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Efficient and maintenance-free technology for hot metal desulphurization

The fluidization cone made by Feldhaus-Technik guarantees trouble-free fluidization and even material flow coupled with a minimum of gas consumption over many years. All desulphurization plants at ThyssenKrupp Steel Europe in Duisburg, Germany, are equipped with the new fluidization system. Also Tata Steel in Jamshedpur, India, has installed the new technology.

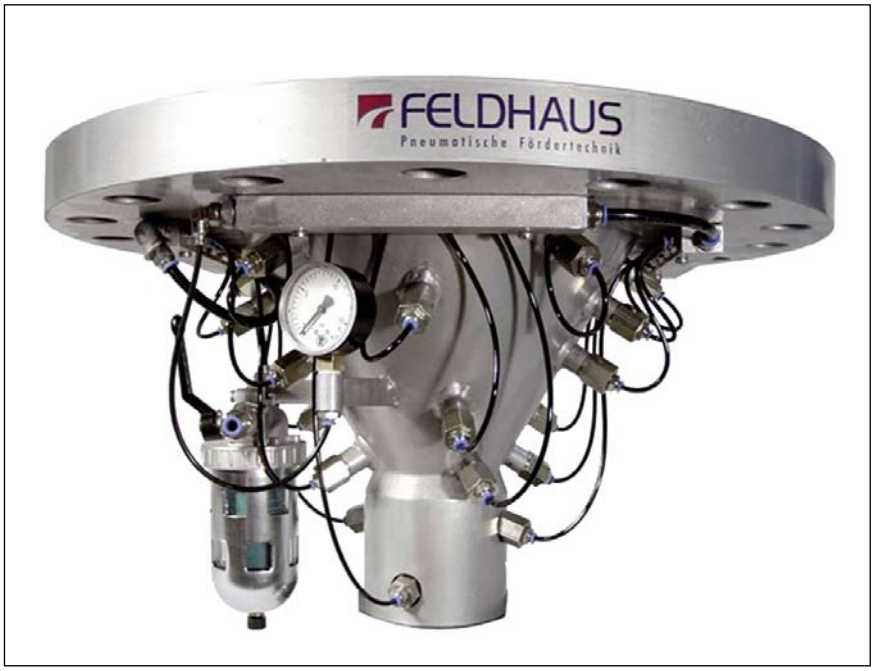

Figure 1. **FFC fluidization cone to fluidize desulphurization agents**

For hot metal pre-treatment, free-flowing desulphurization agents like CaC_2, magnesium and lime are pneumatically injected from a pressure conveying system through submerged lances into the hot melt. The conveying system consists of a vessel, a fluidization cone and a flow control valve.

Conventional fluidization cones are twin-wall cones with a great number of nozzles that are attached to the inner wall of the cone. Fluidization gas is inserted into the space between the walls from which the gas is to spread evenly through the many nozzles (inner diameter: 0.2 mm) into the interior of the cone. Although initially even and effective fluidization of the desulphurization is achieved, after a few months in operation problems occur with the material conveyance even if gas is consistently inserted. This effect first causes choking of the lances, and later will make replacement of the cone necessary. The root-cause is always congested nozzles coupled with one or several nozzles being excessively worn. Gas will then be inserted only punctually rather than evenly through the worn-out nozzles.

To overcome these difficulties, Feldhaus Technik has developed the FFC Feldhaus Fluidization Cone **(figure 1)** over many years in the desulphurization plants of ThyssenKrupp where this principle has been in operation for more than ten years. In 2008, the first cones were commissioned in steel plants of Tata Steel in Jamshedpur, India. The FFC is a single-wall cone consisting of approximately 25 specially designed and manufactured fluidization nozzles. The ultra-fine porosity of the nozzles maintains trouble-free and smooth fluidization over years in combination with a minimal amount of inserted gas. Every nozzle features a fine-adjustment valve to ensure even distribution of gas throughout all nozzles and therewith a smooth and even flow pattern.

The first installed cones of this type have been in permanent use at ThyssenKrupp for more than ten years without any maintenance. During the development phase the outlet area **(figure 2)** had been designed slim and steep to bundle the material flow before it enters the conveying line. The central outlet area is up to 150 mm

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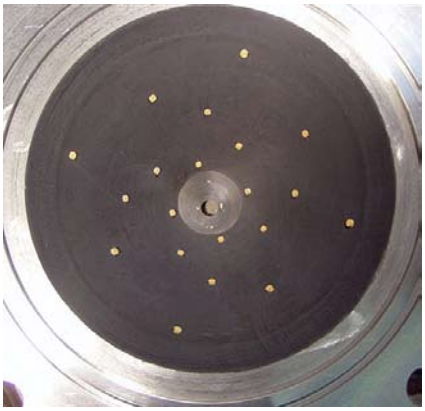

Figure 2. **Outlet area of the FFC cone**

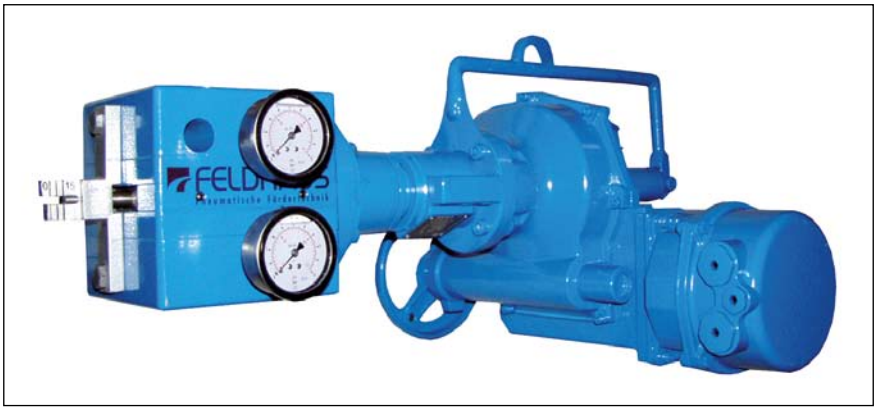

Figure 3. **FCV Flow Control Valve to control the material flow**

high with a gradient of 10°. The 25 evenly arranged highly porous fluidization nozzles distribute finest gas beams in all directions, maintaining ideal fluidization. In contrast to the conventional technology, gas can be turned off whenever the process pauses, because the nozzles operate like check valves. This prevents material from decomposing during stops and leads to substantial savings on fluidization gas.

In parallel to the development of the FFC cone other key parameters were investigated to analyze their influence on the smooth and even conveyance of the desulphurization agents. It quickly turned out that the geometry of the circular section plays a major role in the flow behaviour of the agents. Best results were achieved when using a special flow control device flanged to the cones. The FCV Flow Control Valve **(figure 3)** is made of hardened steel and Al_2O_3 in the contact zones with the material. This valve can be attached to the FFC cones. ThyssenKrupp has operated the prototype of this special flow control device at their steel plants in Duisburg, Germany, for more than 10 years. ■