

# INVENTIONS & INNOVATION

## Impact Sheet



### RETRACTABLE LABYRINTH PACKING SEALS FOR TURBINE SHAFTS

#### Overview

- ⌘ Commercialized by TurboCare Division of Demag Delaval Corporation
- ⌘ Patented field-proven design with over 10 years of operating experience
- ⌘ Installed in over 400 units worldwide, in turbines with capacities from 11 to 1100 MW

#### Applications

- ⌘ Utility and industrial steam turbines for power generation or mechanical drives

#### Capabilities

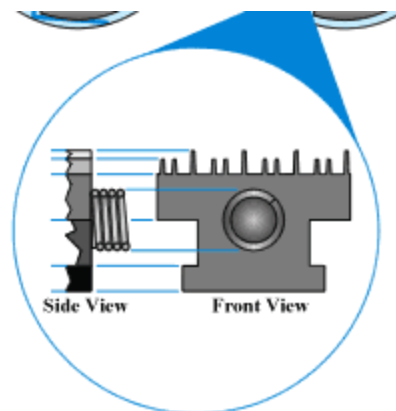
- ⌘ Available for new steam turbines or retrofits to improve seal clearance beyond original design specifications.

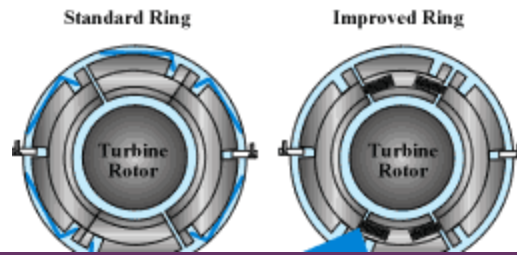
#### Retractable Labyrinth Packing Seals for Turbine Shafts Provide Significant Energy Efficiency Improvements

A grant from DOE's Inventions and Innovation Program helped redesign shaft sealing rings for turbines that will end wear damage and improve turbine efficiency. The Retractable® Packing rings self-adjust from the gap required for turbine start-up to that required during normal operation. This innovative technology offers savings in both energy and operating costs through improved efficiency and reliability.

Conventional labyrinth seals are segmented and positioned by radial flat springs. Retractable® Packing replaces the flat springs with coil springs between the segments to enlarge shaft clearance during start-up to avoid damage caused by thermal distortion and vibration as the unit passes through its critical speed zone. High-pressure steam enters the ring segments to restore design clearance for normal operation. The innovative seals have clearances exceeding original equipment specifications.

The seals are easy to install because they have fewer parts than conventional turbine labyrinth seals. An improved tooth design also reduces blade tip seal rubbing and the seals can be custom fit onsite with an optional brush for upgrading or retrofitting turbines.





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## Benefits

- ⌘ **Reliability.** Prolongs turbine life by making start-ups smoother and eliminating component wear.
- ⌘ **Profitability.** Lowers maintenance costs.
- ⌘ **Productivity.** Increases power plant efficiency.
- ⌘ **Energy Savings.** Higher turbine efficiency lowers heat rates from 1% to 2%. Tighter clearances increase power output between 1% and 4%.

## Energy Savings

1997	Cumulative through 1997
6.379 trillion Btu	52.13 trillion Btu

## Emissions Reductions (Thousand Tons, 1997)

SO <sub>x</sub>	NO <sub>x</sub>	CO <sub>2</sub>	Particulates
6.361	2.487	618.1	1.819



The Inventions and Innovation Program provides financial assistance for establishing technical performance and conducting early development of innovative ideas and inventions. Ideas that have a significant energy savings impact and future commercial market potential are chosen for financial support through a competitive solicitation process. I&I-funded inventions have saved enough energy to light 10 million homes per year. In addition, the program offers technical guidance and commercialization support to successful applicants. Ideas that benefit the Industries of the Future, designated by the Office of Industrial Technologies as the most energy-intensive industries in the U.S., are especially encouraged.

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### ***Encouraging Independent Inventors***

*America's independent inventors represent a National resource that can spur energy efficiency, economic growth, and international competitiveness. In 1995 small businesses in the United States (under 500 employees) produced 24 times as many innovations per R&D dollar as large firms. Many important American inventions, such as Edison's light bulb, were developed by independent inventors. Yet inventors face tremendous financial, technological, and commercialization obstacles to bring new ideas from concept to the marketplace. The I&I Program fills a unique role in the Federal Government supporting individuals and small companies during the critical early phases of technology development. By working with independent inventors the I&I Program helps ensure that future Edisons and future light bulbs continue to illuminate America.*

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