Internal Flow of Rotating Labyrinth Seal with Low Static Pressure Difference and Large Clearance

by

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Abstract

In this paper, we discuss a straight-through-type labyrinth seal. This labyrinth seal is used for axial flow fans that have an outer ring at the blade tip to seal the clearance between the ring tip and the fan shroud, in order to prevent reverse flow or leakage. These fans are used for cooling of automobile radiators. In these cases, the labyrinth seal is used under an extremely low static pressure difference and a large clearance. A significant decrease in leakage rate was reported even when the labyrinth seal rotated at a comparatively low speed under this unique condition in our former study. However, this phenomenon is different from that observed in past research. Furthermore, the cause of this phenomenon has not been determined. Therefore, the internal flow was depicted using Computational Fluid Dynamics (CFD) in order to determine the cause of this phenomenon. The results of CFD show that leakage rate decreases significantly because the carry-over flow is intercepted in the expansion groove. This is a newly discovered phenomenon that occurs under the unique condition of an extremely low differential pressure. This has not been pointed out before as an explanation for the decrease in leakage rate with rotation.

Keywords: Fluid Machinery, Blower, Internal Flow, Computational Fluid Dynamics, Labyrinth Seal

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