SOLID NEWS

ISSUE 13

The newsletter of **AJAX EQUIPMENT** - the **BULK SOLID** performer

AJAX GOES LARGE!

Leading speciality chemicals producer, Vertellus, has installed an Ajax agitated screw feeder and screw conveyor at its Teesside, UK plant. Capable of holding 3.5T of damp centrifuge cake, the agitated screw feeder is the largest produced by Ajax to date.

The stainless steel unit has a large capacity hopper with multi-bladed agitator to provide gentle agitation. This maintains 'live' product condition, disturbs any time consolidation and delivers positive infeed to the integral screw feeder.

"Having successfully operated an Ajax agitated screw feeder, we knew Ajax held the solids handling expertise needed to provide a much larger agitated screw feeder for Vertellus' new product. Ajax carried out tests on our material at a range of moisture contents to reflect the array of flow properties experienced, ensuring appropriate storage, feeder and conveyor design. We are delighted with the quality and performance of the products Ajax has provided." said Andrew McNally, Engineering Group Leader, Vertellus.

LUMP BREAKERS FOR FOOD PROCESSING

Ajax has supplied a process technologies company with two twin shaft lump breakers for processing sugar. Capable of handling 25,000 kg/hr of granular sugar, the 316L stainless steel, lump breakers are designed to ensure the equipment's internal workings meet ATEX Zone 20 and include FDA compliant seals.

Highly polished, with a surface finish of 0.8Ra, the lump breakers feature twin shafts with offset cutting blades providing a contra-rotating action drawing lumps into a central breaking zone. Using a twin shaft lump breaker allows material flow to be spread over a larger area.

In addition to the equipment's self-cleaning action, the lump breakers also feature a removable grill, allowing the equipment to be cleaned and thoroughly inspected.

NOW OPEN: PRODUCT FORMULATION FACILITY

The ease with which powders can be processed can make or break the viability of manufacturing operations. The Centre for Process Innovation (CPI) in Sedgefield, Teesside, now offers a product formulation facility for multi-component, multi-phase products. This dedicated facility includes powder feed and transfer systems, and is supported by powder characterisation and in and off-line measurement options for product assessment. It includes an Ajax sack tip, multiple hopper and feed systems, and process mixers.

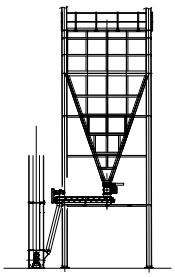
"As a result of Project Chariot, companies now have access to a modern small-scale plant for complex dry and wet mixes, particle coating and granulation. The facility is a great combination of Ajax's machines and the experienced CPI team," says Simon Fields, Ajax senior technical engineer.

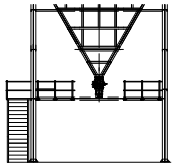
For more details on the facility contact:
simon@ajax.co.uk or **andrew.white@uk-cpi.com**

GETTING POWDER **TO GO WITH THE (MASS) FLOW**

Handling a powder with highly variable flow properties can be challenging. Ajax Equipment worked with mineral processing equipment company, Bradley Pulverizer, in overcoming hopper flow problems that caused erratic flow, bridging and disrupted production at a client's fertiliser production plant in Egypt.

The production plant involved transferring phosphate powder from a milling process to a hopper, via a pneumatic conveyor.





Original plant with pyramid hopper, rotary valve and screw conveyor.

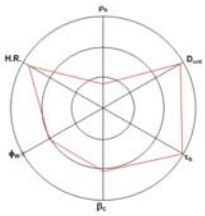
Problem Statement

Flow problems were experienced shortly after start up with material hang ups and occasional flushing; Bradley Pulverizer installed aeration pads in the hopper to blow low volume air into the powder to encourage material flow. However, this resulted in more uncontrollable flow and flooding of downstream equipment.

The problem was exacerbated by the flow regime generated in the hopper, termed 'Funnel Flow'. This arises when the converging wall inclination is too shallow to induce the contents to slip at the walls as the hopper empties. A narrow flow path forms from the outlet to the surface, creating a 'last-in, first out' phenomenon so freshly milled material is the first to come out and original fill material can remain against the walls for a long-time and deteriorating in flowability. To improve flow, Ajax determined the hopper flow regime be converted to Mass Flow to ensure that all the hopper contents moved together during discharge. Material 'first in' is the 'first out' and extended storage time of some of the contents is avoided.

Investigation

Powder testing revealed the root cause of the problem was the flow properties of the fine powder, together with variability in the composition, residence time and consolidating pressures in the silo.



Spider diagram identifies high shear strength and wall friction values which demand steep hopper walls and large outlet sizes for reliable flow.

	Egyptian Phosphate
Bulk Density ρ_b	989 kg/m^3
Critical Diameter D_{crit}	102 cm
Shear Strength T_s	3574 N/m^2
Hopper Wall Angle β_c	69°
Wall Friction Angle ϕ_w	21.9°
Hausner Ratio H.R.	1.47

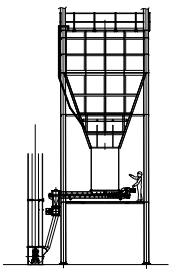
Table lists measured flow properties and calculated hopper parameters

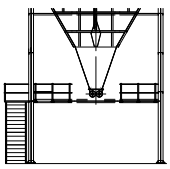
Wall friction testing allowed Ajax to determine the hopper wall inclination needed for the phosphate to Mass Flow, which would increase residence time in the hopper and enhance de-aeration. The wall friction measurements also identified significant slip benefits with 2B finish stainless steel over the existing mild steel surface.

Solution

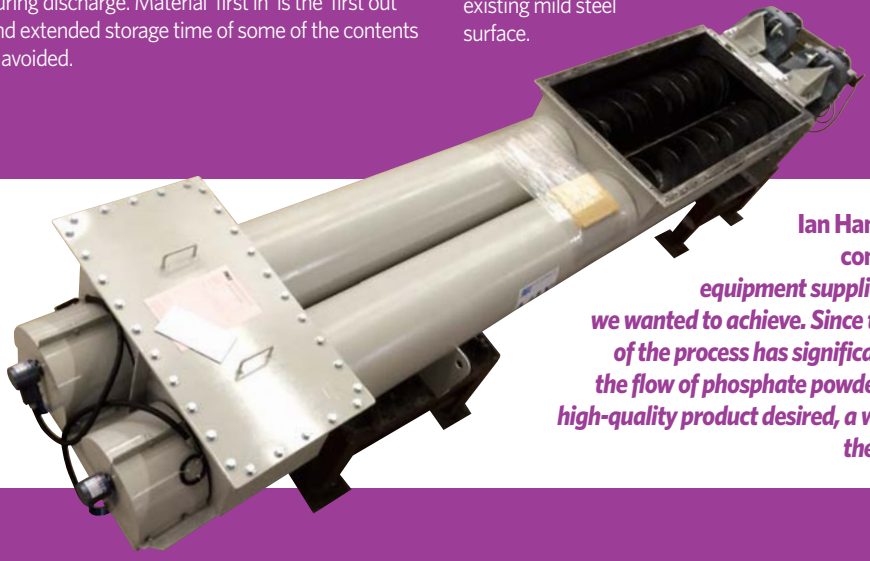
As it would have been expensive to convert the entire hopper to Mass Flow, Ajax proposed replacing a two metre-deep bottom section of the existing hopper with a Vee shaped section to exploit plane flow benefits, and a large outlet fitted with a twin screw feeder of special extraction geometry, to draw from the full width and length of the new hopper bottom.

The solution also incorporated a flow insert to enhance de-aeration and extend the flow benefits into the higher region of the hopper. These changes resulted in a more even residence time of the contents and a large reduction in the flow velocity (spread over a wider area) to further favour de-aeration. It also minimised the plant modifications considered necessary to secure a reliable operating performance. A large proportion of the previously static hopper contents now flows during discharge. A further benefit of fitting an insert is the ability to prevent a direct flow path and force material to draw from the peripheral areas near the walls with even shallower wall angles than required for a conventional mass flow hopper, resulting in increased working storage capacity with a more uniform residence time.





The Ajax Solution showing the insert and de-aeration pipe, new hopper bottom lined with 2B stainless steel, large outlet and twin screw feeder.



Ian Hancock, operations manager at Bradley Pulverizer, commented on the project, *"From the high standard equipment supplied it's clear Ajax understood the process and what we wanted to achieve. Since the equipment has been installed the performance of the process has significantly improved. By providing complete control over the flow of phosphate powder, Ajax's equipment has enabled production of the high-quality product desired, a welcome improvement to plant performance which the plant operator describes as 'the magic solution'."*

POWDER AND SOLIDS **HANDLING INNOVATION**

CHARIOT

Exploring innovative solutions to current industry problems was the theme of a one day seminar at the Centre for Process Innovation (CPI), Sedgewick.

Ajax Equipment, technical director, Eddie McGee, presented on 'Providing solutions for effective handling and processing of powders and other bulk solids' giving delegates an insight into common problems in hopper design and how to avoid them, maximising the efficient operation of screw feeders, the benefits of a dedicated bidirectional screw feeder, and continuous mixing.

Mixing figured strongly in the seminar. It was the first opportunity for many delegates to hear some of the findings of Project Chariot researching the processing of fine powders. CPI features a dedicated mixing facility supplied by Ajax as part of Project Chariot. Jerome Castro of P&G reported on 'Practical Experiments and Experience of the Ajax Twin Screw Mixer from Coating to Agglomeration'. Many aspects of continuous mixing have been explored by P&G including multipoint filling and fill level, spraying liquid, back mixing, inclined mixing and pulsed RTD to measure the mixing and coating effectiveness. The presentation showed how the continuous mixer offers a practically unlimited range of configurable options for mixing and coating, and the ease with which to fine tune mixing to suit project requirements.

For more details, see press release - Powder and Solids Handling Solutions – CPI Event Shows How at: **www.ajax.co.uk/cpi.htm**

ASK **LYN...**

Q **Do you see a brighter future for a science based approach to Solids Handling? Especially now NASA have acknowledged its complexity, saying that 'trial and error', 'over design' and process failure are all too commonplace.**

A Over the years, I have seen the scale and applications for solids handling multiply, and witnessed the challenges posed by steel production, cereal bar mixing and pharmaceutical processing. I remain optimistic that through education and greater understanding of the science behind 'solids handling' the industry will receive the credit and appreciation that it truly deserves.

In many ways it's not 'rocket science', as we already have a set of proven techniques established by Jenike; their underuse is typified by the high proportion of retrofit solutions Ajax supply.

Ajax embraces a science driven approach, innovations like our bi-directional screw feeder demonstrate this, and our continued participation in conferences ensure we remain at the technological forefront of the industry. We have brought together our proven approaches on **www.lynflow.com**, and are happy to share a white paper detailing our developments – why not send an email to **lyn@ajax.co.uk**?

DIARY DATE

The 8th World Congress on Particle Technology

22-26 April 2018,
Orlando World Center Marriott,
Orlando, Florida

The 8th World Congress on Particle Technology is intended to stimulate discussions on the forefront of research in particle science and technology. Ajax's Lyn Bates and Eddie McGee will chair sessions at the event.

Find out more at: **https://www.aiche.org/conferences/world-congress-on-particle-technology/2018**

CHoPS 2018

10-14 September 2018, Greenwich Maritime Campus, London

The theme of CHoPS 2018 is "Fusion of science and industry: from particle contacts to bulk behaviour". It will focus on the emerging opportunities and challenges in solids handling technology, and the application of both these and established knowledge, in the process industries and the equipment manufacturing sector.

CHoPS is organised by The Wolfson Centre for Bulk Solids Handling Technology and supported by SHAPA, IMechE, IChemE, and MHEA with Ajax's Eddie McGee also active on the organising committee.

AJAX PROMOTES UNDERSTANDING OF **SOLIDS HANDLING**

Ajax recently hosted the IMechE's Process Industries Division North West Centre for an evening on the fundamentals of solids handling and processing, and how the challenges posed can be addressed with careful and considered design.

Commenting Ajax's Eddie McGee said, *"Ajax is a key proponent of equipment design based on measured flow properties. We work with customers to better understand their solid's behaviour; supplying equipment that works with the material to provide process enhancing performance."*

Institution of MECHANICAL ENGINEERS

Chair of the IMechE North West Centre, Noel Hensman, remarked *"Visiting Ajax gave attendees a fascinating insight into various aspects of solids handling from hopper design to screw conveying systems. The excellent presentation also gave examples of how handling equipment can be utilised in various scenarios.*

PRODUCTION MATTERS

After 43 years Ajax recently said goodbye to production director, John Crowder. Mark Waters, director, commented *"Everyone at Ajax would like to thank John for all his hard work and wish him happiness in his retirement."*

Joining Ajax as production and estimating manager is Matt Barnes. On joining Ajax Matt said, *"Experience of manufacturing, site installation as well as project engineering benefits me in the role, linking sales and design to production, ensuring Ajax's high standards are maintained and customer satisfaction is met every time."*

TWIN SCREW FEEDER FOR **TATA CHEMICALS**

Ajax has supplied leading chemicals producer, Tata Chemicals Europe, with a twin screw feeder replacing an Ajax unit which reliably performed almost continuously for over 15 years.

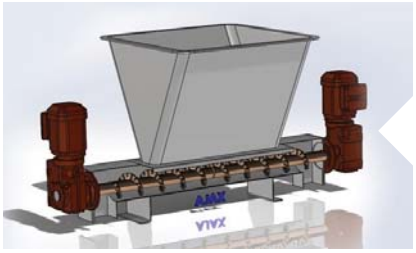
***"Having worked with Ajax and seen the benefits of the previous twin screw feeder it was an easy choice to work with them on the new machine. Ajax's knowledge of materials and how to handle them ensures our twin screw feeder is a strong link in the production line,"* says Martin Philips, Senior Project Engineer - Lostock, Tata Chemicals Europe.**

GET THE LATEST HANDLING & PROCESSING NEWS

Please sign up for our regular e-newsletter and Top Tips series for good advice and information on technology and developments.

Visit **Ajax.co.uk** or email: **sales@ajax.co.uk**

PROCESS SOLUTION: **BIDIRECTIONAL FEEDER**



A truly bidirectional screw feeder capable of serving two outlets simultaneously, or either outlet exclusively, is now available from Ajax. In addition to a host of hopper storage and flow benefits, the feeder is a compact alternative to using a diverter valve and additional chute work where space is limited. Bidirectional screws are available in sizes from 100 to 400mm diameter.

AJAX
QUALITY BY PERFORMANCE
PERFORMANCE BY DESIGN

CELEBRATING 45 YEARS OF EXCELLENCE

KEEP IN TOUCH AND FIND OUT MORE

Register for our enewsletter and Top Tips on solids handling

www.ajax.co.uk/mailgroup.htm

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