'Advances in Cotton Ginning Technology in India 2010-2013'

(A Paper Presented by Mr. M. K. Sharma – President, Bajaj Steel Industries Ltd., Nagpur India
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Preface:

The introduction of TMC and TUF by Govt. of India from year 2000 made great impact on modernization of ginning sector in India and even after completion of TMC in year 2010 it has created a trend of automated and modernized ginning factories in India hence majority of new ginning factories being established even after year 2010 in India are following the guidelines of TMC. This has resulted in significant reduction of trash and contamination in Indian cotton. The Indian cotton has got wide acceptance across the globe on quality parameters and India has achieved the status of second largest exporter of cotton in the world.

The journey of modernization of various operations in a ginning & pressing factory is being continued to further improve the quality and cost efficiency as well as ease of operations for ginning & pressing factories and many advances have taken place in the past few years to improve the processing of this unique crop, each component of which is having multiple uses similar to items like coconut where each component adds to value. Continued journey of advances is day by day improving the areas remaining to be addressed for the cotton processing sector in most beneficial manner.

The Goal:

The full potential of the cotton crop by optimizing the processing parameters and to make its fullest and best use will be achieved only when following goals are achieved:

1. The cotton fibre will be ginned in a way that it retains best natural fibre parameters i.e. maximum length, natural luster, and other natural parameters as they are available on the cotton boll when it is grown on plant in the field.
2. To fully utilize the various components of seed cotton i.e. cotton lint, cotton seed, hull, kernel, and oil.
3. To fully utilize the cotton stalk etc. to make various items such as wood pallets, particle boards, biogas, energy generation & compost making.

Recent Advances in Cotton Processing Technologies:

The areas in which advances have taken place in the Cotton Processing Technologies may be summarized as below:

(1) Transportation, loading-unloading and feeding of cotton
(2) Moisture control in seed cotton
(3) Efficient cleaning of different varieties of cotton and variable trash contents due to picking / harvesting practices of seed cotton such as varieties of semi-opened cotton bolls, hand stripped cotton, machine stripped cotton, machine picked cotton etc.
(4) Uniform & Proper Feeding of Seed cotton to processing machines to optimize the production quantities.
(5) Power efficient individual gin machine seed cotton feeding system.
(6) Moisture control in cotton lint.
(7) Uniform cotton bale with optimized user friendly and cost effective making of cotton bales on modernized cotton baling presses.
(8) Contamination Free Lint.
(9) Best Spinning Parameters retained after processing.

The Central Institute for Research on Cotton Technology (CIRCOT) and Largest Cotton Ginning & Pressing Machinery Manufacturer M/s. Bajaj Steel Industries Limited have put up great efforts in providing the improved machineries for achieving the optimum results in respect of all the areas referred above and some of the recent advances introduced in the period 2010-2013 are mentioned below:

(01) Transportation, loading-unloading and feeding of cotton

Up till 2010 manual unloading of vehicles, heap making and feeding to suction or other mechanical conveying systems were being practiced, which was highly labour oriented and contamination prone methods. To improve this situation tractor mounted attachments for various applications such as; unloading of vehicles, heap making and feeding through seed cotton conveying systems as well as seed heaping and loading have been introduced which have helped to reduce manpower and contamination in the cotton ginning factories in India. Even loading of cotton bales has been made easy by such Tractor Attachments. Some of the pictures given below will illustrate the recent advances in this area.

Attachment for Cotton Grabbing

Attachment for Heaping of Cotton

These new advance attachments started during year 2010 have eased out the loading unloading and feeding of seed cotton in the ginning factories and saved significant manpower.

(02) Moisture Control in Seed Cotton

The cleaning and ginning parameters of the cotton are optimized only when the moisture contents are neither higher than the recommended parameters of 6-8% nor much lower than the same. The major issues observed was that at the beginning of season the moisture contents in seed cotton are higher sometime even up to 25% which makes it impossible to clean the cotton and also affects the ginning efficiency of the ginning machines as the machine can only gin the cotton when it come in to the recommended moisture range, hence holds the cotton in the ginning area till moisture gets reduced within ginning range by the heat generated on ginning rolls or saws, which reduces the ginning capacities significantly as well as damages the quality of cotton. In view of this it was felt that the drying process should be done by proper equipment i.e. Dryer instead of using the gin machine for this purpose to avoid the damages and high cost of doing so on gin machine. The Dryers of different capacities introduced are providing correct solutions to reduce the moisture at recommended level before feeding in to gin machine when the incoming seed cotton is having excessive moisture. A picture of most preferred dryer which is recently introduced for Indian ginning factories is shown below:

Photo of Vertical Flow Dryer

Similarly various devices for increasing the moisture contents in the controlled manner where incoming seed cotton is having lower moisture contents than the recommended range of moisture are being worked upon to replace the current unscientific methods being used at present and the benefits of the same will be available to ginning and pressing factories in recent future.

(**03) Efficient cleaning of different varieties of cotton and variable trash contents due to picking / harvesting practices of seed cotton such as varieties of semi-opened cotton bolls, hand stripped cotton, machine stripped cotton, machine picked cotton etc.**

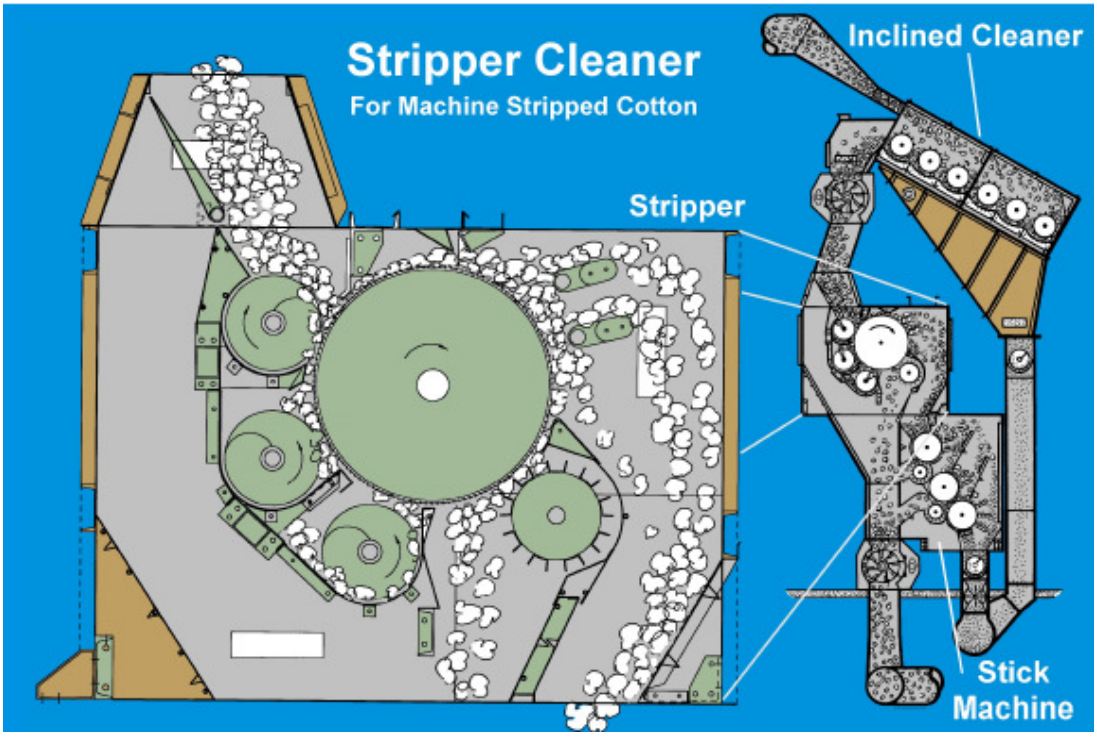
Apart from controlled moisture in the incoming seed cotton the speed of cleaning rollers, incoming micronaire and trash percentage and size of trash, significantly affect the output trash contents. The variety of cotton where the cotton boll is semi opened, requires different type of cleaning machines. The picking methods of seed cotton i.e. hand picking, hand stripping, machine picking, machine stripping etc. requires different treatments for seed cotton cleaning, moreover the mechanical picking is started in India in some part and is likely

to increase in near future, hence the extra cleaning of cotton becomes very important and to optimize cleaning for different varieties and different parameters of seed cotton, a number of advanced machines got introduced during last two years, photos of some of them are given below:

Inclined Pull Through Cleaner

Impact Cleaner

Stick Super III



Stripper Cleaner

These advanced cleaning equipments offer complete solution to hand stripped cottons such as Kala Kapas and all machine picked cottons as well as other cotton varieties which have semi opened bolls or extra trash.

Even for further efficiency some machines are under advance stage of improvement which will further ease out the processing of cotton varieties having semi opened bolls such as Pod Opener as shown in the photo below:

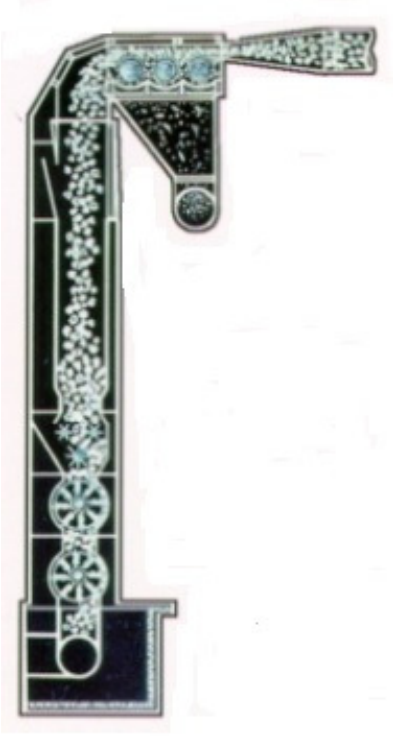
Pod Cleaner

The extensive trials are being taken in India to ensure that all the preparation is done for cleaning of machine picked cotton when the country goes for the same in recent future. One of such extensive trial was conducted in Abohar of Punjab on 6th January, 2014 where Dr. S.K. Shukla of G.T.C. CIRCOT, also witnessed the trial apart from various government functionaries and large number of ginners and farmers. A photo of same is shown below:

(04) Uniform & Proper Feeding of Seed cotton to processing machines to optimize the production quantities.

Uniform feeding of seed cotton to drying, moisturizing and cleaning etc. equipments is very important to obtain proper efficiency of these machines. The hand feeding could never give uniform feeding which normally resulted at least in loss of efficiency by 20% and made significant impact on production costs. During last few years some machines have been introduced to effectively control uniform feeding, which have immensely benefited the cotton ginning factories in India, such as Cotton Dispenser and Cotton Feed Control Box. The photos of the same are given below:

Seed Cotton Dispenser



Cotton Feed Control Box

The introduction of these equipments have improved the efficiency of processing machines by over 20% as compared to hand feeding and benefitted ginning & pressing factories in big way.

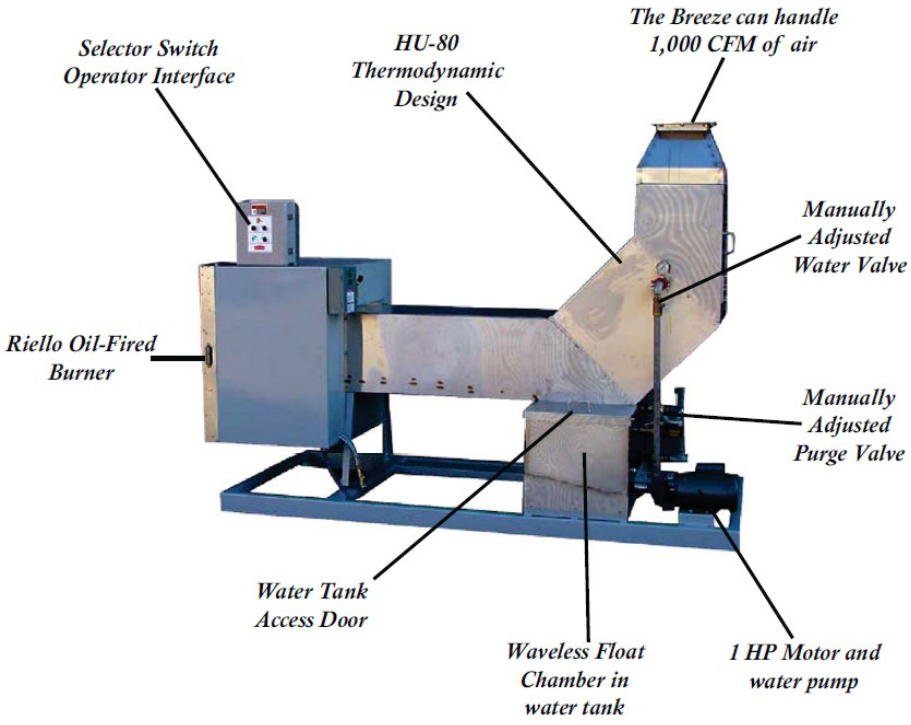
(05) Power efficient individual gin machine seed cotton feeding system.

The most preferred long life trouble free individual gin feeding system by overhead distribution conveyor system with auto regulators were earlier used for each line for feeding of each gin, however the same was consuming extra power and also resulting in extra capital cost. In the year 2012 a twin line overhead distribution conveyor system with advanced auto regulator to simultaneously feed two gin machines on two parallel lines is introduced, which has revolutionized the individual gin feeding for Double Roller Ginning plants and reduced the capital cost and power consumption. This system has also introduced a slide where one can control the escaping of short fibres coming out from seed cotton during the feeding system and can be covered up to the feeding point to the Auto Feeder which finally results in the control of spreading of small fibres in the ginning area and is very environment friendly, finally resulting in clean atmosphere inside the ginning area. Moreover, the maintenance has also been reduced due to lower number of equipments, further also resulted in optimum utilization of carrying capacity overhead screw conveyor. The photo of the same is given below:

Twin Auto Regulator Individual Gin Feeding Conveyor System

(06) Moisture Control in Cotton Lint.

Most of the ginning factories in India use cold water spraying on lint which is certainly a crude and inefficient method creating lot of wastage and jamming in the lint feeding system to bale press. The study has also shown that the bale moisture when taken at the time of bale making is shown higher such as 9% but after 24 hours if the same bale moisture is checked, the same may come down to 3-4%. Further, it creates lot of vibration in the baling process and extra power is used to make the bale when cold water is used in this method, thus the cold moisturization totally defeats the purpose of moisturization rather creates losses due to wastage of lint and operational problems. The cotton ginning industry is now realizing that the correct moisturization system humid-air (not steam) is the proper solution as the moisture contents are retained for a longer time being getting imbibed in to the web of fibre and reduces the power consumption of baling process apart from significantly improving the quality parameters of lint, thus creating benefits to the ginner by getting higher price for better quality lint. A photo of scientific Humid Air System which is now being accepted widely is given below:



Hot Humid Air Generator

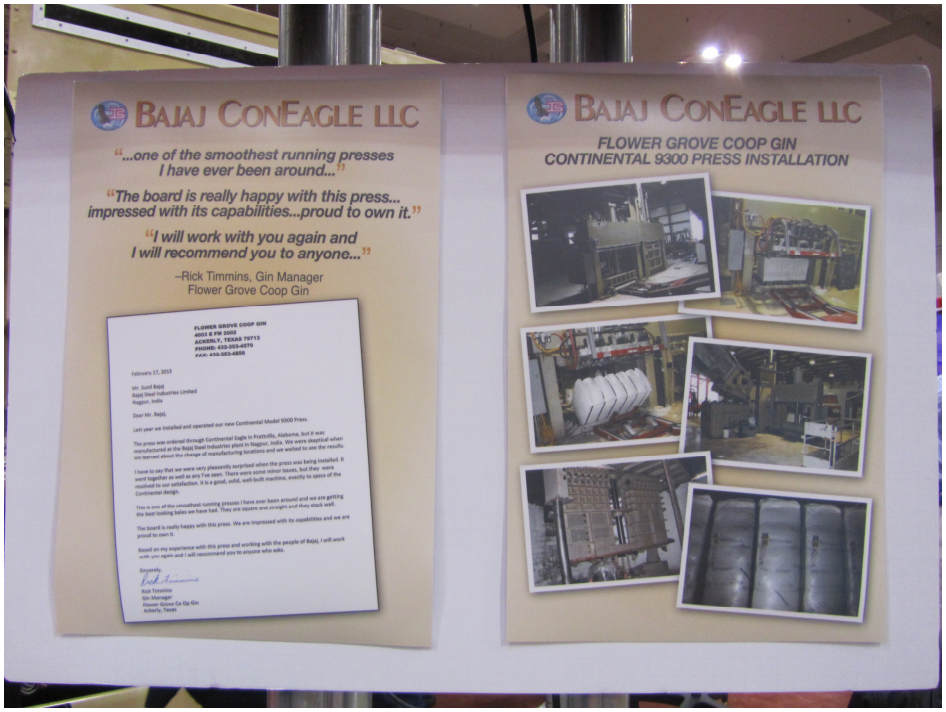
(07) Uniform cotton bale with optimized user friendly and cost effective making of cotton bales on modernized cotton baling presses.

The cotton bale size of 1067 mm x 533 mm (42" x 21") as per International Bale Standard ISO 8115 have been introduced in India in some of the ginning factories where they can optimize the container loading as well as bale weight to the international standard which will certainly be a need of the future. The Automatic bale handling and bale bagging system has facilitated the making of fully covered bales. The computerization of bale weight and bale marking has also improved the bale making process and now the bar coding of the bales is being promoted, these measures will certainly improve the acceptability of Indian cotton bales worldwide apart from saving the wastage and reduction of contamination. The most modern down packing presses of smaller capacities as well as higher capacity have optimized the utilization of plant capacities. Earlier only few models were available and in various cases the capacity utilization was not optimized. Moreover, to meet the requirement of lower height buildings modern Up-packing presses in various capacities have been introduced in the Indian market apart from high capacity (60-80 bales/hr.) for overseas high capacities plants. Photos of most modern baling presses are given below:

Most Modern Down Packing Press (10 BPH to 45 BPH)

Up-packing Press

These presses have optimized the cost of capital equipments as well as cost of making each bale. India has also become the proud producer of highest capacity fully automatic cotton baling presses & supplying the same to the advance countries; such as USA. The photograph one of such press of 60 Bales/hr. capacity supplied by M/s. Bajaj Steel Industries Ltd. in M/s. Flower Grove Co-op. Gin Texas, USA & their appreciation letter are shown below:



(08) Contamination Free Lint.

Since the high capacity colour sensing contamination sorters are not available at present a very few ginning factories use the same, however education to various ginners is being widely extended where the ginning factories are encouraged to stop the pre-cleaners at the raw cotton stage for few minutes after desired intervals to remove the contamination trapped in the cleaners which will significantly reduce the furtherance of contaminates and work is going on for the higher capacity colour contamination sorters which may be available to ginning industry in the near future.

(09) Best Spinning Parameters retained after processing.

Ginning surface temperatures and ginning methods of different technologies play a great role in retaining the best spinning parameters of the fibres and different varieties depending upon micronaire, strength and fuzziness plays a great role, hence the selection of the ginning technology must be with proper considerations. There are at present four ginning technologies used in the world and each is most suitable for certain cotton parameters, therefore the best results can be obtained if correct technology is selected for the variety of cotton desired to be ginned such as

(a) Saw Gins:

These gins are most suitable for short and medium staple cotton where the micronaire is higher and may be trash contents is also higher. Now these gins are abundantly manufacture in India and also exported, hence the ginning of certain cottons such as V797 etc may be more beneficial on these machines.

(b) Double Roller Gins:

These gins are most suitable for hand picked clean cotton where even micronaire may be lower i.e. below 4. Though these gins can gin all type of cleaned cotton but the best productivity is obtained on medium, long and extralong fuzzy as well as black seeded cottons. This is most versatile ginning machine available. The power consumption per unit of production is lowest on this machine. Further, the ginning temperature in the ginning surface is lowest as compared to other ginning technologies; hence the cotton retains maximum natural moisture and luster while in other technologies it may get brittle thereby affecting the ginning parameters adversely. This technology is therefore most preferred if a ginner gets to know the advantages, however being a closed type ginning technology it is necessary that cleaned cotton should only be fed to gin machine. Now the highest capacity Golden Jubilee model ginning machines have been introduced in the year 2011-12 further optimizing the cost of ginning on this technology. A photo of Golden Jubilee model Double Roller Gin Machine is given below:

Golden Jubilee Model Double Roller Gin

(c) Rotobar Single Roller Gin

This ginning machine is primarily designed for black seeded cotton varieties where the fibre is detachable most easily and does not hold much on the seed as like fuzzy seeded cotton hence the force required to separate the fibre from seed is lowest, however this ginning technology / machine is not suitable for ginning fuzzy seeded cotton as it creates seed cuts as well as higher temperature on the ginning surface causes damage to the spinning parameters of the fibre in case of fuzzy seeded cotton. Now high capacity Rotobar gin have been introduced in the recent years. A photo of Rotobar Gin is shown below:

Phonix Rotobar Gin with Feeder

(d) Single Roller Gin

This ginning technology is also known as McCarthy Ginning Technology based on the name of its inventor. This technology is also primarily suitable for medium and long staple cottons, however due to higher power cost and lowest production capacity this technology is being phased out and there is no new development for this machine.

Conclusion:

From the above it will be seen that the post TMC era has kept the momentum of modernization of cotton ginning & pressing sector of India and remarkable advancement has taken place in the ginning technologies to optimize production, reduction of manpower and electrical power and journey is continuing.

Apart from this significant developments have also taken place in the other cotton value chain such as Delinting of cotton seeds, utilization of cotton by-products which can at length only be discussed separately.

Further, the developments taken in the cotton ginning & pressing technologies in India have made India a net exporter of these technologies to various countries including advance countries such as USA, Australia, Greece etc. which certainly is a proud for country. Days are not far away when the India will be the largest exporter of cotton ginning & pressing machineries in the world.

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