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Statement of Purpose

1. Wheat Cleaning System of ADM

- As the largest food processing and commodities trading corporation, ADM processes thousands of tons of wheat annually.
- Several high-capacity combi-cleaners are applied to achieve cleaning.

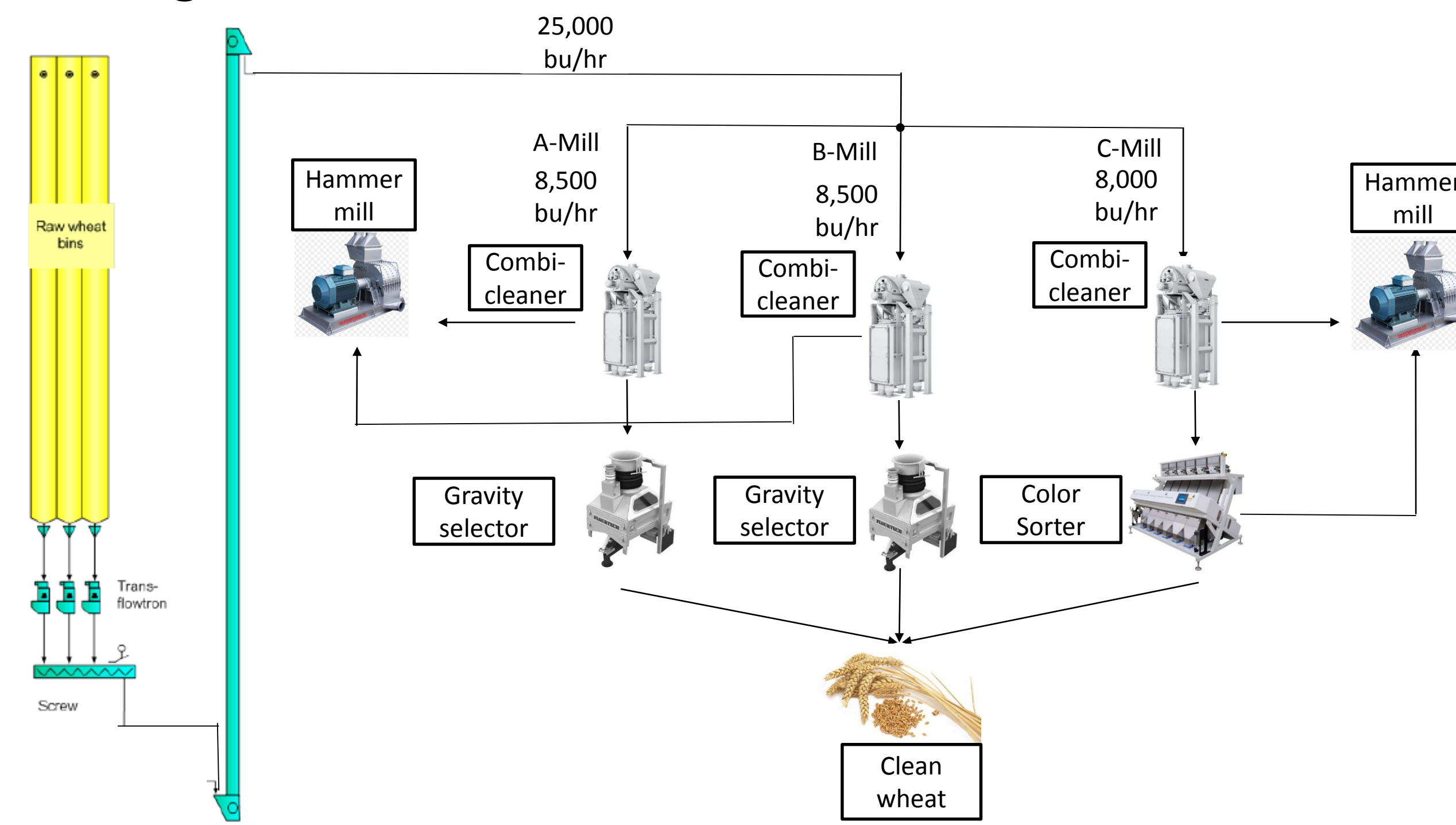


Figure. 1 Wheat Cleaning System of ADM

2. Problems Caused by Large Stones

- Large stones among wheat grains can cause severe damage to combi-cleaners, resulting in high cost of maintenance.

3. Perspective Result

- To protect combi-cleaners from being damaged by large stones, a high-efficiency destoner capable of eliminating large stones from wheat grains is needed.

Background

1. Investigation of Destoners Available

- Advanced destoner technology already exists on the market.
- Most destoners achieve functionality based on differential size or density between grain and stone.

2. Limitation of the Project

- Space is a significant limitation for this project due to the structure of the wheat cleaning building.
- The only space where extra machine can be placed is the roof of the building or elevator lobby.

Methodology

1. Measurement of Physical Properties of Large Stones



Figure. 2 Impurities from combi-cleaners

Material	Density (kg/m ³)
Stone	3020
Wheat	750
Corn	1250
Molded wheat block	1475
Dust block	1540

Table. 1 Density of different materials among wheat grains



Figure. 3 Multi-pycnometer with nitrogen gas tank



Figure. 4 Size of typical large stones

2. Search for Available Destoners on the Market

- Obtained technical data and specifications of available destoners from manufacturers to find a most optimal solution.

3. Design of an Innovative Destoner

- Used SolidWorks to create the concept product of an innovative destoner which is cheaper and more flexible.

Alternative Solutions and Evaluations

Solution	Evaluation
MTSC Buhler destoner	At least 12 Machines needed, far beyond the limitation of space and expense
Drum scalper	Lack of space for installation
X-ray inspector	High cost and low efficiency

Destoners whose working principle is based on differential density is less efficient compared to those based on differential size. Hence, our team final decision is to apply or design a destoner based on differential size.

Impact & Sustainability

Our project provides a solution for removing large stones during grain cleaning process under limited space condition. The self-designed model is inexpensive and also flexible enough to adjust the size of sieves for processing different products.

Final Design

1. Available Destoner on the Market

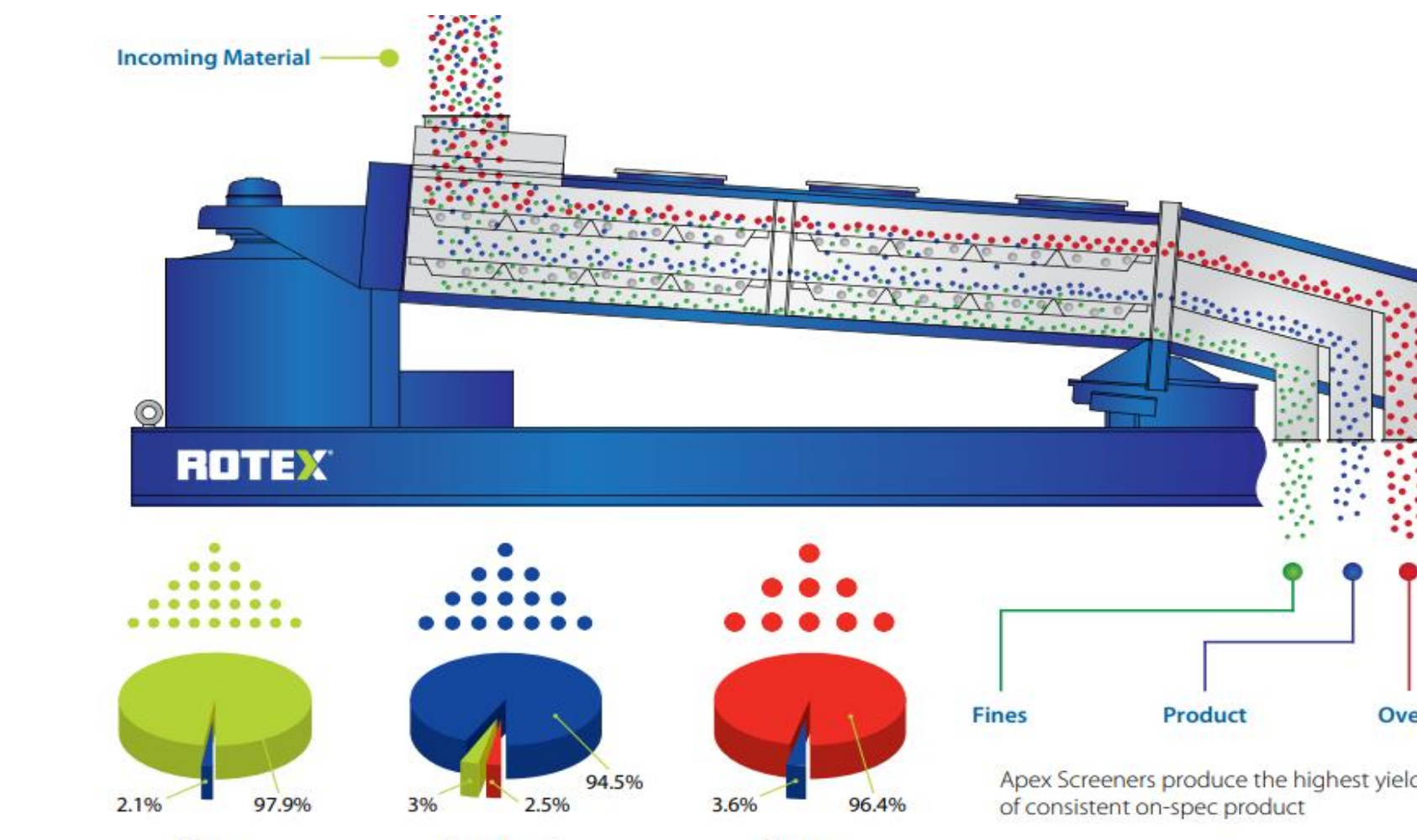


Figure. 5 Work Principle of Rotex Screener (Retrieved from http://www.rotex.com/pdf/specs/apex_brochure.pdf)



Figure. 6 APEX model Appearance (Retrieved from http://www.rotex.com/pdf/specs/apex_brochure.pdf)

The ADM company suggests to apply a APEX model from Rotex company in the elevator. It has a capacity of 25,000 bu/hr and 3/4" square hole for screening.

2. Concept Product of an Innovative Destoner

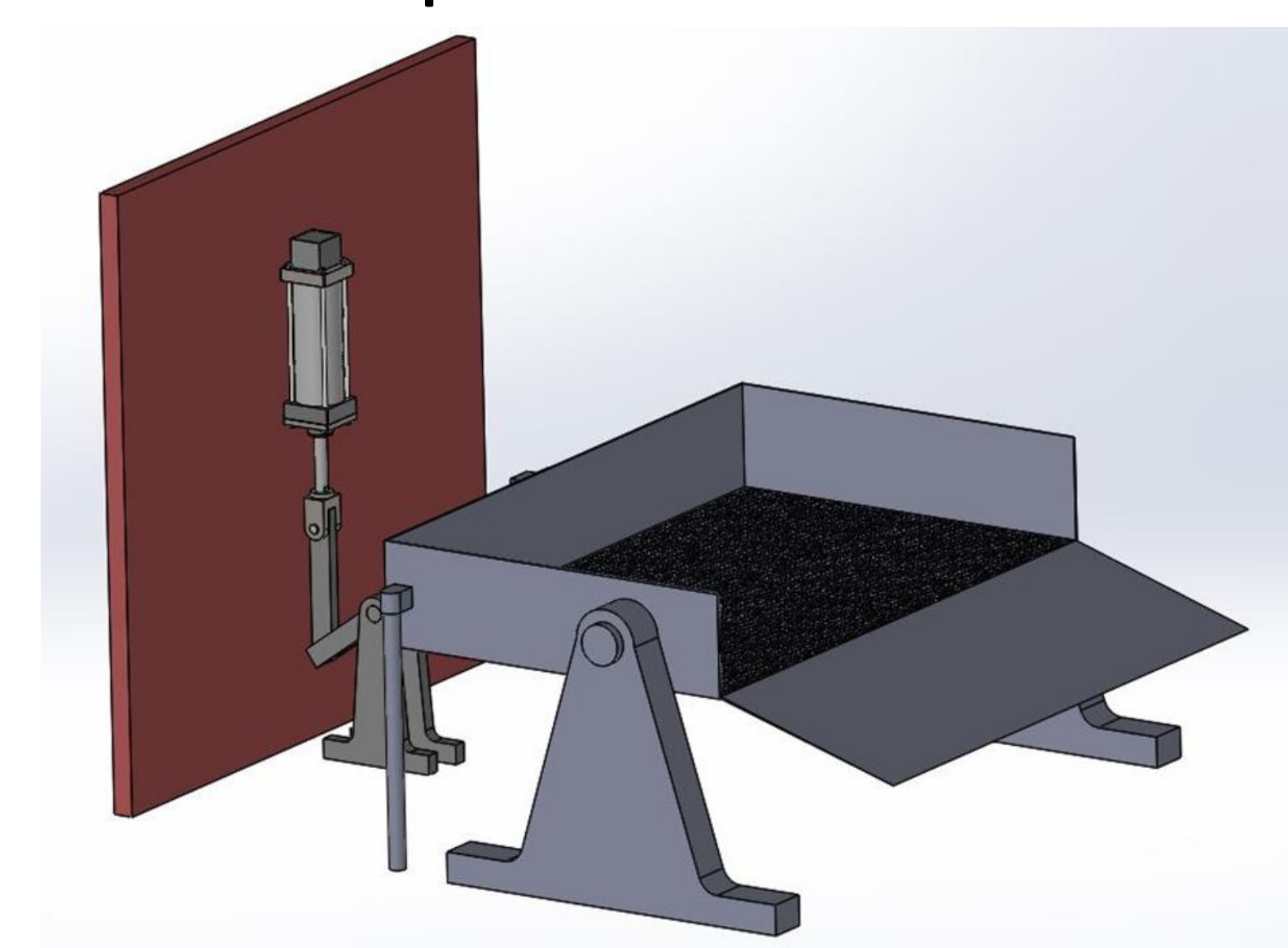


Figure. 7 Front view of the Innovative Destoner

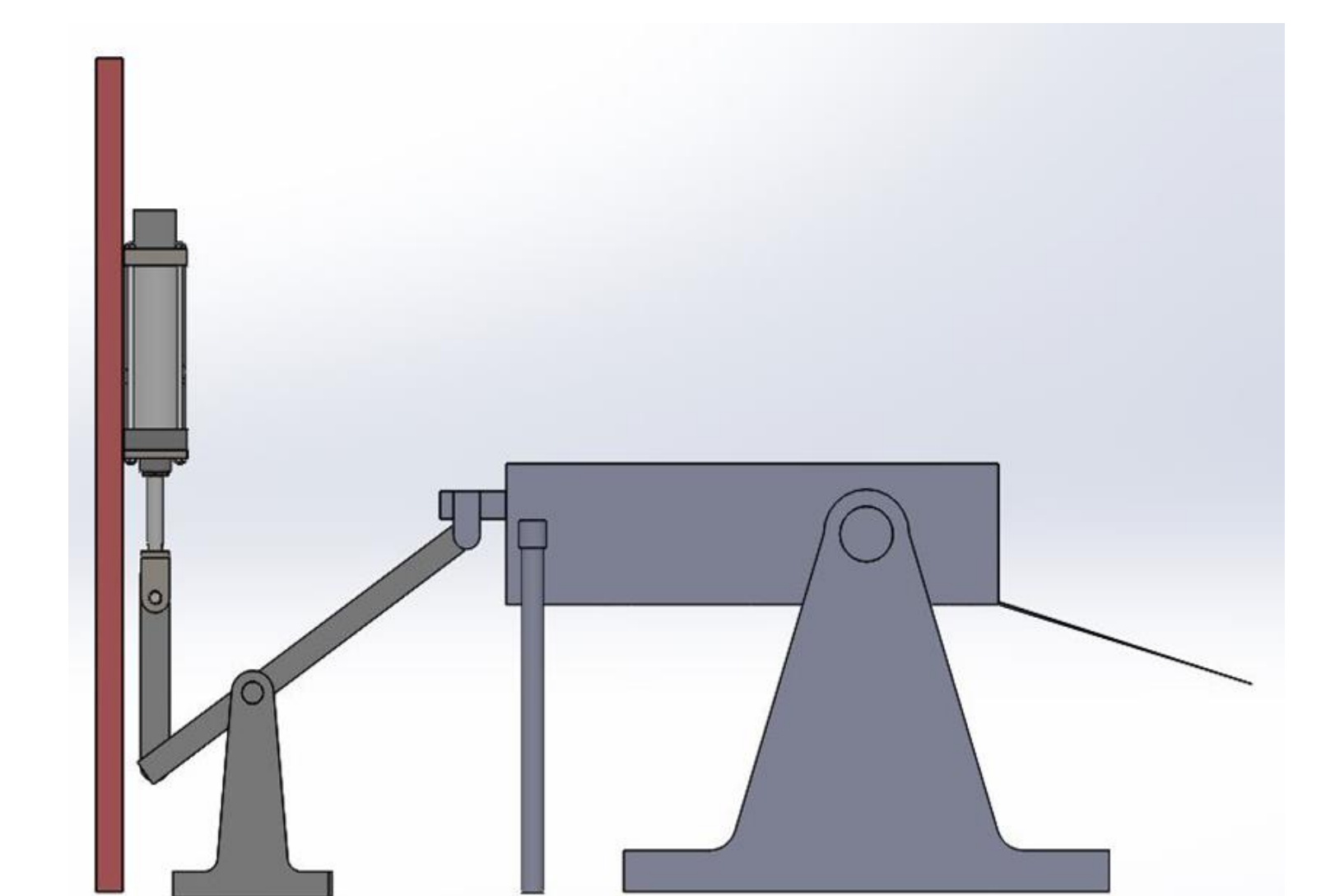


Figure. 8 Left view of the Innovative Destoner

- Assume the destoner needs to process 25,000 bu/hr and the wheat go through the screener with a speed of 0.1m/s, the size of the sieving table should be larger than 2.4 m².
 - Choose stainless steel to build a thick and strong sieve with 3/4" square hole
 - Utilize Andoco Eagle Actuator as power to dump the accumulated stone
- In conclusion, this destoner does not take too much space and less expensive.

Economic Analysis

APEX model	
machine cost	\$150,000
installation	\$250,000
Total	\$400,000

Innovative model	
material cost	\$30,000
power system	\$4,000
manufacture	\$10,000
Total	\$44,000

Anticipated life:
APEX model: 20 years
Innovative model: 5 years
The second one is cheaper.

Design and Project Assessment

- The innovative destoner is much economic friendly than APEX screener.
- Our design is rough so it requires extra tests to gain data for improvement. It is not as reliable as the company product.
- For innovative product, It cannot work consistently because the conflict between dumping and screening process. This can be improved in the future.