Integrated Single Locking Cotton Feeder cum Cleaner for Double Roller Gin

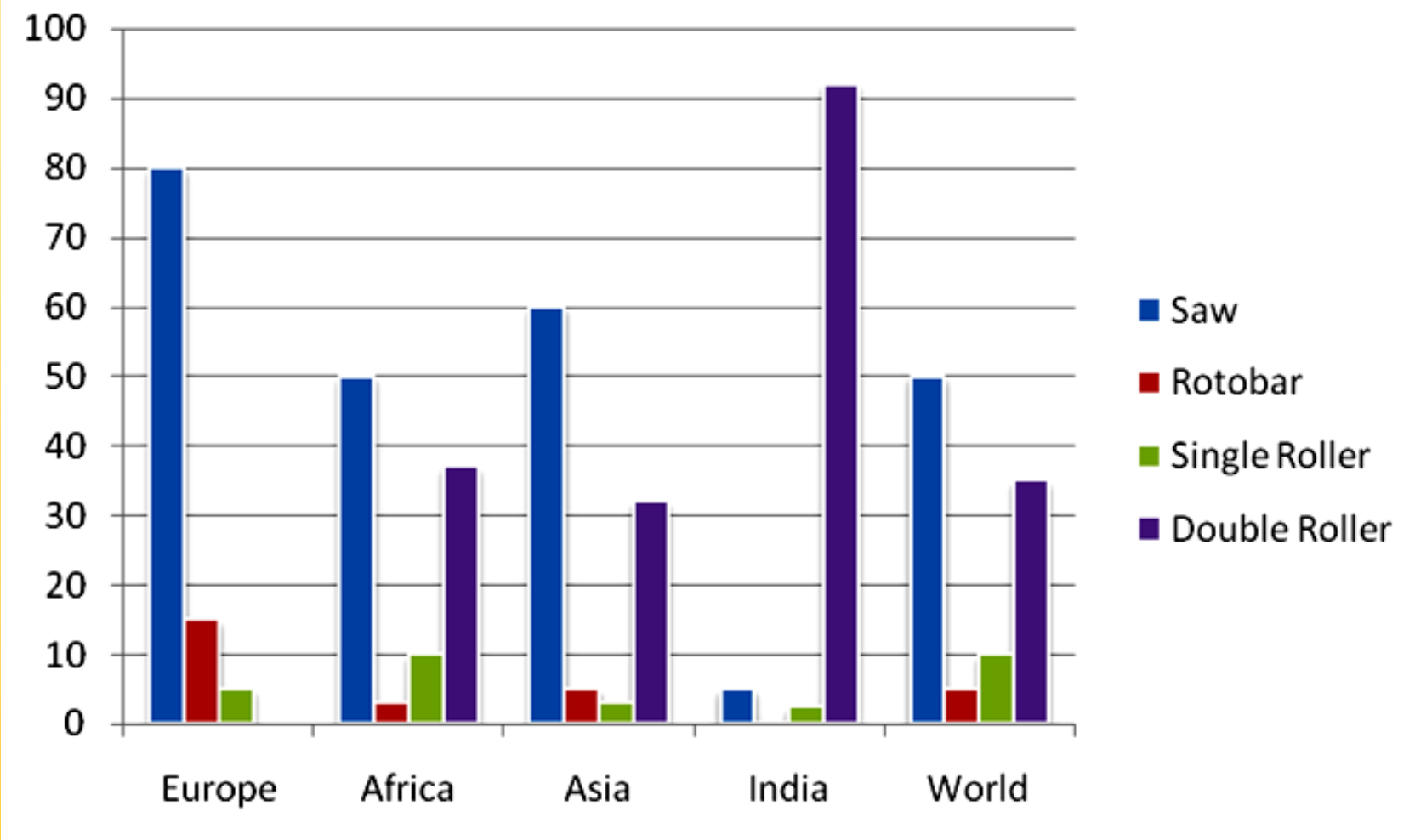
V. G. Arude

S. P. Deshmukh P. G. Patil and S. K. Shukla

ICAR-Central Institute for Research on Cotton Technology, Mumbai,

Email: arudevg@gmail.com

World Scenario of Ginning Technology



Double Roller Ginning

- India: 4000 ginneries
- Modernized Ginneries: 1500
- Number of DR gins: 50000
- 95% of cotton is ginned on DR gin

Issues with DR gin

- Low capacities of DR gins provide an economic barrier to their widespread application

➢ DR gins-90 kg lint/h

➢ Saw gin 500-1000 kg lint/h

➢ Rotary knife roller gin : 425-450 kg lint/h

R & D Efforts so far for Improvements in DR Gin

- Improved versions of DR gin by increasing the length of roller
- Variable speed DR gin
- Modified DR gin with improved power transmission
- Use of self-grooving rubber roller
- DR gin with auto-feeder
- DR ginning with automation in material handling
- Improvement material of construction of critical parts

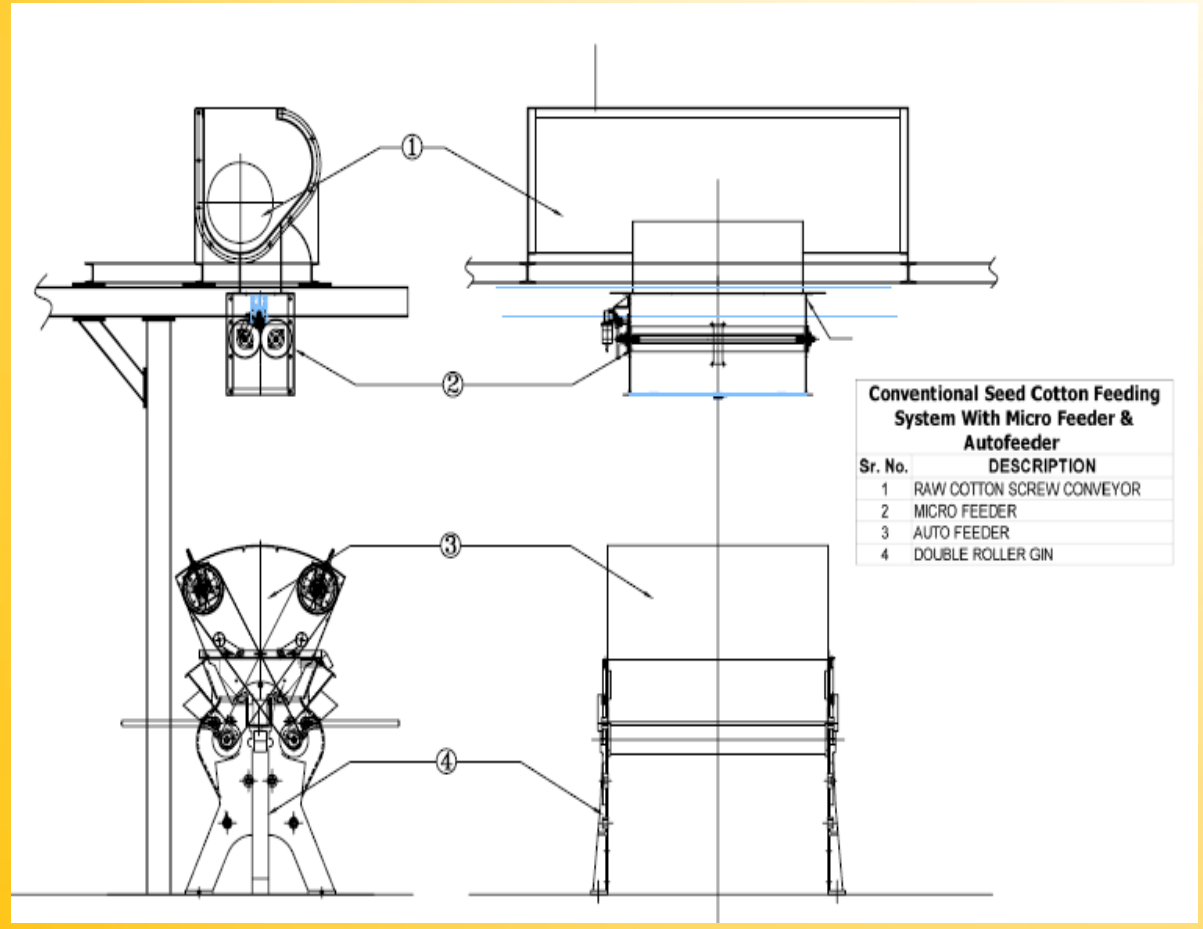
Ginning Efficiency

- Surface speed of roller
- Speed of beater
- Cotton moisture
- Settings & adjustments
- Type of cotton
- Amount and nature of trash
- Feeding mechanism

Feeding means for DR Gin

- Till 1995: Manual feeding: Non uniform, low capacity, contamination, loss of ginning efficiency up to 20%
- After 1995: Auto feeder: Improved output capacity by about 5%
- After 2000: - Automatic feeding with mechanical, pneumatic & electromechanical systems – Reduced labour and contamination, improved quality of lint Ginning efficiency in terms of DR gin productivity not improved to the desired extent

Conventional Feeding System



Conventional Seed Cotton Feeding System With Micro Feeder & Autofeeder

Sr. No.	DESCRIPTION
1	RAW COTTON SCREW CONVEYOR
2	MICRO FEEDER
3	AUTO FEEDER
4	DOUBLE ROLLER GIN

Problems with Conventional Feeding System

- Uncontrolled and erratic cotton flow rate
- Feeding in lumps or bunches
- Entanglement of cotton bolls and locules
- Overfeeding or underfeeding
- Accumulation of cotton in gin hopper
- Failing to feed at ginning point
- Improper metering of the ginned seeds
- Low production capacity of DR gin

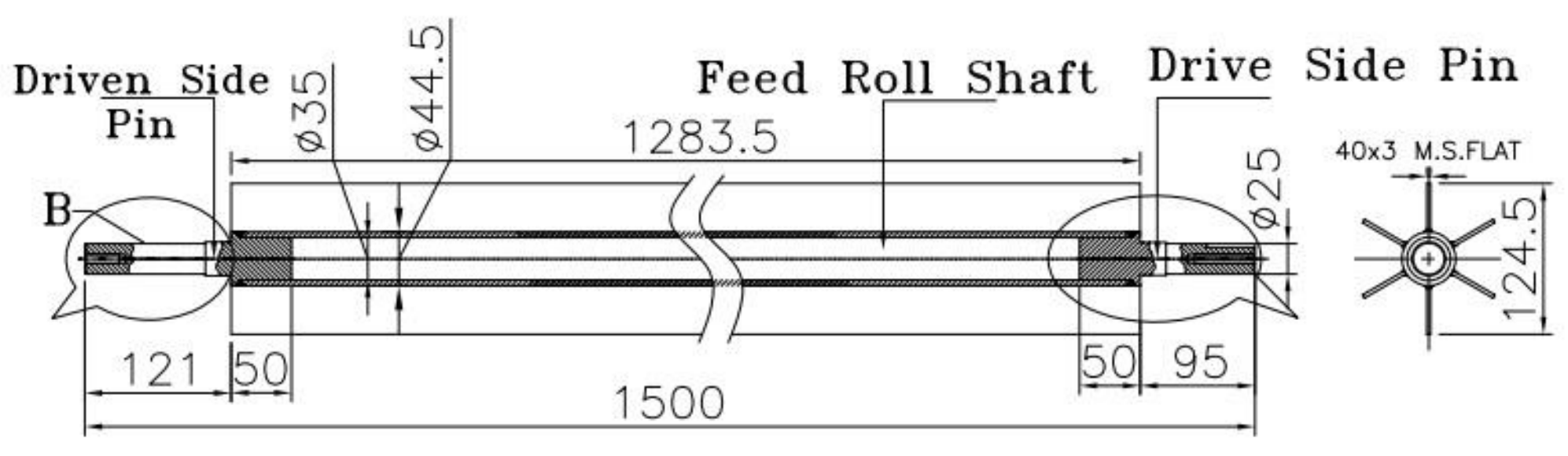
Design Consideration for Single Locking Cotton Feeder

- Unlocking the cotton bolls
- Feeding of the locules near the ginning point
- Feeding continuous batt of cotton across the knife edges
- Synchronisation of feeding rate to the ginning capacity of DR gin
- Proper metering of ginned cottonseeds
- Improving the ginning efficiency
- Preservation for fibre and seed quality

Development of Single Locking Cotton Feeder

- Micro-feeder & auto feeder in conventional feeding mechanism is replaced by single locking cotton feeder
- Feeding mechanism comprises
  - Feed roller assembly
  - Spiked cylinder assembly
  - Grid assembly
  - Feeder hopper
  - Distributor chute
  - Power drive arrangement.

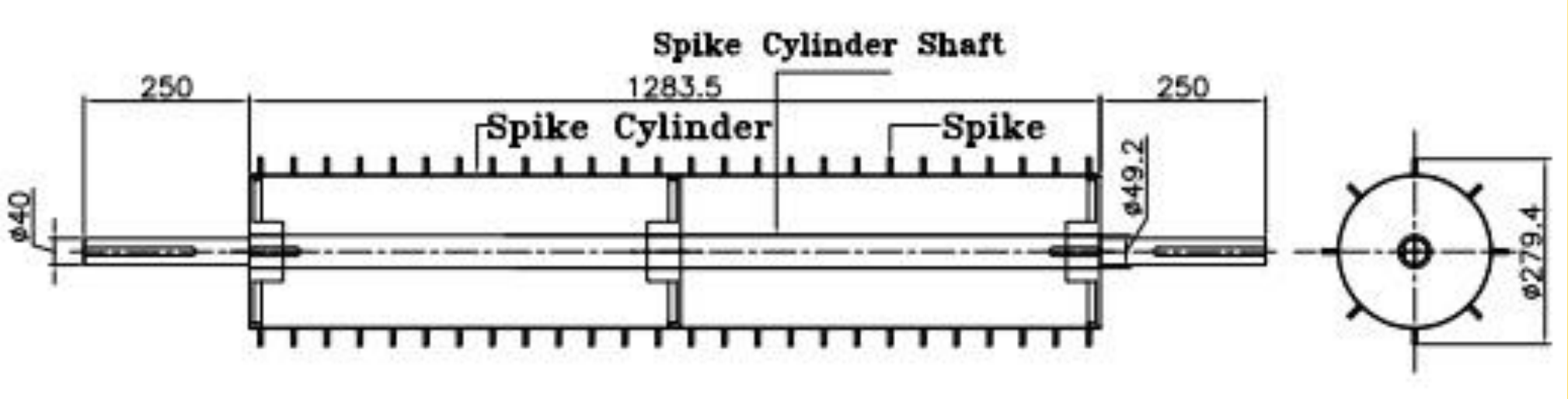
Feed Roller



Feed roller Assembly

Length of feed roller (mm)	1283.5
Number of flats on each feed roller	6
Feed roller diameter (mm)	124.5
DC motor power to drive feed rollers (W)	30
Feed roller speed (rpm)	1-5

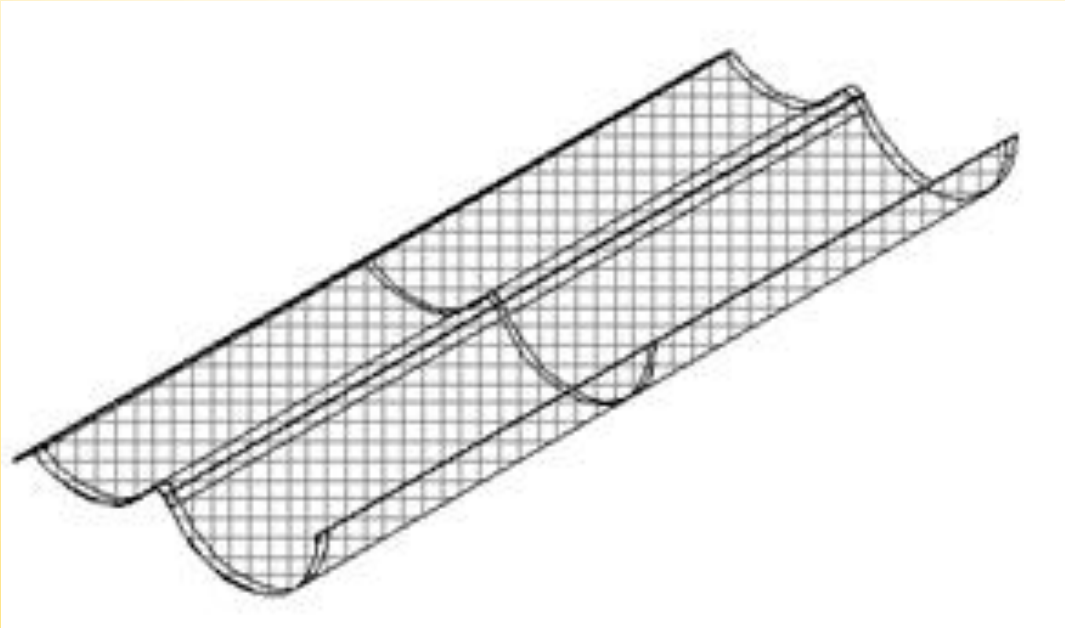
Spike Cylinder



Spike Cylinder Assembly

Cylinder length (mm)	1283.5
Spike length (mm)	25.0
Cylinder diameter with spikes (mm)	279.4
Number of spike rows on cylinder	8
Spike to spike distance in a row (mm)	50
Power to drive spike cylinder (HP)	2
Spike cylinder speed (rpm)	100 - 500

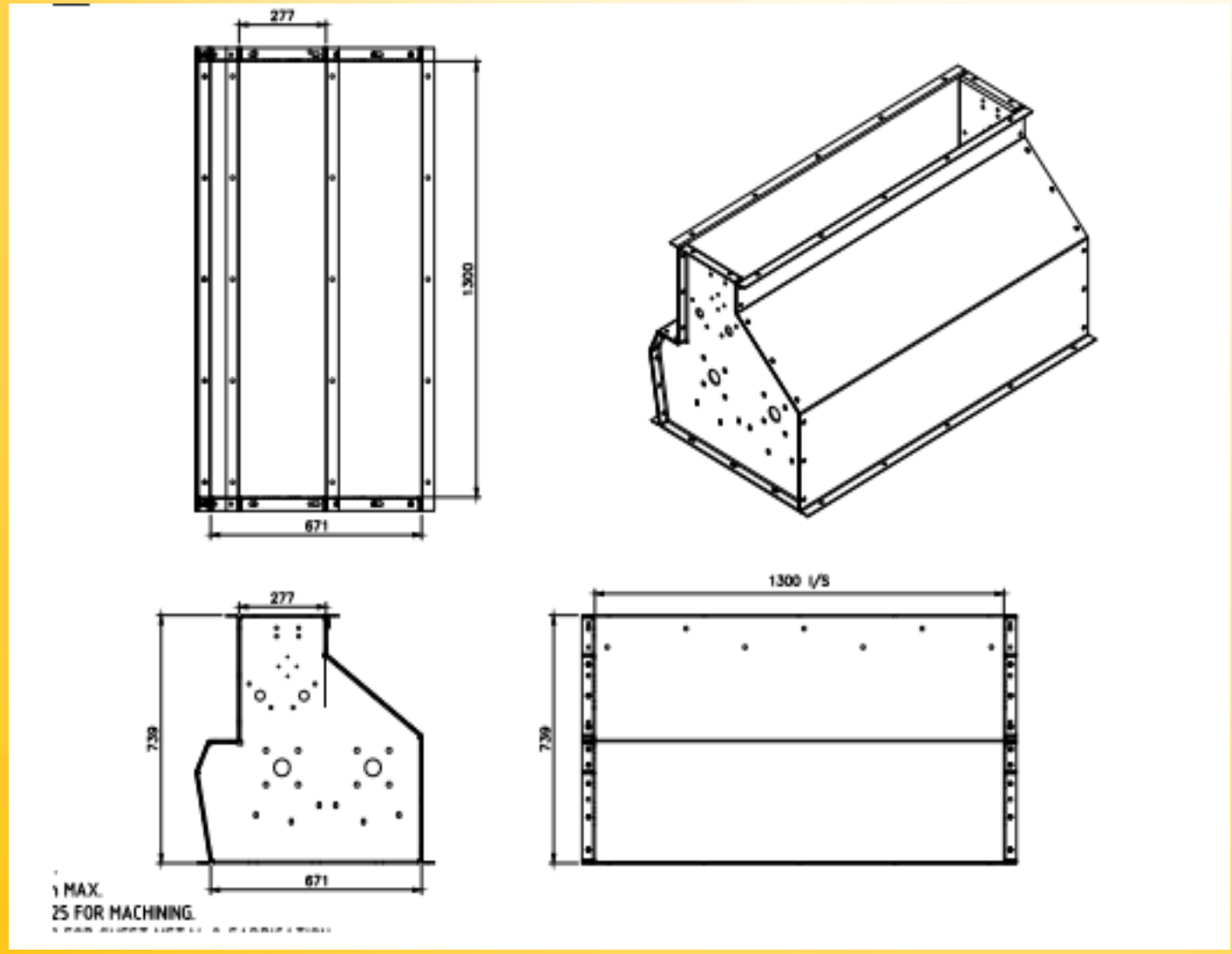
Grid



Grid Assembly

Sieve mesh size (mm)	11.2
Sieve wire diameter (mm)	1.6
Grid concave radius (mm)	150

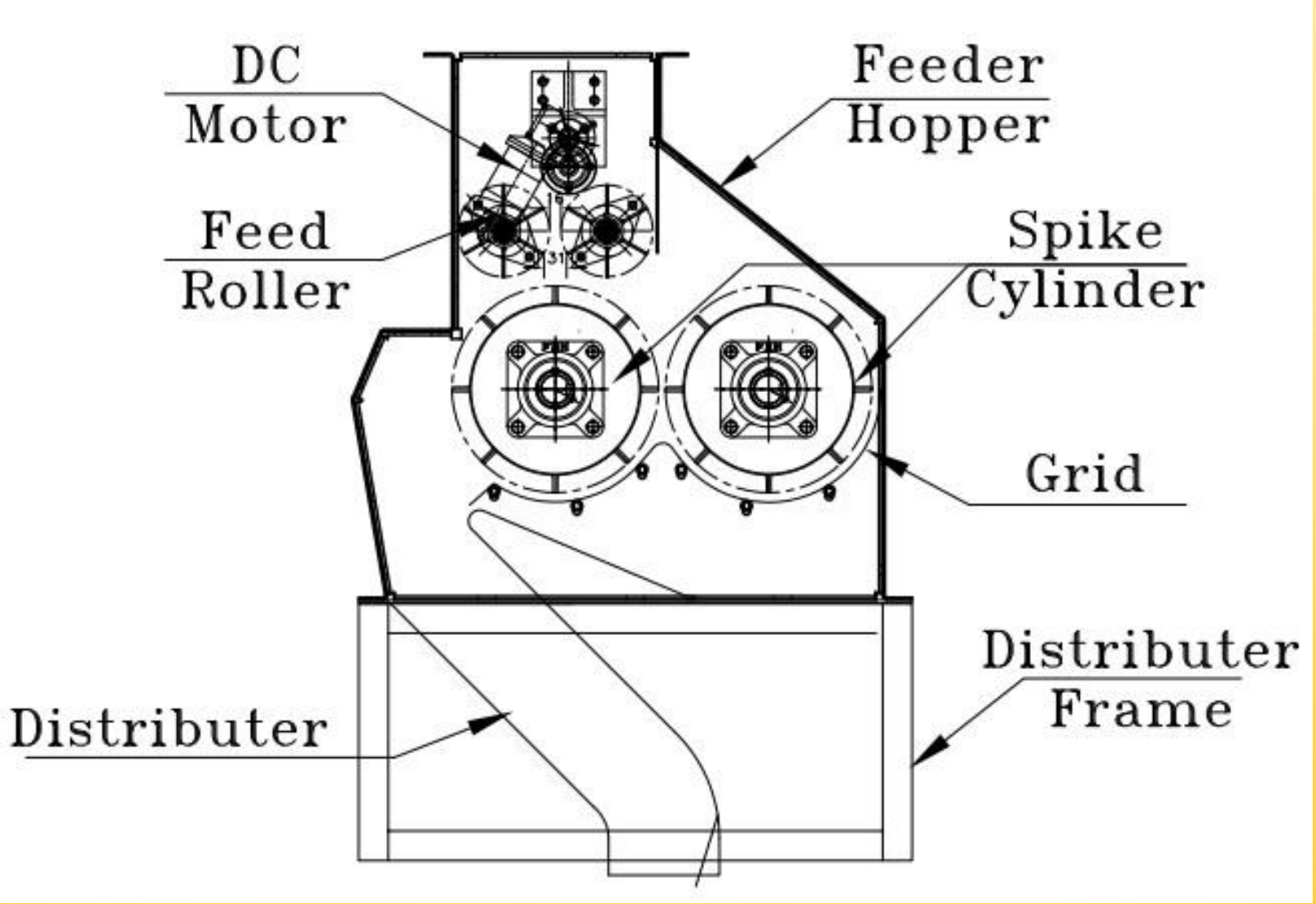
Feeder Hopper



Feeder Hopper Assembly

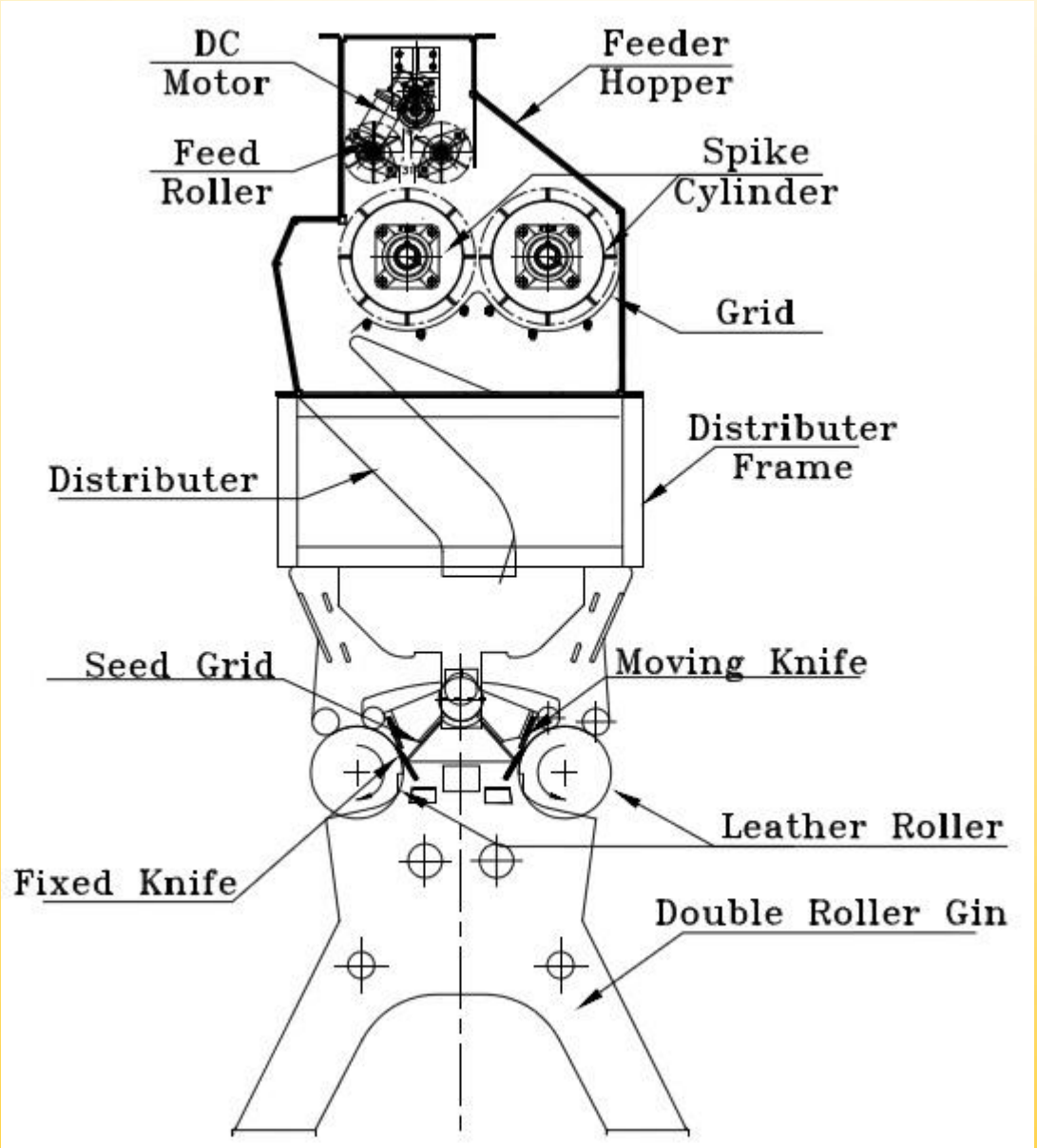
Length (mm)	1300
Top width (mm)	277
Bottom width (mm)	671
Height (mm)	739

Spike Cylinder Single Locking Cotton Feeder Cum Cleaner



Spike Cylinder Single Locking Cotton Feeder cum Cleaner

Prototype with DR Gin



Prototype of Spike Cylinder Single Locking Cotton Feeder Cum Cleaner

Optimum setting and adjustments for spike cylinder type single locking cotton feeder cum cleaner

Settings and Adjustments	Values
Minimum tip to tip clearance between the flights of two feed rollers when diametrically aligned	16 mm
Maximum tip to tip clearance between the flights of two feed rollers while moving in opposite direction	31 mm
Tip to tip clearance between spikes of two spike cylinders when diametrically aligned	10 mm
Clearance between tip of feed roller flight and tip of spike cylinder	12 mm
Clearance between tip of spike cylinder and grid	12 mm

Performance Evaluation

Parameters	Values
Increase in capacity of double roller gin (%)	15-20
Degree of unlocking in terms of decrease in bulk density (%)	10-30
Cleaning efficiency (%)	20-30
Increase in energy consumption (%)	5-7
Increase in degree of whiteness (Rd) of lint (%)	5-10

Conclusions

- Spike cylinder type cotton feeder cum cleaner was observed to be successful for single locking of cotton bolls.
- Output of the double roller gin with the use of single locking feeder cum cleaner was found to increase by 15-20%.
- Fibre quality of the cotton processed using feeder cum cleaner was improved in terms of reduction in trash, improved whiteness and reduction in degree of yellowness.
- With the above advantages the single locking feeder cum cleaner would be highly useful for Indian cotton ginneries.

Collaboration with Industry

Collaborative research work in public private partnership with M/s. Bajaj Steel Industries Ltd, Nagpur and ICAR-CIRCOT, Mumbai.

Thank You

Specifications of spike cylinder single locking cotton feeder cum cleaner

Particulars	Values
Feed roller Assembly	
Length of feed roller (mm)	1283.5
Number of flats on each feed roller	6
Feed roller diameter (mm)	124.5
DC motor power to drive feed rollers (W)	30
Feed roller speed (rpm)	1-5
Spike Cylinder Assembly	
Cylinder length (mm)	1283.5
Spike length (mm)	25.0
Cylinder diameter with spikes (mm)	279.4
Number of spike rows on cylinder	8
Spike to spike distance in a row (mm)	50
Power to drive spike cylinder (HP)	2
Spike cylinder speed (rpm)	100 - 500

Specifications of spike cylinder single locking cotton feeder cum cleaner

Particulars	Values
Grid Assembly	
Sieve mesh size (mm)	11.2
Sieve wire diameter (mm)	1.6
Grid concave radius (mm)	150
Feeder Hopper Assembly	
Length (mm)	1300
Top width (mm)	277
Bottom width (mm)	671
Height (mm)	739
Distributor Chute Assembly	
Distributor chute width (mm)	250
Distributor chute length (mm)	1283.5
Frame Size (mm x mm x mm)	1300 x 749 x 353

Prototype of Spike Cylinder Single Locking Cotton Feeder Cum Cleaner