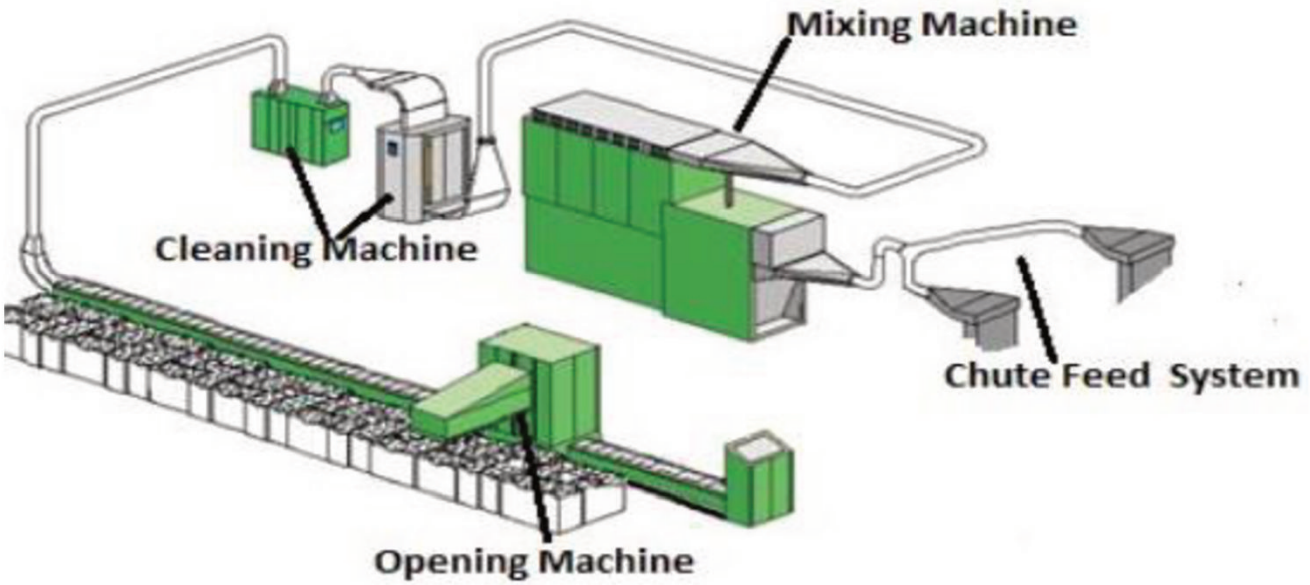
CHAPTER THREE
BLOWING ROOM



By: Lami A.

Cotton Bales

- Cotton harvested from field separated from its seed in ginning industry and made ready for transportation to textile industry after packing it in ***bale form***

Cotton bales
200 to 250 kg.

Cotton is pressed in bale form after ginned:

✓To enable fibers to be transported and stored economically
✓For easy loading and unloading
✓To prevent contamination with foreign particles

So It is important that the fibre in the bales be allowed to relax before the spinning plant can process it. During this relaxation time the bales are conditioned to adapt the RH% and Temperature of the mill

Bale conditioning

- In order to maintain a standard level of moisture in cotton and also to maintain uniformity in moisture within and between lots, it is important to expose cotton of all bales by blooming in a controlled humidly for sufficient time before use in blow room. Blooming/ removing the bale ties enables the cotton to relax and absorb moisture that increases the fibre strength and reduces subsequent fibre damage.

- Air temperature inside the mixing and blowroom area should be more than 25 degree centigrade and the relative humidity (RH %) should be 45 to 60 %.

- The effect of temperature on moisture regain is relative less. However, it is important to maintain temperature as with same RH% there are some changes in content of moisture in air and so the %regain.

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Moisture Content %, MC = (M/W) X 100

Moisture Regain %, MR = (M/D) X 100

Where; M = weight of moisture in fibre, W = weight of fibre before drying (dry weight of fibre plus weight of moisture) and D = Dry weight of fibre

Calculation of correct Invoice Weight

- When a consignment of fibre is delivered and weighed, a sample of about 200g is to be selected according to sampling procedure and immediately stored in air tight container. The sample is weighed and then oven dry weight is determined.

Oven dry mass of the consignment (C) = M X (D/O)

Where D= oven dry mass of the sample, O= original mass of the sample and M= mass of consignment at the time of arrival

Correct Invoice Weight= C X [(100 + R)/100]

Where; R is the standard regain as agreed between the parties.

Bale lay-down

- Arranging of conditioned and bloomed bales according to our mixing plan to feed for the machines.

- It is very important to arrange the bales to minimize “Quality Waves” created by fibre variations found between bales.

- Bale lay down could range from 10 to 200 bales. The number of bales in the lay-down depends on the capacity of the machine, the required blend ratio and production rate. For example, to produce a 75/25 blend of different cotton fibers requires a minimum of four bales to lay down, i.e. three bales of one type and one bale of the other type.

BLOW ROOM

- Blow room is the first section in the process of spinning of short staple fibers. The section named "blowing room" because of the transference of the fibers from machine to machine inside the section is by the aid of blowing air.

- Blow room consists of ***a sequence of different machines.*** It can be chute feeding system or lap feeding system for card bas on the feeding system installed at end line of the section.

- Basic operations in blow room are:
  - ✓Opening
  - ✓Cleaning
  - ✓Removal of foreign materials
  - ✓Blending\mixing
  - ✓Even feed of material to card.

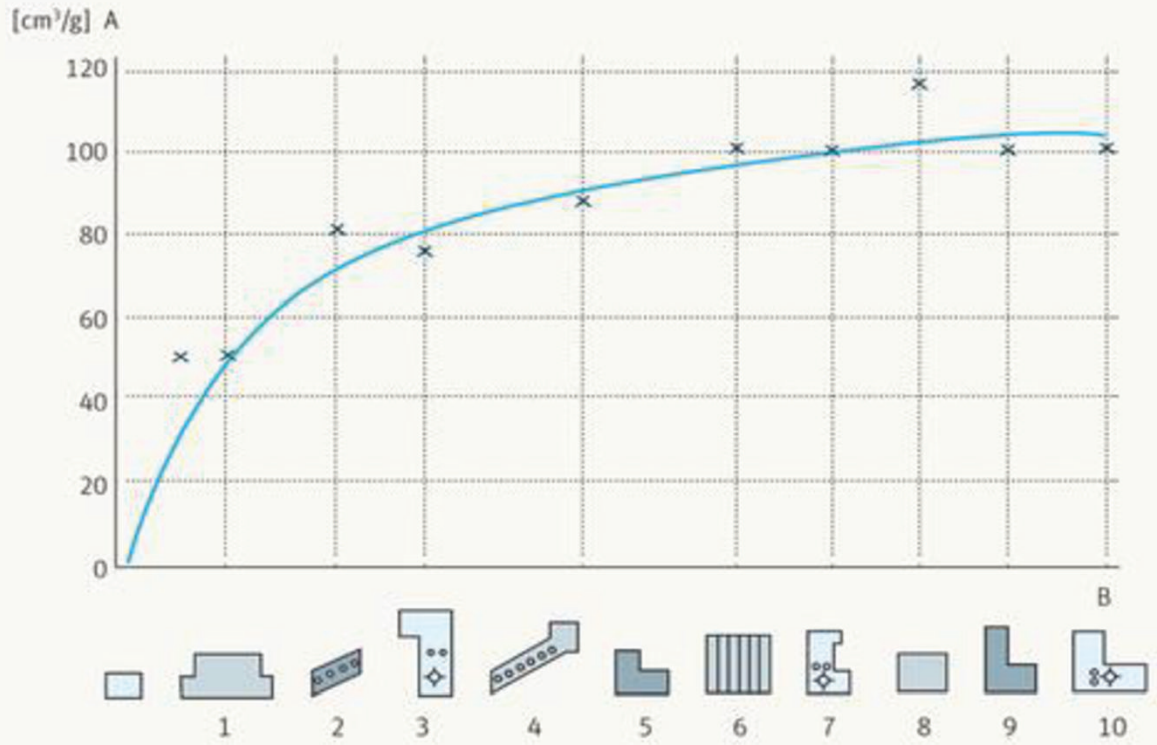
Cotton Opening Mixing and Cleaning

- Spinning the yarn from a loose mass of cotton requires a certain manufacturing process, which will separate and disentangle the fibres, mix them and clean of foreign mater and short fibres.

- To clean, mix and blend fibres they have to be brought into the smallest aggregate form. Only well opened material can be effectively cleaned. In blow room bales are oppened to Tuft weight (about 0,1 mg).

- To enable the fibres to be blended they must be thoroughly opened To prepare the fibres for the carding and subsequent operations they must be opened to the point where there will be minimal fibre damage.

- During these processes cotton passes through a series of machines where it is opened, mixed and cleaned. On passing through these machines cotton gets an ordered condition and is ready for the next process



Openness of the fiber material after the various blowroom machine stages; axis A: Degree of opening (specific volume); axis B: Blowroom stages

Need for mixing/blending

- Mixing and blending are 2 similar but different words. Mixing is a process of combining 2 or more fibres from the same origin (e.g combining 70% cotton/30% linen) while blending is combining of fibers from different origins (eg. 70% cotton and 30% polyster)

- Several bales of cotton are mixed together with the aim of obtaining a uniform quality over a continuous period of time thus ensuring regular work throughout the mill. This ensures required characteristics of end product.

- This uniformity of mixing is obtained due to counteracting lower qualities of some mark lots by mixing them with cotton of other mark lots having better strength, greater length, etc.

- The raw material cost makes up 70% of the cost of the yarn. To bring down the cost of the yarn cottons of various prices should be included into the mix so as to make the mix cheaper without impairing the quality of the yarn.

- By mixing/blending it is also possible to achieve effects by varying fibre characteristic

Number of cotton in a mix

- The use of several cottons in a mixing has both advantages and disadvantages. The advantages include the possibility of maintaining uniform mixing over ling periods, irrespective of the availability of particular cotton, and keeping the cost of the mixing at reasonably low level by blinding cottons of higher cost with those having lower cost. It would appear that these advantages could be best obtained by the use of several cottons at a time.

- inclusion of several cottons in mixing would also create some problems. The probability of proportional representation of mixing in the yarn cross- section becomes lesser as the number of components in the mixing increases. This will lead to segments of yarns having different fibre properties.

- Such a yarn on processing and dyeing would appear patchy when the variation in the fibre properties used in the mixing differs significantly. Therefore, from practical considerations, mixing of two to three components is to be preferred.

Need for CLEANING

➢Cotton bales delivered from ginning industry to textile industry contains trashes such as cotton stalks fro harvesting and seed coats from ginning and impurities such as sands, dusts, metals from broken parts of ginning machine and other particles.

➢The trash and other impurities contained in cotton received by the spinner must be removed as completely as possible to enable an effective spinning operation to be performed at high speeds.

➢A blow room cannot remove all of the foreign matter in the raw material. A blow room installation removes approximately 40 - 70% of the impurities. The result is dependent on:

- ✓ Raw material to be processed;
- ✓On the machinery conditions and appropriate adjustment; and
- ✓Environmental conditions

- Higher degree of cleaning results in fiber loss, in addition to the stressing of the fibers, because of simultaneous beating of the fiber to clean. Normally, good fibers represent about 40-60% of blow room waste.

- Since the proportion of fiber in waste differs from one machine to another, the fiber loss at each machine should be known.

- It can be expressed as a percentage of total waste eliminated in cleaning efficiency, CE. The cleaning efficiency of blow room is 60 to 65%.

Cleaning Efficiency, CE = Trash in waste/Total waste * 100 = $A_T - A_F / A_T * 100$

Where, AT is percentage of total waste and AF is percentage of good fibers eliminated.

Degree of Cleaning (Dc) of the machine is the ratio of the trash removed of total trash fed to the machine which is expressed as percentage value.

DC = Trash in feed – Trash in delivery / Trash in feed * 100

Degree of cleaning in the blow room

Original trash content	Quantity of trash removed
< 1.2%	< 40%
1.3 – 2.0%	40 – 50%
2.1 – 4.0 %	50 – 60%
4.1 – 7.0 %	55 – 65%
>= 7.1 %	60 – 75%

Blow room

➢To fulfil the objectives of blow room, the action of the machines in any blow room range fall into one or more of four main groups namely-

✓The action of opposing spikes (opening)

✓The action of beaters (opening and cleaning)

Beater are responsible for the removal of almost all the impurities extracted in the blow room. Beaters also help the oppening of the fibers.

✓The action of air currents (transport and clean)

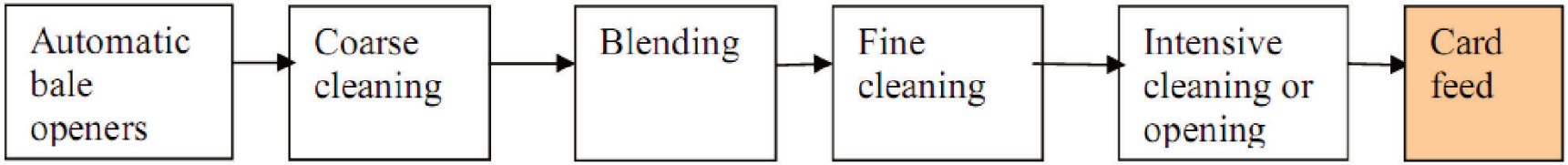
During processing the movement of fibers from machine to machine is done by air current. It also helps the separation of lints and trash.

✓The regulating actions (uniform output)

➢The actions of regulating motions gives the uniform output of cotton fiber by the help of swing door and swing paddle, electric photo cell

Blow room

➢In a modern blow room line installation, six clearly distinguishable operating zones can be identified.



➢If cotton contains only few impurities, then the zone of intensive cleaning may not be necessary. Sometimes, intensive cleaning or opening and card feed can form a single unit.

➢An additional operation in the blow room, namely dust removal, cannot be allocated to any single zone. Dust removal is carried out to a greater or lesser extent at each blow room machine.

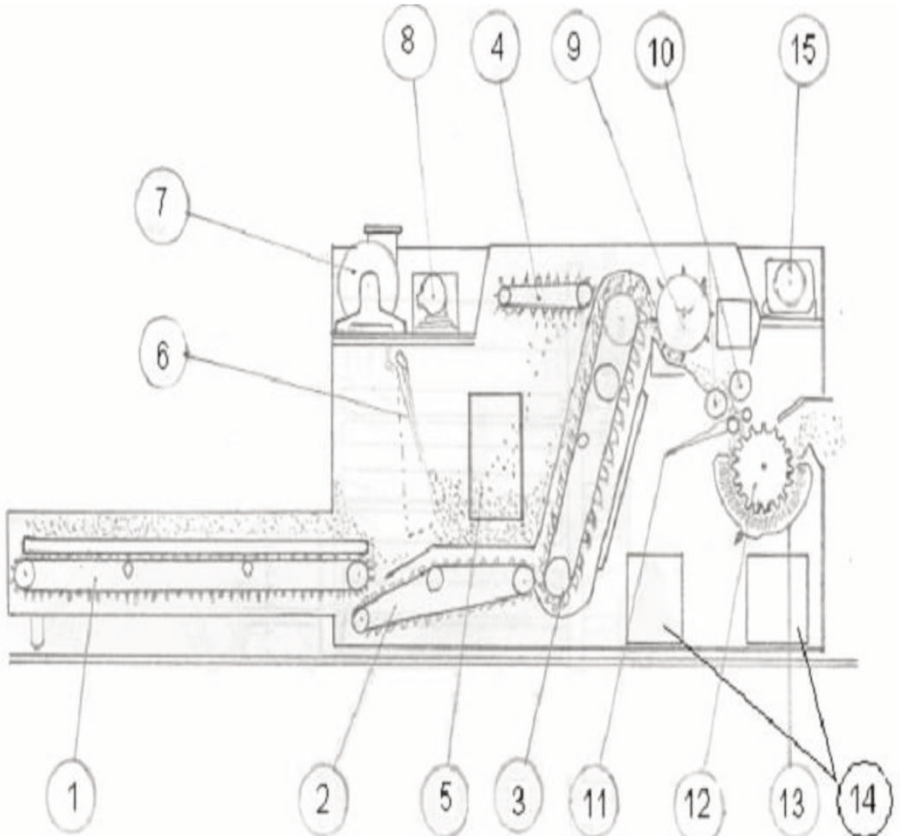
➢However, several manufacturers now offer special dust-removing machines or equipment. In the machine sequence, they appear mostly at the end of the blow room line.

Zone 1: BALE OPENER

➢ the first machine in blow room line used to open and prepare the material properly for the subsequent cleaning stages. It can be automatic bale opener or manual bale opener

➢Bale opener performs the preparatory operation of opening highly compressed bales of cotton breaking them up into small tufts, mixing of cotton from different bales in the hopper, cleaning cotton from some dust and fly

Conventional bale openers (blending feeders)



1. Inlet lattice
2. Bottom lattice
3. Inclined spiked lattice
4. Evener spiked lattice
5. Blending box (hopper)
6. Control rake or screen
7. Suction fan
8. Main motor
9. Detaching roller
10. Conveying roller
11. Nipping roller
12. Porcupine beater with blades
13. Grid bars
14. Waste box
15. Motor driving the porcupine beater

Functions of the different parts of BF

1. **Inlet lattice:** receives cotton manually mixed on it and transports the material to the bottom lattice.
2. **Bottom lattice:** transports cotton to inclined lattice.
3. **Inclined spiked lattice:** has spikes or metal pins to pull bunches of cotton from the bulk and carry them toward the evener lattice and helps in the liberation of dust particles.
4. **Evener spiked lattice:** has spikes or metal pins to further open cotton batches against the spikes of inclined lattice, detach excess cotton coming up by inclined lattice and knock them down to the hopper to mix with the newly fed cotton. It also helps in the liberation of dust particles. The distance between the spikes of inclined and evener lattices is very small.
5. **Blending box (hopper):** is a reservoir of raw material and is used for mixing newly fed cotton and cotton batches which are returned by evener lattice.
6. **Control rake (screen):** senses the excess accumulation of cotton in the hopper and allows the switch button to be pushed so that signal is sent to inlet lattice to stop its motion and then material feed is discontinued. As soon as the supply of material is lower than the blending box capacity, the feed is continued again.
7. **Suction fan:** for sucking dust particles in the hopper and transport it through the piping system to the waste room.

8. Main motor: to initiate motion to all rotating parts of BF, except porcupine beater.

9. Detaching roller: to detach the material from inclined lattice to deliver it to the conveying rollers.

10 & 11. Conveying and nipping rollers: to transport material to the next device and smash impurities bound to the fiber.

12. Porcupine beater: it possesses blades and while rotating the blades beat the material against sharp ages of grid bars to open the cotton batches to small tufts.

13. Grid bars: the material is being beaten on it for opening and cleaning. It also removes impurities, heavy sand particles like sand by gravity.

14. Waste box: collects trash and short fibers not adhering to the tufts of cotton.

Setting & their effects:

i) Vertical lattice & evener lattice

wider :- More mtl passage & less opening; closer :- Less mtl passage & more opening.

ii) Vertical lattice to evener roller.

wider :- Less opening & higher production; closer:- More opening & less production.

iii) Vertical lattice & delivery roller.

wider :- Higher production; closer:- Less production.

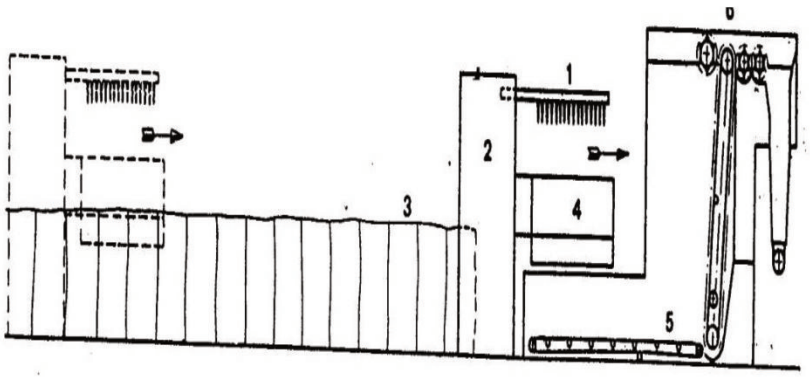
Working Principles of BF

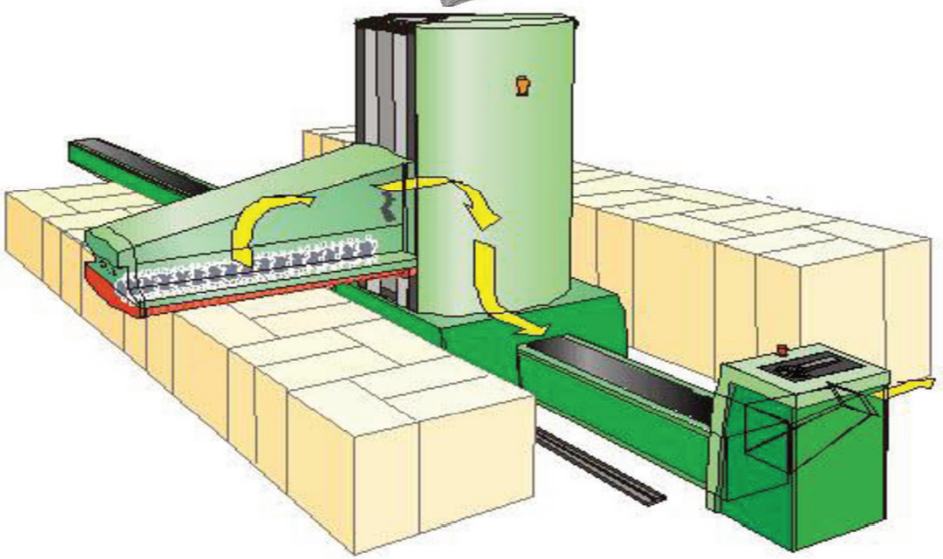
➢Laying of material on the feed table/lattice is performed manually or by a bale opening m/c in the case of automatic bale opener.

➢The bottom lattice pushes the fibre mass towards the inclined lattice. Inclined lattice carry cotton with its spike towards the evener roller for facilitating the feeding. If these cotton lumps are sufficiently opened, they pass between the inclined lattice & the evener roller. However, most lumps are too large to pass through the space between the two units. They are thrown back into the blending hopper by the eve3ner roller & from the hopper they pass once more info the operating region of the two assemblies. Each time they become smaller until finally they can pass through to the next unit. Here evener roller as its name implies it control the amount of passage of cotton by opposite spike action.

➢Wiper roller wipes the cotton to the surface of evener roller. Suction fan to the filter room collect the dust & dirt through pipeling. Blower fans are also activated for transferring the open cotton suitable for next m/c. This operation continue until m/c stoppage. Production rate & degree of opening are determined by the speed of operation of the inclined lattice & its spacing from the evener roller.

Automatic Bale Opening Machines





1.Grab unit can turn through 90°); amount of opening of grab can be set in order to control the tuft size.

2. Travelling unit 2 (1, 2 and 4) move as a unit from bale to bale, lifting materials as per programme.

3. Bales [Bales can be laid on both sides of the travelling unit].

4. Collected material deposited on the container 4.

Once the container has material to a preset level, it deposits the material to the lattice

Benefits/ADVS. of automatic bale opener

- Automatic changeover for bale opening from one side to the other
- Continuous production without manual intervention or supervision
- Long operator-free runs
- Savings of manpower cost
- Controlled pick amount from each bale
- Possibility of running more than one mix

Zone 2: Pre/course -cleaner

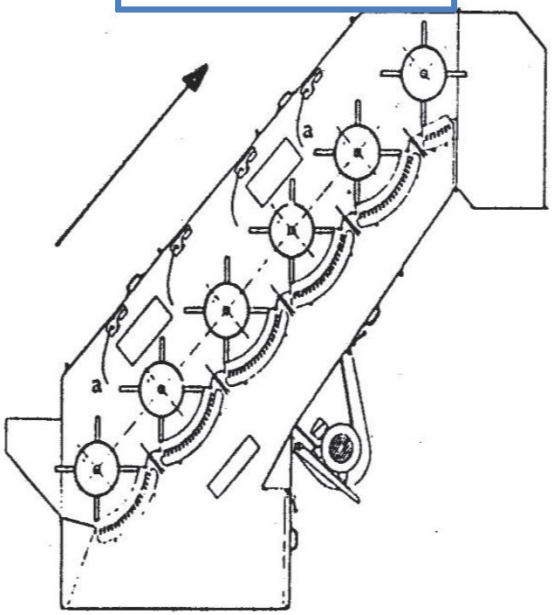
➢ is an efficient cleaning and opening machine which is used immediately after bale opening. It is pre-cleaning machine having a roller with specially designed pins. It has high cleaning efficiency and equipped with adjustable grid bars. The raw material is beaten above the grid bars several times in order to remove the impurities.

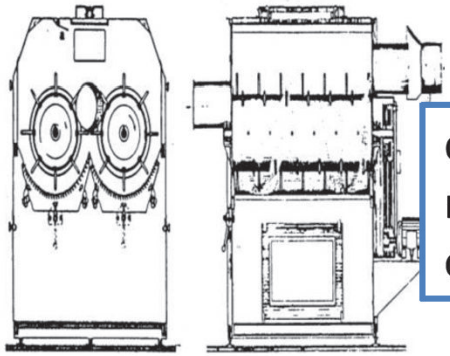
▪Machines of this functions are characterized by The action of openers/beaters on the material in free flight conditions (not clamp feed) and by The beating/opening elements widely spaced.

➢Horizontal cleaner and step cleaners are of this type.

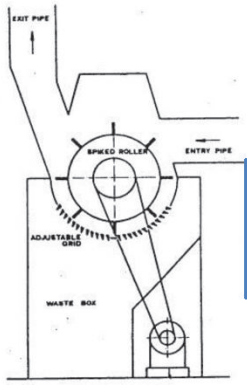
Horizontal cleaner

Step cleaner





dual roller cleaner



mono-cylinder cleaner

- Horizontal cleaner Used to detect and remove foreign materials (contaminants)

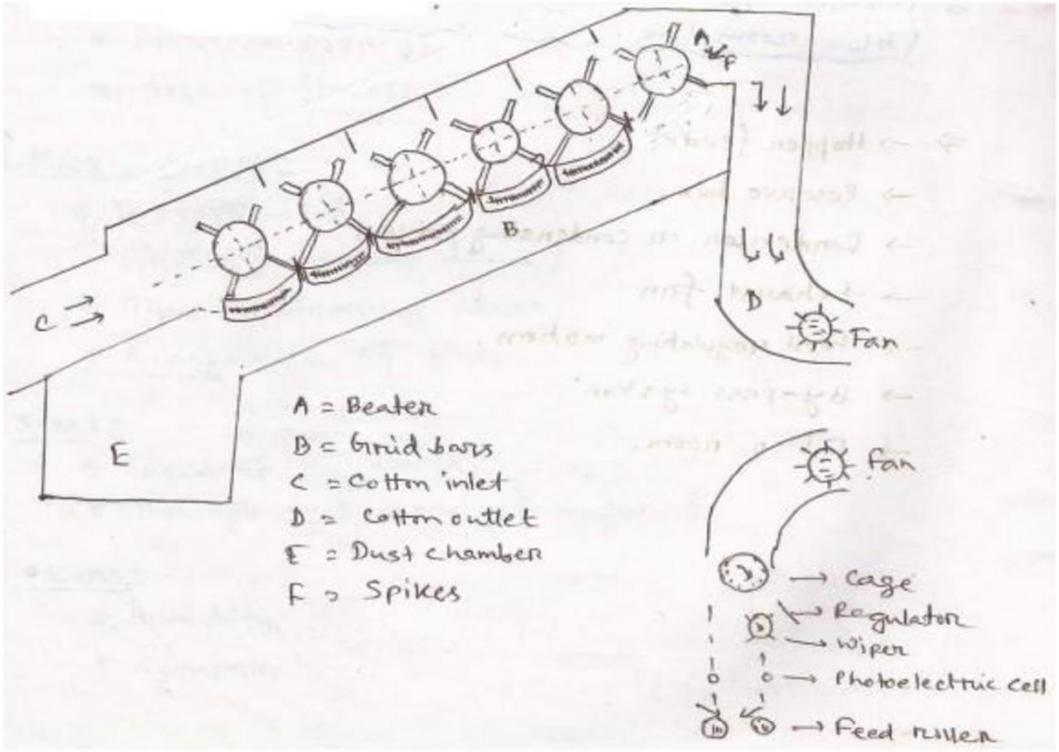
- Works on the principle of
  - cameras for colored materials detection like, rubber, colored fabric, colored yarns
  - ultrasonic system for white contaminants like sisal, jute

- Steps in extraction

✓ CHECK - ultra fast colour cameras scan the cotton tufts from both sides for recognition of the actual size and shape of each particle

✓ DETECT - recognizes the colour of the cotton automatically.

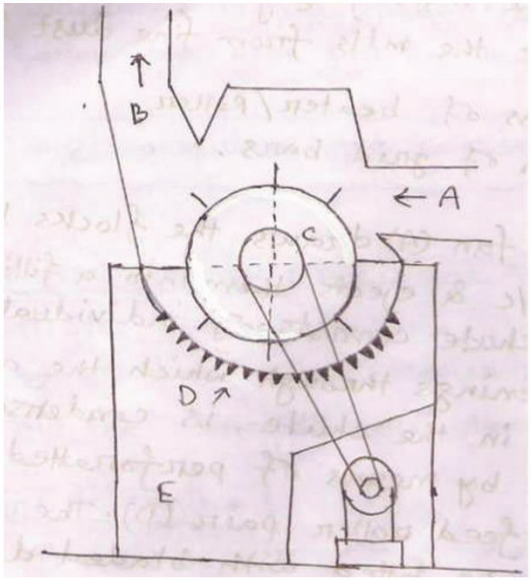
✓ ELIMINATE - Contaminations are ejected at minimum loss of good cotton.



- The material falls into the feed hopper and passes to the first beater.
- From there it is transported upwards by the six (sometimes four) beater rollers, each carrying profiled bars;
- The beaters are arranged on a line include upwards at 45^0.

- Elimination of impurities takes place during the continual passage of the material over the grids arranged under the rollers.

- The speeds of the beaters and the grid bars are adjustable and each have varying speed and setting.
- Super cleaning with Cleaning efficiency 80% and Beater speed of 650-500 rpm. Applicable for all grades of cotton.



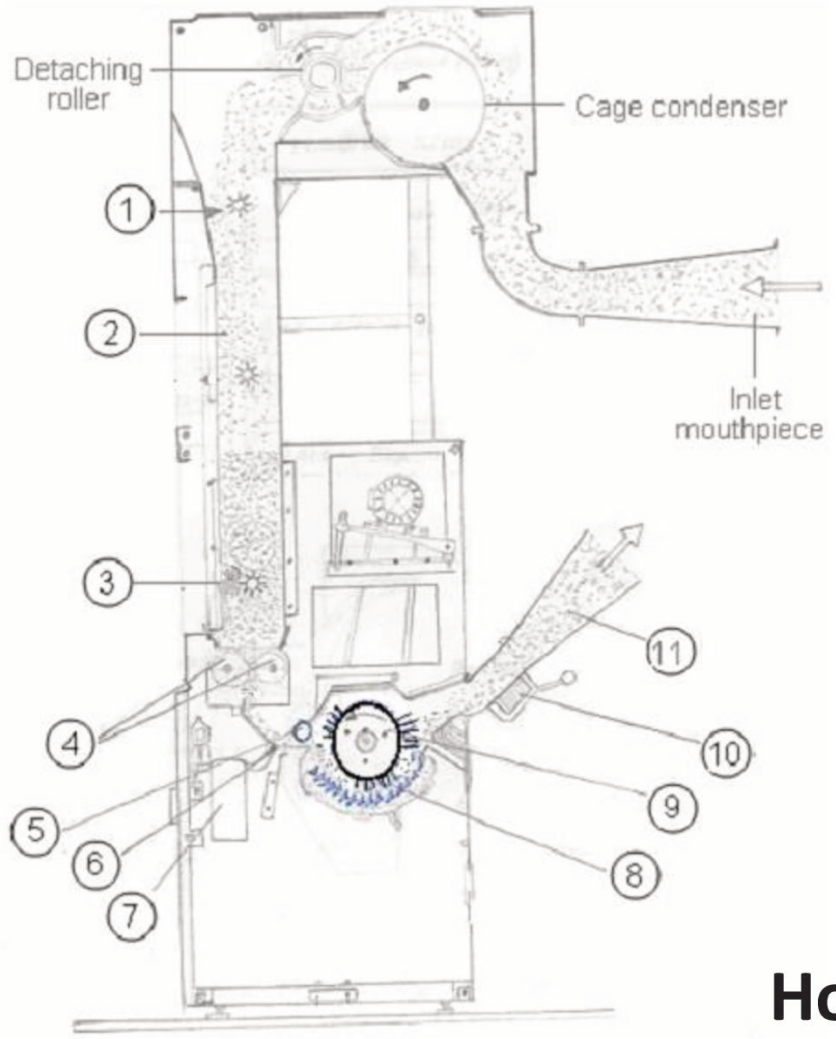
A = Entry pipe
B = Exit pipe
C = spike roller
D = Adjustable grid
E = Waste chamber

➢This is a loose feeding pin opener. Monocylinder cleaner is employed in the blowing room process between the mixing bale opener & Automixer.

➢The advantage of this opener is that the impurities are separated without being crushed.

➢ Separate the impurities from cotton flocks without being crushed and give the cotton flocks a strong cleaning.

➢The machine parameters: No. of beater drum is One, Diameter of drum with spikes is 700mm and Production of 500-800 kg/hr.



Parts of the machine

1. Photocell
2. Silo
3. Adjustable side
4. Feeding rollers
5. Nipping roller
6. Pedal/feelers
7. counterweight
8. Grid bars
9. Carding beater
10. Magnet
11. Outlet mouthpiece

Horizontal opener

➢The cage condenser mounted on top of the horizontal opener creates the under pressure and brings the cotton pneumatically along the transport pipe connected to the previous machine. Cotton could be supplied either from inclined cleaner or automixer depending on the cleanliness of the material.

➢Air and dust is separated from cotton by the help of cage condenser. The cotton deposited on the surface of cage condenser is then removed from it by detaching roller and dropped to the silo. The capacity of the silo is regulated by the adjustable side and the amount of material in the silo is controlled by photocells. These three optical monitoring devices are mounted in the filling chute of horizontal opener.

➢ If the column of material falls below the light barrier 3, then the preceding machine is switched on and delivers material. When the chute has been filled to such an extent that the material interrupts the light beam in light barrier 2, the machine is switched off again. Light barrier 1 is an over fill safety monitor.

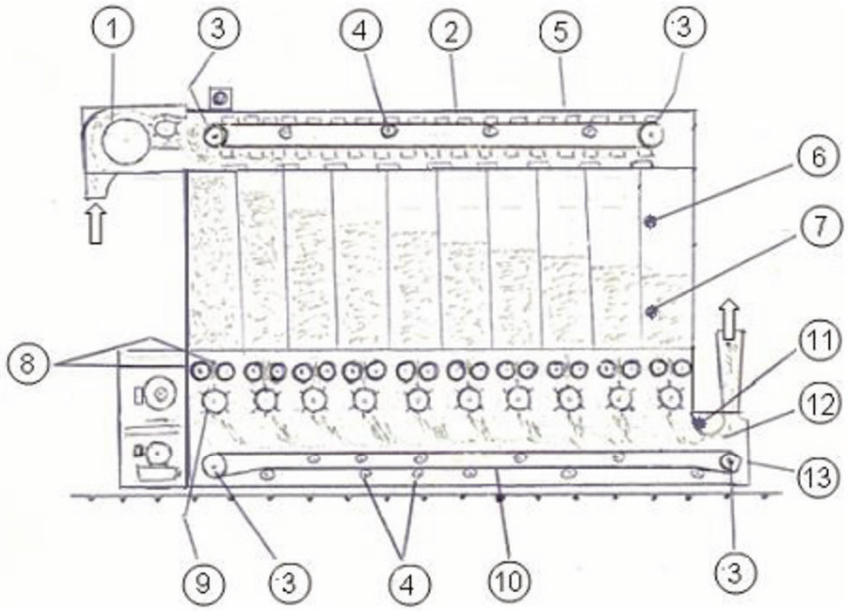
➢Then, the material feed to the carding beater (Kirschner roller), i.e. the opening roller, is proportioned by pedals or feelers to form an even batt. Finally, the opened and cleaned material is forwarded to card as flocks of fibers.

Zone 3: Blending /mixing machines

➢This machine used for only blending the cotton by means of different boxes or chambers. It consists of three parts;

- ✓ A storage section
- ✓ Intermediate chamber
- ✓ Delivery section

➢Flocks of cotton are feed to six or eight J shaped chutes arranged one behind other in storage section.



The main components of the machine are the feeding unit and the delivery unit.

I. Feeding unit

1. Cage condenser with detaching roller, mounted on the automixer to suck the material to the machine
2. Upper lattice for progressive feeding of the cells with lattice driving and supporting rollers
3. Lattice driving rollers
4. Lattice supporting rollers
5. Blending cells (6-8-10) with capacity of 10-50 kg each, according to the type and density of the material
6. Upper photocell to stop feeding when the material reaches the maximum level in the last cell
7. Lower photocell to signal the minimum level of the material in the last cell to initiate feeding

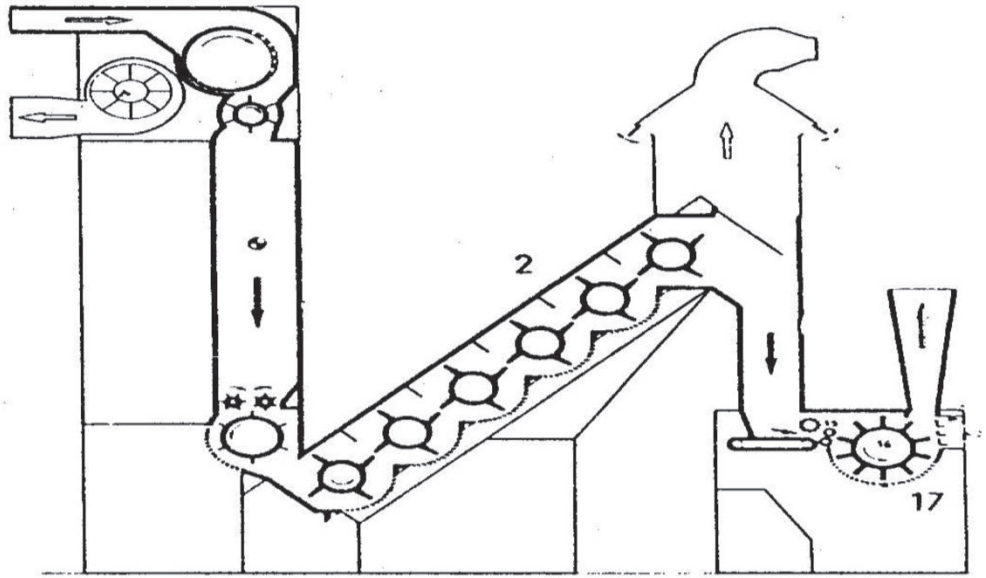
II. Delivery unit

8. Conveying rollers (two per cell) with a very low speed – less than 1rpm
9. Opening roller (one per cell) with a very high speed up to 653rpm
10. Lower lattice to convey the material outside. It has lattice driving rollers (3) and lattice supporting rollers (4)
11. Safety photocell at the delivery to stop the machine in case of material clogging on the lower lattice
12. Mouthpiece for the pneumatic delivery of the material

Zone 4: FINE CLEANING

Common features

- More surfaces need to be created for further cleaning (more surfaces - means more opening)
- Clamp feed arrangements are generally employed.
- The spacing of the striker elements on the rollers must be finer

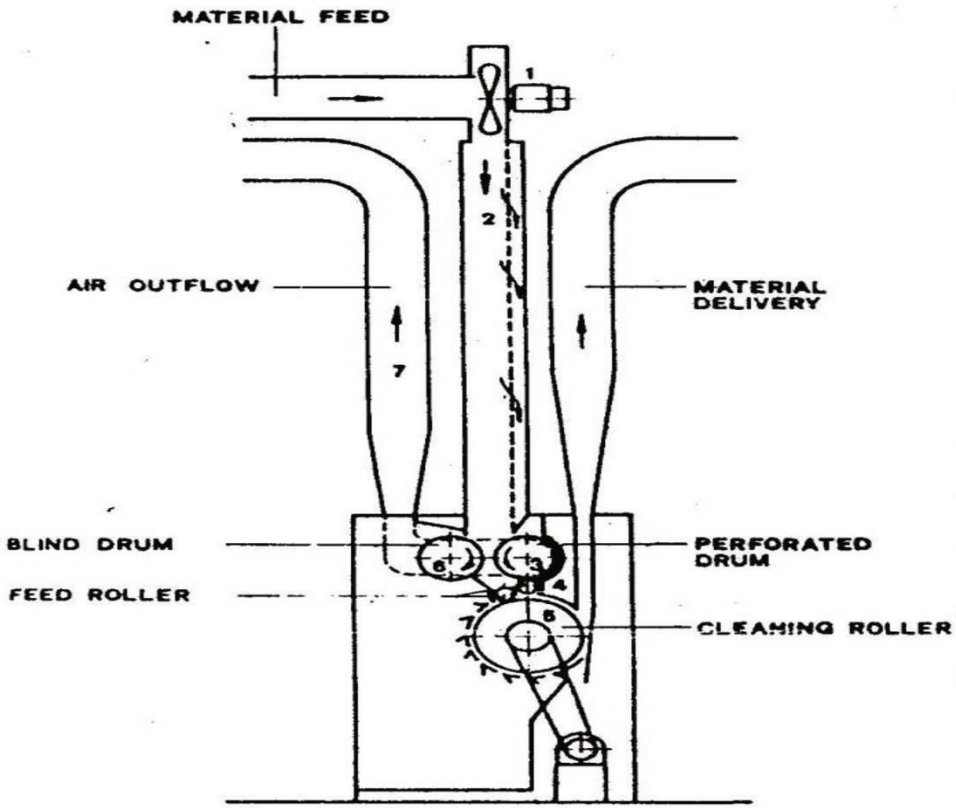


- The material passes directly form a machine of zone 2 (step cleaner) to the filling chute of the RN cleaner.

- Two feed rollers 15 are followed by a bladed roller 16. The striker bladders are made of metal sheet and have double, hardened working edges.

- The diameter of the envelope of the beater is 500mm. Half of this envelope is defined by a two-part grid having in total 36 profiled steel bars. The two grid parts 17 are adjustable independently of each other.

Zone 5: INTENSIVE CLEANING OR OPENING MACHINES



- In older installations, this zone was provided by the scutcher in the form of Kirschner beater. Alternatively, or possibly in addition to the kirschner beater, there may be a saw-tooth roller

- A fan 1 draws the flocks by suction from the preceding machine and ejects them into a filling chute 2. The raw material in the chute is condensed and fed to the opening roller by means of filter drum 3, blind drum 6 and the feed roller pair.

- The opening roller is exchangeable and can be fitted with bladed discs or saw-tooth clothing.
- The grid arranged under the roller consists of eight blades

Zone 5: Card feeding machines

- It is enormously important that the cards receive feed material that itself is homogeneous, uniform from card to card and remains constant over a long period. Fulfilling these requirements is not exactly easy for many modern installations with pneumatic flock feed systems.

- Usually, a certain degree of design effort is necessary to deal with the problem. Lap feed is less problematical in this connection, since each scutcher lap is checked by weighing for constant lap fineness. Hence, deviations in count in card output (sliver) will be nil, as laps exceeding a certain weight range are rejected.

- Lap weight is up to 40kg and its diameter around 0.55m. Further advantages of scutcher are: it can be applied universally and it permits operation with several blends - that means the whole installation is more flexible. In lap feeds, the blends can be allocated to individual machines while in flock feed, only to machine groups.

- Lastly, autolevellers are not required in card with lap feed resulting in less investment and maintenance cost.

- In comparison with flock feed system, however, lap feed has severe disadvantages:

1. greater manual effort in transport and lap change
2. an additional source of faults since a lap running out at the card must be replaced by another one
3. more clean waste caused by lap changing and by correcting of faulty changes
4. an additional burden on the taker-in because laps are heavily compressed.

- Due to the above four problems, modern cards are now supplied only with flock feed installations which will be discussed in the next chapter.

Chute Feed System:

➢In case of chute feed system instead of forming blow room lap, the opened, cleaned, mixed/blended material is fed to the carding machines through pipe line in tuft (sheet form) by the action of air.

Lap Forming

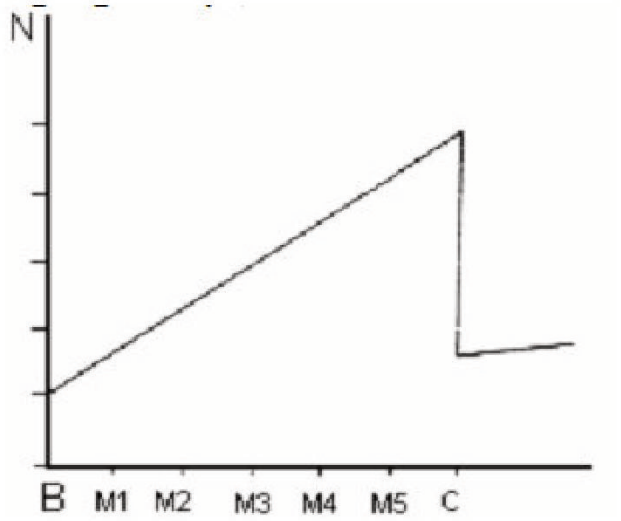
➢To convert the opened and cleaned fibres into a sheet of particular width with uniform weight/unit length is called lap.

➢The Lap so formed is wound on the lap spindle to make it suitable for the next process of carding.

Nep in blow room

Neps are entangled fibers. Causes for Nep formation in Blow room are:

- ✓Cotton with too high or low moisture.
- ✓Extremely fine cottons with high trash content.
- ✓Reprocessing of laps and mixing of soft waste.
- ✓Rough or blunt blades and bent pins on beaters.
- ✓Narrow settings between the feed roller or pedal and beater.
- ✓Long curved and U-bends in conveyor pipe lines.
- ✓Inappropriate ratio of fan to beater speed.
- ✓Wider setting between stripping rail and beater blade.



N = neps
B = cotton Bales
M = Blow room machines
C = carding

Regulation actions in blow room

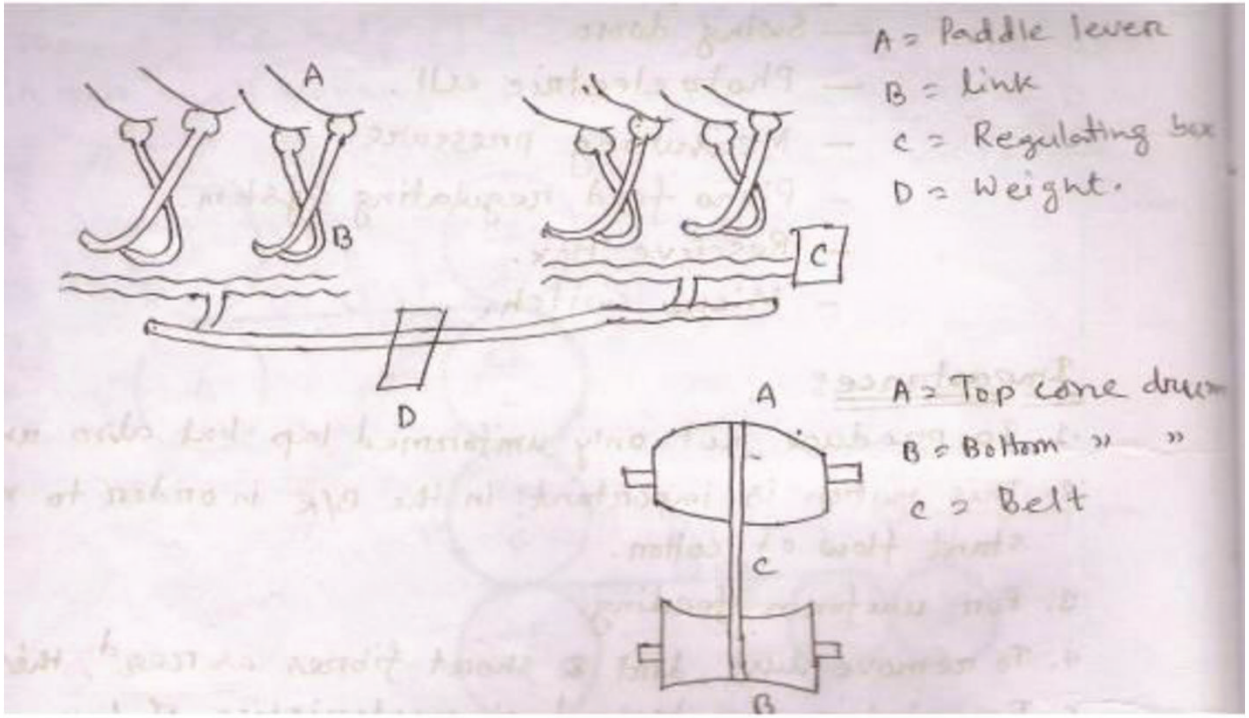
➢Regulating action is responsible for maintaining a constant flow of cotton through each m/c & controlling over the regularity of the mtl throughout the whole process.

➢The correct amount of cotton in the reserve box may be maintained by using –

1. Swing door.
2. Photoelectric cell.
3. Measuring pressure.
4. Piano feed regulating system.
5. Reserve box. 6. Micro switch.

- In photoelectric cell the light source & photocell are fitted opposite a window in each side of the m/c so that the light passes through on to the m/c. While filling the cotton if the light is broken between light source & photo-cell, the feed of cotton is stopped until cotton again moves away from the light source.

- In Piano feed regulating system The pedal movement caused by the thick & thin places of cotton is employed to shift the belt in the cone drums by means of lever to alter the speed of the feed roller in order to keep the feed contains per unit time.



❑The objectives of Piano feed regulating system are:

1. To feed the layer/wave of fibre uniformly to switcher.
2. To control feed by decreasing the speed of feed roller in case of thick places of cotton & by increasing the thin place.
3. To produce uniform lap.

- In Regulation By air pressure When air & cotton are fed, air is sucked by another portion, this air pressure is measured by sensor & is used to determine the amount of cotton present in the hoppers. If pressure is more, it stops feeding & if pressure is less, it allows more cotton to enter.
- The swing door arrangement is such that when the hopper is about 2/3 to 3/4 full of cotton, it is forced down against the resistance of the counter balance spring, then the drive to feed lattice is stopped. The swing door is used for the uniform feeding of cotton to spiked lattice.
- The rugulating actions in blow room are Import for:
  - ✓ To produce not only uniformed lap but also uniformed sliver.
  - ✓ This motion is important in the B/R in order to maintain a constant flow of cotton.
  - ✓ For uniform feeding.
  - ✓ To remove dust, dirt & short fibres as reqd this motion needed.
  - ✓ To maintain the desired characteristics of lap.
  - ✓ To get optimum efficiency of m/c in the B/R.

Mathematical problems

Eg1. A lap contains 4% trash after processed in B/R having the cleaning efficiency of 78%. Find the trash % in raw cotton.

Cleaning efficiency = Trash remains after processing/ total trash
78 = 4%/total trash
Total trash = 4/78* 100 = 5.13%

Eg2. Bottom calender roller dia = 10 inch, rpm = 13 & wt. of every yds lap is 9 oz and cleaning efficiency 80 %. Find out the production of B/R per hour.

Production in lb/hr of B/R = Π *Diameter*RPM*60*Efficiency*lap Wt./36*16*100
= Π*10*13*60*80*9/36*16*100
= 17,634,240/57,600
=306.15lb/hr

Eg3. If lap length constant is 680, then set the change pinion for 32 yds lap.

pinion Change = Lap length constant/lap length
= 680/32
=21T

Eg4. Find the no. of lap per hour in scutcher m/c of Bottom calender roller dia = 12 inch, rpm = 16, efficiency 80%. Lap length 38 yds.

Production in yrds/hr of B/R = Π *12*16*60*80*38/36*100

=109,965,312/3600

= 30,545.92 yrds