

NEW MULTIPORT DRYER COULD REVOLUTIONIZE THE PAPERMAKING INDUSTRY

2006 R&D 100 Award Winner

BENEFITS

The multiport dryers can increase paper production rates by 50% relative to conventional dryers and by 20% relative to dryers fitted with “spoiler bars.” This means that the multiport dryer technology offers paper manufacturers a range of advantages:

- Reduce the number of dryers,
- Increase the production rate, or
- Reduce energy costs through reduced steam pressure .

POTENTIAL MARKETS

An operating paper machine typically has 30-100 conventional dryers. There are perhaps as many as 1,000 of these paper machine operating at speeds over 1500 to 1800 mpm, where rimming condensate reduces the rate of drying. This represents over 30,000 dryers that might benefit from this new technology. Other applications that use steam heating for drying and thermal setting of film products may also benefit from this technology.

Working with partners at the University of Illinois at Chicago and Kadant Johnson, researchers at Argonne National Laboratory have developed a novel “multiport” dryer design that promises to revolutionize papermaking by offering papermakers the option of boosting production rates as much as 50%. The technology recently won a prestigious R&D 100 Award, as one of the top 100 innovations across the globe.



Argonne's new multiport dryer technology for the forest industry could greatly improve the efficiency of dryers used in paper mills. The photo shows a fully assembled Multiport dryer insert installed in Kadant Johnson half-dryer.

Paper manufacturing is a highly energy-intensive industry, mainly due to the drying portion of the papermaking process, in which residual water in newly formed wet paper is evaporated by passing the paper over dozens of large hot cylinders running at speeds up to 1500 to 1800 mpm. Paper dryers are 4–6-ft in diameter and 20–30-ft in length. The cylinders are heated by being filled with steam. The condensing steam can lead to the formation of relatively thick condensation layers on the inner surfaces of the dryers, which lowers dryer surface temperatures and creates temperature variations. The thick condensate layers slow the water evaporation rate at each dryer, leading manufacturers to add more dryers to achieve a given production level, thus greatly increasing capital costs.

Superior by Design

In contrast to conventional dryers, the steam in the multiport cylindrical dryer flows through longitudinally oriented passages, or “ports,” near the dryer’s inner surface. Forcing the steam closer to the cylinder surface minimizes the condensate layer (by up to 90%), which improves heat transfer, increases the dryer shell’s surface temperature, and provides a more uniform surface temperature. Also, since the steam flow velocity is very high in the small ports, the dominant

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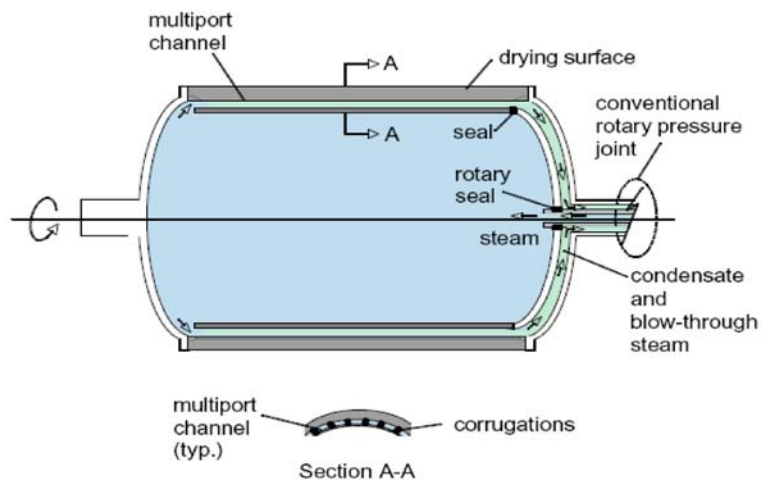
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heat transfer mode in the new multiport dryer design is convection, which is markedly more effective than conduction, the dominant heat transfer mode in conventional dryers. All of this makes each dryer more effective in evaporating water.

Retrofit Available for Cost Savings

The multiport dryer technology offers significant advantages in installation cost. It is being engineered as a retrofit device, which means that it can be installed in existing paper dryers. The installation of a multiport dryer retrofit is projected to cost only 20% as much as the installation of a new dryer cylinder, thus producing an 80% capital savings.



Schematic of Steam Flow in a Multiport Dryer

ABOUT ARGONNE TECHNOLOGY TRANSFER

Argonne National Laboratory is committed to developing and transferring new technologies that meet industry's goals of improving energy efficiency, reducing wastes and pollution, lowering production costs, and improving productivity. Argonne's industrial research program, comprised of leading-edge materials research, cost-saving modeling, and unique testing and analysis facilities, is providing solutions to the challenges that face U.S. manufacturing and processing industries.

New Dryer Enhancements

Looking forward, application of the technology in new dryers may allow designers to reduce the number and perhaps the size of the cylinders, as well as the possibility to reduce the thickness of its walls.



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September 2006



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