ADDING VALUE TO STEEL MAKING PROCESSES AND ENVIRONMENTAL PROTECTION BY OPTIMIZATION OF THE MATERIAL HANDLING SYSTEMS

Dr. Rainer Bertling
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Agenda

1. Introduction

2. Enhancement of environmental protection by material handling solutions

3. Adapted and optimized sinter conveying solution

4. Conclusion
Closed storage systems

Arrangement of Baosteel closed material storage (Source: Baosteel / MCCI)

Avoidance of:
- Fugitive dust
- Wet coal problems,
- Contaminations by rain

- Longitudinal storage buildings
- Circular storage buildings
- Silos

- To minimize costs for buildings as stockpile enclosures the requirement for the open space around the stockpiles needs to be minimized, e.g.:
  - Discharge tripper car for piling (longitudinal storage), portal or Semi-Portal Scraper Reclaimers (SCHADE – world’s biggest machine to South Korea)
Rotary Discharge Machines

Multiple silo arrangement using various rows of Aumund Rotary discharge machines

- space availability limited compared to required storage capacity
  - coal storage by multiple large size silos

- Extraction from circular silos by Rotary Discharge Machines

- Feature:
  - reducing footprint for raw material storage
  - circular storage or silos

SEAISI
South East Asia Iron and Steel Institute
Comparison footprint of different storage solutions

- Footprint silos: 14,000 m²
- Footprint circular: 31,200 m²
- Footprint longitudinal: 72,000 m²

Example: Total volume each solution 400,000 m³
Longitudinal Rotary Discharge

Hydraulic unit
Discharge wheel
Bunker table
Belt conveyor

RDM for Multiple Silos
Technical data for AUMUND BEW Block Model (depending on raw material type)

<table>
<thead>
<tr>
<th>Rotary Discharge Machine type BEW-BL</th>
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<tr>
<td>discharge wheel diameter</td>
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<td>DR (mm)</td>
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Rotary Discharge Machine

Features:

- travelling length, depending on stockpile length or number and size of silos up to 400m
- defined by type of power supply system such as power chain, cable reel or festoon system
- travelling speed is constant
- steel chute / material guide ~ 20mm above belt conveyor running below, guides material from bunker table removed by discharge wheel / serves as dust cover
- distance between chute and belt conveyor provided with rubber strips which can be adjusted in case of wear to avoid material spillage
- extracting raw material also in a stationary position ⇒ blending / mixtures of different raw materials, types of coal to be blended as per individual requirement (not possible by longitudinal storage)

- potential problems with solidification of stored raw material or bridging are avoided due to the first in – first out principle
Types of Rotary Discharge Machines

RDM Block model – high capacity

RDM Block Model Frame – cost optimized

RDM Flat model with swivel drive

Features:

- compliance with safety regulations to explosion protection
  (self-combustion by time)
- by first in first out principle
Rotary Discharge Machine (RDM) – functions and features

- First in – First out
- Simultaneous Feeding and Discharging
- Combination of Multiple Machines in one Row possible
- Controlled Reclaiming of Material
- For Sticky and Poor Flowing Material
- Low Power Demand
- Maintenance with Filled Silo Possible

Type 2-Arm version
Rotary Discharge Machine (RDM) – additional local dust suppression
‘Dust development at hopper extraction by RDM’

⇒ Dust distribution needs to be avoided

Solution:

Aumund RDM dedusting systems

Types:

- Satellite filter car
- On-board filter unit
- Water-spray system
- Dry fog system
Aumund RDM water spray / dry fog system
Hot Sinter Conveyor

Replacement of vibrating feeders / Connecting new Sinter Cooler

Secondary Sinter Cooler / Replacement of belt conveyor

- short return on investment by AUMUND Hot Sinter Conveyors for replacement of maintenance intensive vibrating feeders or belt conveyors
Hot Sinter Conveyor

- Not only high temperatures but also very abrasive behavior of sinter material
  = reason for wear on moving parts

- vibration supports disintegration of sinter material ⇒
  requirement of material recirculation ↑
  capacity ↓

- reducing relative movement between sinter material and conveyor
  ⇒ metallic pan conveyor with special wear protection caps with proven lifetimes > 10 years

- supporting structure is adapted to customize to existing situations / feeding and unloading
  of conveyor is modified as per requirement

- return of sinter fines can be eliminated as sinter disintegration resulting from vibrating effect
  is avoided
Replacement of vibrating feeders

Sinter discharge area with vibrating feeder

Sinter discharge area after reconstruction with Aumund pan conveyor

**Benefits:**

- Significantly reduced energy demand
- Substantially reduced noise emissions (and hence improved working conditions)
- The overlapping design of the pans prevents the development of spillage
  - Reduced wear and maintenance
Hot Sinter Conveyor

Benefits:
- return on investment depends on:
  - individual maintenance / repair requirements
  - re-usability of existing structures
  - space requirements
  - sinter production requirements

Applications:
- replacement of existing sinter cooler due to inefficient operation of existing equipment, e.g. due to increased sinter cooling capacity or to install latest state-of-the-art sinter coolers with optimized heat recovery
- Such heat recovery sinter coolers normally to be installed at a different height
  - increased height requiring lifting the hot sinter material to a charging point on a higher level - inclinations of up to 60° (in case of bucket apron conveyors)
Hot Sinter Conveyor for energy-recovery sinter shaft cooler

- Sinter shaft cooler technology with improved heat and energy recovery and minimized diffusive dust emissions (closed system)
- Counter flow principle is applied with increased height of the sinter bed (bed height 4x) for the most effective heat transfer
- Maximized energy recovery by minimized heat loss realized by also closed conveying system including such heat insulation
Hot Sinter Conveyor

- Latest installation: 3,000 mm wide
- Capacity ~1,500 tons sinter /h
- New permanently lubricated rollers after successfully testing in actual working conditions in other sinter plants
  - Long trial sequences
Hot Sinter Conveyor
Cooling alternative

- Replacement of a sinter cooler always means a major investment
- Sinter after the cooler is often found to still be partially red hot and consequently leading to destruction of subsequent belt conveyors
- Frequent requirement of replacing such belts leads to high operating costs / additional downtimes of sinter plant

⇒ replacement of first belt conveyor by hot sinter conveyor can eliminate this problem
  = additional / secondary cooling step
Conclusion

- Even in times of difficult market situations environmental protection remains a major part of concern for the steel making industry.
- Material handling systems need to be taken into consideration for potential improvements as dust generation and development is an integral part of such processes and can be minimized by using the best applicable systems.
- Also energy recovery and steelmaking costs are influenced by material handling systems.
- Minimization of wear and tear on the one side and reduced heat losses on the other side are ways to optimize the material handling in different applications.
- AUMUND material handling solutions will be customized for each individual situation and therefore adding value to steelmaking process although typically being an area with little focus on, as such systems only support the main process lines.
Thank you for your kind attention!

Dr. Rainer Bertling