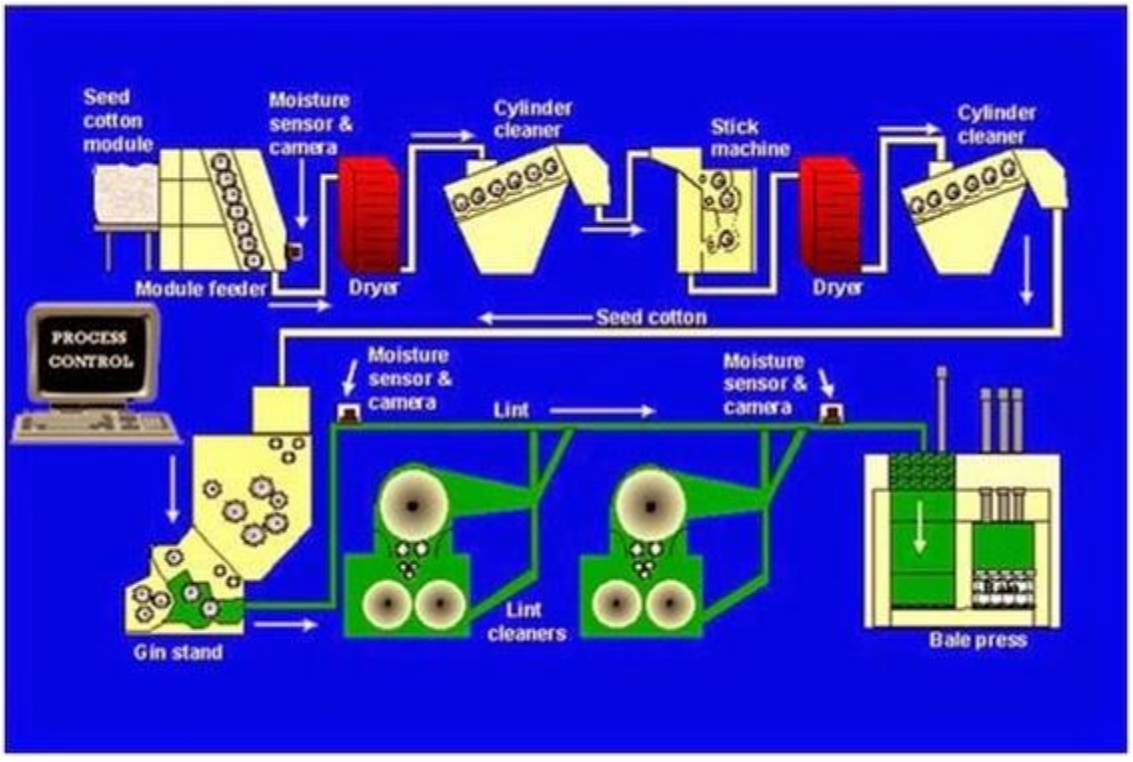
Spinning Technology-I

1. Ginning

Cotton Ginning is the process of separating the cotton fibers from the cotton seeds. Perfect ginning operation would be performed if the separation of fibers from seed was effected without the slightest injury to either seeds or to the fiber. A cotton gin is a machine that quickly and easily separates the cotton fibers from the seeds, a job previously done by hand. These seeds are either used again to grow more cotton or, if badly damaged, are disposed of. It uses a combination of a wire screen and small wire hooks to pull the cotton through the screen, while brushes continuously remove the loose cotton lint to prevent jams. The term "gin" is an abbreviation for engine, and means "machine".



1.1 Objects of Ginning:

To removes the fiber from the seed.

To remove the neps and wastage in some extents.

To collect the seed and seedless cotton fiber separately.

To separate the cotton fiber from the root position of the seeds.

1. **1.2 Types of Ginning**

   As the cotton industry developed, greater production than these were capable of was necessary, and machines driven by power were introduced. Numerous forms of gins have been tried, but at the present time only three are used to any large extent. They are

   1. Knife Roller Gin / Roller Gin

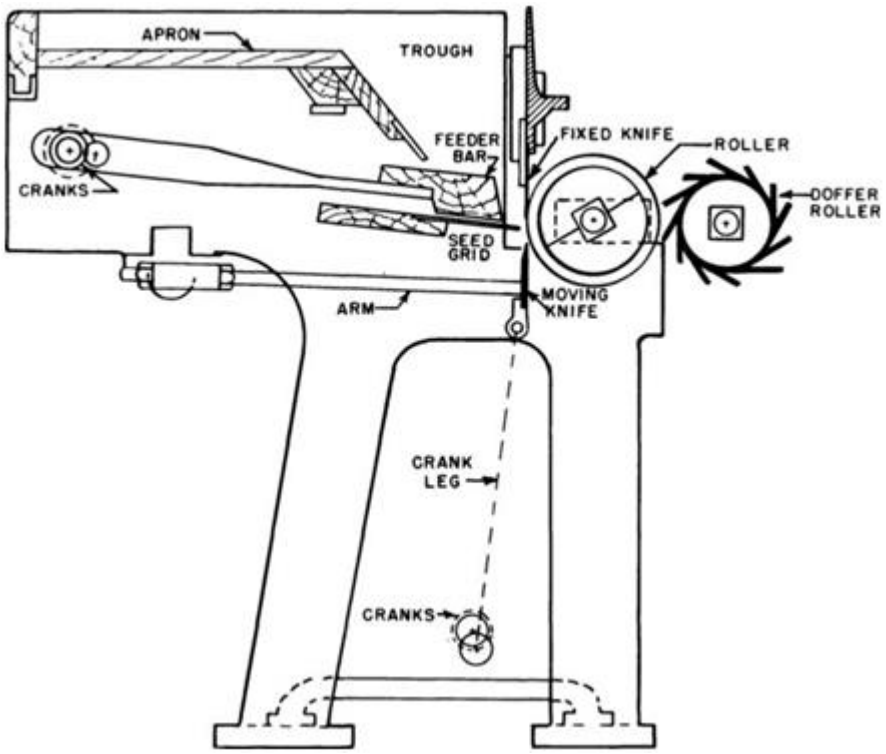
   2. Saw Gin

   3. Macarthy Gin

1.2.1 KNIFE ROLLER GIN

Object: To separate the fibres from seed

The constructional detail of the machine is clearly shown in fig. The seed cotton is placed in bulk on the table. By means of the reciprocating motion of the table by the crank arrangement, the seed cotton comes into contact with knife roller (formed of a number of knife discs).



Auxiliary roller breaks the large cluster of seed cotton and maintains a constant supply of cotton to knife roller.

Knife portion being arranged in such a manner that anything coming into contact with it is given a reciprocal or to and fro motion as well as being subject to a striking action due to its revolution.

The seed cotton is carried forward in the direction of knife roller's motion until it is brought into touch with leather roller. This roller, which has a much roughened surface, due spirally-formed saw cuts. Has pressing against, it by means of spring and steel doctor Knife.

The cotton fibres brought into contact with the leather adhere to it, and are carried round past .the knife. It is impossible for the seeds to follow. So, seeds will remain at the point of contact of the doctor knife and leather roller, with the fibres still connected with it. The essential feature of this gin now comes into play.

The knife roller is so set as to act upon, these adhering seeds, and it gives to them a gentle to and fro motion, repeated very quickly 'and at the same time a slight striking action or pressure also repeated quickly. The combined action soon causes the seeds to separate from the fibres and to fall down through the grid to floor. The freed fibro passing forward is stripped from the roller by some arrangement of the stripping board.

The seed cotton not taken up by one leather roller (on the right of the figure) is brought round into contact with another 1eather roller where same process as described above is gone through and to which the same parts equally apply.

1.2.3.1 SINGLE ACTING MACARTHY GIN

Object: To separate the fibres from seed

The constructional details of the machine are clearly.

The seed cotton is placed on the table. By means of the reciprocating motion of the table by the crank arrangement, the seed cotton comes into contact with the revolving leather covered roller.

Some cotton fibres are carried in the direction of leather roller, but seed cottons are arrested by the doctor knife.

A steel beater blade is connected by means of a connecting rod, with a crank on the driving shaft.

Due to the seeds being acted upon by the rapid reciprocating motion given to the beater blade by the crank, the seeds are separated from fibres.

Ginned cotton fibres are carried onward in the direction of leather roller, stripping board strip the fibres from the leather roller and empty seeds are thrown into grid, through which they pass into suitable receptacle.

1.2.3.2 DOUBLE ROLLER MACARTHY GIN

Object: To separate the fibres from seed.

CONSTRUCTION:
As shown in the figure, there are two leather roller and a" doctor knives is pressed against each leather roller. The beater knives act from above, and are given a reciprocating motion from a crank. Crank pin slide in a slot of arm carried by a vibrating shaft. Beater blades are fixed on arms projecting from vibrating shaft. Also grid and fingers are fixed on vibrating shaft.

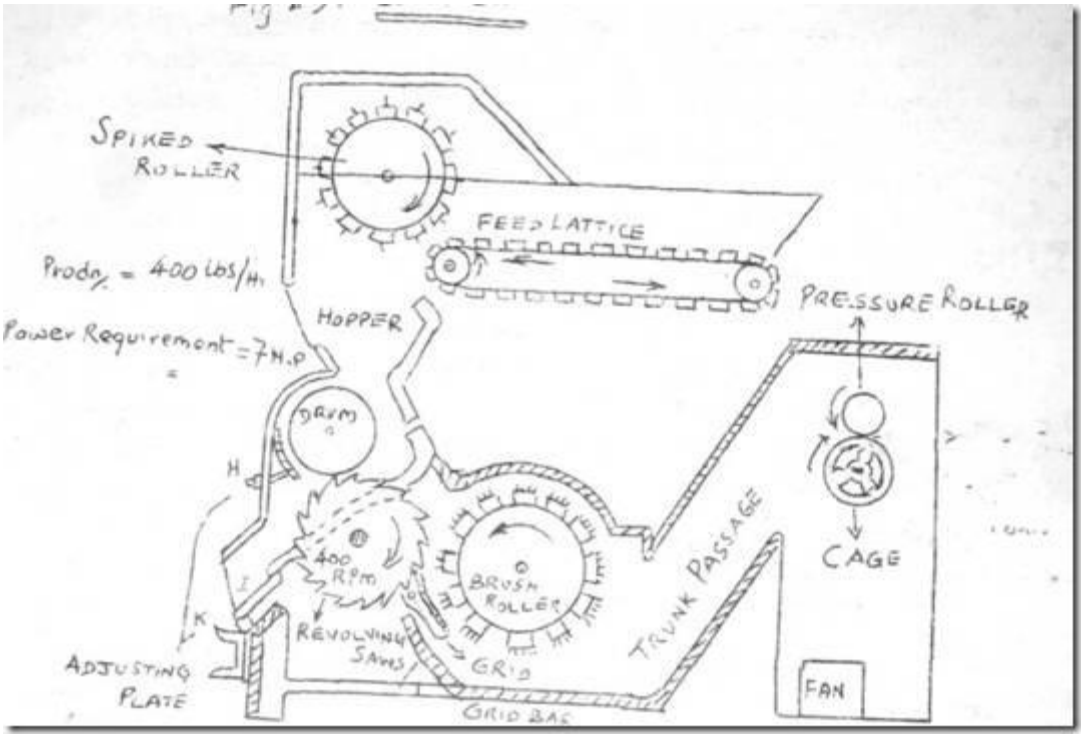
WORKING: Seed cotton is fed into hopper -spaces. The c movement lowers this cotton into contact with leather roller in one side and raises it away from the roller on other side.

When the cotton comes into contact with leather roller, some cotton fibres are carried in the direction of leather roller but seed cottons are arrested by the doctor knife due to the seeds being acted upon by-the rapid reciprocating motion given to the beater blade by crank,(the seeds are separated from fibres. Ginned cotton fibres are carried forward in the direction of leather roller.

1.2.3 SAW GIN

Object: To separate the cotton fibres from the seed.

WORKING: The seed cotton is fed upon the lattice and carried forward to the spiked roller, which loosens the cotton and throw; it into the hopper.



In hopper, the seed cotton comes into contact with rapidly revolving saw roller. App.70 saws are threaded on a shaft.

As the saws revolve, the teeth carry the fibres forward, but it is impossible for the seeds to follow and also, due to the heavier beating of the rapidly revolving saws on the seed cotton, the fibres are separated from seed and taken round until the brush strips the fibre from the teeth.

Empty seeds husks and other broken seeds are thrown into grid, through which they pass into suitable receptacle. An air current from the cage draw the fibres along the trunk passage, and on reaching the revolving cage are brought under the pressure roller and delivered as a sheet, from which it is taken to the baling press.

SETTINGS:

The bars (I) are adjusted at K. The plate, adjustable at H, can be regulated to prevent the seeds falling away until thoroughly cleaned. An air current from cage should be optimum to 'suck only fibres. If air current is high - it will "suck seed also with fibres. If air current is low - fibre accumulation under brush roller causes to block the machine.

Saw gin is suitable to process American cotton and wherever American cotton is grown, such as west Africa- India, Ceylon etc.

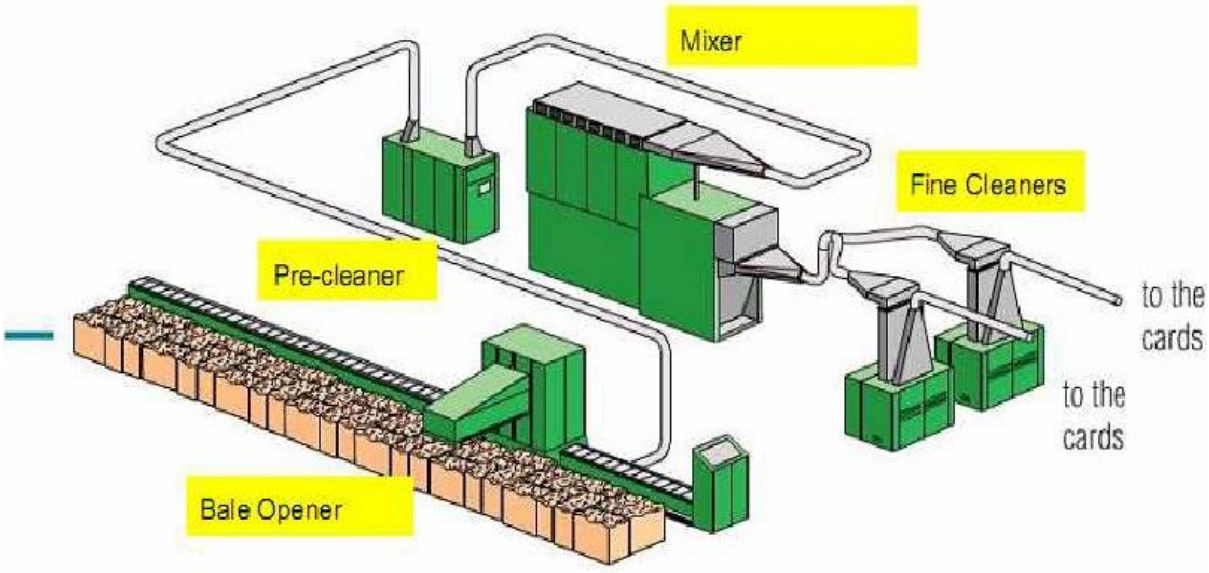
1.2.4 **Faults of Ginning:**

1. Fiber are broken at the middle position so that it becomes shorter in length.
2. Crush seed remain with the cotton.
3. Neps are formed in cotton.
4. Remaining excessive trash in the cotton.
5. Remaining fibres with seed.

2. Blow Room

Blow room is the starting of the spinning operation where the fiber is opened, cleaned, mixed and evened.

The whole machine is subject to suction and the dust is collected in special filters; the material, on the other hand, undergoing contemporaneously, the rotary action of the cylinder and suction along the operating width, effects a helical movement around the drum and exits from the side opposite to that on which it entered. It is then transferred by the delivery hopper into the transportation conduit.



2.1 Functions of Blow Room

1. Opening- The opening is the first operation within the blow room in which the goal is always a high degree of openness of material with gentle treatment and a fiber loss as less as possible.

The opening is the first operation it means, tearing apart the compressed and matted cotton until it is very much loosened and separated into small tufts with a gentle treatment, and a fiber loss as small as possible.

The opening is also related to cleaning as where is opening there is also cleaning.

2. Cleaning - Cotton contains up to 18% trash in most cases. To clean the material it is unavoidable to remove as much fiber as much waste.

Therefore it is necessary to measure the amount of the waste removed and its composition. As it is of high importance also called cleaning efficiency.

The cleaning efficiency always has to be optimized and not maximized, since the fiber quality (short fibers, neps), as well as fiber loss, is always negatively affected by maximum trash removal.

3. Dust removal-To extract the contamination in the cotton such as leaf, stone, iron particles, jute, poly propylene, colored fibers, feather and other foreign material from cotton by opening and beating.

An often underestimated task of the blow room line is the removal of dust. However, it is as important as the removal of impurities.Dedusting in the blow room happens by air suctioning only, either between the machines, e.g. by dust cages, dust extractors, etc. or within the machine by normal air separation.

Every blow room machine must be capable of extracting dust, so that special dedusting machines should be needed.

The efficiency depends not only on the devices but also on the size of the flocks. The smaller the flocks, the higher is the efficiency.

4. BlendingMixing

Mixing: It is generally meant as the intermingling of different classes of fibers of the same grade.

Blending: IT is meant as the intermingling of different kinds of fibers or different grade of same fibers e.g. polyester & cotton, Viscose & cotton.

The blending of fiber material is an essential preliminary in the production of a yarn.

Fibers can be blended at various stages of the process. These possibilities should always be fully exploited, for example, by transverse doubling.

However, the starting process is one of the most important stages for blending, since the components are still separate and therefore can be metered exactly and without dependence upon random effects.

A well-assembled bale layout and even (and as far as possible, simultaneous) extraction of fibers from all bales is therefore of paramount importance.

2.3 Objectives of mixing or blending

1. Economy
2. Processing performance
3. Functional properties
4. Even feed of material to card
5. To uniform feeding to the next stage such as carding machine.
6. Recycling the waste material

2.4 MONO CYLINDER CLEANER.

Object : To open and clean the cotton.

Advantages : Impurities are separated without being crushed.

This proves favourable during subsequent operations.
Type : Loose feeding pin opener.

The well opened tuft of cotton from mixing bale opener enter the machine at right angles to the pin cylinder axis.

The pin cylinder has 8 rows of six pins each, arranged spirally -around its circumference.

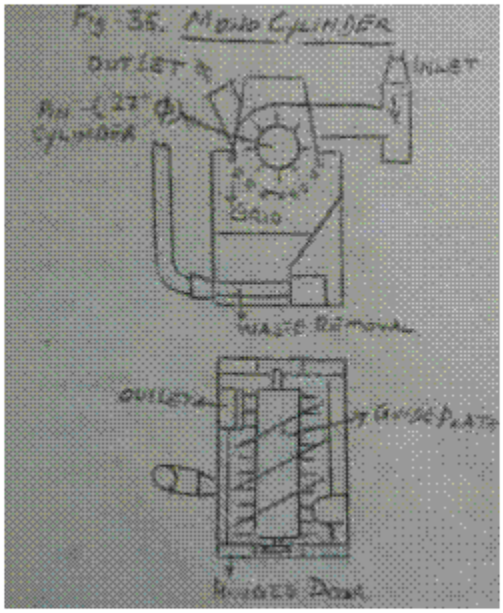
Due to the collision of the cotton tufts with rapidly revolving pin cylinder against grid bar, impurities from cotton is extracted and passed through the spacing of the grid bar.

After the tufts come into the contact with the grids for the first time, they are flung into the top part of the housing. Owing to the guide plate, the tufts moves along a helical path, so that they fall on the pin of the cylinder again and retaken past the grid a second time. At the same time the tufts are turned over, so that all their surface are brought into contact with grid, assisting the removal of dirt. The

spiral path is continued by the guide plate and the tufts pass over the grid a third time, after which they leave the machine at the outlet.

The grids are arranged in two separate section which can be adjusted individually. The grid can be adopted to handle any degree of impurities and opening in the cotton to be processed by means of the lever provided with the scales. The grid can be adjusted regarding spacing (0 to 12 mm) between the grid bar, as well as inclination (angular setting of the grid bar -0° to 30°). It is thus possible to adjust the amount of waste and its quality to the requirements and the different types of raw material ,

Magnetic Double Elbow : This is installed in mono cylinder to remove larger or smaller solid foreign bodies of metallic and non-metallic origin. By deviating the fibre-air stream through a sharp angle, heavy particles are thrown in to the metal box by inertia. Light metallic parts are further more attracted by a permanent magnet plate.V



ERM- Cleaner -Universal opening and cleaning machine

Object : To open and clean the cotton.

Type : Gripped and controlled feeding & saw toothed disc opener The fibre is blown into the laminar chute by an integrated fan. The filling of the chute is monitored by 2 photocell. Thepair of spring loaded feed roller in it ensure a controlled feed of the fibre tufts. Due to the heavier beating of the rapidly revolving saw toothed disc on cotton tufts against knife grid, highest possible degree of opening and cleaning of the fibre is achieved.

By means of graduated lever, the grid bar can be adjusted regarding spacing between the knife grid bar & brought into proper position relative to opening Roller according to handle any degree of impurities and opening in the cotton to be processed. It is thus possible to adjust amount of waste and its quality to the requirements of different types of material.

After opening and cleaning, the material is conveyed pneumatically through outlet pipe to the next machine.

Axiflo cleaner or spiro cleaner

Object : To open and clean the cotton.

Type : Loose feeding pin opener, Major cleaning point.

The coton is drawn into the Axi-Flo machine through inlet Pipe. The construction of the two beating cylinder with grid bar arrangement, is clearly shown in figure.

Opening and cleaning of cotton is achieved by the repeated beating action of the rapidly revolving two beating cylinder on cotton against grid bar. Trash particles from the cotton is extracted through the grid bar and is collected below the grid bar.

Smaller tufts that are already sufficiently opened for a quick and thorough cleaning, thus leave the Axi-flo earlier without receiving unnecessary beating. This prevents loss of good fibre, formation of neps and fibre entanglement. Fibre contained in large tufts cannot get entangled or lost through the grid. They remain in the machine till they are transformed in to small tufts and release their impurities easily.

An adjustable guide plate fixed to the inlet pipe control the angle at which the tufts approach the right beating cylinder.

This cylinder takes the tuft downwards, guides them over the broad waste grid and throws them up against the adjustable defector

plate. The defector plate directs the tuft stream within the reach of the left cylinder which then passes the material over its own grid and transfers the 1arger tufts back to the right cylinder. The position of the adjustable guide plate between the two cylinders *decides* how long the tufts remain under the influence of each cylinder.

The angular position of the bar is adjustable for each set separately. Each set of grid bar can be raised or lowered to alter the distance between the grid to the end of the spike. It is thus possible to adjust the amount of waste and its quality to the requirements and the different types of raw material.

PORCUPINE BEATER

(Improved porcupine opener)

Object: To open and clean the cotton.

A controlled motor with an infinitely variable speed unit drives a star roller and a pair of feed roller. Star roller drive the material from the delivery funnel of the precedingmachine to the feed roller. Pair of feed rollers are fluted and spring loaded.

Due to heavier beating of the beater blades of the beater on compressed sheet of cotton delivered from feed roller against grid bar, the cotton tuft is opened and impurities are extracted and passed through the spacing of the grid bar.

The beater blades have double notched and bolted to the cylinder in pairs. This types of fixing is rigid and no vibration during beating action, so, beating is accurate and definition. In conventional porcupine opener, individual striker blades are revetted and they are not very rigid due to the free length of blades and method of fixing to the discs.

The waste grid consists 25 specially profiled steel bars and can be adjusted during operation. A graduated scale helps the repositioning for favourable settings.

AUTOMATIC SCUTCHER

Construction of the automatic scutcher is clearly shown in the figure. Condenser with fan suck the material from opening line and feed to reserve trunk of the pneuma feeder. An adjustable photo electric cell in the reserve trunk monitor the height of fibre and signals stop or start commands to the preceding machine. Delivery roller guide the material to a coarse spiked opening rol1er without compressing it too much. This opening roller beat and open the cotton and then flings the tufts into an air current generated by a fan. The air current transports the tufts into the feeding trunk. There they are compressed uniformly across the full width by the pressure of air current.

Feeding trunk width can be adjusted according to the fibre bulkiness. An adjustable, sensitive pressure switch located with in the feeding trunk monitor the height of fibre and switches off or on the material transport from delivery roller.

Much narrower limits of density of stock are obtained in the feeding trunk than unstable condensation of a conventional hopper feeder. So, scutcher receives a very regular feed in its absolute weight in width and length. No nep formation due to absence of spiked lattice.

Uniform feed to the scutcher due to effective control by P.E. Cell in the reserve trunk and pressure switch in the feeding trunk.

Two delivery rollers in the scutcher take over the material from the feed trunk. They pass it on to the feed roller which in turn passes it to the sensing levers and the kirschner beater.

An integration of the sensing lever movements control the position of the cone regulator. The movements of the cone belt from its basic position actuate a differential drive. It regulate the speed of the feed roller in a definite ratio to the constant speed of v-belt drive for the transfer of drive to the feed roller.

Press button switches are provided for the regulations of the lap weight per yard through servo motor on the P.I.V. drive. The current position of the PIV drive and degree of regulations are clearly indicated on a scale. It is possible to determine the setting very quickly in case of blend or count changes overs. In case of fully automated scutcher, only the basic lap wt/yard is set by using corresponding press button switch. All later adjustments are carried out by the lap weigher.

The fine opening & ultimate cleaning is achieved by the mild combing action of kirschner beater on cotton tufts.

The grid under the kirschner beater can be adjusted by manual setting of a hand lever provided with an index plate, and completely closed while processing synthetic fibres. The first four of ten grid bars are separately adjustable.

A compact, one layer lap collects on the dust cage with a large surface area. In this manner with a dia of 55 cm cotton lap of 40 kg and synthetic fibre lap of 24 kg can be prepared which unroll with out any peeling on carding.

A strong fan exhausts the cage diametrically across its whole width. This ensures a uniform distribution of the material across the cage and also a careful extraction of the dust.

The sheet of cotton delivered from the cage deliver roller runs almost horizontally through the calender, as shown in the fig. By this arrangement a

wider surface pressure is achieved, enabling higher compression of the sheet of cotton (LAP) without endangering the fibres. And also eliminate cracking of lap surface and false draft which occur when lap would have to run around the calender roller in a vertical position in the conventional scutcher.

The calender rollers are loaded pneumatically. This ensures always even pressure on both sides. The applied pressure can be read on a monometer and steplessly regulated to 6000 KP by a pressure reduction valve.

The machine stops on the entry of thick places of foreign bodies between calender roller. This eliminates break downs.

Rack heads are pneumatically loaded. The applied pressure can be steplessly regulated upto 100 KP and can be read on a manometer.

Latest automatic lap doffing:The required length of lap is pre-set by means of counter with decimeter setting. The impulse for lap change is given by limit switch, as soon as the lap attains a definite diameter. Immediately upon reaching the required lap length, the counter jumps back to preset length.

A 0.75 kw, 105 RPM reduction gear motor accelerate the lap roll in order to cut the lap. Simultaneously the pressure cylinder for the loading of the rack heads is counter ventilated. The rack heads rise and deliver the completed lap into the lap. tray. The lap spindle from the stand-by postion is placed on the forth coming lap. The beginning of the lap is tightly wrapped around the lap spindle. Rack heads are reloaded. The preparation of new lap begins.

By ventilating the pressure cylinder, the lap tray together with finished lap is moved sidewards. The lap together with the lap rod is completely stripped off the lap spindle. The lap Spindle rolls to the stand-by position where it waits ready for next lap doff.

LAP rod inserter: During the sideward movement of lap tray, the lowest lap rod from the rod magazine, that accomodate 20 lap rods, is released and inserted into the lap spindle of the lap under preparation during the return movement of the lap tray.

Lap weighter: The lap rolls into the tray of a lap weigher or a lap reserve tray the lap weigher register the lap weight deviation from the nominal weight on the register tape of the recorder and gives the impulse to the lap colour coder.

Lap colour coder: Every lap receives a washable colour spray marking on its side. This marking may be given a definite meaning eg blend, the number of the scutcher etc., laps out of tolerance receive an additional marking with another colour. Simultaneously it indicate the deviation on a dial. Should the deviation from the nominal weight be large than the predetermined tolerance, the lap weigher gives an impulse to the servo motor and PIV gear that readjust the lap unit length weight to within acceptable tolerances.

Lap store: Depending on its size, the lap store automatically takes over 6 or more weighed laps. It is also possible to couple 2 or more lap stores in tandem. The lap store can also be connected to automatic lap conveyor system.

Automatic lap doffing mechanism

The construction of the various parts of the auto lap doffing Mechanism is clearly shown in fig.

Ratchet & pawl is Provided in lap length measuring motion.

A graduated disc is provided along the ratchet. On the graduated disc, a projection is given which rotates with the ratchet the same ratchet shaft, the rack pinion and two shoe projection s1 & s2 are fixed.

The graduated disc and projection in it (lap length measuring motion) is set in such a manner that as soon as the lap attains a required pre-set length, it will start the lap doffing device i.e., projection press the micro switch MC4.

MC4 release the brake and start the rack motor when the brake the released, the lap is detached by speeding up the shell roller (at the time of doffing only) by the operation of separate micro switch.

As the rack motor is started, Rack moves upwards, the rack penion rotates in clockwise direction. As the rack moves upwards, full lap is ejected by ejector arm and will drop on the lap tray. When the racks in the top most position, a pair of loading arm (fixed with rack) will take the spare lap spindle from the reserve position.

As the rack penion rotates in clock wise direction it will press the projection sl ,which operate the micro switch MC2. MC2 is a reversing switch for rack motor. So, the racks moves downwards, loading arm will bring the lap spindle and place it in between two shell roller. When the rack moves in down

ward, the rack penion rotates in anti-clockwise direction & press the projection S2/ which operate the microswitch MC3. MC3 putoff the rack motor.

Brake is applied and shell roll motor is put off which speed up, the shell roll at the time of lap doffing only. In the first stage of operation, the graduated disc is reversed & put back to its normal position. The beginning of the new lap sheet is folded by the folding handle and lap is wound around the lap spindle and it is leaded again.

All the above operations are completed with in a few seconds while the machine is continuous to run without any interruption. This makes non-accumulation of material at the dust cages during the lap changing, thus no thick and thin places in the lap. results. The production is also increased by 10% at the same working speed, since the m/c is not stopped for 1 lap changing, High reliability in operation due to the greatly simplified and improved automatic changing.

Thus a uniform and even lap with good compactness is produced in the scutcher.

Also work of the operative is reduced, so it is possible for one operative to attend more number of scutcher.

CHUTE FEEDING OR AERO FEED SYSTEM

Chute feed is a system of feeding small tufts of cotton fibres directly from blow room to a series of cards, arranged in a circuit through pneumatic pipe.

A condenser in the pneumatic pipe sucks the material from blow room and delivers it to the flock feeder through pneumatic pipe by way of the filling trunk.

Photo electric cell in the filling trunk regulates the supply of material from blow room. From here, the material is fed to the kirschner beater by way of two ridged roller and two feed rollers. Krischner beater open the cotton into desired size tufts.

A fan blows the tufts from the kirschner beater into horizontal c closed circuit loop situated above the cards. The return trunk has the duty of returning the surplus material(after the supply to last card) to the beater that also of uniting well opened material with supply of fresh material thus delivering it directly to the horizontal duct again.

The separating head arranged in the horizontal closed circuit loop divert the part of tufts from air current into vertical feed

chutes above the card inlets. Vertical feed chute ensures a uniform supply of material over the full working width of the card. Uniform separation of the tufts from the air current is achieved by adjusting the nose in the separating head. Raising the leading edge produces more separation and vice versa.

The weight of the card f,eed per meter depends on the static excess pressure in the installation. This drops practically linear from separator to separator by about 2mm head of water. The weight of the feed per unit length must be adjusted in accordance with this drop by increasing or deducting the distance between the glass front and the rear wall of the feed chute. The weight per meter ranges between 600 to 700 gms.

Thus while deviation of the card sliver count from one card to another must be regulated with the glass plate. The specific count of the sliver itself must be adjusted with the count change wheel.

Card Feed Chute: The feed weight at the card depends on the static pressure in the aerofeed system and the chute depth adjusted. Since the pressure diminishes from one feed chute to another, the chute depth must be matched accordingly. It can be varied from 80 mm to 120 mm and is read off on the scale at the arrow mark.

Advantages of flock feeding or chute feed sytem :

1.The automatic continuous feed directly linked to the blow room eliminates the lap formation. This increases the working efficiency of the blow room.

2.The main power requirement in doffing the lap, weighing, transportation to card and feeding at the card is eliminated.

3.The processing of rejected laps in the blow room is avoided.

4.The fibres are fed to the card in loose sheet form as against compressed form so that trash particles can be easily extracted from fibres by the carding action.

5.Excessive sliver irregularities due to the lap licking during high humidity, double lap feeding, lap splitting, lap piecing etc, are eliminated.

6.When compared to lap fed, there is a reduction of 1 % CV flock feeding card sliver.

7.Crushing of foreign materials seed bits and other trash particles during calendering and difficulty of removing a subsequent processes is reduced.

Disadvantages or limitations of chute feed system :

1.Blow room should run the same number of hours per week as the cards do.

2.The card production must be kept excessive to assurecontinuous feed to draw frame at the time of stoppages at blow room due to maintenance and other unavoidable problems

3.Chute feed system control short term variation but not the medium and long term variations.

4.A reliable check on the nominal count can be established in lap forming system by controlling total lap weight and C.V. value of the weight per unit length. There is no such control in the chute feeding system.

5.Change of mixing will result in more waste in chute feed.

6.Proper selection and positioning of machines in blow room line

7.Feeding techniques of all the opener and cleaning machines can be broadly classified into two types.

1. Loose feeding (free beating points)

Examples: Vertical opener, step cleaner, mono cylinder, S.R.R.L. Ope ner,Axiflo cleaner, etc. ,

2. Semi-fast gripped feeding(controlled feeding)

Examples: Porcupine opener, 3 bladed beater, ERM cleaner,etc.,

Loose feeding beatingtechnique is employed in the initial cleaning line so that heavy impurities are removed, otherwise

they will be crushed into fragments while fed into gripped

feeding through pair of feed roller and it is very difficult to Remove crushed impurities.

Certain machine gives its best in terms of cleaningefficiency, it must be fed with m aterialthat has been preopened to a certain degree.

The kirschner beater is a minor cleaning point and becauseof its intensive combing action and it improve the evenness andtexture of lap. So it must be placed as the la st machine of the scutcher.

Proper speeds & settings:

This decides the amount of opening & cleaning that can beachieved by a machine. Highbeater speed & closer beater settingsgives better cleaning. But, beater speed & settingdepends upontype of cotton, maturity & trash content. Improper setting, spee d results fibre damage, nep generation of cotton.

Type of raw material to be processed : Selection & No. of openers

& beaters depends uponthe type of cotton & trash in them Long, finer & immatu re cottons cannot be subjectedto too many cleaning

points, since over treatment will results fibre damage, and neps.

low grade cotton with high trash content will require more beating points.

Factors affecting the lap rejection and theCV % of 1 metre

wrapping of lap & causesfor high lap weight variation

BEQ: How the uniformity of the lap is controlled in a scutcher?

Lap rejection % indicate the variability between lap weight

and CV % of 1 metre wrapping oflap indicate the variability of

weight/metre of with in the lap.

Both these measures are particularly importance in control *of* yarn count. Both the with inand between lap weight & its

regularity are the first steps in the control of count variation.

Factors affecting the both with in & between Lap weight variations and steps to be taken to control the same are:

1.In sufficient opening of cotton.

2.Wide variation in tuft size,

3.Variation in level of cotton in reserve box of hopper feeder

4.Fluctuations in the feeding rate to the scutcher.

5.Ineffective working of feed control devices like swing door, BE cell, micro switch, piano feed regualting motion etc.

6.Irregular & faulty air flow on cage

7.Unnecessary and frequent adjustment of feed regulating motion.

8.Uneven mixing of soft waste with cotton

9.Worn pedal links, knife and cone drum bearing.

10.Malfunctioning of length measuring motions.

The production rate of the blending hopper feeder and other should be so adjusted that they run for about 80 to 90% of therunning of the scutcher and there should always keep the hopper with cotton in 3/4 level at all time.

The cotton should be fed at uniform rate to the scutcher. The 1 front sheet of the reserve box of the scutcher Hopper feeder is capable of moving forward or backward to increase the volume of the chute, to suit the require weight per yard of

lap. So front sheet setting should be corrected according to the lap hank & weight required.

Backsheet in the reserve Box of the scutcher Hopper feeder reciprocates alternatively. This ensures the maximum regularity of the feed to scutcher. So back sheet should function efficiently.

Swing door in the Hopper Feeder, photo electric cell in the reserve box of hopper feeder, step cleaner should be sensitive to avoid fluctuation in the level of cotton in the reserve bin.

Pedal feed regulating motion should be so set that the cone drum belt operate about the centre of the drum, otherwise full correction is not achieved.

Free movement of the pedal lever and connecting rod must be ensured and care should be taken to see that the movement of the pedal levers is fully transmitted to the belt fork.

Uncontrolled variation in atmospheric conditions can lead to high lap weigh variation. with an average lap out of 16kg, the natural fluctuations in temperature and humidity may account for as much as 1/2 kg variation in lap weight merely due to change in moisture regain. To over come this,

Direct reading measuring instruments are recommended in preference to the correction table since the later assume that the lap, as it is produced, is in equilibrium with departmental humidity which is not really true because of 1. the effect of heat developed by the machine and huge velocity of air coming in contact with cotton during its passage through the machine.

Large variations in weight between lap rods can give factious values of full lap weight. So, lap rods must be weighted once in three months' and standardised.

Defects in Blow room and causes.

1. Causes for Nep formation in Blow room;

*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.

3. Causes for curly cotton:

*Grid bars setting too close to beater.

*Hooked or bent pins on kirschner beater.

*Too wide a setting of stripping rail.

*Long and bent conveyor ducts with low fan speed.

4. Causes for lap licking :

*Use of too much soft waste in mixing

*Too high fan speed, excessive beating.

*Weigher cotton is damp or departmental humidity is high.

* Sticky nature of material

Remedies: use of roving ends within the lap to act as a layer Separation.

Incorporation of lap felter's.

Use of antistatic spray while processing synthetic.

5. Causes for conical lap:

*Improper functioning of pedals on one side due to pedals being choked with dirt.

*Air entering at one side frcm under the grid bar of beater.

*Defective beater blade at one side.

*Uneven suction at the cages leaving to deposition of more material on one side than another.

*Lap roller racks, calander roller not exerting even pressure across the lap width. *Cages may not be properly levelled.

6. Causes for Soft lap

*Calender pressure inadequate due to wear and tear of weighting mechanism.

2. Carding

Carding is a mechanical process that disentangles, cleans and intermix fibers s to produce a continuous web or sliver suitable for subsequent processing. In this process fibers are opened, parallelized & removes dust, impurities, short fibers to produce continuous strand of sliver. This is achieved by passing the fibers between differentially moving surfaces covered with card clothing. The word is derived from the Latin “CARDUUS” meaning thistle or teasel, as dried vegetable teasels were first used to comb the raw wool.

Objectives of Carding:

There are many objectives of the carding process and these can be summarized as:

1. **Opening the tufts** into individual fibers
2. **Eliminating** all the **impurities** contained in the fibers
3. Extracting of neps
4. **Fiber blending** & orientation
5. Removal of short fibers
6. Parallelizing and stretching of the fibers
7. Transformation of the lap into a sliver

1. Opening the tufts into individual fiber: Card opens the tufts into the stage of individual fibers , whereas the blow room only opens the raw materials into flocks. This is essential to enable the elimination of impurities and performance of the other operation to be achieved.

2. Elimination of impurities: Elimination of the impurities of the fiber is mainly done in taker in zone. The degree of cleaning achieved by the modern card is very high, in the range of 80-95%. The overall degree of cleaning efficiency by the blow

room & carding together is 95-99%., but carded sliver still contain 0.005-0.3% foreign matters.

3. Elimination of Dust: The card also removes a large quantity of micro particles that are bound to the fibers produced in the blow room. Card is considered as the best dust removing zone.

4. Removal of short fiber: Very small or fewer than 10% short fibers are removed from the card. Those short fibers can only be removed if those are pressed into the clothing.

5.Blending of fibers : Intimate fibers with fibers mixing is achieved here for the formation of web and repeated rotation of the fibers in the main cylinder. It should be noticed here that, carding is the only machine for processing the individual fibers.

6.Fibers orientation: It is often attribute the effect of parallelizing. The card can be given the task of creating partial longitudinal orientation of the fibers.

7. Formation of sliver: The main output of carding is sliver. Here sliver is formed to deposit the fibers material for further operation. It also done to transport from blow room to draw frame process.

Carding is The Heart of Spinning:

It's one of most important process in the spinning mill. It is directly determines the final features of the yarn. In carding process, fibers are opened individually; more dust & impurities are removed here. Parallelizing & stretching of fibers are also done here. Fiber orientation & transformation of fiber into sliver are also done here. Since, all the major qualities of yarn are gained here, that's why carding is called the heart of spinning.

Working principle of carding machine:

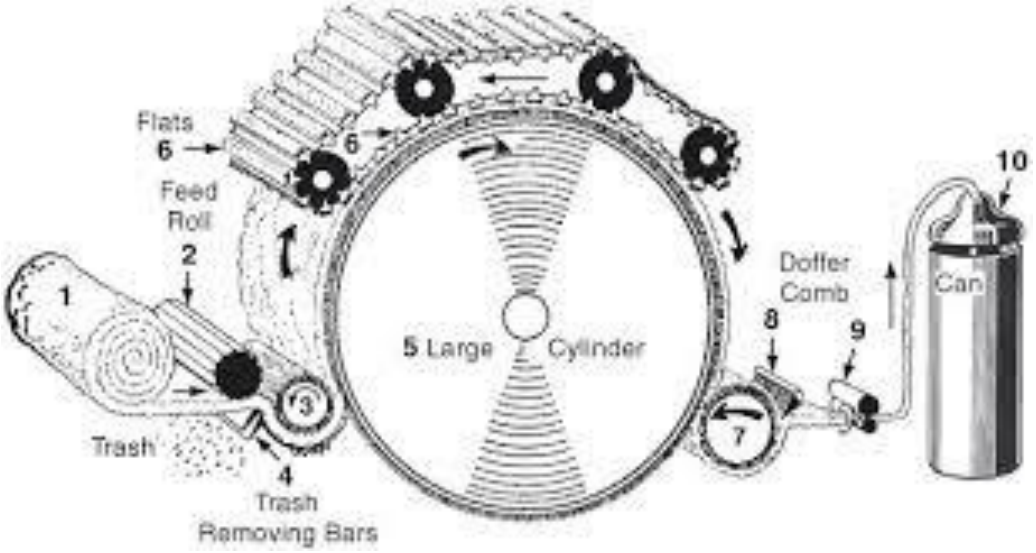


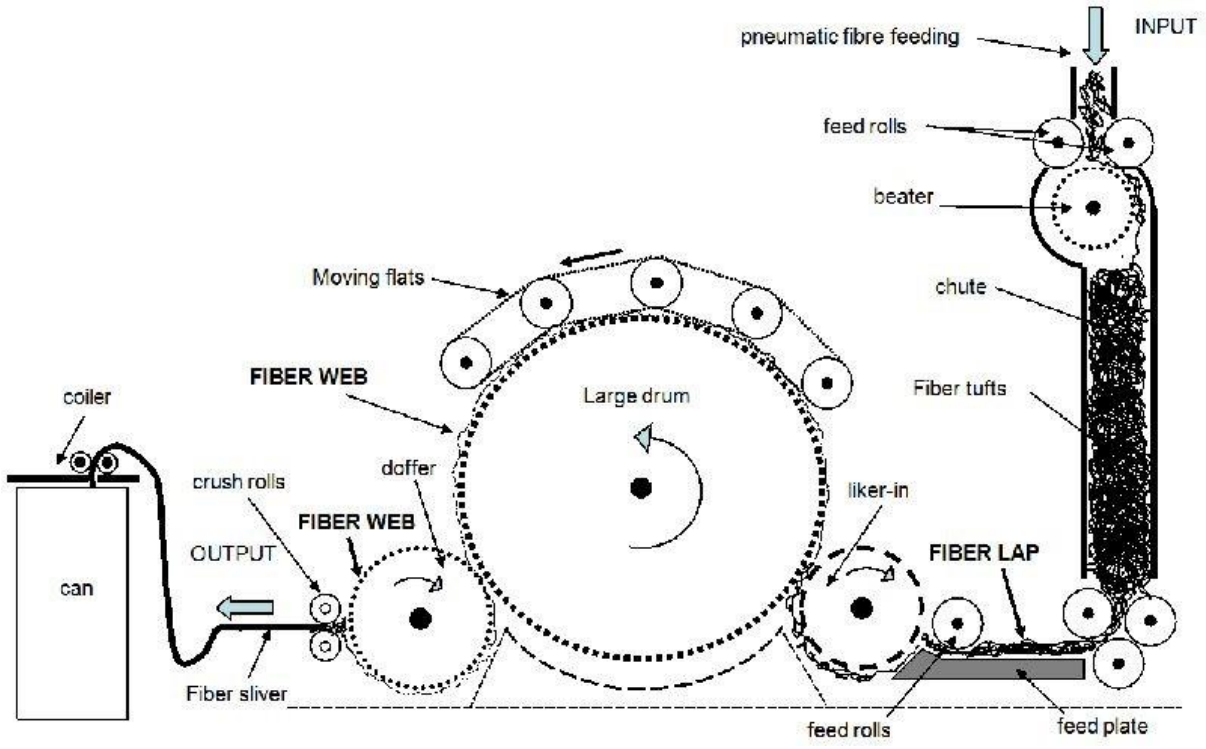
Fig: Parts of carding machine

Parts of Carding Machine:

1. pipe ducting
2. feed chute
3. transport roller
4. feed arrangement
5. taker-in/licker-in
6. grid equipment
7. suction duct
8. main cylinder
9. fixed carding bars
10. flats
11. Cleaning unit
12. Fixed carding bars
13. Cover plates/grid
14. Doffer
15. Stripping device

16. Calendar roller
17. Cans
18. Coiler

Material Passage Diagram of Carding Machine



1 . Feed roller- taker in zone: From the feed arrangement, the chute mat is pushed into the working zone of the feed roller-taker in. The chute mat is opened to tufts by the taker in wire through combing action.

2 . Taker in-cylinder zone: From the feed roller-taker in zone, the opened tufts are transferred to the taker in-cylinder working zone for opening to small tuft size. For cleaning, the material is passed over grid equipment and mote knife attached the underside of taker in. Here points are in face to back arrangement. Suction ducts carry away the waste from trash box.

3 . Cylinder-Flat zone: The small tufts are then transferred to cylinder-flat zone and opened up into individual fibers which are defined as the actual carding process. Here points are in face to face arrangement. Neps are removed in this zone. The flats comprise 80-116 individual carding bars combined into a belt moving on an endless path and approx. 30-50 flats are active to the main cylinder. The rest are on the return run. During this return, a cleaning unit strips fibers, neps and foreign matter from the flat bars.

4 . Cylinder-doffer zone: After the carding operation, the cylinder carries along the fibers s that are opened to single and loose condition as well as lie parallel without continuous structure. For the purpose of forming a

continuous structure of the carded single fibers s the doffer is required. The doffer combines the fibers s into a web. Here points are in face to face arrangement.

Carding Action

Carding is a mechanical process that disentangles, cleans and intermix fibers s to produce a continuous web or sliver suitable for subsequent processing. In this process fibers are opened, parallelized & removes dust, impurities, short fibers to produce continuous strand of sliver. This is achieved by passing the fibers between differentially moving surfaces covered with card clothing. The word is derived from the Latin “CARDUUS” meaning thistle or teasel, as dried vegetable teasels were first used to comb the raw wool.

Actions in carding machine:

I . Stripping action: when two close surfaces have same wire direction but their speed direction is opposite to each other, then the action between two surfaces is called stripping action. Opening and cleaning of fibers is done by this action.

- Action between taker in and cylinder
- Wire direction same
- Speed direction opposite
- Face to back arrangement of wires

II . Carding action: If two closed surfaces have opposite wire direction and their speed direction is also opposite to each other, then the action between two surfaces is known as carding action. Opening to individual fibers and neps removal is done by this action.

- Action between cylinder and flat
- Wire direction opposite
- Speed direction opposite
- Face to face arrangement of wires

III . Doffing action: when two close surfaces have opposite wire direction and their speed direction is also opposite to each other, then the action between two surfaces is known as doffing action. Web formation of fibers is done by this action.

- Action between Cylinder and doffer
- Wire direction opposite
- Speed direction opposite
- Face to face arrangement

Card Clothing

The pin which is used to cover the surface of carding roller such as taker in, cylinder, doffer and are of fine in diameter, spaced closely and bended in shape is defined as card clothing.

Selection of card clothing:

1. Type and design of card
2. Rotation speed of the cylinder
3. Production rate
4. Material throughput
5. Raw material type (natural or man-made fibers)
6. Fiber characteristics (mainly fineness, length, bulk, dirt content)
7. Overall quality requirements
8. Price of the clothing
9. Service offered by the clothing supplier.

Types of card clothing:

1. Flexible card clothing
2. Semi-rigid card clothing
3. Metallic card clothing

I . Flexible clothing: Flexible clothing have hooks of round or oval wire set into elastic, multi-ply cloth backing. Each hook is bent into a U-shape and is formed with a knee that flexes under bending load and returns to its original position when the load is removed.

Advantages of flexible clothing:

1. Higher point density so better carding action
2. Fiber damage is less due to flexible wire point
3. Only the damaged part of the clothing is needed to be repaired
4. Exerts desirable force on cotton causing good carding
5. Less expensive.

Disadvantages of flexible clothing:

1. Requires textile fabric or rubber as foundation material.
2. The wires can be loosened
3. Production less due to stripping
4. Need regular grinding
5. Wire and foundation maybe damaged as both wire and foundation are flexible

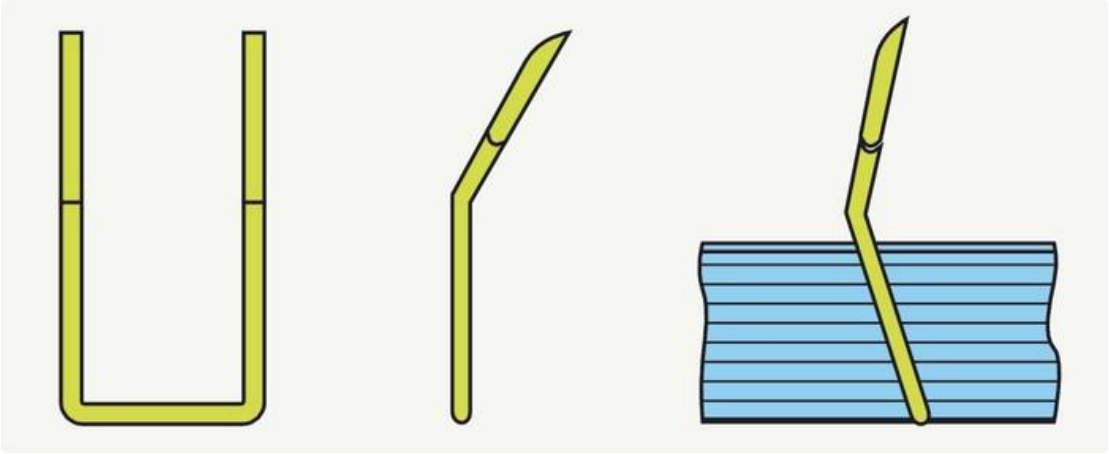


Fig: Flexible card clothing

II . Metallic clothing:

These are continuous, self-supporting, square wire structures in which teeth are cut at the smallest possible spacing's by a process resembling a punching operation.

Advantages of metallic card clothing

1. Does not require separate foundation material. The metal surface of the machine works as foundation material.
2. The teeth do not get loose as teeth and foundation both are metallic rigid.
3. Can choose any carding angle
4. Does not require regular grinding
5. Production increases as regular grinding and stripping is not performed.

Disadvantages of metallic card clothing

1. Fiber damage is more as the wire points are metallic.
2. Difficult to repair in the mill when a portion of it is worn out
3. If any part of the wire is damaged, then the total clothing is rewind.
4. Expensive

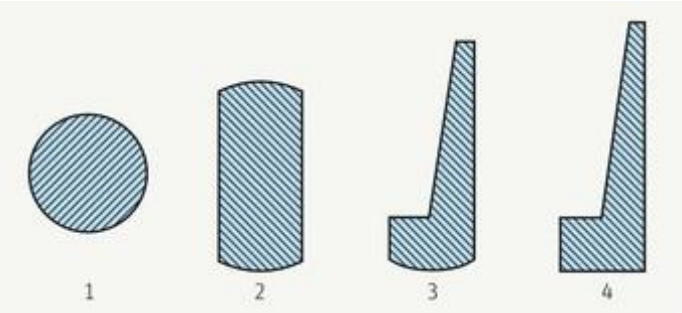


Fig: Metallic card clothing

III . Semi-rigid clothing: Semi-rigid clothing have wires with square or round cross-sections and sharp points are set in backing which is less elastic than that of flexible clothing. This backing is a multi-ply structure with more plies than the backing of flexible clothing, comprising layers of both cloth and plastics.

Advantages of semi-rigid clothing:

1. Does not choke with fiber

2. Eliminate less flat stripping
3. Does not need sharpening

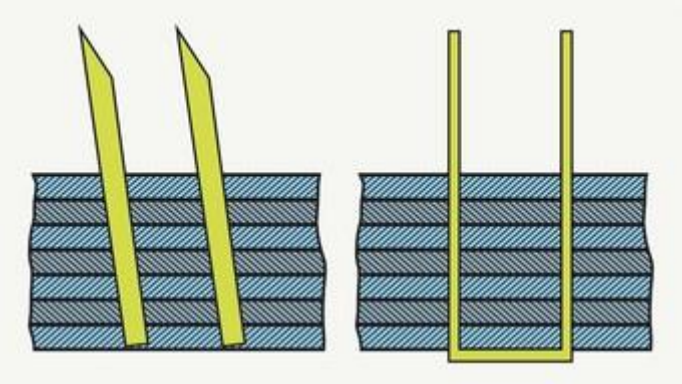


Fig: Semi rigid card clothing

Auto Leveling in Carding

In the spinning mill, the card is the effective start of the process, since the first intermediate product, the sliver, is produced here. A relatively high degree of evenness is required in this product. For various reasons, the card cannot always operate absolutely evenly, for example, owing to uneven material feed. Spinning mills are therefore forced to use auto leveling equipment under highly varying circumstances. Different principles for auto leveling can be selected depending upon the quality requirements and the operating conditions in the individual mill.

Classification of Auto Leveling in Carding:

1. Short term auto leveling
2. Medium term auto leveling
3. Long term auto leveling

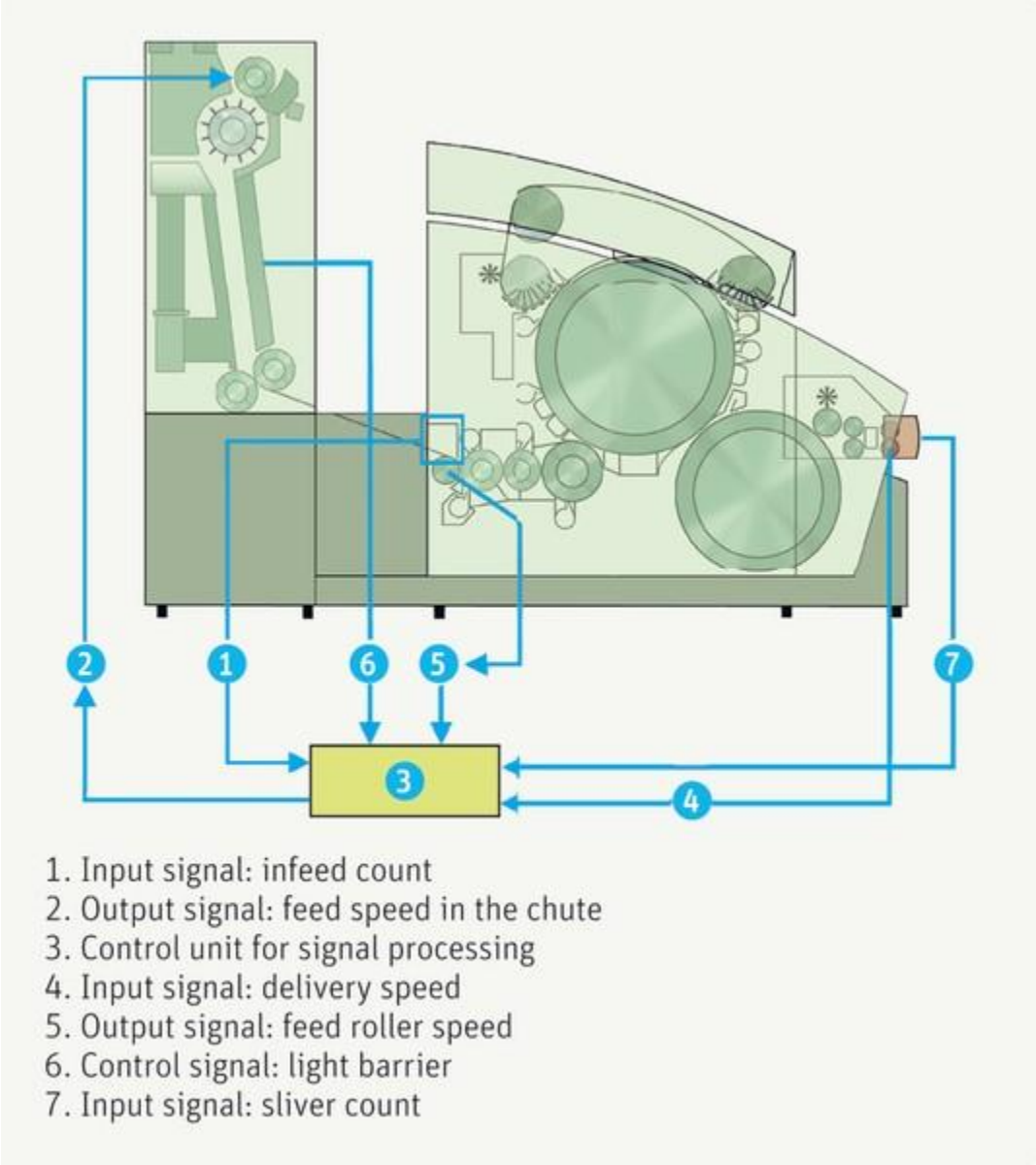


Fig: auto leveling system of carding m/c.

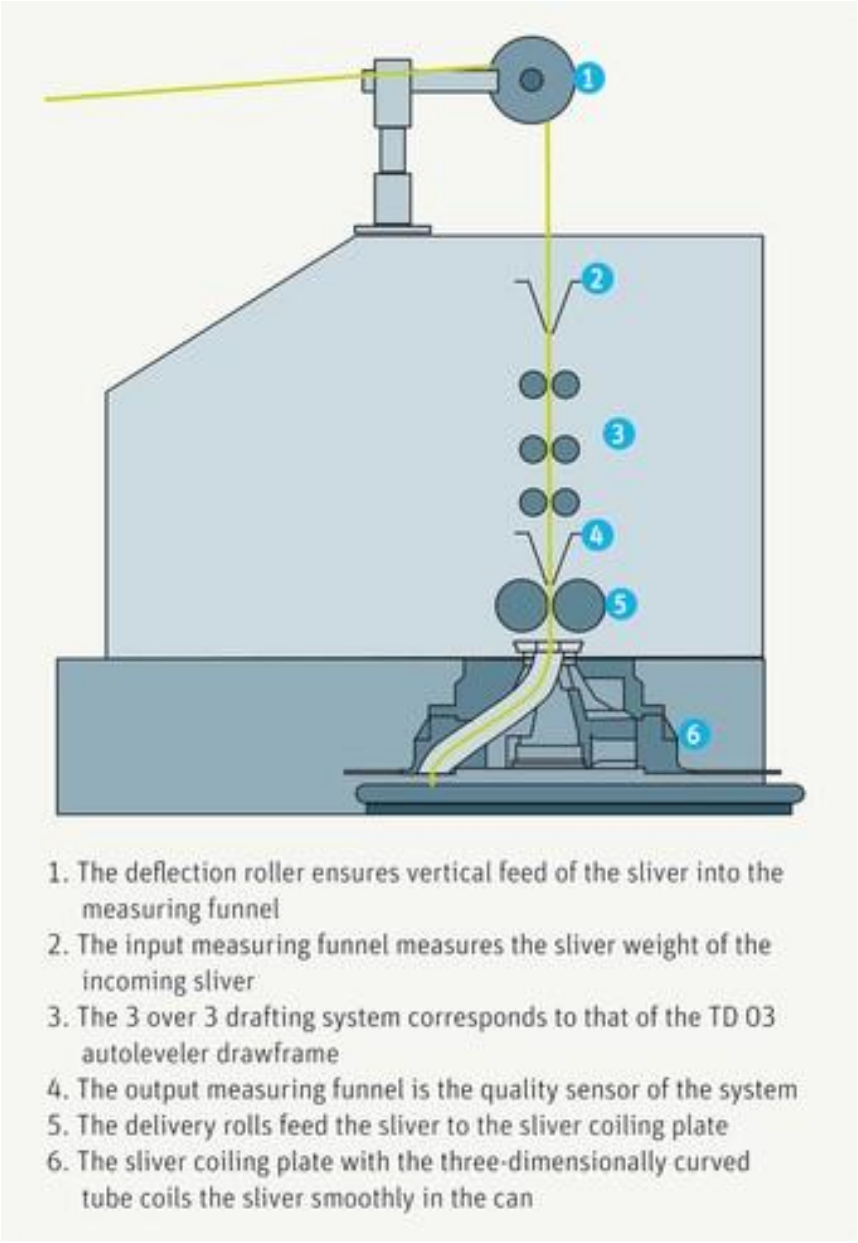
I . Principle of short term auto leveling:

Regulation at the delivery:

If this is used, it calls for a drafting arrangement before coiling.

In the open-loop control system illustrated in figure, a measuring point (2) is provided upstream from this drafting arrangement to sense the volume of the incoming sliver and transmit corresponding pulse signals to an electronic control unit. The control signal generated by this unit is passed to a regulating device that can be of various design, and which adapts the speed of the delivery drafting rollers to the measured sliver volume. If the measuring point is located downstream from the drafting arrangement, or if the delivery roller pair itself provides the measuring point, then the system is operating on the closed-loop control principle.

If the open-loop principle is used in a short-term auto leveler, short lengths can certainly be made even, but it is not always possible to hold the average sliver count constant. On the other hand, closed-loop control is not suited for regulating short-wave variation because of the dead time inherent in the system. Finally, the drive to the delivery can present problems, since in this system the delivery speed must be continually varied, and in very small ranges. There are two possible applications for assemblies of this type, namely in processing comber noil and where card sliver is fed directly to the rotor spinning machine.



1. The deflection roller ensures vertical feed of the sliver into the measuring funnel
2. The input measuring funnel measures the sliver weight of the incoming sliver
3. The 3 over 3 drafting system corresponds to that of the TD 03 autoleveler drawframe
4. The output measuring funnel is the quality sensor of the system
5. The delivery rolls feed the sliver to the sliver coiling plate
6. The sliver coiling plate with the three-dimensionally curved tube coils the sliver smoothly in the can

Auto leveling in the in feed:

Reiter card leveling operates as medium-term to long-term leveling (closed-loop, produced by a proportional-integral regulator) and is performed by a microprocessor. In the feed of the card the feed measuring device records the fluctuations in the cross-section of the batt feed. The speed of the feed roller of the card is changed electronically so that these fluctuations in the cross-section are

leveled out. The chute is also included in the control loop. However, the filling level is not used for regulating the feed rollers in the chute but is considered as an additional control parameter. In the delivery of the card a pair of disc rollers scans the cross-section of the carded sliver as it emerges. These readings are compared electronically with the preselected set value. Deviations in the set value are corrected electronically by altering the speed of the feed roller in the card.

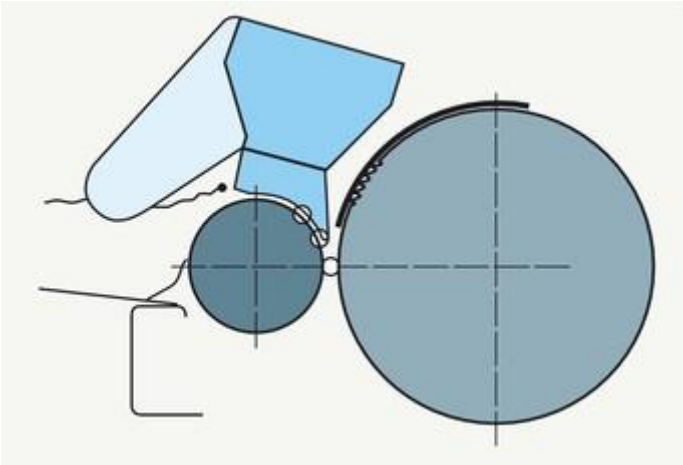
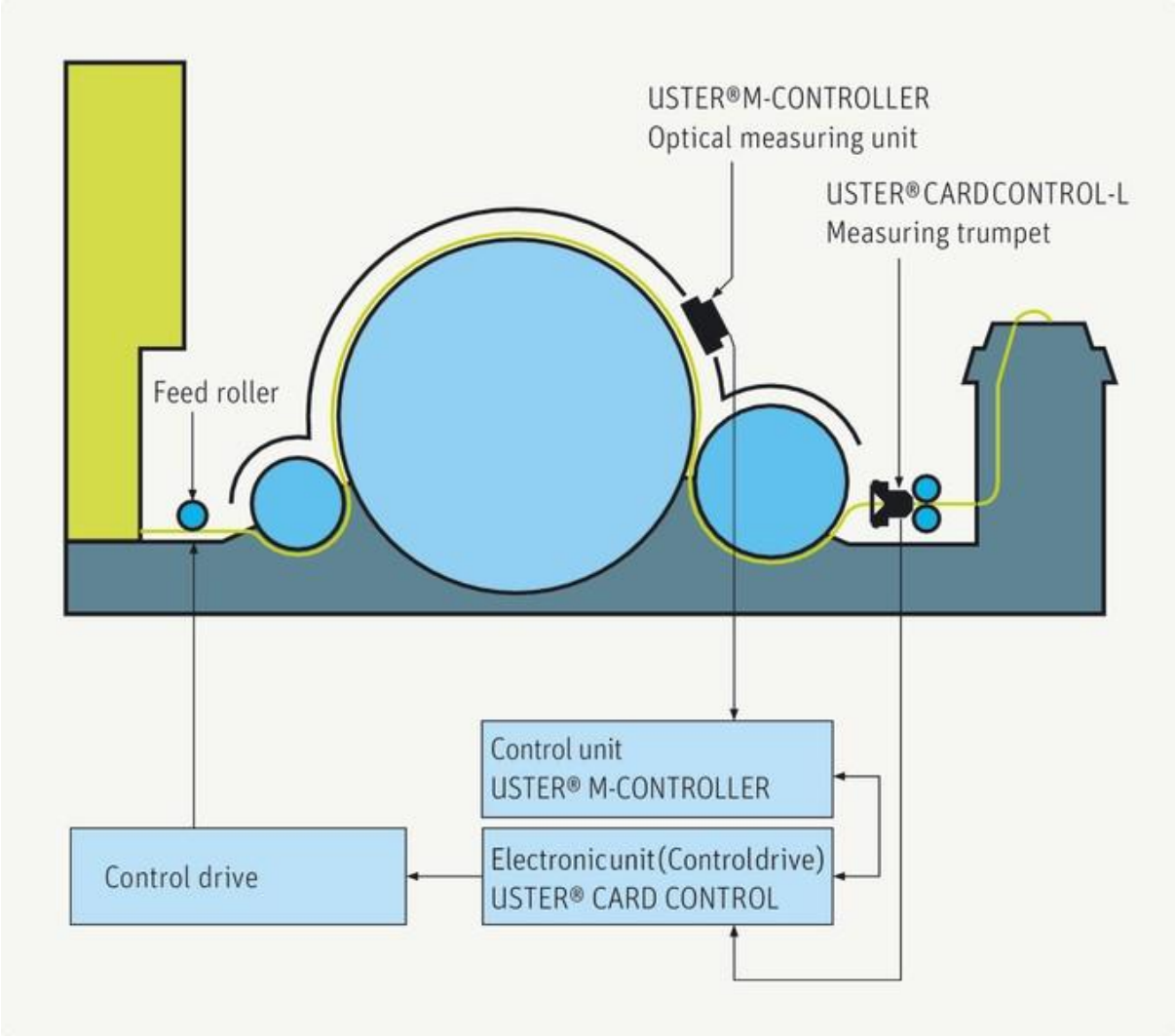


Fig: Auto leveling with sensing at the feed roller

II . The principle of medium-term auto leveling:

In former Zellweger equipment a medium-term auto leveler was provided as an addition to the long-term auto leveler. An optical measuring device () detects relative variations in the cross-section of the fiber layer on the main cylinder over the whole width of the cylinder. The measuring device is built into the protective cover above the doffer. The device measures reflection of infrared light from the fibers.

After comparison with the set value, a difference signal is generated and passed to an electronic regulating unit. This operates via a regulating drive to adjust the in feed speed of the card so that the depth of the fiber layer on the main cylinder is held constant.



III . The principle of long-term leveling:

This is the most commonly used principle of card auto leveling and serves to keep the sliver count constant. Measuring is performed by a sensor in the delivery (at the delivery roller). The pulses derived in this way are processed electronically so that the speed of the in feed roller can be adapted to the delivered sliver weight via mechanical or electronic regulating devices.

Long-term auto leveling is an integral part of modern cards, and in any case used in production of carded yarns and in the rotor spinning mill.

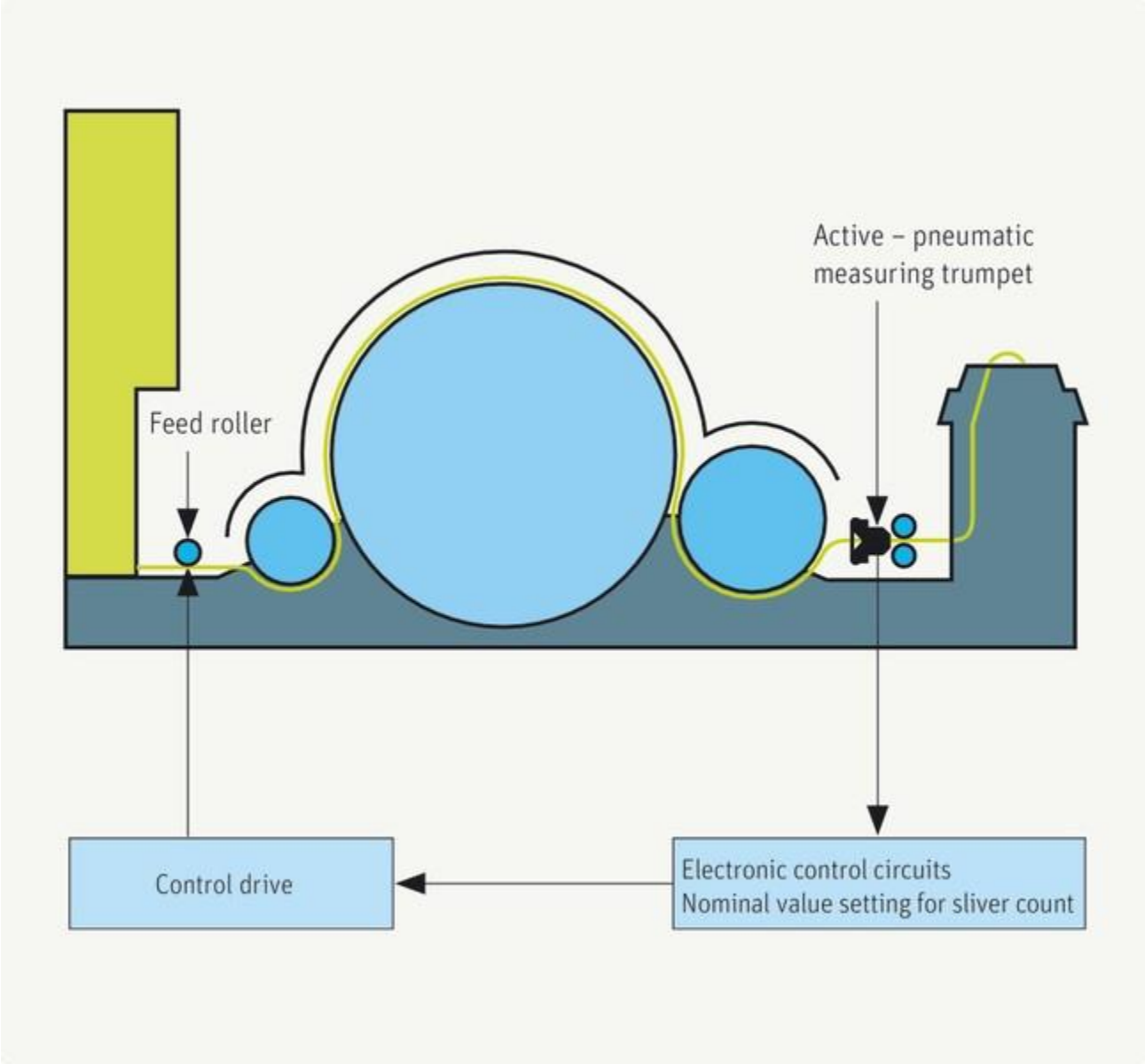


Fig: Long-term leveling (Zellweger, Uster)

Striping:

When the wire points of two closed surface are inclined to the opposite direction and both the surface rotate to the opposite direction then the action is called stripping direction. Stripping action occurs between taker-in and cylinder.

Methods of stripping:

Roller stripping

Dustless stripper

Vacuum stripper

Air stripper

Continuous stripper

Static stripper

1 . Roller stripping: Conventional method of stripping. A wooden roller of about 6” diameter and equal length to the card width, covered with a special stripping wire fillet is put against the cylinder by opening the front door. The stripping is done by passing the point of stripping roller to the cylinder wire by point to back action and with higher surface speed for the stripping roller.

2 . Dustless stripper: this method consists of plain roll, partially enclosed by sheet metal hood from which a large flexible tube leads to a special stripping truck. A small suction fan fitted on the truck exhausts into a fabric bag. It works exactly like roller stripping but brass normally is kept running during stripping. As a result, dust which would normally be thrown into the air is drawn away by the suction and collected in the dust bag.

3 . Air stripper: In this method truck is completely eliminated by one small stripping brush covered with special stripper clothing placed just above the junction of the doffer and cylinder. The roller is driven by main cylinder pulley through binder pulley.

4 . Vacuum stripper: No stripping roller is used. This system requires special air pump to maintain a high vacuum and large waste receiving drum where the waste is collected. Nozzle is used to collect waste from the surface of the cylinder or doffer etc.

5 . Continuous stripping: This is also nozzle and suction type stripping. It is automatic continuous stripping device. Its several advantages are given below:

Reduction waste and saving in cotton.

Reduction in labor cost required for stripping.

More machine utilization and more production.

More savings in power.

More fillet life

Grinding: Grinding is the operation by which the good working condition of the wire points of all organs in the carding machine is maintained.

Intervals between grinding

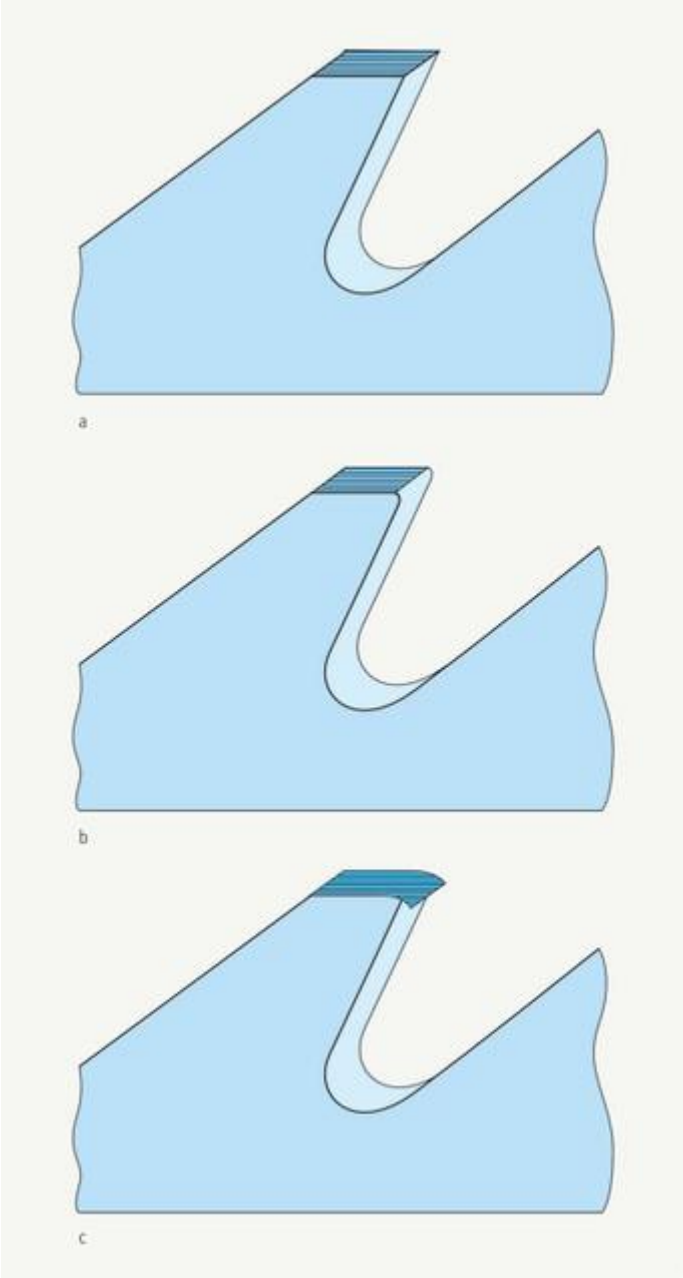
The operating life of clothing is quoted in terms of the total throughput of material. For the cylinder it normally lies between 300,000 and 600,000 kg, but it can be higher in some circumstances.

The deterioration in quality from one grinding interval to the next arises from the fact that the teeth are ground down to successively lower heights, the lands at the teeth points become steadily larger, and softer metal layers are gradually exposed. The following grinding intervals are currently in use:

	CYLINDER	FLATS
FIRST GRINDING AFTER [KG]	80,000 – 150,000	80,000 – 150,000
Each additional grinding after [kg]	80,000 – 120,000	80,000 – 120,000

Grinding Depth:

Grinding is carried out with the cylinder rotating in its normal direction at normal speed, so that the grinding roller moves with (not against) the teeth of the clothing. The grinding depth is such that a plane surface with a sharp edge is produced at the point of the tooth (a). Satisfactory carding will not be achieved if too little material is ground away so that the front edge stays rounded (b), or if the grinding operation is too harsh (too much pressure on the grinding roller) so that a burr is formed at the tooth edge (c).

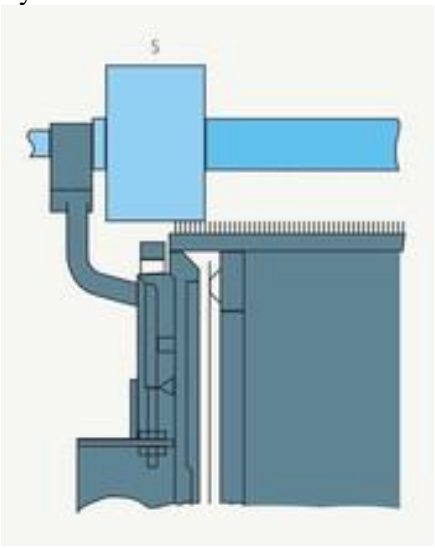


Methods of grinding:

Traverse wheel grinding

The dead roller or full width grinding roller.

Traverse wheel grinding:

In this method there is an emery roller of 3.5” width which moves from one side to another by traversing motion. 

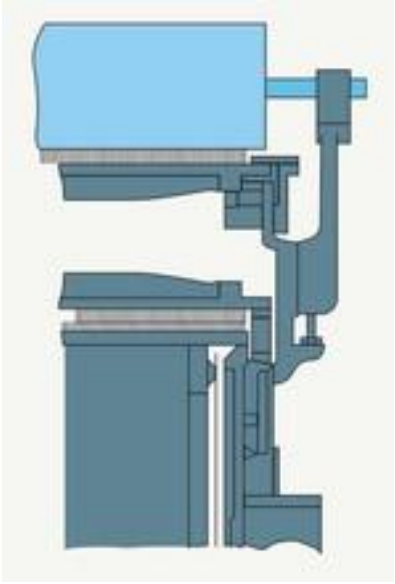
Advantages:

Better grinding action.

No risk of hooking or fusing of wires.

The dead roller or full width roller:

Here rotate covering the full width of the card. Roller is covered with emery fillet.



Advantage:

Long grinding roller is used in case of high speed grinding.

It is used to produce low and medium count yarn

SETTINGS:

The setting between cylinder and doffer is the closest setting in the card. This setting mainly depends upon the cylinder speed, hank of the delivered sliver and the type of wire. Cylinder speed up to 360, the setting should be 0.1mm. For cylinder speeds more than 450, the setting ranges from 0.125 to 0.15.

If the setting between cylinder and doffer is very close, the wires will get polished and this will affect the fibre transfer. If the setting is too wide, the fibres will not be transferred to doffer from the cylinder, hence cylinder will get loaded. While processing synthetic fibres cylinder loading will badly affect the yarn quality. Moreover, it is difficult to improve the wire condition if the loading is severe. \

The only solution would be to change the wire. Therefore enough care should be taken while processing synthetic fibres.

The most critical setting in a carding machine is between cylinder and flat tops. While processing cotton, it can be as close as 0.175 mm provided the mechanical accuracy of flat tops is good. Since most of the cards are with stationary flats at the licker-in side, the setting from the back to front for flats can be 0.25, 0.2.0.2, 0.2, 0.2mm.

Closer the setting between cylinder and flats, better the yarn quality. Neps are directly affected by this setting. Of course, very close setting increase the flat

waste. For processing cotton the setting can be 0.25, 0.2, 0.2, 0.2, 0.2mm. For synthetic fibres it can be 0.3, 0.25, 0.25, 0.25, 0.25mm
Most of the cards are with 6 to 1 1 stationary flats at the licker-in side. This setting can start with 0.4 mm and end with 0.25mm.

The wire points can start with 140 ppsi and end with 320 ppsi. The work done by the first few stationary flats is very high; therefore the wear of these flats is also high. It would be better if the first 50% of the flats are changed after 100000 kgs of production and the rest after 150000 kgs of production.

These stationary flats open the material so that, the setting between cylinder and flats can be as close as possible.

The setting between feed plate and Licker-in depends upon the type of feed plate. Conventional feed plate setting is decided mainly by the feed weight and to some extent by the fibre length and type.

With the latest feed plate and feed roller arrangements, the setting is decided mainly by the fibre length and to some extent by the feed weight.

Normally the setting between the feed plate and Lickr-in is around 0.45 to 0.7mm, depending upon the feed weight and fibre type.

The setting between Licker-in and the first mote knife is around 0.35 to 0.5 mm. This helps to remove the heavier trash particles and dust. Closer the setting, higher the wastage. The setting between

Licker-in and combing segments is around 0.45 to 0.6. This helps to open the material.

Some cards have two mote knifes in the Licker-in under casing. The setting is around 0.4 to 0.5mm.

This helps to remove the smaller trash and dust particles.

The setting between the cylinder and stationary flats at Doffer side helps to transfer the fibres to doffer by stripping the fibres to the top of the cylinder wire. This setting can be as close as 0.15mm.

The number of wire points on stationary flats also plays a major role. It is normally around 300 to 400. For a high production application it can be as high as 600.

For cotton processing, the stationary flats are fixed with a knife attachment. The setting should be as close as possible, i.e. around 0.15mm. This helps to remove the trash particles of very small size.

The setting between cylinder and cylinder under casing should be as per the manufacturer's recommendation. The design of under casing is different for different manufacturers. This setting is very important, as wrong settings will affect the fibre transfer and can also create air turbulence.

SPEEDS:

Higher cylinder speed helps fibre transfer. Higher the production, higher should be the cylinder speed.

Higher cylinder speed improves carding action, thereby imperfections are reduced.

Higher Licker-in speed for coarse fibres and dirty cotton helps to remove the trash and improves, the yarn quality. For fine and long cottons, higher speed results in fibre rupture, therefore, flat waste and comber noil will be more.

Higher flat speed, improves yarn quality and at the same time increases the flat waste.

With the same flat speed, higher the carding production, lower the flat waste and vice-versa.

Very high tension drafts will affect carding U%. It is better to keep the draft between feed rollers to doffer around 75 to 95. The results are found better with these drafts.

WIRE MAINTENANCE:

For a modern cylinder wire of 2mm height, grinding with the normal grinding stone is not recommended. It is better to use TSG grinder to grind the wire every 2nd or 3rd month, so that the
sharpness of the wire is always maintained.

TSG grinder does not grind the wire, therefore if the wire is worn out very badly the quality improvement using this grinding machine will be nil. Frequent grindings are recommended. If TSG grinder is not available, it is better not to grind 2mm wires.

The number of traverse should increase depending upon the life of the wire. The number of traverse for successive grindings should be like this 3, 5, 10, 17 etc. Anyway the best method is to confirm with the microscope. If the grinding is not sufficient, the number of traverse should be increased.

Doffer is still working with a concept of Land formation. A normal grinding machine will be good for doffer grinding. All the wire points should be touched by the grinding stone. A slow and gradual grinding with the grind-out concept will give the best results. Harsh grindings will result in burr formation on the land. This will increase the number of hooks in the fibre; thereby the effective length of the fibre from this card will be reduced.

Flat tops grinding is very important. Every time a flat top is ground, yarn quality is improved. It is better to use a grinding machine with the emery fillet. Frequent flat tops grinding will result in less neps and the yarn quality will be consistent.

Some mills increase the life of the flat tops compared to cylinder wire. But it is better to change flat tops and cylinder wire together for better and consistent yarn quality.
It is a good practice to check the individual card quality before changing the wire.

Licker-in wire should be changed for every 150000 kgs. Earlier changes will further improve the yarn quality.

Stationary flats should be changed for every 150000 kgs. But it is a good practice to change the first 3 or 6 stationary flats at Licker-in side for every 100000 kgs. This helps to maximize the carding effect between cylinder and doffer which is critical for better yarn quality.