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Alumina unloading in China

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General

Its increase in aluminum consumption, and consequently the need for raw materials, is one of the signs of China's rapidly growing industry. Investment in modern unloading technologies to handle (unload) alumina, the main raw product of aluminum smelters, is a consequence.

Alumina is a very abrasive and difficult to convey powder material. Two tonnes of alumina are used to produce one tonne of aluminum. Normally the smelters are located in a place with inexpensive, abundant and reliable electric power. It takes some 15.7 kWh of electricity to produce one kilogram of aluminum from alumina.

Using traditional grabs to convey alumina is almost impossible because of the spillage caused. This is due to a variety reasons: grab tightness, hopper without dedusting and, the main reason, high wind. Materials lost through spillage add to costs and also have an impact on pollution in the area. Thus, the preferred method is the use of a pneumatic system, whose only disadvantage over traditional grabs is its higher energy consumption. Its advantages, however, outweigh this because of its continuous enclosed system and superior vacuum clean up facility which picks up the material.

Qingdao Port (the second biggest port in China, which unloaded 1.7 million tons of alumina in 2005) has chosen NEUERO to supply two alumina unloaders M300AL with a capacity of 300t/h each.

Three neighbouring ports compete for the unloading operations for alumina: Qingdao, Rizhao and Lianyungang. The shipper decides which port he is going to dock at close to arrival. Price and time are important factors in making this decision.

NEUERO's vast experience in grain, and more recently in Biomass handling, coupled with their extensive background in alumina handling, provided the client with the necessary confidence to choose NEUERO. Two years ago, NEUERO proved its capacity for complex targets by supplying its first continuous biomass unloader to the industry. Their first foray into the alumina handling industry began back in the 1980's with Maquinas Condor at the Valesul (Reynolds) smelter in Sepetiba, Rio de Janeiro, Brazil.



Figure 1. M300AL unloaders at Qingdao Port.

Design

The Multiport M300AL unloader design uses standard NEUERO components.

The heart of the unloader is its blowers and the airlock. These components, together with the correct design of the conveying pipes, will achieve material flow and capacity.

The biggest advantage of this design is its quick delivery of the critical components – the blowers. The blowers are less sensitive to dust and provide quick delivery compared to roots blowers, for example.

Another advantage is the use of 132 kW low voltage motors.

The filter column is part of the structure and integrates the filter system. The machinery house position also acts as a boom counterweight, saving weight. The movements of the machine permit the ability to reach large areas of the hatch using a combination of travelling, slewing, horizontal telescoping, vertical telescoping and luffing.

The airlock delivers the alumina to the chain conveyor. The conveyor is equipped with basalt lining for wear protection. This conveyor feeds the bagging station, which is travelling together with the Multiport. The bagging station has six bag filling areas, each with two to three workers. Silos and bulk transportation are



Figure 2. Each M300AL has a capacity of 300t/h.

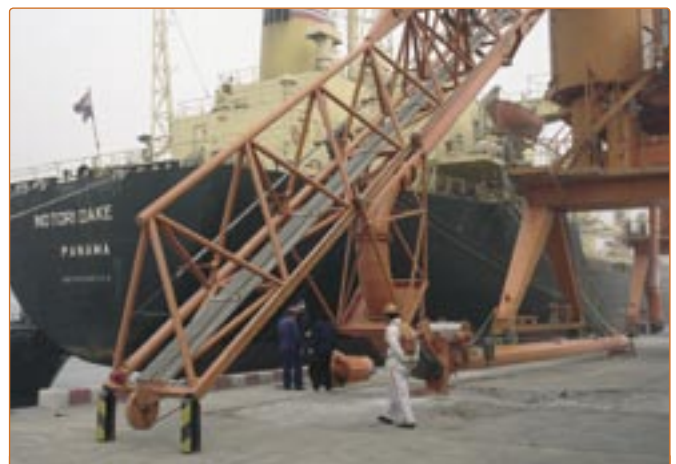


Figure 3. The ability to lower the boom is a helpful feature.



Figure 4. The Machinery House.

no longer available in China's ports; therefore, the need for big bags has developed. They can be stored outside, and normal trucks or rail wagons can be used to transport them.

Each machine has incorporated a winch to lift a pay loader up to five tonnes. Pay loaders are used inside the hatch for cleaning.

Most of the machine is accessible by stairs; a spiral stair connects the fixed gantry part to the mobile rotatable upper part.

Another helpful feature is the ability to lower the boom to the ground. This facilitates the maintenance of important parts such as the telescopic winch, the tightness of the pipe system and the monitoring of wear progress. It also provides access to the lights used for night work.

Machinery House (MH)

The machinery house of the Multiport is designed using the dimensions of 2 x 20' containers with the twist locks to help during transportation. The MH is also sound insulated and has forced ventilation at the blowers' room and air conditioning in the separated electrical room. The main blowers are wired and dry tested, and the MH also features an airflow regulator and auxiliary devices such as an automatic greasing device, silencers and vacuum breakers.

The MH is preassembled and function tested in the factory. For transport reasons, it is unassembled and then reassembled on site. Inside the MH, the blowers and electric sections are separated.

Turbo blower station

Each 132 kW electric motor drives a turbo blower's stage. Two stages connected in series form the turbo blower station, and two stations in parallel supply the necessary air volume. The turbo blower stages are accommodated inside the MH. The turbo blower stages consists of a supporting frame, a turbo blower and an electric motor, which are connected using V-belts. The automatic belt tension (ATB) enables constant belt tension so that the V-belts need not be re-tensioned. The belts tension is created by the weight of the electric motor pivoted to the frame and aligned with the blower.

Belt Airlock (BA)

In normal airlocks, the small gaps between the rotor and housing allow a flow of alumina at high speeds and, therefore, cause a high degree of abrasion. The gap can be reduced only by repairing (machining) the housing and welding the tips of the rotor. This is expensive and time consuming.



Figure 5. Turbo blower station.

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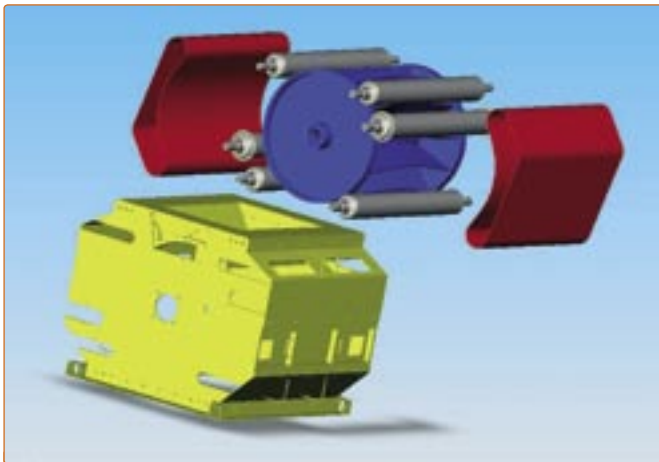


Figure 6. Explosion drawing with belts, carcass, idlers and rotor.



Figure 7. Assembled form showing the External bearings of the belt idlers.

This wear control makes the belt airlock a main component of the alumina unloader. The BA uses belts to seal the rotor instead of a metal housing (cast or welded) with the advantage that the belts, running with the rotor blades, avoid a gap and consequent wear at this point.

The atmospheric air pressure from the bottom of the airlock tries to enter the filter housing that is under vacuum pressure. This difference can come to 0.5 bar. The air expansion causes material particles to flow at high speed, causing wear.

The wear is located between the fixed parts and the belts. The advantage here is that the fixed wearing parts can be checked and changed locally at the most convenient time, avoiding disturbances caused by ship unloading operation.

Another important characteristic is the flexibility of the belts; foreign bodies can pass through without blocking the airlock and stopping the ship unloading operation.

Finally, another helpful maintenance feature is the external bearings. The inspection is easy without dismantling any parts. This is important again because the fine abrasive alumina can enter into any small area. The main parts of the BA are shown in Figures 6 and 7.

Filter

The M300AL cleaning filter uses the scavenging reverse flow system. It is very simple and effective because it does not need to use air compressors. No external air can get into the system as the blower sucks the air from the clean side and blows it into the bags, while a rotating arm with the air nozzles brings the scavenging air to the inlet of the bags.

Wear

One of the biggest tasks is to protect the machine against high wear. One of the principal components in achieving this is by using basalt lining, such as on the conveying bend and the chain conveyor. The conveying pipes also need a special steel alloy to achieve longer life cycles. Where it is not possible to install such materials, one must predict the wear. This is the case for the belt airlock seals, for example. They can be controlled and changed on site or automatically changed after a ship's discharge.

Dedusting

Finally, in order to maintain the dust at a minimum, all transfer points are equipped with point filters.

ABOUT THE AUTHOR

Tomas Kisslinger has twenty years experience in bulk handling, especially in grain related areas. Since 1992, he has been Managing Director of NEUERO Industrietechnik.

ABOUT THE COMPANY

NEUERO is a manufacturer of mobile pneumatic conveyors, grain vacs and ship unloader/loaders for transport of bulk materials such as bulk grain, meals, plastics and alumina.

NEUERO started in pneumatic grain conveying over 80 years ago with the manufacture of small agricultural machines. Since then, the company has delivered equipment in the 20 t/h to 2000 t/h range to many installations around the world. NEUERO has two companies with sales, engineering, manufacturing and service facilities in Germany and in the US.

ENQUIRIES

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