



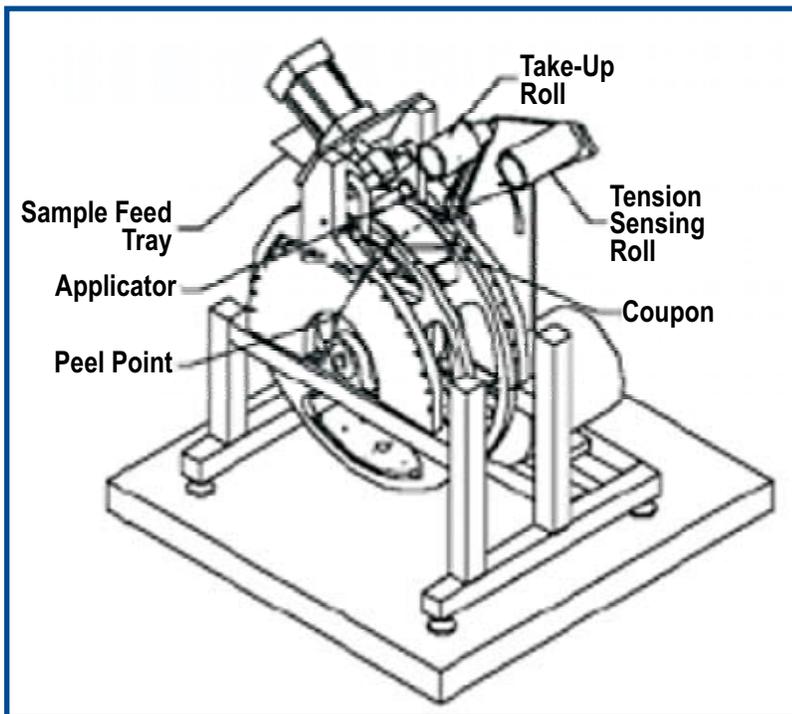
INDUSTRIAL TECHNOLOGIES PROGRAM

Press and Dryer Roll Surfaces and Web Transfer Systems for Ultra-high Paper Machine Speeds

New Technology Will Overcome Barriers to Higher Speeds

The U.S. pulp and paper industry will need paper machines that operate at substantially higher speeds than those used today if it is to remain competitive in coming decades. There are a number of barriers that researchers must overcome, however, to achieve these improvements. A primary issue is to solve the problem of transferring the web at ultra-high speeds from press rolls and dryer cylinders. This requires a better understanding of the physical mechanisms that account for adhesion forces between the paper web and roll surfaces.

If this project is successful, industry will achieve higher operating speeds in its paper machines. Other potential benefits are less downtime for the machines and fewer breaks in the paper web. The first dryer section will be better used, which will reduce energy use and improve the efficiency of the machines. Finally, there will be less damage to the paper sheet during processing, improving the surface properties of the final paper.



The schematic shows a web adhesion and drying simulator, part of the research effort to develop new high-speed paper machines.



Benefits for Our Industry and Our Nation

- Improves paper machine runability (fewer breaks per day)
- Increases capital effectiveness of industry
- Improves utilization of the first dryer section
- Enhances machine and energy efficiency
- Achieves higher operating speeds for machine
- Improves surface properties of paper sheet

Applications in Our Nation's Industry

Beloit Corporation will be responsible for demonstrating and commercializing the new technology.

Project Description

Goal: To develop new technology that allows the paper web to be transferred at ultra-high speeds from press rolls and dryer cylinders.

Researchers studied the materials on the roll surfaces and how they influence web transfer. These materials represent the chemical make-up of the rolls and contaminants that accumulate during use. They also examined models of web transfer at ultra-high speeds including the Mardon equation, and technology for roll surface conditioning.

Five tasks were performed during this project:

- 1) Identify contaminants and measure surface topologies at mills;
- 2) build equipment to simulate contamination process;
- 3) build equipment to simulate web transfer;
- 4) develop empirical models of contamination, adhesion, and picking;
- 5) develop and verify models to predict web transfer; and
- 6) develop and demonstrate roll surface conditioning technology.

Results

There were four significant results from the project:

- 1) Development of the Web Adhesion and Drying Simulator (WADS). This device is unique in that it allows the measurement of the work of web separation under a wide variety of both drying and pressing conditions. It continues to be used for the study of web separation. It has also been used for the study of cockle development due to dryer can contamination.
- 2) Development of a web separation mathematical model. The geometry of web separation from the WADS more closely resembles actually paper machine web separation than has previously been simulated or modeled. The web follows a catenary curve as it leaves the roll surface, this web path is difficult to treat analytically. A model which does accurately treat this geometry was developed and verified.
- 3) Development of a lumped parameter dryer section model. This model allows the estimation of productivity losses due to dryer can contamination.
- 4) Preliminary development of a polymer roll wipe for contamination control. A solid polymer roll wipe, not a doctor blade, was successfully tested using pilot scale equipment. This work was initiated after the no cost extension period of the project. Plans are in place to test the system on a production paper machine.

Project Partners

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A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.



U.S. Department of Energy
Energy Efficiency and Renewable Energy

Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

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