VORTEX HEAT- AND MASS-TRANSFER DEVICE

Description
The vortex heat- and mass-transfer device is designed for heating, pre-drying, drying, separation, cleaning, and cooling of grainy materials. Material processing occurs in a centrifugal homogenous fluidized bed providing high gas-flow velocities around the particles.

Technical specifications
The data below are given for vortex heat and mass exchangers for cereal cleaning and drying

<table>
<thead>
<tr>
<th>Output, t/h</th>
<th>Air flow rate, m$^3$/h</th>
<th>Pressure difference, Pa</th>
<th>Size, m</th>
<th>Weight, kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1 500</td>
<td>2 200</td>
<td>1.2x1.0</td>
<td>90</td>
</tr>
<tr>
<td>20</td>
<td>15 500</td>
<td>3 000</td>
<td>2.9x2.2</td>
<td>350</td>
</tr>
</tbody>
</table>

Vortex heat- and mass-transfer device

Technical appraisal and economic benefits
- heat and mass transfer enhancement;
- small overall dimensions and weight of the device;
- uniform gas-flow impact on all particles;
- output control and monitoring of particle residence time inside the centrifugal bed within a wide range of time from several seconds to several hours;
- combination of several processes within the same time period.

Application area
Cleaning and drying of cereals in agriculture.
Drying of granular materials with moisture concentrated primarily at the particles surface, e.g., coal particles.
Chemical reactions on the particles surface in a swirled fluidized bed.

Development stage
Vortex heat- and mass-transfer devices with an output capacity ranging from 2 to 30 t/h have been designed.
Vortex heaters for grain with a production rate of 2 x 20 t/h and 2 x 6 t/h have passed state testing and are recommended for industrial production. The tests showed that grain moisture can be reduced down to 3% during its processing in a centrifugal bed during 3-6 sec, grain is heated to an acceptable temperature, and up to 99% of light admixtures are removed. A vortex
device located as a pre-heater ahead of a shaft dryer allows a 45% increase in dryer efficiency and an 11% decrease in cost per unit of fuel. The use of the vortex device for grain pre-heating before grinding is more efficient than conventional heaters by a factor of 2.9. In addition, the weight of the vortex heater is 2.3 times smaller than that of conventional devices. The safe shelf life of grain after treatment in the vortex device increases by a factor of 3 to 5.

**Patent situation**

**Commercial offers**
Sales of licenses and individual units. Investment agreement on device commercialization.

**Estimated cost**
To be discussed.

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