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August 2021

FLUID THRUST BLADE

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Recommended Citation

INC, HP, "FLUID THRUST BLADE", Technical Disclosure Commons, (August 02, 2021)
https://www.tdcommons.org/dpubs_series/4509



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Fluid Thrust Blade

The trend for laptop development is to provide thinner and smaller machine with higher processor power to customer, while keeps cooler thermal experience and quieter noise experience simultaneously. To achieve this design target, fan with high performance is desired and new design is required.

Traditionally, laptop fan uses smooth blade surface design because of manufacturing limitation, and there is airflow loss when the blade is pushing air out of fan through the exhaust vent. This air loss generates unwanted noise and degrades the fan performance because less intake flow volume is utilized.

To eliminate this flow loss during operation, a guiding structure is added on each blade to allow the intake flow directly to move toward exhaust vent without escaping through the designated path. With this approach most of intake air volume is used for cooling and less turbulence is generated through the fan operating, further reducing the blade noise generated which might annoying customers.

Detail design / manufacturing process is listed as below

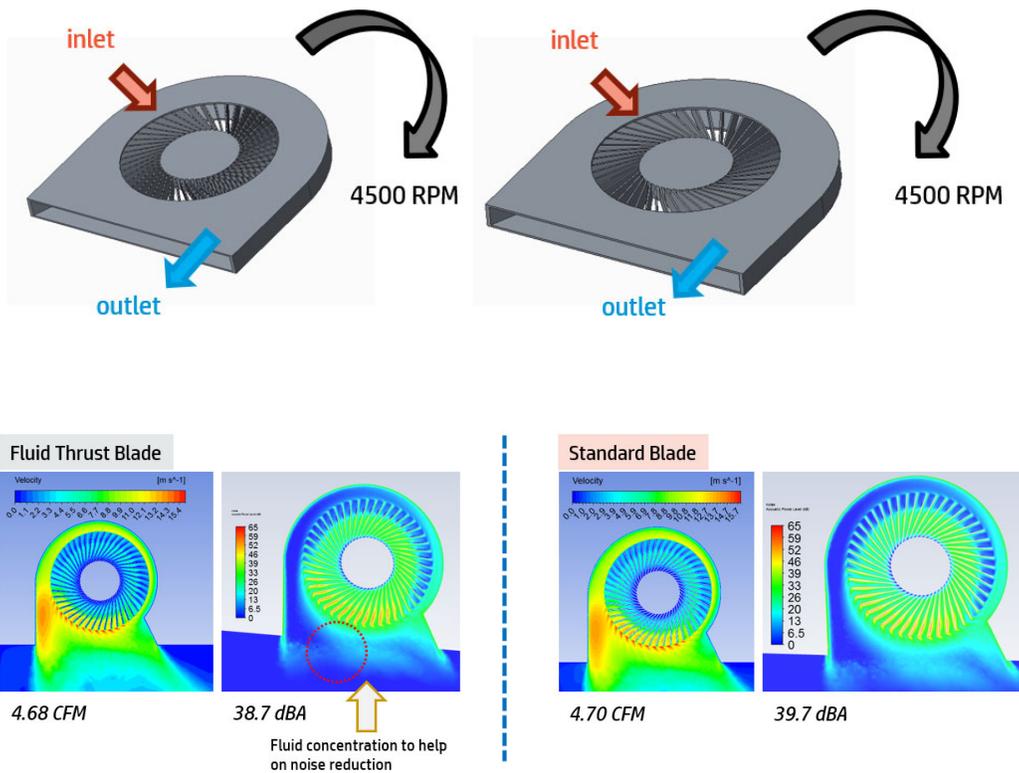
1. *Design the guiding structure with herringbone pattern to create flow path on each blade*
2. *Manufacturing blade one by one with below methods*
 - *For metal, using sheet metal bending process to create the blade, then using punch process to create the extruded herringbone structure*
 - *For metal, make the herringbone structure on tool directly, and manufacture the blade through one stop injection process. Post machining process could be applied if needed*
 - *For plastic, make the herring bond structure on tool directly, and manufacture the blade through one stop injection process. Post machining process could be applied if needed*
3. *Assemble each blade into the center hub structure to form the central fan structure*
4. *Based on the system condition, if there is only one side opening on the blower, guiding structure could be modified from herringbone pattern to single curved pattern*

With this guiding structure design, air could be thrust to exhaust vent without leakage through the pathway so almost 100% intake air volume could be utilized for cooling, the

overall efficiency is improved, and fan performance is enhanced. In addition, there is no air leakage through the pathway and no unwanted turbulence is generated, reducing the noise emission due to unstable flow field.

Moreover, this design could be applied on general fan and not limited to laptop product. The fan performance improvement could benefit Desktop/Workstation/AIO/Docking products if a blower is used

CFD simulations are conducted to support this design theory. With fixed fan outline dimension and fixed rotational speed as the boundary conditions, CFD result indicates this Fluid Thrust Blade design could have 3% noise reduction without flowrate degradation. It's believed that customized optimization could have this number being further improved.



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