

Thermoelectric exhaust-air heat pump

Ventilation system with thermoelectric heat transfer for air heating and cooling

Invention

Modern houses often have a heat pump heating system and a ventilation system with heat recovery. This combination uses ambient heat and reduces the building's energy requirements. Adding sufficient insulation allows building operation that is almost greenhouse-gas neutral. This



Fig.: Exhaust-air heat pump function

invention from the Aachen University of Applied Sciences, a thermoelectric exhaust-air heat pump, builds on this principle. It uses thermoelectric elements to extract heat energy from exhaust air and transfers it to the supply air. Several thermoelectric elements are inserted between the supply air and the exhaust air duct and arranged according to the countercurrent heat exchanger principle.

The invention can extract much more heat energy from exhaust air than heat recovery alone can manage. The supply air can also be heated beyond the exhaust air temperature with thermoelectric elements.

Buildings with high energy efficiency classes therefore need no additional heat generation system and thus save space and money. The thermoelectric exhaust-air heat pump can also cool the building, making an air conditioning system unnecessary. The system is quiet and compact enough to be integrated into the facade.

Commercial Opportunities

The technology described is especially well suited to both new and existing houses with high energy efficiency class and to small housing units. They can be used in place of conventional heating and ventilation systems.

Current Status

A sample system has verified function. A German patent application has been submitted to the German Patent and Trade Mark Office. On behalf of the Aachen University of Applied Sciences, we are offering interested companies the opportunity to license this technology and cooperate with the inventors at the Aachen University of Applied Sciences in its refinement.

Relevant Publications

Hagenkamp, M., Blanke, T. & Döring, B. Thermoelectric building temperature control: a potential assessment. *Int J Energy Environ Eng* 13, 241–254 (2022). <https://doi.org/10.1007/s40095-021-00424-x>

Hagenkamp, M., Blanke, T., & Döring, B. (2022,.). Thermoelektrische Lüftungswärmepumpe – theoretisches und praktisches Potenzial. *e-nova International Conference* (pp. 173-178). Pinkafeld: Verlag Holzhausen. ISBN: 978-3-903207-64-6

An invention of Aachen University of Applied Sciences.

Competitive Advantages

- Combines a ventilation system with a heating system
- Uses the heat pump principle
- Compact and space-saving
- Additional cooling function
- Quiet

Technology Readiness Level

123456789

Technology validated in lab

Industries

- Heat pump manufacturers
- Ventilation system manufacturers
- Thermoelectric element manufacturers

Ref. No.

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