REMOVING SEED COAT FRAGMENTS WITH A LINT CLEANER GRID BAR AIR KNIFE

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Abstract

Seed coat fragments (SCF) in ginned lint cause quality problems during textile mill processing. SCF affect not only the quality of the finished product, but also are a factor while processing yarn, and are often responsible for ends down or yarn breakage in spinning. Current research is focused on alleviating SCF at the saw-type lint cleaner with newly-designed grid bars working in conjunction with an experimental air knife. Previous videography with a high-speed camera showed that SCF impacting the grid bars were difficult to remove due to the high strength of attachment of the fiber/SCF to the lint cleaner saw. The fiber/SCF bundles swung out away from the lint cleaner saw, impacted the grid bar, and paused (velocity went to zero) before being drawn back into the saw (Figure 1). An auxiliary air knife mounted on the 1st lint cleaner gird bar may help to remove SCF from the lint stream by blowing the SCF off of the grid bar. In theory, the air knife emits a high intensity sheet of air directed towards the juncture of the lint cleaner saw cylinder and grid bar. The air velocity from the knife must exert a force large enough to remove SCF that are being dragged on the grid bar. The air knife consists of a pressurized air plenum 1.7 m (66 in.) long (width of lint cleaner) that contains 124 holes 1.6 mm (0.0625 in.) in diameter. It is powered by a high volume (0.04-0.06 m^3/s or 90-120 ft^3/m), low pressure (12.4-37.3 kPa or 50-150 in. of water), 4.5 kW (6 hp) industrial blower with a 50.8 mm (2 in.) diameter globe valve that adjusts air pressure in the plenum. There is an adjustable deflector to direct air flow to the juncture of the grid bar and lint cleaner saw. Figure 2 shows the air knife in relation to the experimental 105° grid bar and saw surface on a benchtop. Flow and pressure readings of air exiting the knife showed that air flow patterns along the grid bar was easily influenced by the position of the deflector in relation to the grid bar. Air velocity exiting the air was not uniform along the grid bar and varied considerably from 0-23.9 m/s (0-4700 ft/min) (about one-half of what was expected). Velocity profiles indicated that air did not attach to the surfaces of the deflector or grid bar. Future work will continue to exam air flow and velocity profiles, boost the exit air velocity by adding a second deflector, and/or build a new plenum that would release the air closer to the juncture of the grid bar and lint cleaner saw. The performance of the air knife will be documented in a formal test that will include fiber properties and lint cleaner efficiency.

Acknowledgement

The authors would like to thank Cotton Incorporated, Cary, NC, for partial funding of this research.

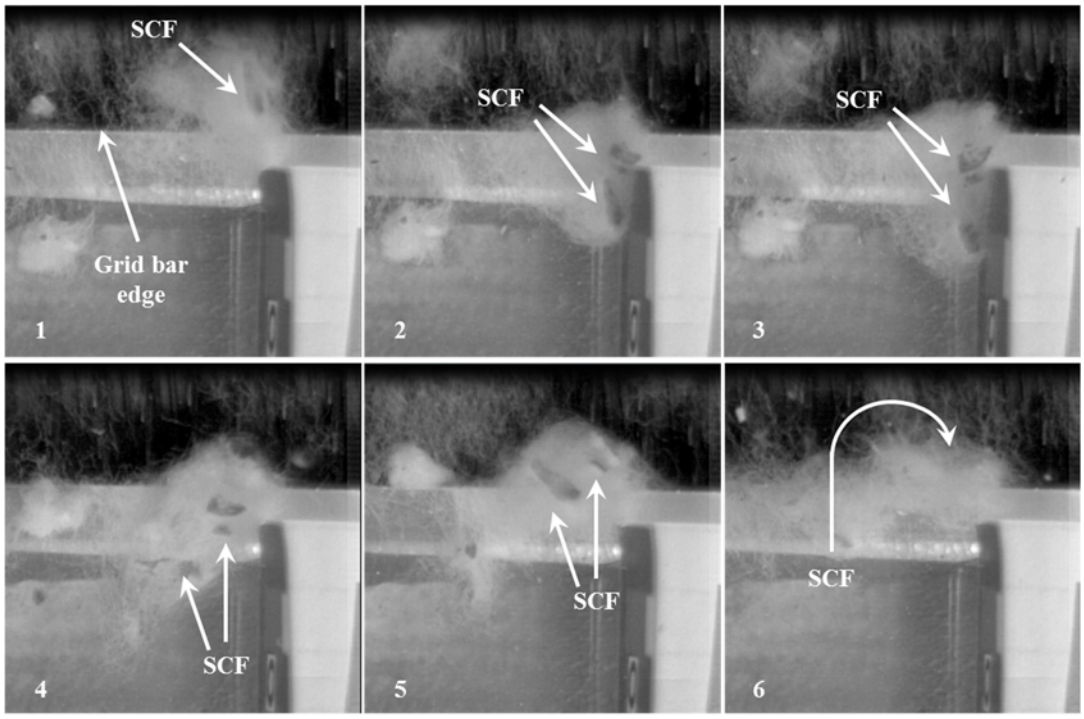

Figure 1. Sequential high-speed video frames showing SCF attached to saw (1), the same SCF impacting the edge of the grid bar (2, 3, and 4), and the same SCF being pulled back into the lint stream on the saw (5 and 6).

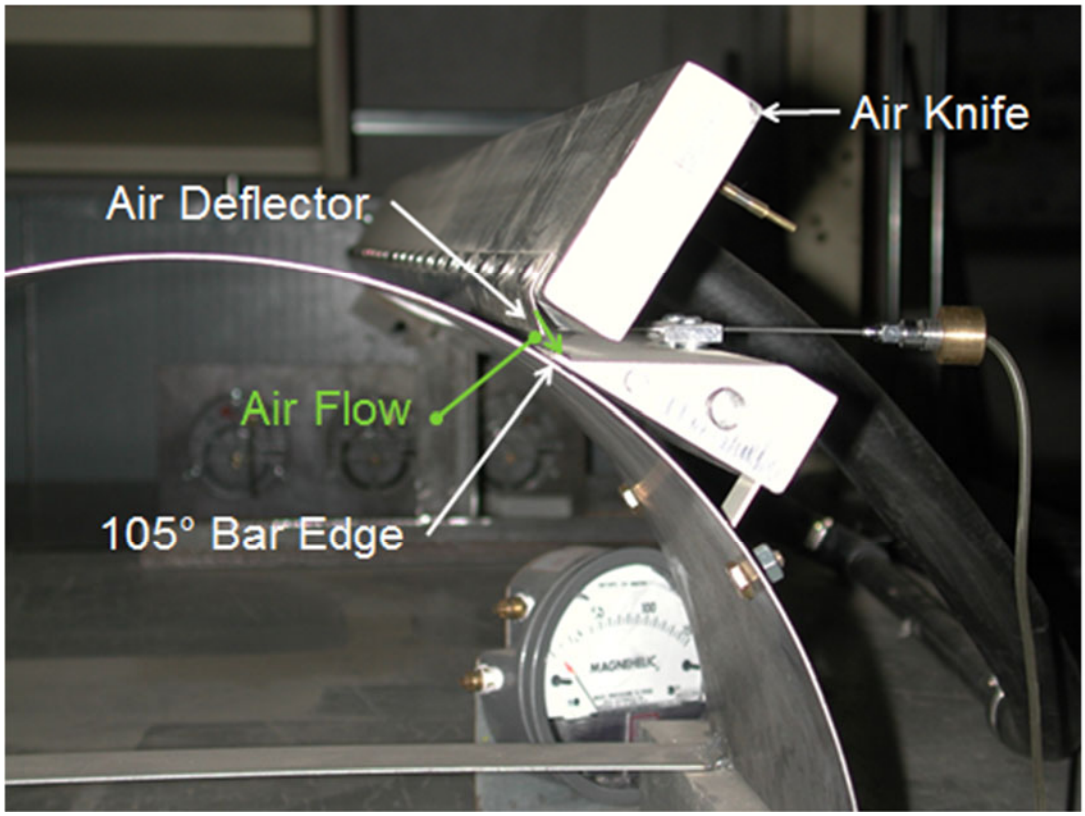

Figure 2. Air knife, deflector, and lint cleaner grid bar on a benchtop.