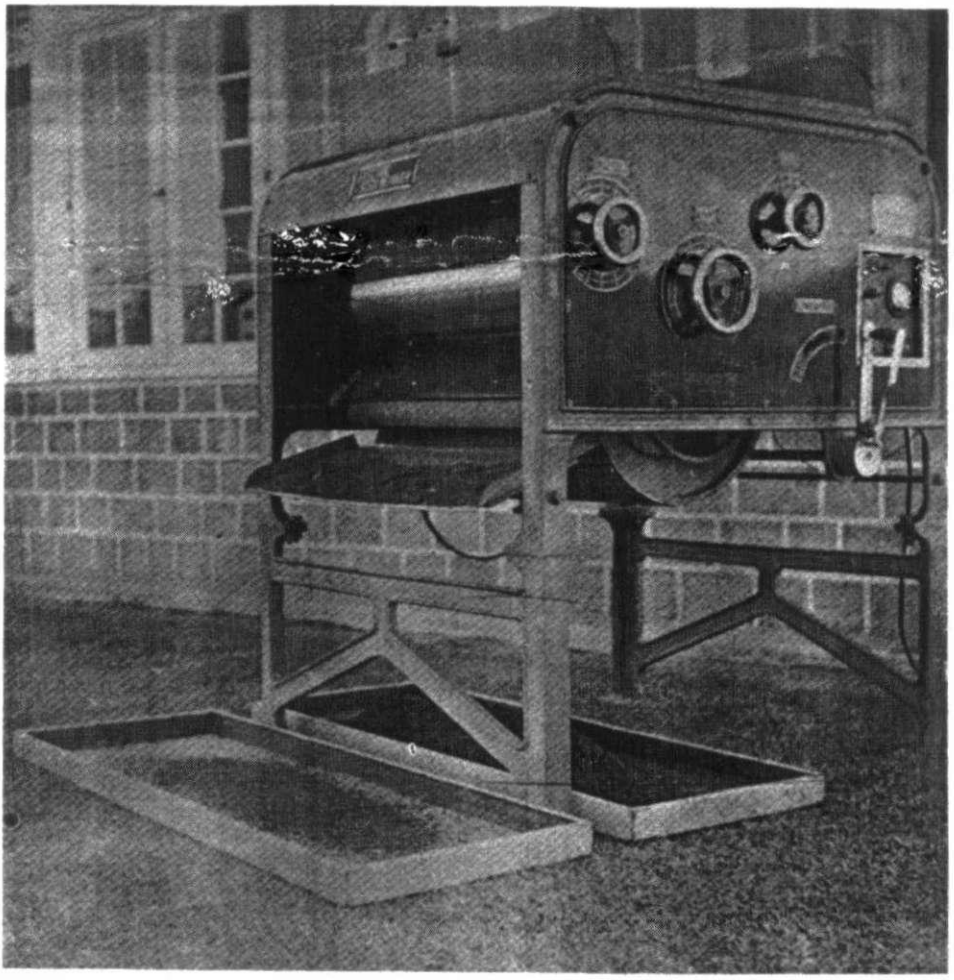
(ii) The conveyor.

(iii) The high tension source.

(iv) The two rollers.

(v) The separating plate.

Each of these is variable and the success or otherwise of the performance of the machine depends entirely on how the adjustments are made in relation to one another. A certain amount of skill and judgment is therefore called for, and can only be acquired by familiarity with the operation of the machine. Once experience is gained, the special procedures required for different types of tea present no serious difficulty. Nevertheless critical control appears to be necessary to get the best results. The efficiency of the machine is therefore determined by a correct co-ordination of the five controls with respect to the type of tea handled.



The photograph above shows a front view of this machine, which is $4\frac{1}{2}'$ high and occupies a space $3\frac{1}{2}' \times 3'$.

The interior construction is not visible, but a part of the rotating roller over which the tea is conveyed can be seen. The receptacle directly below it receives the fraction which is free from stalk, whilst the tray in the foreground collects the separated stalk. The roller in the front carries the high tension charge, which is responsible for attracting the stalk. The adjustable deflector, which regulates the degree of separation of stalk is also visible.

All the controls are situated on the same side. The three wheels which can be seen, adjust the separator, the gap between the rollers and the rate of feed. The hand lever controls the speed of the rollers, and the panel adjoining it holds the electric switches.

The material to be treated is fed into a hopper situated at the top of the machine.

The machine tried out at St. Coombs has so far been used in an experimental capacity only and the results have been most encouraging. They may be summarized as follows:—

(1) All stalk is not completely separated but a considerable proportion of it can be removed.

(2) The separated fraction is not entirely stalk. A certain amount of tea finds its way into the stalky fraction, retreating of which still does not bring about a true separation. However, owing to the stalks being concerntated in a relatively smaller amount of tea, a separation is more easily effected by hand-picking.

(3) Heavy stalk defies separation, the force of attraction of the charged roller not being sufficiently strong to overcome the weight of the stalk.

(4) There appears to be no difference in the degree of separation between freshly fired teas and teas stored for some time.

(5) The machine cannot be used with success for unsifted teas, probably because of the uneven sized particles being 'electrified' differently.

(6) The best degree of separation is obtained with graded teas, particularly the small sized grades such as Fannings and Dusts. Orange Pekoe on account of its peculiar structure does not lend itself to easy separation. For a similar reason tightly twisted big bulk is not suitable material to treat. Excellent results are however obtained with a big bulk comprising flaky leaf and light stalk.

(7) The machine also removes fibre and a certain type of stalk which is most difficult, almost impossible, to separate by the usual winnowing methods.

(8) In the case of the B.O.P. grade, a fraction almost free from stalk, of about the same standard as a hand-picked tea, can be obtained. Hand picking of the other fraction, which amounts to nearly 10 per cent. of the weight of treated tea, is necessary.

An almost perfectly clean separation can be secured when Fannings and Dusts are passed through the machine.

The Broken Pekoe and Pekoe grades, which generally contain heavier stalk, do not give such satisfactory results, and the indications are that little is to be gained by employing the principle of electrostatic separation for these two grades. It is very unlikely that even with a stronger electric field it would be possible to get a reasonable measure of success.

(9) The machine is particularly efficient in separating the rubbish from off-grades, which cannot be separated by other devices.

(10) The output of the machine varies of course with the size of the particles of tea, the rate at which it is fed, and the fineness of separation required. Roughly speaking, it is capable of handling about 200 lb. of B.O.P. or cut leaf per hour, and a quantity of up to 500 lb. of Fannings, Dusts or off-grades.

(11) The current consumption by the high tension supply is extremely low, being only 100 watts. The cost of operating the machine is therefore virtually the cost of running the ¼ h.p. motor used for driving the conveyor belt and rollers.

From the results obtained so far there is no room for doubt that the electric stalk separator is an asset in a tea factory. Although not a hundred per cent efficient, it can be used for a part of the day's make as a general utility machine for B.O.P., Fannings, Dusts and off-grades. Even though it is not especially useful for other grades, the overall cost of hand picking can be susbtantially reduced by at least 50 per cent. There is reason to hope that picking costs can be reduced further if certain technical modifications are incorporated. For instance,

(i) Improved spreading of the tea by the use of say a vibrator.
(ii) A variable speed for the charged roller.
(iii) An additional stage of separation by the introduction of another pair of rollers.
(iv) A stronger electric field.
(v) An extra hopper for collecting the 'middlings'.
(vi) A more easily adjustable deflector.

We consider that these further improvements are required for the machine to be adaptable for the many different types of tea produced in Ceylon. Still, in its present form it serves to fill a long felt gap in the processing of tea. But for use on a commercial scale there are yet a few urgent requirements.

These are:—
(i) Complete protection from electrically charged parts of the machine.
(ii) A better feeding device.
(iii) More precise controls.

Much of the manipulation now needed in the operation of this machine may well be done away with by the refinements suggested. If these are provided it would not be difficult for an intelligent labourer to manage the machine properly after a few days experience.

Particulars of cost, and other details can be obtained from the sole agent, Mr. P. P. P. Jinadasa, Meddawatte, Matara.

APPENDIX

Since the above was written we have been informed by the agent that in the latest machines the following modifications are to be made:—

(1) An improved feeding system which ensures an uniform spread of tea.

(2) The introduction of an elevator to enable the tea to be passed through again. With this arrangement there will be no need for the tea to be carried and fed at the top of the machine.

(3) A more easily adjustable deflector.

(4) Protection of the electrically charged roller by means of a transparent Perspex panel or nylon mesh.

(5) More precise controls (The manufacturers give the assurance that there is no fear of these going out of adjustment with use).

(6) Safer operation. The high voltage source will be modified and the roller at the high potential will no longer retain the electric charge after the current is switched off.

We have also been informed that the machine carries a one year's guarantee and free service during this period. The cost of a machine operated from any A.C. supply is Rs. 6,500/-. A.D.C. model will cost a little extra.