ADM Demonstration Model Sifter

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ADM Demonstration Model Sifter

Problem Statement
Archer Daniels Midland Company was established in 1902 by George A. Archer and John W. Daniels under the name Archer-Daniels Linseed Company. To summarize Archer Daniels Midland Company, here is a snapshot from their mission statement, “Today, we’re one of the world’s largest agricultural processors and food ingredient providers, with approximately 32,000 employees serving customers in more than 170+ countries. ADM has a globally recognized value chain that strives to connect the harvest to the home” (Archer Daniels Midland, 2018).

The problem we worked to solve is improving operator knowledge of sifter and sieve operation and function. There is general lack of experience in the milling industry due to employee retirement and the difficulty of attracting and retaining employees in a demanding industry. Sifters are essential components to the milling process. Employee knowledge of material flow, particle size separation, and maintenance are critical for operators to understand. Without the proper knowledge and practices, sifters will not be used to their full potential. Two demonstration model sifters are required to aid in employee development and allow for valuable interactions with sifter components, concepts, material flow, and maintenance.

Known attributes of the problem: Sifter concepts and topics are challenging to communicate effectively and clearly; Sifters are large, moving pieces of equipment that pose various safety concerns if employees are unaware and not cautious when working around them; Test sifters are to be used in the ADM Milling Academy Class; Test sifter operation aims to be around 15-20 minutes for adequate operator training sessions; People need to be able to see inside the sifter to show stock flow and sifter flow paths; and An additional small granulation sifter will be used for demonstrating size separation.

It is crucial for operators to understand the operation, material flow, maintenance, and above all, safety of sifters. The demonstration sifters will aid in the knowledge required by ADM’s mill operators and lessen the inherent employee risks inside mills. Increased knowledge and experience, also presents a beneficial business opportunity of running ADM’s sifters more efficiently. Two improvements include keeping a higher percent of flour out of the feed streams and improved extraction yields.

Disciplines
Bioresource and Agricultural Engineering | Industrial Technology

Authors
Brian Davis, Ross Henning, Kyle Henik, Levi Benning, Joseph R. Vanstrom, and Jacek A. Koziel

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ADM Demonstration Model Sifter

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*course instructors and corresponding authors.


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  - Richard Flack, Manager ADM Econo-FLo, Richard.Flack@adm.com
  - Ashley Wall, Manager - Colleague Development, Ashley.Wall@adm.com
1 Problem Statement

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- An additional small granulation sifter will be used for demonstrating size separation

It is crucial for operators to understand the operation, material flow, maintenance, and above all, safety of sifters. The demonstration sifters will aid in the knowledge required by ADM’s mill operators and lessen the inherent employee risks inside mills. Increased knowledge and experience, also presents a beneficial business opportunity of running ADM’s sifters more efficiently. Two improvements include keeping a higher percent of flour out of the feed streams and improved extraction yields.

Business Case Statement
ADM is in need of two small-scale sifters to aid in teaching wheat flour millers and other employees. Each model will have its own purpose. The granulation sifter will be used to sift only for size and demonstrate how a sifter sorts stock by material size. The Tru-Balance sifter will be used to show material flow and visual demonstration of the internal components of a sifter.

The education of ADM’s mill operators strategically allows safer and more efficient operation of a crucial piece of milling equipment. Increased knowledge also dictates the more effective use of finite resources. Decreased risk and better production are byproducts of an increased knowledge.
2 GOAL STATEMENT

Our goal was to design and update and modify a Tru-Balance 221 wheat sifter. The modifications allow increased visibility and access to sifter outputs for teaching purposes.

- The main objective is to enable employees to visually examine the interior of a sifter during operation. This assists in training mill operators to comprehend the components, concepts, and material flow that are associated with full scale wheat sifters (Wiechman, 2018)
- In addition, compile a Standard Operating Procedure (SOP) for operation and cleaning of the model including possible risks and hazards to the operator (Means, 2018)

Specific objectives include:

- Improvement of a sifter that meets all client criteria and constraints:
  - Criteria
    - Showing the flow path within the sifter
    - Run time of 15-20 minutes
    - Easy setup and operation
  - Constraints
    - Clear side panels
    - LED lighting system
    - Self-contained material collection

- Rationale
  - Relatively portable sifter able to be used in a variety of settings
  - Enhanced viewing allows direct understanding of the process being taught
  - The ability to be ran for 15-20 minutes per ADM’s request
  - Sifter will hold inputs and catch outputs with separate containers

3 PROJECT PLAN/OUTLINE

A. Methods/Approach

- Reference Materials
  - For the intent of this project, a variety of resources were utilized to allow for the thorough retrofit and deployment of the sifters into the ADM Milling Academy curriculum.
    - ADM was very accommodating to our questions and their wealth of knowledge was great to utilize.
    - Various group members also possessed a wide range of skill and experiences which also aided in the development of the project.

- Data collection
  - Data for this project pertained to the information needed to safely operate and thoroughly train employees regarding sifter operations.
    - Throughput of the Tru-Balance sifter was needed to allow for 15-20 minutes of run time
    - Electrical specifications required to safely supply each aspect of the final product with sufficient power was also needed (motor, feeder, lights, receptacles, etc.)
Skills
- The team working on this project contained a vast amount of valuable knowledge regarding general milling operations, design and creation of parts, product testing, and continuous development.
- Group members have worked alongside one another to help others understand the milling process as well as the operation of various types of sifters to assist in the creation of this demonstration model. The group was also fortunate enough to tour the Barilla milling operation in Ames to supplement their current knowledge on the topic.
- Courses in our curriculum that aided in the development of this project include:
  - TSM 116, TSM 210, TSM 216, TSM 240, TSM 340 and TSM 363

Proposed Solutions
- After assessing the current scenario and utilizing our various resources, we were able to compile a list of retrofit requirements to allow the ADM Milling Academy to adequately train their mill operators.
- Addition and implementation of the following created a successful project:
  - Clear side panels to allow trainees to visualize flow paths
  - Increased feeder speed to allow for 15-20 minutes of run time
  - Lighting and imaging systems for close-up views of product in hard to see areas
  - Self-contained material collection bins to reuse material for various training sessions
  - Implementation of electrical sequencing for safe operation of the sifter and its components
  - Addition of a brake sifter to shoe extraction rates
- ADM assisted in the retrofit process prior to shipment of the sifter to its location in Ames. By diligently working alongside ADM we were able to successfully deploy this piece of equipment and it will operate to the desired standards set forth to aid in the milling academy curriculum (Flack, 2018).

Organization
- The team met at least once a week throughout the entire process to discuss general project updates.
- Other meeting times throughout the week were addressed accordingly as milestones needed to be accomplished, documents need to be reviewed, and implementations of the solutions occur.
- Current document organization was being facilitated with the utilization of GrabCAD. Other forms of communication between the group, ADM contacts, and ISU faculty were face-to-face interactions, email, text message, and phone calls.
- Based on the communication and project ideas, a list of major milestones was developed.
  - Define essential project requirements
  - Design effective, functional components to support use of training model
  - Fabrication and implementation of various sifter elements (Behrens, 2018)
  - Product operation, testing, and validation of newly added sifter features
B. Results/Deliverables

There is a list of essential milestones that had been set forth that played a role in the development of the main project deliverables (Petersen et al., 2017; Koziel, 2018; Vanstrom, 2018). Each major milestone is listed below with its associated week of completion. In addition to the major milestones, we were able to coordinate the main deliverables for the project, too.

➢ Define essential project requirements
  ○ 11-6-2017
➢ Design effective, functional components to support use of training model
  ○ 1-1-2018
➢ Fabrication and implementation of various sifter elements
  ○ 2-26-2018
➢ Product operation, testing, and validation of newly added sifter features
  ○ 3-19-2018
➢ Documentation of sifter operation, cleaning procedures, and technical specifications
  ○ 4-2-2018

Project Deliverables:
  o Demonstration model sifters
    ▪ Existing Tru-Balance sifter needed to be retrofit to show the flow of stock during sifter operation
    ▪ Small-scale granulation sifter needed to be utilized for showing separation of stock by granulation in a sifter
  o A standard operating procedure was established for the model including possible hazards and risks to the operator
  o Technical specifications needed to be provided for the fabrication and retrofit of the demo model
    ▪ Bill of Materials

4 Broader Opportunity Statement

The implementation of the Tru-Balance 221 and small granulation sifter into the ADM Milling Academy had many benefits outside of the classroom. By utilizing the newly implemented demonstration sifters, ADM will be able to train their operators with a more hands on approach. Benefits such as transparent sifter box walls, sufficient run times, and well-lit sifter box internals, operators in training will be able to gain a better understanding of the essential components of sifting equipment. In the simplest of forms, it is important to understand the basic fundamentals of milling. Each member of ADM’s milling team must understand sifter operation, material flow, maintenance, and safety to successfully operate sifting equipment efficiently and effectively.
Utilization of the two demonstration sifters will allow ADM to improve their in-house education programs as well as improve workplace safety. Sifters are a huge component within a wheat mill and it is important that operators are well trained and taught to perform their job in a safe manner.

5 PROJECT SCOPE

Project Scope
- Small-scale demonstration models and related SOP were required for ADM’s Milling Academy educational class
  - ADM provided a sifter in working condition
    - Great Western Tru-Balance 221
    - Small scale granulation sifter
  - To increase visibility for the operation of a test sifter that will assist in training mill operators in the areas of sifter components, concepts, and material flow
  - To provide features (lights, self-contained stock collection bins, safe electrical circuit) for safe and easy operation
  - Deploy a consistent and dependable unit that would sufficiently operate for 15-20 minutes to allow for proper operator training
  - Documentation of technical specifications and bill of materials
6 Graphical Abstract

<table>
<thead>
<tr>
<th>Sifter Inputs</th>
<th>Particle Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.30 in</td>
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<tr>
<td></td>
<td>0.25 in</td>
</tr>
<tr>
<td></td>
<td>0.20 in</td>
</tr>
<tr>
<td></td>
<td>0.15 in</td>
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</tbody>
</table>

7 References


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8 APPENDIXES

Process Gantt Chart with Milestones and Deliverables

<table>
<thead>
<tr>
<th>Milestone Performance</th>
<th>Milestone Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Project Milestones</td>
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</tr>
<tr>
<td>Project Milestones and Supporting Details</td>
<td></td>
</tr>
<tr>
<td>Define Project Needs and Details</td>
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</tr>
<tr>
<td>Define Fabrication or modifications of site</td>
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</tr>
<tr>
<td>Space Allocation and Logistics</td>
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</tr>
<tr>
<td>Purchases through ADE or CUB</td>
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<tr>
<td>Design of Test site or addition</td>
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<tr>
<td>Flow path requirements</td>
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<tr>
<td>Construction modifications (storage, feeders, etc.)</td>
<td></td>
</tr>
<tr>
<td>Rebuild, Storage Area, leveling system, Transportation points</td>
<td></td>
</tr>
<tr>
<td>Electrical Work</td>
<td></td>
</tr>
<tr>
<td>Fabrication of the test site</td>
<td></td>
</tr>
<tr>
<td>Rebuild, Storage Area, leveling system, Transportation points</td>
<td></td>
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<tr>
<td>Fabrication of the test site, floor and serves</td>
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<tr>
<td>Electrical Work</td>
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<tr>
<td>Product testing, operation, and validation</td>
<td></td>
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<tr>
<td>Storage systems</td>
<td></td>
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<tr>
<td>Modification and redesign if necessary</td>
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<tr>
<td>Standard Operating Procedure</td>
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<tr>
<td>Operator and Training</td>
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<tr>
<td>Assembling parts and reads of the SOP</td>
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</tr>
<tr>
<td>LOTO</td>
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</tr>
</tbody>
</table>

| Project Deliverables | | |
| Draft Paper | | |
| Final Paper | | |
| Final Report Semester 1 Draft | | |
| Final Report Semester 1 | | |
| Final Report Semester 2 | | |
| Oral Presentation | | |
Beginning stages of the Tru-Balance sifter

Generalized ideas and locations of implementation on the Tru-Balance sifter
Various viewpoints of the small-scale granulation sifter and sieves
Tru-Balance as of 12/7/2017
Ingredient Feeder for Project Use
Sifters as of 1/23/2018
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Tru-Balance as of 4/4/2018
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Tru-Balance as of 4/14/2018
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Tru-Balance as of 4/24/2018
Department of Agricultural and Biosystems Engineering (abe@iastate.edu) aims to be a premier team serving society through engineering and technology for agriculture, industry and living systems. ABE welcomes opportunities to discover and improve new technologies for all stakeholders.
Parts Designs
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### Parts Ordering Forms/Receipts

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<th># To Order</th>
<th>Unit Price</th>
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The table below lists the items purchased and their corresponding costs:

<table>
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<th>Item Description</th>
<th>Quantity</th>
<th>Cost</th>
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<tr>
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<td>Weather Flow 36 in. x 40 in. Galvanized Steel Flat Sheet</td>
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<tr>
<td>25 Amp Commercial Grade Duplex Outlet, White</td>
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<td>$5.50</td>
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**Store Pickup (2 Items):**

- **Hydey Crunch 12 in. Adjustable Metal Wall Mount Clamps (2-Pack)**: $8.49
- **3/4 in. Zinc Rigid Box Spacer (2-Pack)**: $1.21

**Ship To Home (1 Item):**

- **1 in. x 72 in. Plain Steel Flat Bar with 1/8 in. Thick**: $39.72

**Order #WD10797770**

**Billing Information**

- **Created by**: Brian Davis
- **Placed on**: Mar 26, 2018

**Order Details**

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<td><strong>Hydey Crunch 12 in. Adjustable Metal Wall Mount Clamps (2-Pack)</strong></td>
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**Pick Up In Store**: FREE

**Shipping**: FREE

**Sales Tax**: $0.00

**Total**: $8.77

**Subtotal**: $337.47

**Pick Up In Store**: FREE

**Shipping**: FREE

**Sales Tax**: $21.19

**Total**: $358.66

**You Saved**: $10.49

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