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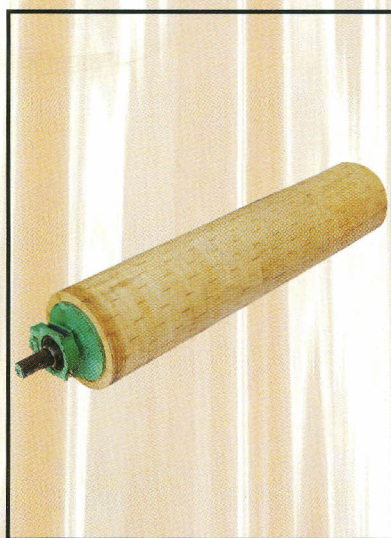
Self-Grooving Rubber Roller

An Alternative to Chrome Composite Leather Roller

&

Modified Double Roller Gin

with Rubber Roller



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Introduction

The roller gins are commonly used in countries like India, Turkey, Uganda, Kenya, Myanmar, Tanzania, Thailand etc. In India about 80% of cotton produced is processed using double roller gins. Double Roller (DR) gin is the most important machine in ginning Industry. The roller is the main component of a roller gin machine.

The chrome composite leather rollers are widely used in ginneries. Annually about 2 lakh rollers are required. At present leather rollers are easily available, cheaper and easy to convert into a roller and efficient ginning is being achieved with leather roller. However some problems are associated with use of chrome composite leather roller

Problems with Chrome Composite Leather Roller

Roller Wear : The surface of the leather roller gets polished very fast while running. Therefore ginning output drops continuously. The decrease in output is observed to be up to 40-50% and monetary loss of about rupees twenty thousand per machine per season is seen. Service life of the roller is about 1500 h.

Roller Grooving: Periodical grooving of leather roller is required to make the grooves of optimum size and make surface rough in order to catch the fibres. This process is labour intensive and lot of human drudgery is involved. Grooving is to be carried out manually and daily. It results in high downtime of gin machine, upto 1 hour per roller. Hence grooving operation is many a times uncared and neglected. It directly affects the production and deteriorates fibre and seed quality.

Non-uniform pressure: It is very difficult to apply uniform pressure over the entire length of the chrome leather roller, which causes uneven ginning.

Water absorption : The leather roller tends to absorb water and gets swelled whenever environment humidity becomes very high, moisture

content in cotton is more and during rainy season. It creates difficulties in ginning due to chocking of cotton between the roller and fixed knife. It leads to loss of output and damage to the fibre quality.

Chromium contamination : Leather washers contain 3 to 4 % chromium. During ginning process chromium gets mixed up into the lint, seed and air. Subsequently it contaminates the products made out of the lint and seed.

Health hazards : Chromium emitted during ginning process pollutes ginning factory and premises. Since it is carcinogenic material, the gin and mill workers are exposed to the threat of respiratory diseases, allergic symptoms, brain damage, chronic ulceration, byssinosis disease, and continuous exposure can even lead to lung cancer.

Eco-standards : As per the eco-standards, chromium content in cotton and its products should not be more than 0.1 ppm but SPM and RSPM chromium concentration are found in the range of 50 to 190 ppm. There is a near possibility of the major developed countries introducing a specification limit for the extent of chromium level on finished cotton. Cotton processed in the chrome leather ginning machines will disqualify this criterion.

Self-grooving rubber roller is developed to overcome the problems encountered in chrome composite leather roller.

Self-grooving Rubber Roller

Self-grooving rubber roller was made out of rubber discs of hard and soft rubber compound prepared in a specially designed die by moulding technique. Roller was made with nitrile rubber having radial layers of softer rubber compound to form grooves. Compounding ingredients in appropriate proportion were added to provide sufficient hardness, temperature resistance, and to ensure effective ginning. The

hardness and the abrasion resistance of two rubber parts are adjusted in such a way that the soft rubber area abrade faster and form a groove. Self-grooving rubber disc comprises of three parts i.e. inner hard core, outer ginning body and soft groove area.

Inner hard core : It is a composite of rice husk, nitrile rubber and phenol formaldehyde resin. The inner core is hard enough to give stability to the roller and it prevents the roller from thermal expansion during ginning.

Outer ginning body : Outer body is made with nitrile rubber. It can withstand high service temperature and is oil resistant. Ginning body catches fibre and performs the actual process of ginning.

Soft groove area : Soft groove is more abrading compared to the ginning body and forms the groove which in turn washes out the trash, cut seed etc., along with the ginned lint.



Fig.1 Rubber roller disc

Rubber disc in required shape and size is moulded, in a specially made die. Each disc is made with hard rubber compound which is moulded in the form of a disc in which a number of layers are made with soft rubber compound of

1 to 4 mm width and 30 to 35 mm deep and thickness equal to that of the disc radially to the hard rubber surface.

The number of layers of soft rubber compound can vary in such a way that the peripheral gap between two soft areas is 20 mm or less for rollers ginning small staple cottons, 20 to 30 mm for rollers ginning

medium staple cottons and 30 mm or more for rollers ginning long staple cottons. This special design of hard and soft rubber compound eliminates periodical grooving operation. The inner core of the disc up to a diameter of 130 mm is moulded with organic filler materials like rice husk.

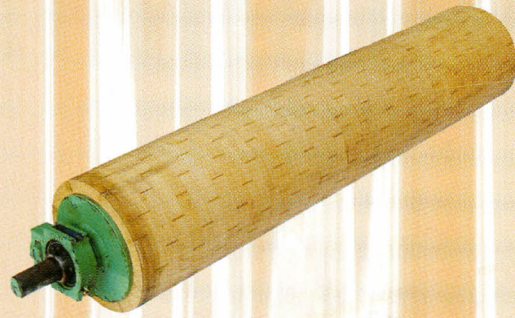


Fig.2 Self-grooving rubber roller

Required numbers of rubber discs are inserted on the steel shaft and pressed from both the ends to bring all the rubber discs together and are secured in that position by putting flanges on either side. The roller is resized as per the requirement of roller gins on a lathe machine. By

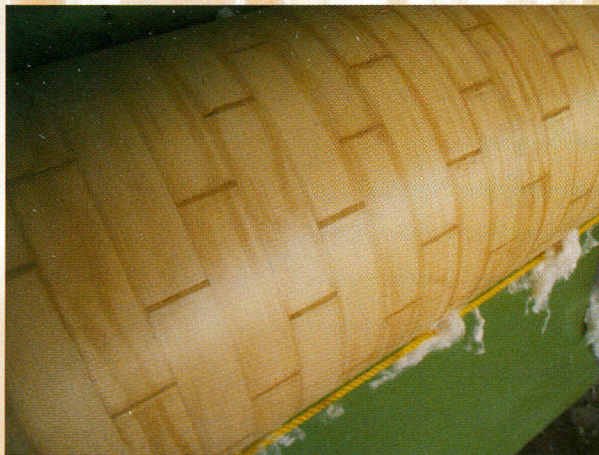


Fig. 3 View of self-grooving rubber roller showing the groove pattern

scattered array of grooves for ginning is formed. By inserting rubber discs with spiral soft rubber layers successively with centre hole rotated

serially inserting similar rubber discs on a shaft a straight groove can be formed on self-grooving rubber roller. By alternately inserting rubber discs with centre hole rotated at half the angle of intersection of soft rubber layers on a shaft a self-grooving rubber roller with

at equal angle to the of intersection of soft rubber layers on a shaft a self-grooving rubber roller with spiral peripheral grooves for ginning is formed.

Performance of Self-grooving Rubber Roller

Self-grooving rubber roller was tested on commercial double roller ginning machine.



Fig. 4 Self-grooving rubber roller in operation

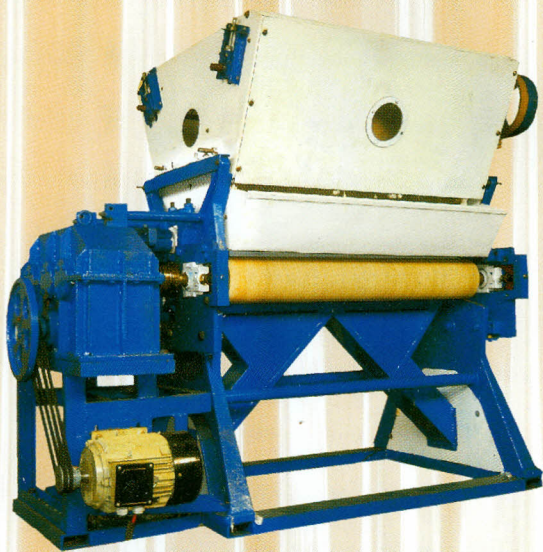
Effective ginning was achieved and self-grooving principle was found to work satisfactorily. Roller has very high abrasion resistance and temperature rise during ginning was found within the acceptable range.

The roller speed of 40 rpm was

observed to be optimum for ensuring effective ginning. Lint output of DR gin with rubber roller at a speed of 40 rpm was found to be 25-30% higher than that of conventional DR gin. Self-grooving rubber roller can be used as a substitute to leather roller for use in roller gins after making recommended modifications in the gear box of the existing DR gin to run the roller at 40 rpm.

Modified Double Roller Gin with Rubber Roller

The conventional double roller gin can be modified to make them suitable for using the rubber rollers. The drive system comprising of the gear box and roller fixing mechanism needs to be modified. The new gear box was designed and developed to rotate the roller at a speed of



*Fig.5 Modified double roller gin
with rubber roller*

40 rpm. The modified machine was tested commercially and found to give good ginning performance. The self-grooving rubber roller and the modified DR gin with rubber roller give the following advantages over the conventional double roller gin with leather roller.

Advantages of Self Grooving Rubber Roller and Modified DR Gin over Conventional DR Gin

- Increased (25-30%) and consistent output throughout the roller life.
- Working life of rubber roller (5000 h) is three times that of leather roller (1500 h).
- Increase in working life of fixed knife in modified DR gin.
- Energy consumption is less by 15%.
- Periodical grooving is eliminated.
- Reduction in downtime (2 hours per machine).
- Roller is non-hygroscopic in nature.
- Eco-friendly roller with no chromium contamination.
- No environmental pollution and health hazard to workers.
- Reduction in machine vibrations, noise and maintenance cost.
- Increased bale value and export market.

Self-grooving rubber roller can be used as a substitute to chrome composite leather roller for use in roller gins. With suitable modifications, conventional DR gins can adopt self-grooving rubber roller. Additional investment on modifications can be paid back within six months.

Developed in collaboration with

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