1.0 Introduction

This invention refers to improvements to drying towers with particular emphasis on drying rubber laces and similar applications.

Rubber laces produced by passing coagulated rubber latex through rollers still contain fairly high amount of moisture which has to be removed to preserve the laces without molds and fungus formation. This is done by hot smoke in RSS varieties whereas laces are dried by hot air thereby achieving better quality.

Further this invention enables the conversion of existing conventional drying towers to the modified system without heavy additional expenses. The cost can be recovered within a very short period by the improved efficiency with the resultant saving of production costs.

2.0 Present Method

Conventional drying tower used for drying rubber laces and for similar applications is shown in figure 1. Usually this consists of three floors as shown, with adjustable trap doors on the ceiling to control escape of saturated air. The air ventilators are provided on the ground floor.

A hot water boiler - usually of firewood type - heats water supplied from a feed water tank. The hot water is circulated through the radiators fitted on the ground floor.

The Radiators are fed through two pipe lines one from the boiler to the top side of the radiator to feed hot water and the second connects the bottom side of the radiators to the bottom of boiler to feed the water back to the boiler after passing through the radiators. This arrangement makes use of the thermostatic syphon system, or natural convection.

The capacity of the hot water boiler and the size of radiators are selected according to the capacity of the drying tower. The air heated by the radiators flows up, carrying moisture from rubber laces thereby drying them. Air ventilators provided on the ground floor enables fresh air to enter the tower while adjustable trap doors provided on the ceiling allows controlled flow of air by natural convention.

According to this conventional system, the minimum drying time is about 3½ days in most efficient drying tower while it may be around 5 to 6 days in the majority of towers seen in Sri Lankan Plantations.

It is necessary to open the doors of the tower daily to load and unload laces, which causes substantial loss of heat. Further the additional time needed for stabilization of temperature and convection current prolongs the duration of drying the laces. In this system more height has to be kept between the ground floor and the first floor, compared to the other floors.


Mr. Kulasekera obtained National Diploma in Technology for Hardie Senior Technical Training Institute. He worked at the Department of Buildings and State Engineering Corporation. Then he worked as Engineer at the Sri Lanka Sugar Corporation, State Distilleries Corporation and the Rubber Research Institute.

At present he is Regional Engineer at Sri Lanka State Plantation Corporation Board III.

Mr. Kulasekera recently received patent for Improved Drying Tower on which he is presenting this paper.
where only stacking height is needed, in order to bulk air automatically using natural convection currents.

3.0 Description of the Invention

In this invention above disadvantages are removed and efficiency increased by using the steps described below.

A longitudinal section of the modified tower is shown in figure 2 while figures 3 and 4 show the new forced DRAUGHT system in perspective and plan views.

The tower is divided into at least 2 or more vertical sections creating two or more different compartments (Fig. 2). Individual radiators are replaced by one or more master radiator fixed on the outside - preferably just outside or on the wall. A transformation duct is used to reduce the area of duct and hot air is sucked in from radiators by a suction fan placed just behind the transformation duct. The fan supplies hot air to the main hot air distribution duct which in turn is connected to a number of distribution ducts depending on requirement. The distributor ducts are supplied with air control dampers as shown in Fig. 3 and 4. Fig. 4 shows the three separate vertical sections, fed with six distribution ducts. The radiator could be a industrial type which are freely available in the market.

As forced air circulation method used in this system caused faster removal of heat from the radiators it is preferable to have a pump to feed hot water from the radiator back to the boiler. The major difference of this system is that the large number of small radiators normally used have been replaced by a few master radiators placed just outside the wall of the tower. The air ducts going into the tower are placed on the ground floor and occupies only a very small height.

Thus, the ground floor earlier only to install the radiators and piping and not used to stack laces and yet had to be of reasonably large height to enable proper bulking of air through natural convection, can now be made use of to stack laces while housing the air ducts which take only a minimum of space. Since forced DRAUGHT is now used hot air distribution is very uniform and the quality can be very easily and accurately controlled by the dampers.

4.0 Advantages

Since an additional floor is created by this invention the capacity of the tower is immediately increased by $33\frac{1}{3}\%$. Further as the space allowed for passages in the conventional system is eliminated in the new system the total space increase is about 40%.

Since the Tower is now divided into 3 separate vertical sections, each section can now be separately controlled using the forced draft system.

Unlike the traditional system in the new method loading and unloading of day's produce do not cause loss of heat. While loading and unloading can be carried out in one loft (or vertical column) other two lofts are unaffected. The separate controls will allow continuing the drying process without loss of heat from those two sections. Once the loaded section doors are closed, they need not be opened again until the drying is completed. For loading and unloading of produce the next day, the next section is opened and so on. As forced DRAUGHT is used now, it is observed that the drying of laces is much faster and it was observed that complete drying is done within about 1½ to 2 days. An experimental unit, based on the invention, is now being tested for nearly an year and the results show that the time of drying is reduced from 5 days to about 1½ to 2 days in addition to increasing the bulk capacity by nearly 40% (i.e. a total increase of out put by to 1.4 x 5/1.5 i.e. approx. 3½ to 4 times).

Thus an old tower modified based on the invention can now handle 4½ to 5 times the out-put it earlier handled. It was observed that the cost of modification could be recovered within a very short period. The modification also enables saving of additional expenditure that would have been incurred for construction of a new tower to cater to the increases in production of latex.

As a further improvement it is also possible to incorporate a recycling duct positioned at suitable height, preferably around top of 2nd floor according to results of the experiments, filled with dampers.

This duct will be connected to the inlet of
the blower fan, connected at the transformation duct, to recycle a controlled amount of hot air depending on the requirements.

Many modifications and adaptations of this system are quite possible particularly with changes in dimensions, capacity, number of ducts, radiators etc. yet retaining the basic concepts and features of the invention and naturally any such modifications too are covered by my patent application.

FIGURE (1)

LONGITUDINAL SECTION  STANDARD NATURAL CONVECTION HEATING SYSTEM
FIGURE 3
NEW FORCED DRAUGHT HEATING SYSTEM
FIGURE 4

PLAN

GROUND FLOOR

NEW FORCED DRAUGHT HEATING SYSTEM