

COOLED ROLLERS.

ROLAND V. NORRIS.

It has been well said in a recent publication on the manufacture of tea that unnecessary heat is the enemy of quality. In no stage of manufacture is there more risk of excessive development of heat than during rolling. Such heat development, as has already been pointed out in these pages, while partly caused by the mechanical friction of the roll is much more due to the chemical action taking place in the leaf when the leaf juices are expressed. The extent of such heat production is not, perhaps, generally recognised but, means uncommon to find the leaf in the rollers at a temperature unless suitable precautions are taken during rolling, it is by no more than 20° in excess of that of the rolling room. There can be no question that such temperatures are highly detrimental to fermentation and result in a definite loss of quality in the tea.

Up to the present the only means available for controlling such rises of temperature have consisted in various devices for maintaining the rolling room as cool as possible and in careful regulation of the pressure used during rolling, the pressure cap being raised at frequent intervals to allow the leaf to cool off before pressure is again applied. Such methods have their limitations, however, with the result that, in the low-country in particular, in many factories the number of rolls that can be carried out and the degree of pressure that can be employed are both restricted to a point below what would otherwise be considered advantageous.

A totally different method of overcoming the above difficulties has recently been patented and put on the market in the form of the Marshall-Boustead cooled rollers. By the courtesy of Messrs. Boustead Bros. and the Superintendent, New Peacock Estate, an opportunity was recently afforded the writer to inspect a battery of such rollers and to collect some data as to their performance.

The essential principle of the new rollers lies in the provision of means by which a stream of chilled calcium brine can be circulated through the rollers, whereby the temperature of the leaf, even in a long series of rolls, can be maintained at the temperature of the room or lower.

The rollers themselves are the ordinary double action Marshall rapid rollers but the table, leaf box and pressure cap are each jacketed, the jackets being connected by means of flexible piping to the main brine pipe line running along the side of the rolling room behind the rollers. By means of a centrifugal pump the brine, which has been cooled to the desired temperature in an ammonia

type refrigerating plant, designed by the Lightfoot Refrigeration Co., is circulated through the jacketed parts of the rollers, the volume thus circulating to each roller being readily and easily controlled by means of screw cocks on the distributing pipes. The temperature to which the brine is originally cooled is easily regulated and, by manipulation of the valves referred to above, any desired degree of cooling in the roller can be maintained without difficulty. The control of the plant is, in fact, very simple and effective and should present no difficulty in ordinary factory working. In practice the rate of flow is regulated according to the temperature of the exhaust brine as indicated by thermometers fixed in the return pipe lines, normally about 1,500 gallons of brine per hour being circulated through four rollers.

On the day the inspection was made, manufacture was carried out simultaneously, both in the cooled rollers and in ordinary rollers so that it was possible to obtain comparative data, both in regard to rolling and to the teas ultimately produced.

Temperature production.—The table below shows the temperatures of the rolled leaf of each dhool in the two sets of rollers:—

TABLE I.

No. of dhool	Temperature of leaf leaving the rollers				Room Temperature °F.
	A. Cooled Rollers. °F.	B. Ordinary Rollers °F.			
1	67	81	...	70	
2	66	80	...	70	
3	65	80	...	71	
4	65	85	...	72	
5	66	88	...	72	
6	64	—	...	73	

The leaf was rolled six times in the refrigerated rollers as against five times in the ordinary rollers. It will be seen that the difference in temperature of the leaf in the two sets varied between 14°-22° in favour of the cooled rollers, the leaf from the latter being throughout at a lower temperature than that of the room, while in the ordinary rollers the leaf attained a temperature 16° in excess of room temperature in the 5th roll.

The brine entering the cooled rollers was at a temperature of 25° F. for the first roll and increased in temperature to about 30°. During the subsequent rolls the brine temperatures were approximately 30° and 35° in the inlet and outlet pipes. An idea of the quantity of heat developed during rolling can be obtained when it is realised that nearly 375 gallons of brine were heated about 5° in the course of one hour, when about 300 lbs. leaf were being rolled.

Separation of dhools.—The quantity of leaf separated in each dhool is shown in Table II below. In the case of the refrigerated rollers, no pressure was applied in the first three rolls, light pressure in the fourth and fairly heavy pressure in the last two rolls. In the case of the normal rollers, no pressure was applied in the first roll, light pressure in the second, half pressure in the third and full pressure in the fourth and fifth rolls. In both cases the speed of rolling was about 40 revolutions per minute.

TABLE II.

No. of Roll	Percentage dhool obtained			
	Refrigerated Rollers		Ordinary Rollers	
1	...	9.9	...	9.1
2	...	11.9	...	9.1
3	...	14.9	...	9.1
4	...	20.0	...	20.9
5	...	16.2	...	30.8
6	...	20.1	...	—
Big bulk	...	7.0	...	21.0

The leaf coming out of the last roll with the cooled rollers had undergone but little fermentation and had still a bright-green colour, whereas in the case of the ordinary rollers even the third dhool was a copper-brown colour.

Composition of dhools.—Analysis of the dhool samples showed that the loss of tannin as between the second and the last dhools was about 0.7% in the cooled rollers as compared with a loss of about 1.2% during rolling in the ordinary plant. There was also a slight difference, in favour of the cooled rollers, in the water-soluble content of the two sets of teas. These two factors definitely point to an improvement in quality and body of the liquors as a result of employing the new rollers.

Made teas.—The above conclusions were borne out by the comparison of the two sets of made tea, the samples from the cooled rollers being generally preferable in quality and strength to those made the normal way. The fourth and fifth dhools from the normal rollers gave rather soft liquors without much briskness and were inferior to the teas from corresponding dhools from the refrigerated rollers.

Arising from the above considerations it may be said that the new type of roller appears to offer very definite advantages, particularly in the case of low and mid-country manufacture.

Under the temperature conditions prevailing at such elevations, the number of rolls that can be carried out is definitely limited by the amount of heating to which the leaf is subjected during rolling. With the new rollers, this objection does not apply and it is thus possible to reduce very considerably the percentage of big bulk without any risk of over-fermentation. It should thus be practicable to increase the percentage of the more remunerative grades without recourse to repeated cutting. The gain is thus twofold; first a general improvement in quality and secondly, a greater amount of the better grades.

Again, with the cooled rollers, less attention need be paid to the cooling of the rolling room generally, a matter which is frequently difficult to carry out at low elevations. Practically, no fermentation takes place in the chilled rollers and this process can be carried out in a separate, smaller room in which temperature and humidity can be much more easily controlled.

Economic considerations.—From the point of view of initial cost, the chief item is the refrigerating plant as the cost of the actual rollers should not largely exceed that of ordinary rollers. Only one refrigerating plant is of course required, the capacity of this depending on the number of rollers to be used. At the time the plant was inspected, the price had not been finally settled. We understand that definite quotations can now be obtained from Messrs. Walker, Sons & Co. Ltd., Colombo. It is anticipated that quotations will also shortly be available for the conversion of existing rollers.

As regards running costs, certain additional power is required for the refrigerator and the slightly heavier rollers. This, we are informed, amounts to 14-15 H.P. in the case of the four-unit set inspected. Apart from such additional power, there seems little reason why running costs should be any higher than with ordinary rollers. The whole plant is simple in construction and maintenance charges should be low.

In view of the very definite advantages in manufacture which these rollers would appear to afford, it is greatly to be hoped that they may receive an extensive trial.