

# SOLID NEWS

ISSUE 11

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

## AJAX SCREWS DRIVE PROJECT CHARIOT FORWARD

As part of Project Chariot, Ajax has supplied the Centre for Process Innovation (CPI) with several screw feeders, continuous mixers and a screw elevator. Ajax is collaborating with Proctor and Gamble, CPI and the universities of Birmingham, Durham, Leeds and Cranfield to develop a novel particle system for fine particles based on the company's continuous screw mixing technology. The equipment enables complete flexibility when configuring the continuous mixer, giving researchers the opportunity to use the

layout best suited to their study. Initially one of the continuous mixers, which can be converted to batch production, is being utilised by the University of Leeds. All the mixers have easy clean features with adjustable flights, providing the ideal helix angle for the material under test.

Ajax Equipment director, Mark Waters, said "As a key collaborator in Project Chariot, Ajax has established partnerships with leading organisations as well as gaining the chance to enhance our

knowledge of handling super fine powders. The learning from the research will deepen our knowledge, allowing us to better meet our customers' needs and provide opportunities for future sales and business growth."



## RECORD THROUGHPUT WITH INCLINED SCREW FEEDER

Essentia Protein Solutions, a leading protein producer for the food processing industry, has improved handling and inspection of pork rind with an Ajax stainless steel hopper and inclined screw feeder, setting record levels of throughput.

The hopper features steep walls and a more generous outlet size promoting material discharge, and allowing the rind to flow into the screw feeder consistently. The design also takes account of the awkward aspect of changing the flow direction of a product that does not flow easily.



Describing the impact on the process Paul Setchell, factory manager at Essentia Protein Solutions, said "The previous machine was unable to withstand the variation in material and consistently provide the throughput required, creating a bottleneck in the process. Since installing the new Ajax hopper and feeder we have reached the desired level of production, setting record levels of process throughput."

## AJAX MOBILE LUMP BREAKER FOR RESPIRATORY CARE SPECIALIST

Ajax has a growing range of size reduction systems for solids handling. Recently it supplied leading respiratory medical device designer, manufacturer and supplier, Intersurgical, with a mobile lump breaker and feed hopper for the processing of set lime and phosphorous.



The stainless steel lump breaker features an integrated control panel and a number of operator safety features. These include sliding safety gates to restrict side access to the discharge area during operation, and Rotacam safety switches fitted to the integral holding hopper and hinged cover.

"With increasingly higher volumes of product being manufactured weekly and the inevitable waste that is generated, a fast and effective method of dealing with it was essential. Ajax's lump breaker has proven to be consistent and reliable with a design that ensures the safety of our staff," commented Daniel Rakauskas, production engineer, Intersurgical.

**Also inside...** Ajax Hopper Inserts: An Approach to Solving Poor Flow

• Pharmaceutical Powder Handling • Ask Lyn • Dairy Dates • Top IMechE Award for Ajax's Lyn Bates • A Year of Top Tips • Design Team Enhanced • Ajax Online

**BULKEX**  
2015  
MEET AJAX ON  
STAND 65 IN HARROGATE  
21 - 22 OCTOBER

We hope you find our newsletter informative and interesting, your feedback is appreciated.

Please call +44 (0)1204 386 723, send an email to [sales@ajax.co.uk](mailto:sales@ajax.co.uk) or visit [www.ajax.co.uk](http://www.ajax.co.uk) for more information.

# AJAX HOPPER INSERTS: AN APPROACH TO SOLVING POOR FLOW

The enormous volume of bulk materials handled every year means solids must be stored in hoppers, intermediate bulk containers, silos and other storage devices, often several times before being processed.

**However, storage can result in a number of handling issues including erratic surges, arching, ratholes, packing, flushing, dead regions, feed upsets, and in some cases can reduce the suitability of the product for the next process stage.**

Although it is seemingly counterintuitive to introduce an obstacle into the storage container as a solution to these problems, the use of inserts can enhance storage container performance.

An insert is usually a static fitting on the inside of a bulk storage container, including liners and other modifications that alter the internal space of a vessel. Flow regimes are determined by how the individual particles in a bulk solid respond to local forces at contact points. An insert alters the flow regime of a material by determining whether a particle moves, which direction it moves and if it remains intact.

## Top Reasons for Using Inserts

- Counter segregation
- Reduce particle attrition
- Minimise dust generation
- Increase flow rates
- Expand the flow channel
- Alter the flow pattern
- Secure flow through smaller outlets
- Save headroom / Secure more capacity
- Prevent arching & ratholes
- Improve the extraction pattern
- Improve consistency e.g. density

## Performance Objectives

One of the key questions to ask when investigating insert design is, what are the performance objectives? An optimal insert design will balance these objectives; some of which can be seen in 'Top Reasons for Using Inserts'. Here we look at two of these reasons and how inserts can help enable them:

### Countering Segregation

Segregation can be countered in non-Mass Flow hoppers by either introducing an insert to diffuse the material upon entering the hopper, or using a tributary type insert to extract material from multiple regions during hopper emptying, or both.

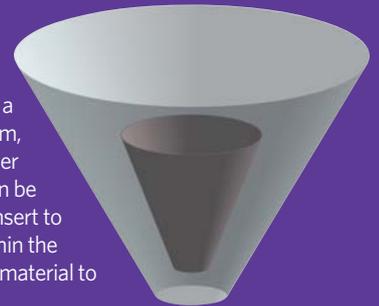
A Mass Flow pattern can re-mix products segregated during filling. When the level of material in the storage system falls to the point where the walls begin to converge, material flows faster in the centre than at the walls leading to regions with mainly coarse fractions. An insert can help by increasing the area of draw-down, or diluting local aggregations by drawing product from multiple locations.

### Preventing Arching & Ratholes

If a bulk material has cohesive properties it may 'arch' or 'bridge' over an outlet. This depends upon many factors, such as the size and shape of the outlet, the time and degree of compaction, and whether the storage

system is designed for Mass Flow or not. There are several insert options used for preventing arching including tube inserts to reduce bulk strength, a vibrating reed is sometimes used to break the arch and wall liners to decrease wall friction.

Even if a stable arch does not form, in a conical hopper a 'rathole' may still form, leaving a large proportion of the hopper contents in dead regions. Ratholes can be prevented by using a 'cone-in-cone' insert to create a radial Mass Flow system within the cone insert whilst shielding the outer material to promote flow.



## Insert Selection

It must be emphasised that inserts are not a cure-all for deficient designs. However, a well-designed insert can make a considerable difference to hopper discharge. Insert performance is dependent on hopper geometry, feeder type and operating conditions, therefore the design of inserts must be based on the overall system and the properties of the material used. The design of inserts when retrofitting will be influenced by space constraints, the structural integrity of the container, and the ability to install the insert in situ.

## Research and Innovation

Many insert concepts and designs have been developed and introduced by equipment evolution, rather than arising from fundamental research. Ajax has been at the forefront of their exploitation in systems from mobile pharmaceutical bins to large steelworks bunkers. Recently Ajax has been collaborating with the University of Bolton in further researching the Lynflow™ Bates insert. For his final year project Vivek Ganesh, BEng (Hons) Mechanical Engineering, carried out trials with various poor flow and segregating bulk solids in conical hoppers fitted with the Bates insert. This is an inclined tube which projects over the outlet and produces a special skewed form of Mass Flow. Vivek's work revealed the change of flow pattern within geometries that wouldn't normally allow Mass Flow without the insert fitted. There are, of course, still areas that need further fundamental research e.g. calculating stresses on inserts while filling and during flow conditions.



Through the sustained examination of materials, hopper geometries and influence of insert design, Ajax continues to deliver cutting edge design, and enhanced hopper performance.

University  
of Bolton



# PHARMACEUTICAL POWDER HANDLING

Pharmaceutical powder handling is a particular strength of Ajax Equipment. Recently Ajax has supplied leading powder processing equipment maker, Hosokawa Micron with an agitated screw feeder, and integral hopper, to handle and control the feed of pharmaceutical powder into a milling machine.



Bulk pharmaceutical compound is tipped from a big bag into the agitated screw feeder's large hopper section allowing gravity flow to a robust, multi-bladed agitator, and screw feeder. The auger features a stepped shaft with variable pitch, to pick up the cohesive powder progressively from the full length of the agitated feeder outlet.

"Ajax's experience in agitated feeder design has enabled the best hopper shape possible for gravity flow in the limited head space available," said Mike Coffey, project manager, Hosokawa Micron Ltd.

## Rotary Powder Sifter

In another pharmaceutical application, Ajax has developed a rotary powder sifter unit in Hastelloy. Powder enters the sifter from a feeding screw, where the rotating paddles force the powder through the elongated sifter slots and into a collecting screw. "The sealed unit is designed to provide a gentle sifting action and controlled feed for pharmaceutical powders," says Eddie McGee, technical director, Ajax Equipment.



## ASK LYN...

**Q** A difficult to handle material forms a rathole when I am emptying the bin it is stored in. Should I install a vibrating discharge station or is there an alternative option?

**A**n alternative is to use a bin with geometry that provides a more favourable approach to the outlet. Lynflow™ bins exploit the benefits of plane flow to ensure Mass Flow. This significantly reduces the headroom normally required with this type of bulk container. Fully interchangeable with traditional shaped bins, the Lynflow™ polypropylene moulded IBCs draw on the latest developments in bin design technology to provide gravity flow discharge of bulk materials.



The smooth, low friction internal surface of the bins enhances its potential to provide significant flow improvements over conventional bins. Moreover, the IBC provides process engineers with a cost-effective alternative to high maintenance, vibrating discharge stations, while the seamless moulded construction also addresses the hygienic limitations often associated with inbuilt bin and discharging systems.

## DIARY DATE

### Institution of **MECHANICAL ENGINEERS**

Computer Aided Engineering for Bulk Materials

**Thursday 24 September 2015, Institution of Mechanical Engineers, London.**

Review how the latest Computer Aided Engineering tools can improve the accuracy and speed of the design process from the preparation of sales presentations to manufacturing drawings. Expert speakers will also outline how to integrate all the relevant design disciplines to optimise designs and avoid conflicts that would be costly to resolve onsite.

**Find out more at**  
<http://events.imeche.org/ViewEvent?code=S6258>



**21 - 22 October, Harrogate International Conference Centre.**

Organised by the Materials Handling Engineers Association, the BULKEX 2015 exhibition and seminar programme will bring together all areas of the materials handling industry, providing a unique showcase of products and services. You are invited to visit **Ajax on stand 65** to discuss your solids handling needs; from lump breakers to screw conveyors and feeders, and hoppers.

**Find out more at [www.mhea.co.uk/bulkex-2015/](http://www.mhea.co.uk/bulkex-2015/)**



## TOP IMECHE AWARD FOR AJAX'S LYN BATES

Ajax founder and managing director, Lyn Bates, was recently honoured by the Institution of Mechanical Engineers' Process Division with the Most Distinguished Achievement Award. This is the first time the award has been presented and recognises Lyn's outstanding contribution to the process industries through his research into bulk solids handling over many years.

The award was presented by Mike Buckland, chair of the Process Industries Division Board before an evening lecture at the IMechE in London. Lyn's achievements include designing various powder-testing devices, introducing state-of-art technology for flow, feeding, de-aeration, bin systems and countering segregation. Lyn has also authored several books and more than 100 papers at conferences and seminars in the UK and overseas.

Mike Buckland commented, "It was a privilege as the Chair of the Process Industries Division to present this award to Lyn. The passion that Lyn holds for his chosen field of engineering was great to see and a reminder to us all of what a rewarding career engineering can provide", Mike continued, "He continues to provide a vitally important bridge between industry and academia and his excellent award winning paper on which his submission is based clearly demonstrates a contribution valued by his peers."

## AJAX ONLINE

You can find more news and information about solids handling at [Ajax.co.uk](http://Ajax.co.uk), on Twitter @AjaxEquipment and on Facebook. In addition, Ajax has posted videos on You Tube showing many aspects of solids handling and equipment testing.



## DESIGN TEAM ENHANCED

Ajax has recently enhanced its design team with the appointment of Lewis Shaw as Design Draughtsman. A qualified mechanical engineer Lewis will use his engineering skills to design solids handling equipment to Ajax customers' requirements. As part of Ajax's training, Lewis has also been involved in shop floor work to see for himself how Ajax's craft engineers use the design drawings to produce high quality equipment.



"Lewis is a welcome addition to Ajax's design team. With his combination of experience in the solids handling industry, enthusiasm for new technologies and an eagerness to learn, Lewis fits in well at Ajax" said Eddie McGee, technical director, Ajax Equipment.

Ajax also recently celebrated the retirement of Marilyn Bourke after 20 years service. She has kept Ajax Equipment clean and tidy and ensured its staff are well looked after with tea and coffee.

Mark Waters, director, Ajax commented "Everyone at Ajax would like to thank Marilyn for her work over the past twenty years and wish her every happiness in her retirement."



(L to R) John Crowder, production director, Marilyn Bourke, Mark Waters, director.

## A YEAR OF TOP TIPS

Our 'Top Tips' series has now been bringing you the essentials of bulk solids handling for over a year.

"We're glad that so many people are finding Top Tips useful. So far Ajax Top Tips has covered segregation, particle attrition and achieving reliable flow. We look forward to covering many more aspects of solids handling in the future" said Mark Waters, director, Ajax Equipment.

You can receive Ajax's Top Tips by signing up for our newsletters at

<http://www.ajax.co.uk/mailgroup.htm>



**AJAX**  
QUALITY BY PERFORMANCE  
PERFORMANCE BY DESIGN  
CELEBRATING OVER 40 YEARS OF EXCELLENCE

+44 (0)1204 386 723  
[sales@ajax.co.uk](mailto:sales@ajax.co.uk)  
[www.ajax.co.uk](http://www.ajax.co.uk)

SCREW CONVEYORS • SCREW FEEDERS • SCREW ELEVATORS • IBC SYSTEMS  
BIN INVERTER STATIONS • CONTINUOUS MIXERS • BATCH MIXERS • SLIDE VALVES  
HOPPERS • KEG FILLERS • DIVERTER VALVES • LUMP-BREAKERS • HOPPER INSERTS  
FLIGHTS ONLY • SCREW AUGERS • SACK TIP STATIONS • POWDER TESTING

Ajax Equipment Limited, Milton Works, Mule Street  
Bolton BL2 2AR, UK.