HOW DIFFERENT LINT CLEANING PROCESSES AFFECT FIBER LENGTH UNIFORMITY INDEX

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Abstract

There is a need to develop lint cleaning methods that reduce fiber damage and improve fiber length properties, length uniformity index in particular. Improvements in fiber length may promote more use of newer and more efficient spinning technologies such as air-jet spinning. A literature review on recent lint cleaning research showed that 1) the feed bar on a conventional saw-type lint cleaner reduced uniformity, 2) the roller gin stand preserved uniformity better than the saw gin stand by about two percentage points, and 3) roller gin lint cleaning reduced uniformity, but to a lesser degree than saw-type lint cleaning. The objective of current research is to determine how uniformity is affected by 1) conventional lint cleaners found in saw and roller ginning plants, 2) the saw gin coupled lint cleaner, 3) the Lummus Sentinel II lint cleaner, 4) the Cherokee Regal lint cleaner, and 5) the roller gin coupled lint cleaner. Figure 1 shows a diagram of a conventional controlled-batt, saw-type lint cleaner where a batt of lint is formed on a condenser screen, and a feed works assembly removes the batt from the condenser and directs the batt to a feed plate. The close-up view shows how the slow moving batt is pinched tightly between the feed plate and feed roller, and a fast-moving saw cylinder with sharp teeth, travelling in the opposite direction of the batt, grabs the fiber at the tip of the feed bar; this is where fiber damage occurs. Figure 2 shows a diagram of the experimental saw gin coupled lint cleaner where the gin stand section is "coupled" directly to the lint cleaner section, and a doffing brush transfers fiber from the gin saw to the lint cleaner saw. This technology was studied 30 years ago. Interestingly, the main objective of the coupled lint cleaner was to eliminate pneumatic transport between the gin stand and lint cleaner to reduce energy costs and particulate emissions; the lesser objective was to reduce fiber damage. The saw gin coupled lint cleaner eliminates the condenser batt, feed works, and feed plate. Past research showed that fiber processed through the saw gin coupled lint cleaner was significantly longer and had fewer short fibers compared to fiber processed through a conventional saw-type lint cleaner. Figure 3 shows a diagram of the commercially-available Lummus Sentinel II lint cleaner where individual tufts of fiber are applied directly to the saw cylinder, thus eliminating the condenser batt. The feed works assembly is eliminated, but the feed plate is retained. The Sentinel lint cleaner was developed based on the concept of the saw gin coupled lint cleaner, but the saw gin section remains separate from the lint cleaner section and pneumatic transport is required. Field tests by the manufacturer have shown an improvement in uniformity from the Sentinel lint cleaner compared to the conventional saw-type lint cleaner, but a formal laboratory test has not been done. Figure 4 shows a diagram of the commercially-available Cherokee lint cleaner where a rolling feed bar and splined roller removes the batt from the condenser drum, and the batt is then fed directly onto the saw without changing direction. The fact that the fiber does not change direction while being placed onto the saw cylinder may lessen fiber damage. Figure 5 shows a diagram of the roller gin coupled lint cleaner where lift tufts from the ginning roller are fed directly onto a saw cylinder. This technology was studied 20 years ago for Pima cotton. A conventional roller gin lint cleaner is a bulk system that takes ginned fiber from many gin stands. The bulk system has high loading rates and requires

pneumatic transfer, but has low cost. The roller gin coupled lint cleaner uses a unit system where each gin stand has a lint cleaner. A unit system has a lower loading rate and higher cleaning efficiency, and eliminates pneumatic transfer of lint, but has a higher cost. However, with the advent of high-speed roller ginning, or possibly a wider roller gin stand, unit system costs may be reduced. A formal gin and spinning test is planned for 2018 to test the different types of lint cleaners just discussed.

Acknowledgement

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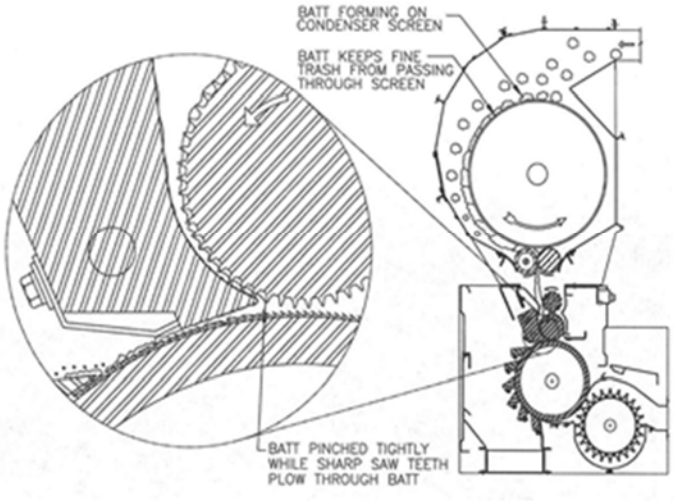

Figure 1. Conventional controlled-batt saw-type lint cleaner.

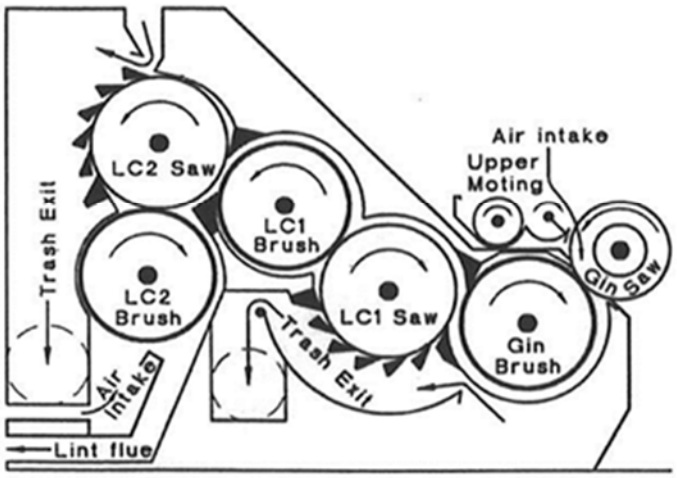

Figure 2. Saw gin coupled lint cleaner.

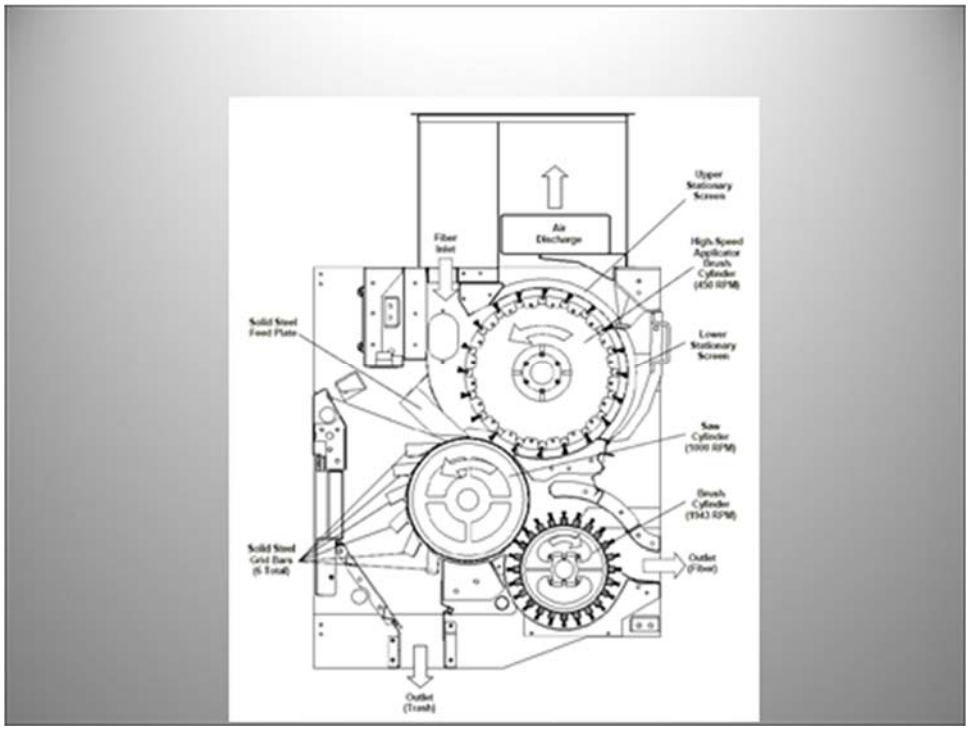

Figure 3. Lummus Sentinel II lint cleaner.

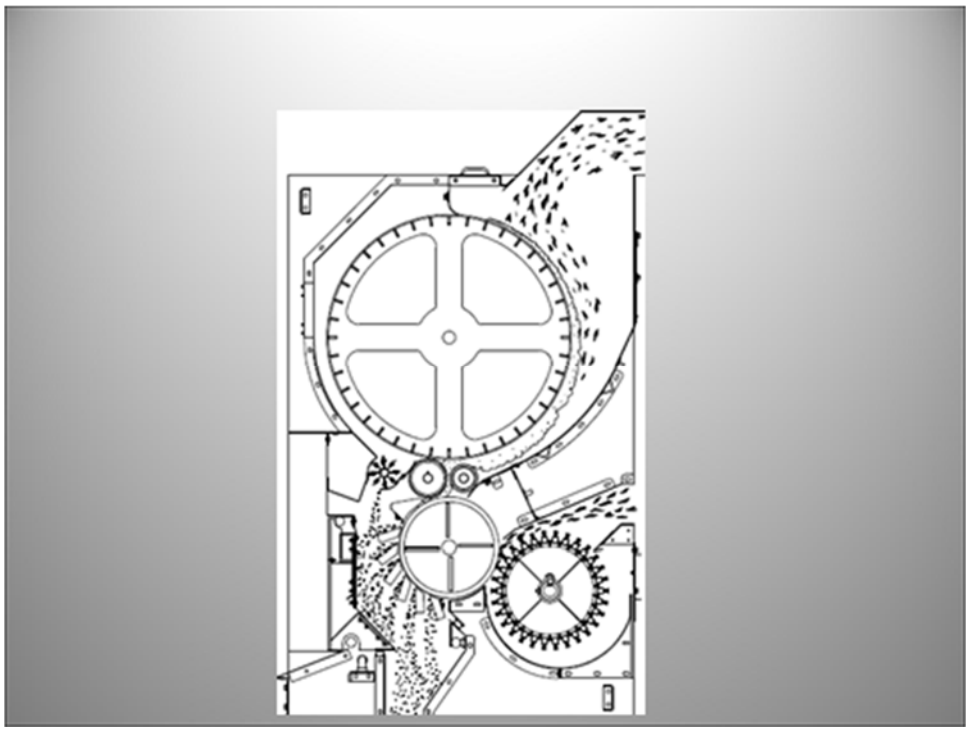

Figure 4. Cherokee Regal lint cleaner.

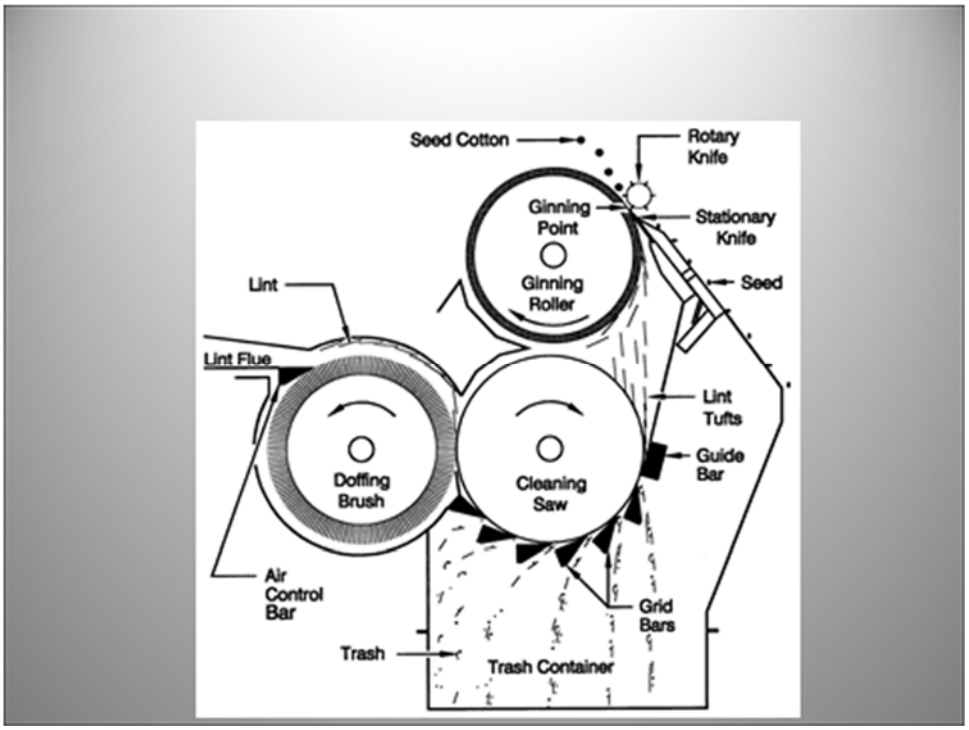

Figure 5. Roller gin coupled lint cleaner.