2005 Beltwide Cotton Conferences, New Orleans, Louisiana - January 4 - 7, 2005

REAL TIME LINT PROPERTIES MEASUREMENT, MOISTURE AND FLOW HELPS ADJUST GIN OPERATING PARAMETERS FOR IMPROVED PERFORMANCE

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Abstract

As the volume of cotton processed in cotton gins grows, so does the need for tighter control over the process and the quality of the lint produced. Small variation in the gin operating parameters can result in significant saving or loss to the ginner and the growers who process their cotton there. The need for integrated controls and monitoring systems for ginners and the produces has been addressed by Advanced Sensing and Controls (ASCI) through the development of a family of products to sense and control the most important of gin parameters: lint grades, moisture and flow. This paper describes the various systems and how they help the ginner improve the gin performance and enhance the producers lint value.

Introduction

This past year ASCI devoted significant resources to enhance and complement its gin *sensing and control* systems. Our systems help make gin operation more efficient and increase the value of the lint for the producers.

Our objectives:

- Increase Turn Out
- Better control on leaf grade
- Improve staple
- Increase producer income

The Systems we offer provide solutions in the following areas:

Lint Cleaner control - the Lintoptimizer(tm)
- Variable rate cleaning for maximum product value
- Leaf grade measurements and control
- Enhanced grid bars performance

Microwave Moisture monitoring and control - the Liquidtroller(tm)
- Module moisture and drying control
- In-process moisture maintenance
- Bale moisture monitoring and control (bales)

Flow monitoring and control for lint and seedcotton - the Accelerator(tm)
- Module feeder control
- Blockage detection and prevention
- Batt thickness control

We also offer:
Optical seed weight monitoring - the Loader(tm)
Module locating and navigation system - the Moulocator(tm)
Data recording, display and reporting - the Monitor(tm)

Gin Control Systems

Variable Rate Lint Cleaning

The operating speed of the cleaners has traditionally been the only parameter the ginner can control (simply by manipulating the incoming voltage or the frequency of the incoming electrical supply). Otherwise, almost all lint cleaners are designed as *invariant* machines. Their operating parameters do not change as a function of the lint they process or any other measures of it. The Variable rate lint cleaning concept was designed to allow the ginner adjust the cleaning process to the need of the fiber.
Clean cotton need not to be cleaned as much as lint with significant amounts of leaf and trash. The ability to adjust the cleaning in real time allows the ginner to fine tune the grade of the lint he process. The cleaning grid bars in the new machines are motorized, allowing the ginner to engage or disengage each of them with the cleaning process.

In Lyford Gin, TX the installed Lintoptimizer provided financial benefits of over $10 per bale per test performed at that location in the summer 2004.

The Variable rate lint cleaning machine, as dubbed by the Lintoptimizer trade name is a system which consists of the following components:

- Operator terminal (Figure 1) to allow the operator to monitor and control the cleaning process.

Shown in the image is the operator screen where he has real time information
on the grade of the lint and the position of the grid bars. He also has the ability to set a desired leaf grade for automatic operation or to control the grid bars manually.

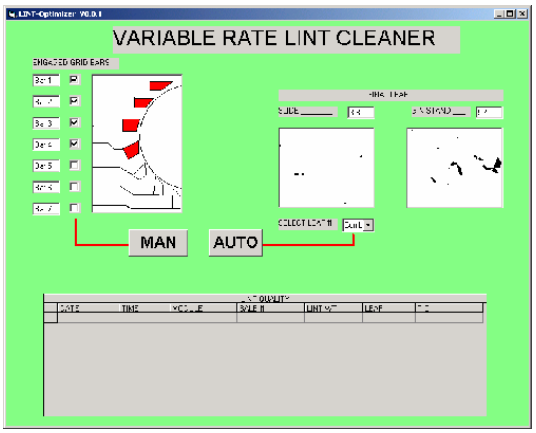

Figure 1; Operator terminal

- Motorized grid bar system (Figure 2)

The motorized grid bar sub system is the mechanical components which manipulate the grid bars to their engaged or disengaged positions. The position of each of the grid bars can be adjusted individually by the ginner or automatically y the control system. Shown in the image are the pivoting grid bars and the pneumatic cylinders which manipulate them to their position.

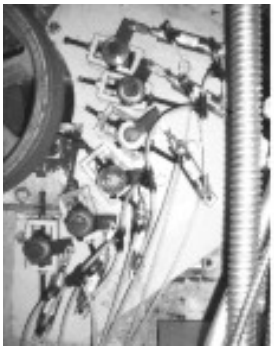

Figure 2; Motorized grid bars

- Optical leaf grade sensors (Figure 3)

A camera is used to estimate the leaf grade of the lint before and after cleaning. These reading are displayed to the operator and are also used by the controller to run the system in an automatic mode.

Figure 3; Camera for leaf grade images.

- Processor and PLC

The system is operated by a main processor and a programmable control. Their function is to monitor lint leaf grade and control the operation of the grid bars.

Performance data has been published by the author.

Microwave Moisture Monitoring and Control

Measuring lint moisture with microwave signaling system has been shown to be the most accurate and repeatable. ASCI with the cooperation of the USDA engineer M. Pelltier, has developed and introduced a high accuracy lint moisture sensor for modules and bales. These sensors are used to control the drying at the start of the ginning process, and the moisture re-introduction at the end of the ginning process.

The Microwave sensor transmit *microwave signal* through the module or the bale and is able to estimate it moisture content throughout, side to side and fore to aft. This type of measurement is more complete and capable. It can detect water concentration in leaking module tarps, and moisture variation due to defective restoration systems. Figures 4 and 5 are showing the sensors antenna for module and bale systems.
An elaborate control algorithm was developed to implement the drying control function using the above sensors, flow and other sensing devices for better efficiency.

Figure 4; Microwave moisture sensor, module

Figure 5; Microwave moisture sensor, bale

Flow monitoring and control

Using ASCI optical flow sensors (figure 6) a module feeder control system was designed and deployed with few gins to enhance flow and gin utilization.
Module feeder control system is used to automatically control the feed speed of the module feeder such the gin stands are always fully utilized. Other optical and electrical sensors used in this system. In a GA gins the controller modulate the free air for manual wagons feeding.

In Buttonwillow gin, CA the controller is used to regulate the rotation rate of the battery condenser so that the bat thickness is kept uniform.

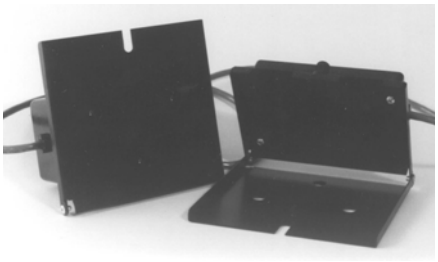

Figure 6; Optical flow sensors

Other systems offered for the cotton gins are:

- Optical seed weight monitoring which measure the seed weight in the air pipe.
- Module locating and navigation system which helps the driver navigate to the modules in the field.
- Data recording, display and reporting.

Further details about these and other gin products are available from Advanced Sensing and Controls.

References

R. V. Baker, A. D. Brashears; Effects of Grid and Saw Variables on Lint Cleaner Performance; Transactions of the ASAE 1989

Mike Gvili, Advanced Sensing and Controls, Marty Northern, Northern/Lucus Machines; Motorized Grid Bars in Lint Cleaner Enhance Lint Value; Beltwide conference, New Orleans; LA, USA 2005

W. Mayfield, R.V. Baker; Effects of Grid Bars On Lint Cleaner Performance; The Cotton Gin and Oil Mill Press; June 13, 1992