

Development of Air Contolled Cotton Cleaning Machine in Blow Room



P.S. Hibare, B.B. Deshmukh

Abstract : In textile industries cleaning of cotton is essential due to impurities which are present in the cotton such as firestones, leaves, seeds etc. fibre cleanliness influences the processibility of cotton and yarn. Coventional machineries used for cleaning uses mechanical beaters for opening and cleaning of fibers. The change in the settings of beaters at different stages of blow room changes the cleanliness of fibres For this purpose firstly we need to study conventional cotton cleaning machine. This this paper deals with the air controlled cotton cleaner whose main advantage is that it does not required to change the setting at all and also the compressed air which is available in mill premises itself and also it requires less maintainence and damage to fibers are less than conventional machinery

Keywords: Firestone, opening, cleanliness, processility

I. INTRODUCTION

The raw material for the manufacture of cotton yarn comes generally in the form of highly compressed bales of cotton. Each bale consists of a very large number of tightly packed layers of tufts of cotton and each tuft contains hundreds and thousands of fibres. The tufts contain, embedded between the fibres, a large quantity of foreign matter, leaf and seed particles. It is the problem for the spinner to open out these tufts of cotton, eliminate trash as far as possible and prepare an even strand of sliver. High degree of cleaning of fibres is essential for good quality yarn

but how does this cleaning occur is also equally important This paper reprints the method of cleaning of cotton in blow room, in blow room the cottons are available bales which weighs approximately 150 kg through bale plucker it feeds the cotton into cleaner where with the help from beaters the fibers get opened and cleaned and waste is collected. Figure 1 shows the waste which are present in the cotton



Figure.1. Waste Present In Cotton

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II. PROCESSES INVOLVED IN BLOW ROOM FOR CLEANING OF COTTON

Cotton fibers arrive at the cotton spinning mill in the form of cotton bales that are packed densely. At blow room stage, the cotton has 1–15% of impurities (e. g. dust, dirt, vegetable matter) which must be removed. In order to convert the raw cotton into fibers that are separated and aligned in a suitable manner for yarn production, the cotton passes through the following processing stages in blow room

- A) Opening
- B) Cleaning
- C) Dust Removal

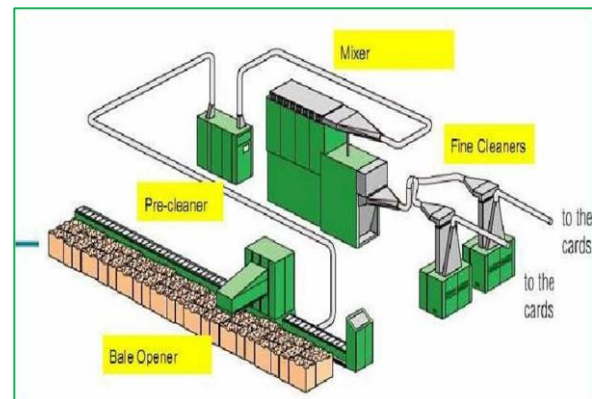


Figure.2. Blow Room Department's Work Flow

A) Opening

Opening is the first operation in the blow room department with the goal of always a high degree of openness of material with gentle treatment and less damage to the fiber as possible. Opening is the first operation which has objectives of tearing apart the compressed cotton until it is very much loosened and separated into small tufts with a gently, and a fiber loss as small as possible. Opening relates to cleaning as where is opening there is also cleaning.

B) Cleaning

Cotton mostly contains up to 18% of trash. For cleaning the material it is inevitable to remove as much fiber as much waste. Therefore it is essential to calculate the amount of the waste removed and its composition. As it has high importance it is also called as cleaning efficiency. The cleaning efficiency has main motive of optimization and not maximization, since the fiber quality as well as fiber loss is always affected by maximum trash removal.



C] Dust Removal

To extract the impurities in the cotton tufts such as leaves, pebbles, iron, feather and foreign material from cotton by opening and beating with the help of beaters. Dust removing in the blow room department happens by air suction only, either between the machines or within the machine by normal air separation. Every blow room machine must be equipped with functioning extracting dust, so that dust removing machines should be needed. The efficiency depends not only on the devices but also on the size of the tufts. The smaller the flocks, the higher is the efficiency.

III. PROBLEM IDENTIFICATION

In conventional cotton cleaner in blow room the opening is done with the help of mechanical beaters. Due to impurities which are present in the cotton, when it gets beaten on the the surface of the beaters it makes thudding sound also affects the quality of the fibers. Due to pebbles which are present in the cotton it also causes fire hazards and jamming of beater. To overcome the above problems this projects are undertaken to develop air controlled cotton cleaner by using the existings compressed air which is in company premises itself. This project will reduce power consumption and improves the quality of fiber

IV. LITERATURE SURVEY

The amount of trash present in the cotton influences the formation of faults during spinning process. The common faults during spinning are lap weight variation, neps formation etc[1]. A higher degree of opening in blow room, good cleanliness and maintenance of machinery reduce the fault formation. The common faults during blow room areneps formation, lap licking & curly cotton etc[4]. The heavy particles such as pebbles which are present in the cotton are the main reason behind the often breakdowns & reduction of quality[2].

V. COVENTIONAL CLEANER IN BLOW ROOM

Firstly the material falls into the feed hopper and passes through the first beater. After that it is transported upward by the six beater rollers, each carrying profiled bars and the beaters are arranged on a line inclined upward at 45°. Elimination of impurities takes place during the continual passage of the material over the grids arranged under the rollers. Some step cleaners have a high flow chamber with special baffle plates (a) to improve cleaning intensity. The grids are always adjustable and usually also the beater speed.

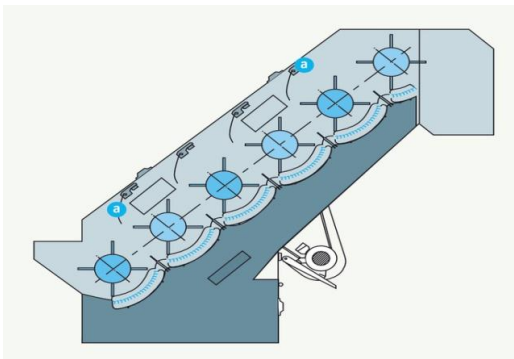


Figure.3. Conventional Cotton Cleaner In Blow Room

A. Important Aspects of Cleaner In Blow Room

- The fiber treatment in this machine is very gentle because of the fibers has not been gripped by the feed roller during beating. Fiber tufts had been treated by the pin beater when it is carried along by air.
- All heavy trash particles falls down before it gets broken
- Mostly all of heavy seeds falls down in this machine without any problem
- Around 50 Pascal suction pressure is maintained in the waste chamber for better cleaning efficiency
- Beater speed, velocity of air through the machine, setting of grid bars and gap between grid bars will affect the cleaning efficiency
- A lot of trials to be conducted to arrive at optimum beater speed, air velocity, grid bar setting and grid bar gap.
- In general the beater speed is maintained around 750 rpm and minimum 50 Pascal pressure to be maintained in the suction chamber

But this process has some disdvantages

- Setting changes all the time
- Makes thumping sound when fibers hit the beaters
- Requires high maintainence
- High wear and tear

B. Cleaning efficiency of conventional cotton cleaner

The cleaning efficiency of blow room is defined as the difference between the percentage of trash in the bale cotton fed to blow room and percentage of trash in the lap delivered as percentage of trash in able cotton. For this purpose the machinery is use dis shirley analyzer which directly shows the percenatge of trash present in the cotton. For this process total 3 no of samples were taken from lap fibers. In this machine the cotton is fed into the feeding tray where it performs its operation on the raw or processed cotton and shows the result with the help of software which is present in th statistical quality department of the company.



Figure.4. Sherley Analyzer

Now calculate the cleaning efficiency of conventional cleaner by taking lap sample no 1 by formula

$$\begin{aligned} \text{Trash present in bale cotton} &= 9.2 \text{ g} \\ \text{Trash in lap} &= 4.0 \text{ g} \\ \text{Cleaning Efficiency} &= [(9.2-4)*100]/9.2 \\ &= 56.52\% \end{aligned}$$

Efficiency Of conventional cotton cleaner is 56.52%

VI. MODEL OF AIR CONTROLLED COTTON CLEANER IN BLOW ROOM

In conventional cotton cleaner unit the fibers are opened and cleaned with the help of mechanical beaters which tends to damage the fibers and also a chance of break down due to the foreign particles which are present in it but in air controlled type there are no any mechanical parts the opening and cleaning happens in cylindrical compartment which set at a different heights from each other due to which when bale cotton comes from inlet pipe and flows towards outlet pipe vortex is created in the chamber due to which cotton gets opened and all the trash goes towards the trash compartment where it gets separated. The main parts of this type of machine are as following

- A] Cylindrical Chamber
- B] Inlet Pipe
- C] Outlet Pipe

A] Cylindrical Chamber

In this setup this is the main part because opening and cleaning operation is carried out here. Firstly the radius and height is considered as 500 mm and 1000 mm respectively and to make it cost friendly the material used is sheet metal with 18 mm of thickness. The model is shown below

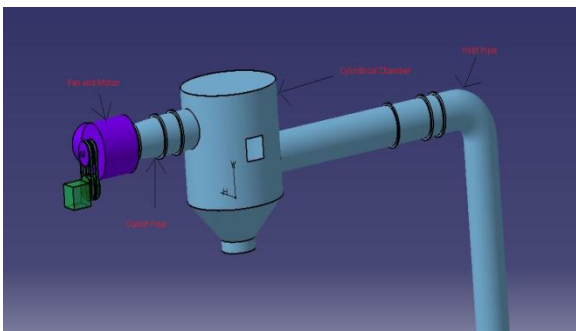


Figure.5. Model Of Air Controlled Cotton Cleaner In Blow Room

A. Calculating fan speed

As we see in the model the cylindrical chamber is connected with LA 5/4 suction fan which is readily available in the blow room line connected with three phase AC motor which runs at 2910 rpm and 2.5 kw from which we can calculate the fan speed

$$\begin{aligned} \text{We have,} \\ \text{Diameter of motor pulley} &= 140 \text{ mm} \\ \text{Diameter of fan pulley} &= 216 \text{ mm} \\ \text{Motor speed} &= 2910 \text{ rpm} \end{aligned}$$

$$\text{LA 5/4 fan speed} = \text{motor speed} * \text{motor pulley diameter} / \text{fan pulley dia}$$

$$\begin{aligned} &= 2910 * 140 / 216 \\ &= 1886 \text{ rpm} \end{aligned}$$

The fan creates the suction pressure of 450 Pascals (Source- LMW Blow Room Manual).

B. Calculating Surface Area And Volume Of Cylindrical surface

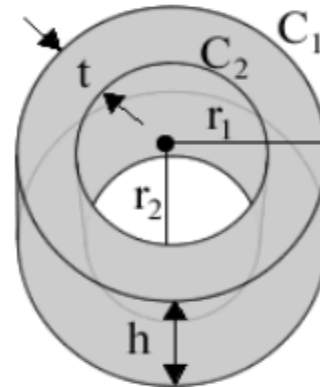


Figure.6. Nomenclature of Hollow Tube

Considering the above structure same as hollow tube we calculate the surface area and volume of the structure as below

$$\begin{aligned} \text{We have,} \\ t &= \text{thickness} = 18 \text{ mm} \\ r_1 &= \text{outer radius} = 518 \text{ mm} \\ r_2 &= \text{inner radius} = 500 \text{ mm} \\ C_1 &= \text{outer circumference} \\ C_2 &= \text{inner circumference} \\ h &= \text{height} \\ \text{calculating surface area } A & \\ A &= \pi(r_1^2 - r_2^2) \\ &= \pi(518^2 - 500^2) \\ &= 57566.5 \text{ mm}^2 \end{aligned}$$

$$\begin{aligned} \text{Calculating volume } V & \\ V &= \pi(r_1^2 - r_2^2) * h \\ &= \pi(518^2 - 500^2) * 1000 \\ &= 57566500 \text{ mm}^3 \end{aligned}$$

C. Inlet Pipe Diameter

The inlet pipe has 350 mm of diameter throughout the plant (Source LMW Plant layout)

D. Outlet Pipe Diameter

The outlet pipe has 350 mm of diameter throughout the plant (Source LMW Plant layout)

E. Advantages of this process

- No mechanical parts
- Less Maintenance
- High cleaning efficiency
- Cost friendly

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F. Cleaning efficiency of air controlled cleaner

Calculating cleaning efficiency with the help of sherley analyzer of lap fiber sample no. 1 same as above

Trash present in bale cotton= 9.2 g

Trash in lap= 3.2 g

Cleaning Efficiency= $[(9.2-3.2)*100]/9.2$
= 65.21%

Efficiency Of air conrolled cotton cleaner is 65.21%

VII. RESULTS

For cleaning efficiency firstly total 3 samples were taken from 3 diffrent bales and then they processed at conventional cleaner at plant no 1 and also at air controlles cleaner at plant no 2 and results of conventional cleaner are as following

Sample No	Trash in Bale Cotton (In gm)	Trash in Lap Cotton(In gm)	Cleaning Efficiency
1	9.2	4.0	56.52%
2	8.5	3.4	60.00%
3	8.9	3.7	58.42%

Table No 1. Cleaning efficiency of conventional cleaner

Results of air controlled cleaner are as following

Sample No	Trash in Bale Cotton (In gm)	Trash in Lap Cotton(In gm)	Cleaning Efficiency
1	9.2	3.2	65.21%
2	8.5	3.1	63.52%
3	8.9	3.5	60.67%

Table No 2. Cleaning efficiency of air controlled cleaner

VIII. CONCLUSION

There is no fibre damage during the cleaning of cotton as there are no mechanical parts and it saves energy as it is operated on compressed air available in a mill. As we seen from above that there is a rise in cleaning efficiency. Due to less mechanical parts there are less chances of break down. We can conclude that from this method we can get better cleaning efficiency with less fiber damage

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