



## BAJAJ STEEL INDUSTRIES LIMITED

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### VALUE ADDITION TO COTTON CHAIN IN INDIA – SIGNIFICANT CONTRIBUTION BY BAJAJ STEEL INDUSTRIES LIMITED

(A Paper Presented by Mr. Lav Bajaj & Mr. M.K. Sharma at International Workshop on *“Utilization of Cotton Plant By-produce for Value Added Products”* November 9-11-2009 at Hotel Pride Nagpur India)

#### Introduction:

The Indian cotton production was about 14 Million bales around year 2000 and the same was termed as most contaminated cotton in the world due to various deficiencies in production, ginning and cleaning practices and equipments, however there has been a rapid growth in the cotton production during last 10 years and now in the year 2008-2009 cotton production has reached to about 30 Million bales and the Indian cotton is now at a quality which is acceptable to all importing countries at par with cotton of advanced countries.

The increase in cotton production has been achieved mainly due to following factors:

1. Increase in area under cultivation of BT Cotton Seed.
2. Commensurate increase in required ginning capacity with addition of cleaning capabilities.
3. Introduction of Technology Mission on Cotton and efforts by research agencies like CIRCOT.
4. Government Policy of minimum support price.

Out of the above four factors the Bajaj Steel Industries Limited Nagpur as largest and modern manufacturer of cotton ginning, pressing, delinting & decorticating and other cotton processing machinery has played a vital role to achieve the factor listed at serial 2 above.

#### Historical Background:

The cotton produced by the farmers in India was having a very low yield i.e. of about 300 Kgs. per hectare at average which has rapidly grown to about 526 Kgs. Fibre per hectare during the year 2007-2008 and is expected to cross to 700 Kgs. Fibre per hectare by 2012, thus the cotton production from the existing area of about 9.3 million hectares under cultivation is projected to cross 37.5 million bales by 2012 as projected by Ministry of Textiles, Govt. of India.

The Indian cotton ginning factories were run mainly in labour intensive mode without cleaning equipments and the manual operated cotton baling presses were normally a separate factory situated at a distance from ginning thus leaving great scope for addition of contamination up to year 2002-2003 however now most modern online ginning & pressing factories have replaced the Indian Cotton Ginning & Pressing sector where majority of the machinery has been supplied by M/s. Bajaj Steel Industries Limited. These ginning & pressing factories now provide high quality low contamination cotton at higher outturn.

#### Current Scenario & Journey So Far:

With the increase in cotton availability the demand for better quality cotton fibres nearer to that of hand ginned cotton in adequate quantity became the challenge before the cotton ginning & pressing machinery manufacturers in India and the optimization of the process cost with higher outturn was necessitated to face the intense competition.

The Indian Cotton Mills which use to accept cotton with higher trash started demanding best quality cotton, the smaller labour intensive ginning factories started finding it difficult to achieve economy against composite ginning & pressing factories being setup under Technology Mission on Cotton and Technology Up-gradation Fund. This has thrown a further challenge before the Cotton Ginning & Pressing Machinery Manufacturers to produce high quality Cotton Ginning, Cleaning & Pressing Machinery in adequate quantities. M/s. Bajaj Steel Industries Limited geared up to meet the challenge and provided best solutions to meet complete demand.

The selection of right machinery to achieve the highest cost efficiency with best fibre parameters and to standardize the cotton ginning & pressing technology was another challenge before the Indian Cotton Ginning & Pressing Sector. Thus it was necessary to carefully compare the various options available. In the selection of cotton ginning & pressing machinery in India some the details mentioned below have guided the selection

### “Saw Gins”

“In advanced countries most of the ginning is performed on saw gins. Of late, however, there has been renewed interest in roller ginning especially because of its positive advantages over saw ginning in respect of higher ginning percentage and better retention of fibre length. It may be mentioned here that saw ginning always results in loss of fibre sometimes to the extend of 3%. Further most short fibres with lengths less than 12mm are left unginning requiring further processing. It is also known that saw ginning leads to more neps in the yarn.” *Dr.N.C. Vizia and Dr. K R K Iyer – Ginning Research in India-Future Prospects – Page 169 Book of Papers, 21<sup>st</sup> International Seminar on Cotton & its Utilization in the 21<sup>st</sup> Century (Dec.1999) CIRCOT.*

**Table 1 – Performance of Different Gins**

Cotton Variety	Type of Gin	GOT %	Process Loss %	2.5% Span Length (mm)	U%	Card Web neps/500 Sq. cm.	Yarn Strength (CSP)	Short Fibre%
H 4	Saw Gin	32.2	0.7	27	46	17	2244 (40 <sup>s</sup> )	25
	DR Gin	35.6	0.2	27.5	49	5	1940 (40 <sup>s</sup> )	17
M C U. 5	Saw Gin	33.7	3.9	29.5	42	33	2016 (60 <sup>s</sup> )	30
	DR Gin	37.3	2.7	31	42	10	1866 (60 <sup>s</sup> )	30
D C H. 32	Saw Gin	33.7	3.9	35.2	51	33	2208 (80 <sup>s</sup> )	32
	DR Gin	38.1	1.1	36.8	43	9	2256 (80 <sup>s</sup> )	28.4

*Dr.N.C. Vizia and Dr. K R K Iyer – Ginning Research in India-Future Prospects – (170) Book of Papers, 21<sup>st</sup> International Seminar on Cotton & its Utilization in the 21<sup>st</sup> Century (Dec.1999) CIRCOT*

### “Rotobar / Rotary Knife Roller Gins”

“Rotobar or Rotary Knife Roller Gin includes ginning roller and a stationary knife to which seed cotton is conveyed by the friction surface of the ginning roller for separating lint fibers from the cotton seed, and a rotary stripping blade divide adjacent the stationary knife having blades forming channel-like pockets there between for receiving the seed cotton deposited on the surface of the ginning roller and advanced to the zone of the stationary knife. The blades of the stripping blade device extend radially from a center shaft to span the width of the gin and are arranged in a one turn spiral path about the center shaft, and the stripping blade device has a diameter which is a small fraction of the ginning roller diameter and rotates at a speed causing the surface speed of the blade edges to be approximately the same as the surface speed of the ginning roller such as to restrain seeds in the channel-like pockets while the seeds are advanced over the edge of the stationary knife from the “pinch point” to a “release point” while the ginning roller strips lint from the restrained seeds and then releasing the seeds from blade restraint at the release point before they are pushed beyond the length of the fibers attached at the “pinch-point” (after they travel about ½ the staple length beyond the knife edge) to return to the knife edge before the next blade applies advancing force to the seed and thereby withdraw substantially all the fibers from the seed. An auxiliary feed control roller for providing more even feed to the blade device and comb structure to return unginning seeds to the ginning zone are also disclosed. This technology is having major disadvantages of seed cut and



unginned cotton going with seeds". - M.K. Sharma – *New Developments in Cotton Ginning - 67<sup>th</sup> Plenary Meeting of the ICAC in Ouagadougou, Burkina Faso (4<sup>th</sup> Breakout Session)*.

"In the case of cage Gins the fibres are pushed between two small rollers (diameters~1/2") and are ginned by means of either leather clad or hard rubber clad rollers that are pressed against the former. Thus ginning is limited to long fibres due mainly to the factors like the size of the seed, dimensions of the cage rollers and the gin rollers. Thus these are not efficient". - Dr.N.C. Vizia and Dr. K R K Iyer – *Ginning Research in India-Future Prospects – Page 172 Book of Papers, 21<sup>st</sup> International Seminar on Cotton & its Utilization in the 21<sup>st</sup> Century (Dec.1999) CIRCOT*.

"Templeton Rotor gin is of a different design based on roller gin principle. It employs a huge drum of 1.5M diameter rotating at 350 rpm and containing leather segments. Cotton is ginned with the aid of fixed knives all radiating from the centre of the drum. There are no reciprocating knives however. As per the admission of the designers it can gin only long fibres" - Dr.N.C. Vizia and Dr. K R K Iyer – *Ginning Research in India-Future Prospects – Page 172 Book of Papers, 21<sup>st</sup> International Seminar on Cotton & its Utilization in the 21<sup>st</sup> Century (Dec.1999) CIRCOT*.

### **"Single Roller Gins"**

The McCarthy roller gin utilizes a leather or composition roller to draw the fibers between a fixed knife and the roller. The pulling action of the roller on the fibers combined with the pushing action of moving knife are required to remove the fibers from each seed. The seed then falls through a seed grid and the fibers are removed from the roller by a rotating doffer.

Single Roller ginning has long been the preferred method for ginning extra-long-staple, fine-fibered Sea Island, Egyptian, American-Egyptian, and Pima cottons (Bennett, 1956). While it is possible to gin these types of cotton with a saw gin, the resulting quality is substantially lower than that obtained with roller gins. Saw Ginning tends to decrease the fiber length of these types of cotton and to greatly increase their nep content (Chapman and Stedronsky, 1965) while one major disadvantage of the McCarthy Roller Gin is its low ginning capacity.

### **"Double Roller Gins"**

In a double roller (DR) gin, two spirally grooved leather rollers, pressed against a stationary knife with the help of adjustable dead loads, are made to rotate in opposite direction at a definite speed. The three beater arms (two at end and one at the center of beater shaft) are inserted in the beater shaft and two knives (moving knives) are then fixed to the beater arms with proper alignment. This assembly is known as beater assembly, which oscillates by means of a crank or eccentric shaft, close to the leather roller. When the seed cotton is fed to the machine in action, fibres adhere to the rough surface of the roller and are carried in between the fixed knife and the roller such that the fibres are partially gripped between them. The oscillating knives (moving knives) beat the seeds from top and separate the fibres, which are gripped from the seed end. The process is repeated a number of times till all spinnable fibres are separated from the seeds, which are carried forward on the roller and doffed out of the machine. The ginned seeds drop down through the slots provided on seed grid, which is part and parcel of beater assembly, which also oscillates along with the moving knife. (P.G. Patil, GTC, CIRCOT). In this ginning mechanism fibre comes out from the bottom side and falls either below on the floor for manual collection or in the Lint Flue Chute for Pneumatic Conveying for a series of Double Roller Gins or falls on a Lint Slide for conveying by Belt Conveyor fitted along a series of Double Roller Ginning Machines in the modern ginnery. There are various models of double roller ginning machines available, however two models, one based on British Middleton Model and second based on Volkart and Monforts M. Gladbach model, are commercially used in India.



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The careful examination of various ginning technologies available throughout the world Indian cotton ginning & pressing factories preferred and adopted the Double Roller Ginning Machines to obtain best fibre parameters and highest benefits.

The Vol kart and Monfort M. Gladbach model is the most popular among the ginneries. Out of about 70000 Double Roller Gins about 65000 are that of Vol kart and Monforts M. Gladbach model type improved Double Roller Ginning Machines and majority of them are manufactured by M/s.Bajaj Steel Industries Ltd. Nagpur India. Against about 32 million bales produced in India around 30 million bales are produced on Double Roller Ginning Machines only. Further, Double Roller Gins are extensively used in Tanzania, Uganda, Zambia, Zimbabwe, Myanmar, Egypt, etc. At present over 40 million bales of cotton are ginned on Double Roller Ginning Machines, in these countries which constitutes about 30% of total world cotton production. This technology is having various advantages i.e. higher production as compared to McCarthy Gin, retention of all fibre properties similar to McCarthy Gin, possibility of setting up a smallest size ginning factory i.e. half bale per hour to largest size ginning factories i.e. 60 bales per hour. In India, at present, large volume i.e. 2000 bales per day plants are setup using multiple modules of 35 bales per hour capacity while smaller ginneries are also setup conveniently using this technology in large numbers i.e. over 5000 ginneries.

The various up-gradations and new introductions made by Bajaj Steel Industries Ltd. have helped to add value to Indian cotton in a great way:

### 1. Brief Introduction of the Company:

- A Company of Bajaj Group – Nagpur, serving
- Public Limited Company with over 4000 Shareholders.
- Listed Company on Bombay Stock Exchange
- Largest & Modern Cotton Ginning & Pressing Machinery Manufacturer in India.
- An ISO-9002 and ISO/TS 16949 certified manufacturing facility.
- Professional & Diversified Management
- High Growth – Year on Year Basis
- Innovative Manufacturing of Machineries & Equipments
- Turnover in 08-09 Indian Rupees 2250 Millions.

### 2. Prominent & Professional Board of Directors

- Shri Hargovind G. Bajaj – Chairman
- Shri Rohit H. Bajaj- Managing Director
- Shri Sunil H. Bajaj- Executive Director
- Shri Vinod G. Bajaj - Director
- Shri Mohan Agrawal- Independent Director
- Shri Kamal Koshore Kela - Independent Director
- Shri Raj Kumar Lohia - Independent Director
- Smt Ramadevi Ruia - Director
- Shri Alok Goenka - Independent Director
- Shri Rajiv Ranka - Independent Director

### 3. World Class New Expansion Facility

New Expansion Factory with SICOM Assistance

(A) World Class New Expansion Building at C-108 MIDC Hingna, Nagpur

Photograph

(B) New Expansion Building at Imambada Road, (Corporate Office & Main Factory)

Photograph



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CNC Mill Center  
CNC Turn Center

World Class New Expansion Facility  
New Expansion Factory with SICOM Assistance  
(C) World Class New Machines for Superd Finish Accuracies & Higher Production  
(D) Turning Center  
    Outer View Inner view  
(E) Milling Center  
(F) Drilling Center  
(G) Assembly Center

Dedicated Research & Development Team of Highly qualified and experienced professionals of

- |                         |                   |
|-------------------------|-------------------|
| 1. Mr. Sunil Bajaj      | ... B.E.          |
| 2. Mr. V. Shankar       | ... M. Tech. AMIE |
| 3. Mr. Nitin Bagokar    | ... DME           |
| 4. Mr. Tushar Bonde     | ... ITI D' Man    |
| 5. Mr. Anant Sonune     | ... DME           |
| 6. Mr. Nilesh Wasnik    | ... ITI D'Man     |
| 7. Mr. Gunvant Lakhe    | ... BE            |
| 8. Mr. Sunil Gawande    | ... BE            |
| 9. Mr. Suryanath Ingole | ... BE            |

Supported by manufacturing & other staff.

#### Research & Development Facilities

1. Auto CAD 2 D
2. Auto Cad Inventor 3D Software
3. Inventor 3D Product Design Software
4. Inventor 3D Product Ananalysis Software
5. Dedicated Engineering Books Library
6. Isolated Study Room
7. Proto-type Manufacturing Facility
8. Availability of Funds for making working models.
9. Desktop and Laptop with advance Configuration with advance printers.

#### Technical Collaborations

1. Central Institute for Research on Cotton Technology (CIRCOT) ICAR Govt. of India
2. M/s. Samuel Jackson Inc. USA for Humidification
3. M/s. Continental Eagle Corporation USA for Delinters

Apart from above our technical keep on visiting USA and Europe and various technical exhibitions to upgrade the product and manufacturing practices.





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### Awards & Achievements

- Awarded Largest and Modern Cotton Ginning & Pressing Machinery Manufacturer in India by the hands of Hon'ble Shri Shankar Singhji Waghela, Minister of Textiles, Govt. of India on 4th Jan, 2008.
- Awarded Best Performer "Lalit Doshi Memorial Award 2008-2009" by SICOM Ltd. Mumbai on 20.07.2009.

#### Product Innovations – A continuous Journey

#### 4. Product Improvements and Additions

##### i. **High Efficiency Double Roller Ginning Machine:**

Uptill 1998, Double Roller Gins were of lower capacity i.e. about 50-60 Kgs. Lint/Hr. thereby operating cost was higher and the ginning was uneconomical. After year 1998, high capacity, Jumbo Model of Double Roller Gins is having a capacity of about 90 Kgs. Lint/hr. The modifications have improved the working of ginning factories significantly. The research to further increase productivity of the Double Roller Gin to reduce the grooving cycle, roller washer technology for longevity and strengthening of machine to increase the ginning speed is going on and in the future a higher capacity Double Roller Gin will be available to Ginning Factories.

##### ii. **High Efficiency Pre -cleaners:**

Absence of proper pre-cleaning machines were an impediment in obtaining cotton with lower trash and contamination. These equipments were designed to suit the Indian cotton in different sizes and capacities which are used now by the cotton ginning & pressing industry to obtain clean cotton. Further improvements are underway to improve the grid, spike and speed to optimize fibre parameters and efficiency. Further, trash collection conveyor is added to improve the trash removal system.

##### iii. **Pneumatic / Mechanical Cotton Conveying Systems:**

The manual conveying of seed cotton into the ginning hall was replaced by well designed, suitable capacity, electrical power efficient, pneumatic suction system to pull the cotton from length up to 750 feet with multiple points. This has resulted in reduction of substantial number of manpower and dependent inefficiencies due to erratic working / non-availability of manpower. Moreover, regular supply of seed cotton has resulted in uniform and sufficient feeding to Double Roller Gins thereby increasing productivity. This has also helped in reducing the contamination and trash. Further efforts to improve airseparators, vacuum wheels, optimized calculations of suction requirement to improve power efficiency as well as maintain fibre parameters are underway.

##### iv. **Automatic Individual Gin Feeding System:**

Sensor based individual Gin feeding auto regulators and Overhead Distribution Conveyors over a series of Double Roller Gins in one row and parallel rows has eliminated complete requirement of manpower for feeding each gin and ensured continuous and controlled feeding as per requirement of gin which has helped higher production and reduction of manpower requirement greatly.

##### v. **Improved Auto Feeder / Lattice Feeder on Double Roller Gin:**

Earlier each gin was required to be continuously fed and cotton was to be stirred to avoid chocking of beater area. Now improved Auto Feeder / Lattice Feeder provides a reservoir for about 10 minutes feeding to each gin and level sensors signals re-feeding as soon as cotton level in the feeder goes below minimum level hence continuous feeding of cotton is ensured while the rotating lattice spikes removes excess material as well as stirs the cotton in the beater area, thus manual involvement is fully eliminated. As per paper "Performance evaluation of Lattice Feeder for Double Roller Gin" published in journal of The Indian Society for Cotton Improvement – Volume 28, December 2003 (03) "The



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Lattice Feeder assists in continuous feeding and even distribution of seed cotton to Gin”  
“Use of Lattice Feeder led to an average increase in Ginning output of 7%”.

### **vi. Automatic Lint Suction System from Each DR Gin:**

A well designed Lint collection chutes, Lint Collection Boxes and incremental lint suction ducting has automatized lint collection up to lint cleaner. This has eliminated total requirement of manpower for lint collection from each Gin and its carrying up to Lint Cleaner. Further improvements in respect of central suction pipe connections, improvement in lint collection hopper has improved the efficiency greatly.

### **vii. Fibre Friendly Lint Cleaners:**

Use of fibre friendly Lint Cleaner with improved Grid and Spike systems has helped to remove trash from lint without damaging the fibre. Further trash removal systems introduced recently have greatly improved the trash removal efficiency.

### **viii. Use of Scanners for Contamination Removal:**

Camera and sensor based contamination removal systems have been introduced after the lint cleaner to remove the colour contaminants, which take out all coloured contaminants thereby providing the contamination free cotton to spinning industry.

### **ix. Multipoint Suction System to connect to the Bale Press:**

Multipoint suction systems or single point suction system from the end of lint collection conveyors fitted below series of lint cleaners for each module of ginning machines, has facilitated the high volume single ginning factories based on double roller ginning technology and plants upto a capacity of 2700 bales per day using multiple bale presses of 35 BPH each, on three shifts basis being setup in India making them world's highest capacity ginning & pressing factories.

### **x. Use of Humidification Systems :**

Modified Humidification systems to suit Double Roller Ginned lint coming out in blanket form have been incorporated in the lint feeding slide or lint feeding belts which can add moisture in controlled manner thereby providing all the benefits of humidification before baling. This has been well accepted by the ginning factories based on Double Roller Ginning Technology. M/s. Bajaj Steel Industries Ltd., Nagpur have provided world-class online Humidification System in collaboration with M/s. Samuel Jackson USA.

### **xi. Use of Down Packing Automatic Baling Presses with online Bagging Arrangements:**

Earlier Double Roller based ginning & pressing factories used to have up packing old fashioned manual cotton baling presses requiring a pit of about 40' below the ground level and using large number of manpower being double stage. Now fully automatic, down packing baling presses with online bagging arrangements are being installed in most of the new factories after year 2001. This has resulted in full covering of the bales which finally saves it from contaminants and manpower requirement has come down to 4 persons only. To provide baling solutions to smaller ginneries so that they can operate as composite units a small capacity single box fully automatic press has been introduced by M/s. Bajaj Steel Industries Limited for 8 bales per hour capacity.



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### ***Value Addition New Trends by Delinting & Decorticating & Oil Milling:***

Uptill now the Indian oil millers were using the cotton seed coming out of Double Roller Gin having much lower linter as compared to saw gin i.e. about 8-9% against 12-14%, without delinting as the process cost of delinting was much higher then the realization from linters and delinted / decorticated seeds, however in view of new uses found and higher value for linters, D.O.C. and better oil percentage a new trend of delinting and decorticating plants has started. Now world-class machinery is being introduced in India by Bajaj Steel Industries Limited in technical collaboration with Continental Eagle Corporation U.S.A. and full range of machinery for cotton seed delinting and decorticating is available in India.

#### **Delinters:**

The high capacity about 5 Tons Seed Processing capacity per hour Delinters have been introduced in India which will increase profit for the cotton seed processors as they will earn higher for linter and black seeds. Further oil mills will get better yield percentage.

#### **Decorticators:**

High capacity Decorticators will further add the profit by way of removal of hull and cotton seed meat. Thus increasing the total value and oil percentage

#### **Oil Milling Machinery:**

M/s. Bajaj Steel Industries Limited, is under active discussions to introduce world class oil mill machinery to Indian Cotton Seed Crushing which will further add value to cotton chain due to better realization for cotton seed.

Apart from above Bajaj Steel Industries Limited are in the process to add various other items needed for better working of Indian cotton sector which will certainly will help this sector to add value.

- Improved Humidification Applicator
- Quick Link Manufacturing
- Quick link applicator for automated bales production
- Tractor mounted heap making, heap breaking, seed cotton feeding, bale and seed handling systems for automated handling of these operations.
- Targeting to achieve turnover of Rs.500 Crores in three years.

Looking to the contribution and achievements by Bajaj Steel Industries Limited various awards have been conferred upon.

1. Awarded "Largest & Modern Cotton Ginning & Pressing Machinery Manufacturer in India" by Textile Association at Ahmedabad on 4<sup>th</sup> Jan, 2008 kby the hands of Hon'ble Shri Shankar Singhji Waghela then Minister of Textiles, Govt. of India.
2. Awarded Best Performer "Lalit Doshi Memorial Award 2008-2009" by SICOM Ltd. Mumbai on 20.07.2009.





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## **Conclusions:**

The technological developments in Ginning & Pressing Machinery has acted as an driving force in structural shift from old outdated to more productive advanced machinery. By and large the good pace of technology development and dissemination has been witnessed in India in the last 10 years. This has helped to produce good quality cotton and also met the need to gin and press additional quantities of cotton produced by the country in a better way. This has also helped the acceptance of Indian Cotton in the world market and about one million bales of cotton were exported in the year 2007-2008 from India. The Indian Textile Industry is now getting better cotton, thus can produce world-class fabrics and resultant benefits are accruing. It will strengthen further and in all probable the ginning industry would emerge out of its inglorious past and march ahead with pride, by providing world standard cotton lint. The continuous thrust of Government, research institutes like CIRCOT, organizations like Cotton Association of India and machinery manufacturers like 'BAJAJ' towards technological developments will prove a driving force for the further improvement of cotton ginning & pressing machinery in future and the Indian Cotton Ginning & Pressing factories will achieve best fibre properties due to gentle ginning technologies at the same time with the matching speed of developed countries and further add value by delinting, decorticating, better oil milling and utilization of by-products in useful manner. We at Bajaj Steel Industries Limited are continuously upgrading ourselves to meet the challenges of demand for world class processing equipments to optimize the value addition in cotton chain.

Thank You !

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