Counterflow Heat Recovery Fan

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Existing Principle
Combination of Fan and Heat Exchanger

Principle:
- rotating porous material for ventilation and heat recovery
- double spiral casing
- wall for separation of warm and cold air flow

Advantages:
- cheap production
- compact design
- no frost protection needed
- humidity recovery

Disadvantages:
- low ventilation efficiency
- low heat recovery rate
Measurement and Simulation of the existing system

<table>
<thead>
<tr>
<th>Betriebspunkt</th>
<th>Drehzahl [Hz]</th>
<th>Volumenstrom Fortluft [m³/h]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stufe 1</td>
<td>15,2</td>
<td>103</td>
</tr>
<tr>
<td>Stufe 2</td>
<td>19,7</td>
<td>136</td>
</tr>
<tr>
<td>Stufe 3</td>
<td>22</td>
<td>150</td>
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</tbody>
</table>

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<thead>
<tr>
<th>Betriebspunkt</th>
<th>Drehzahl [Hz]</th>
<th>Statischer Druck Außenluft [Pa]</th>
</tr>
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<tbody>
<tr>
<td>Stufe 1</td>
<td>15,2</td>
<td>-15,9</td>
</tr>
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</tr>
</tbody>
</table>
Modified Concept

Zgaga et al. (2014)

Speer et al. (2014)
Flow Conduction of the Counterflow Heat Recovery Fan

CFD-model of the flow conduction

First small scale prototype

Flushing chambers

Interior part of the fan

Zgaga et al. 2014, Speer 2014, Speer et al. 2015
Rotor Concepts

- Rotor with numerous fan blades
- Rejuvenation along the fan blades
- Rotor with implemented porous foam
- Rotor with implemented horizontal layers
Laboratory prototype and installation concept
Acoustic Measurements
Concept of the modified CHRF

First CHRF Concept

Modified CHRF Concept
CAD of the new laboratory prototype
Concept for Ventilative Cooling

Outdoor air intake axially

The “cross flow fan” can be used as radial fan

Advantages
The entire fan area can be used for cooling mode
High flow rates
Energy efficient ventilation

Challenges to solve for the cooling mode
Removal of the inner part
Removal of the heat recovery unit
(foam or horizontal layers)
Flow conduction for axial outdoor air intake
Simulation results and potential of the CHRF

**Single Room Unit**
- dimensions: 350x400x200 mm
- fan diameter: 190 mm
- rotational speed: 15 Hz
- ext. pressure drop: 100 Pa (at 50 m³/h)

**Heat recovery mode**
- flow rates: 30-60 m³/h

**Cooling mode**
- flow rates: 150-250 m³/h

**Cooling potential**
Radial Fan – e.g. Ebm G4E180-FS11-01
- diameter: 180 mm
- flow rate: 820 m³/h
- ext. Pressure drop: 90 Pa
- power consumption: 140 W
- spec. consumption: 0,17 W/(m³/h)

**Potential and Outlook**
- The geometry of the CHRF can be optimized for the cooling mode to increase the flow rates.
- Through axial outdoor intake, the fan can be used as efficient radial fan with large diameter.
- For the cooling mode the rotational speed and thus the flow rates can be further increased.
- Technical issues for the bypass and the opening/closing of in-/outlets for the cooling mode must be worked out.
Thank you for your attention

Counterflow Heat Recovery Fan – Heat X Fan

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Bibliography

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Speer et al. 2015:

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Zgaga J., Lanthaler D., Speer C., Pfluger R.: „Development of a decentralized and compact comfort ventilation system with highly efficient heat recovery for the minimal invasive refurbishment of buildings“, Proceedings 35th AIVC Conference, Poland, 2014

Speer 2014:

Speer et al. 2015: