



Do we need impact machines?

Impact

- Impact, Abrasion, or Crushing occurs when
 - Harvesting, moving product, processing, and impact machines
 - Think of scenarios where this happens
 - Elevators-grain turning (why do you turn the grain?)
 - Subsistence farmers-tumble beans to kill bean weevils
 - Higher insect mortality with pneumatic conveyors (multiple impacts) than with drag, belt or screw conveyors
 - Fourth stage larvae and pupae of maize and granary weevils are susceptible to impact

Advantages and Limitations

- Advantages
 - Non-toxic, no chemical residue, insects may not develop resistance
 - Can be placed in stream (on-line system)
 - Operating costs-may be cheap or expensive
- Disadvantages
 - Kernel damage - Depends on product, process, speed of impact and moisture of grain
 - 100% insect control not reached in all methods
 - Not a long-term control method



Insect Mortality from Impact

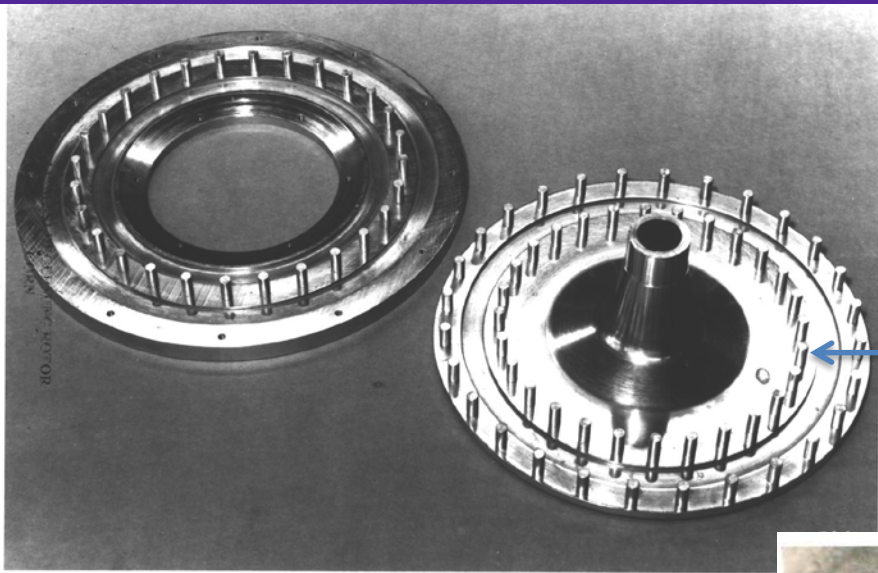
- Instantaneous effects
 - Kills or damages adults/immature stages
- Delayed effects
 - Affects development
 - Moisture loss from abrasion or wounds caused

Sources of Impact

- Harvesting – 50% kernel damage
- Conveying
 - Screw – 80% adult and 60% larval mortality
 - Pneumatic
 - wheat 90-100% adult mortality
 - Longer the distance, higher the mortality
- Dropping – Whole grain onto bin concrete floors
- Turning – impact grain-to-grain, conveying, disturbs the grain mass and insects, helps break up hot spots
- Processing – Hammer mills, roller mills, etc.
- Impact machines and infestation destroyers

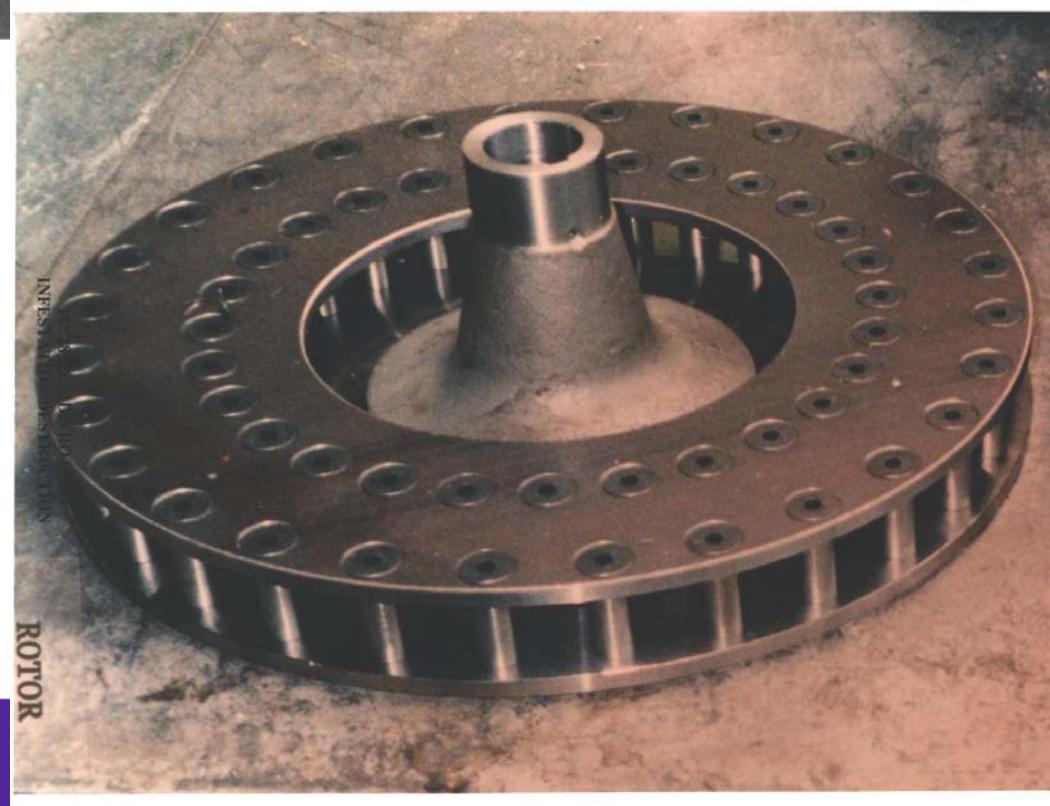
Impact machines or infestation destroyers

- **NEED IMPACT with Pegs**
 - insects are more susceptible to impact than acceleration
 - Acceleration of 20,000 times gravity for 1 hour results in only 50% mortality
- Mortality increases with rotor velocity
- Particle size decreases and kernel breakage increases with increase in velocity
- Moisture decreases mortality
- Throughput decreases mortality




← ← Pegs in two rows offset

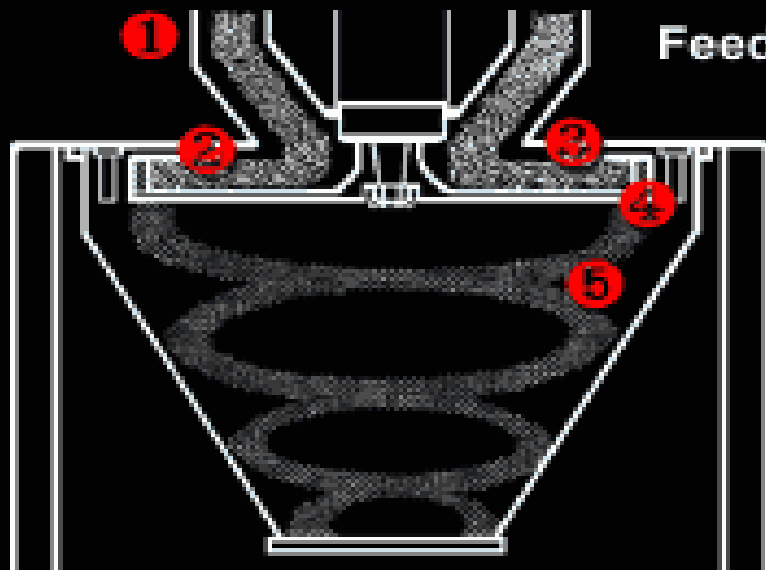
Impact machine rotors



Impact machines

- First marketed in 1940 in US-Entoleter Co.
- Speed-1750-3500 rpm
- Converting rpm (revolutions per minute) to tangential velocity (V) in meters per minute
- $V = (22/7) \times \text{rotor diameter (meters)} \times \text{rpm}$
- $V = \text{meters/minute}$
- $V = \text{meters}/60 = \text{meters/second}$
- Other uses-particle size reduction, mixing, scouring, degerming, and dehulling

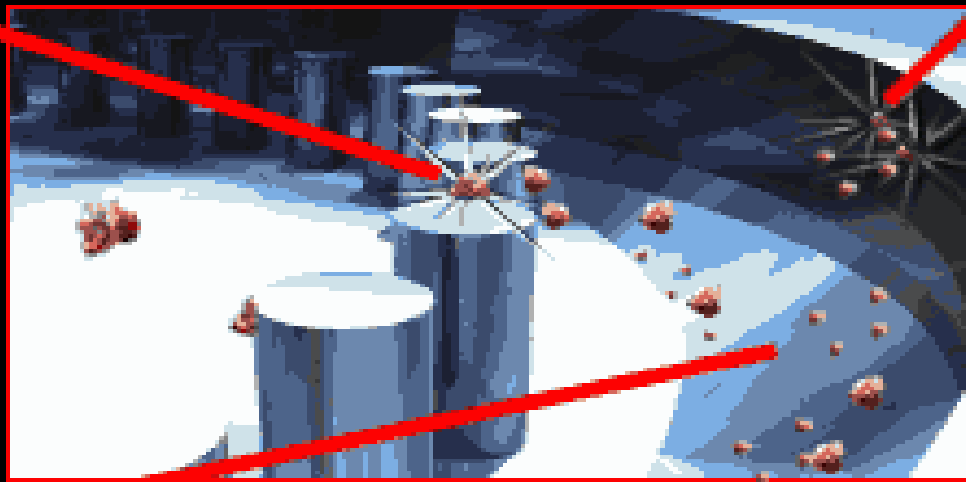
- 
- Flour and Semolina (65-100 m/s flour, 39 m/s semolina)
 - Very effective on all life stages of insects
 - Semolina will abrade waxy coating of insects
 - Very little reduction in particle size
 - Whole grain
 - 90% of adults in grain can be killed at 25 m/s
 - Internal infestation cannot be controlled without damaging the kernel
 - Grain moisture will affect breakage and mortality



Feed material enters through the top of the mill and is distributed onto the spinning rotor. Centrifugal force hurls the material outward at high speed.

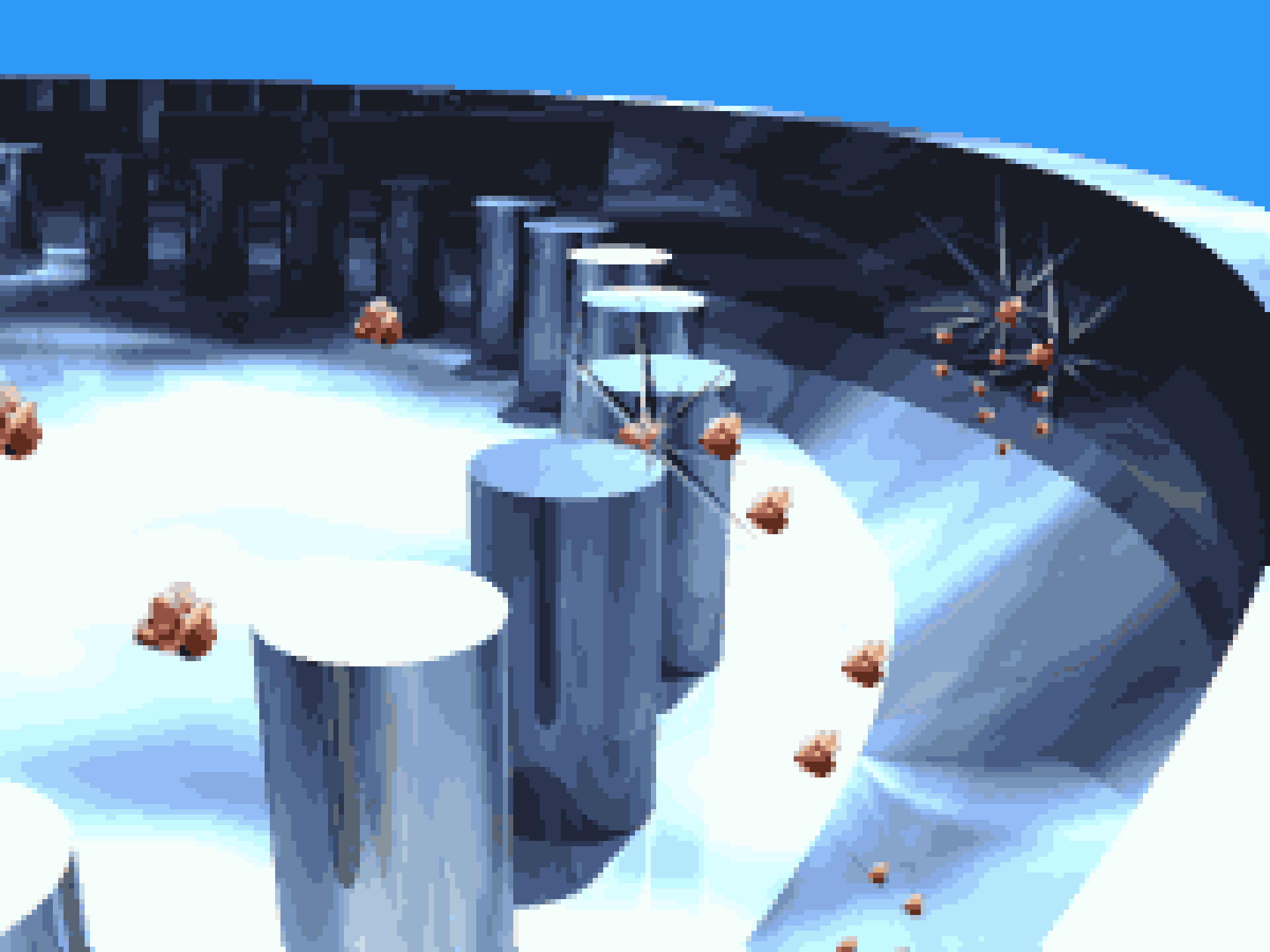


Primary size reduction occurs when the material impacts the row(s) of pins.



After impacting the rotor pins, feed material is discharged off the rotor against a stationary liner for further particle size reduction.

The processed material then spirals to the bottom of the conical discharge hopper and into a bin or a conveyer.






SERIES 27-3CBP ESA®
BEAT DRIVE
600 EU



SERIES 40-1CDP EID®
DIRECT DRIVE
1000CWT



Companies That Make Impact Machines

- Strutevant
- Ocrim
- Buhler
- Spomax
 - 5,000 – 150,000 lb/hour



Removal of impacted kernels and insect fragments

- After impact grain has to be aspirated to remove insect fragments and broken kernels
- Rice weevil adults contributed to more fragments followed by three week old larvae and one week old larvae
 - Adults produce more fragments than larvae
 - Dead (brittle insects) contribute to more fragment counts

Aspirators

- Remove insects, weed seeds, and other contaminants from a variety of grains
- Single pass and multiple pass aspirators are common
- 90-99.6% efficiency
- Based on terminal velocity of a falling object
- Rate of fall is affected by air resistance
- If velocity of resisting air is same as terminal velocity the object will float

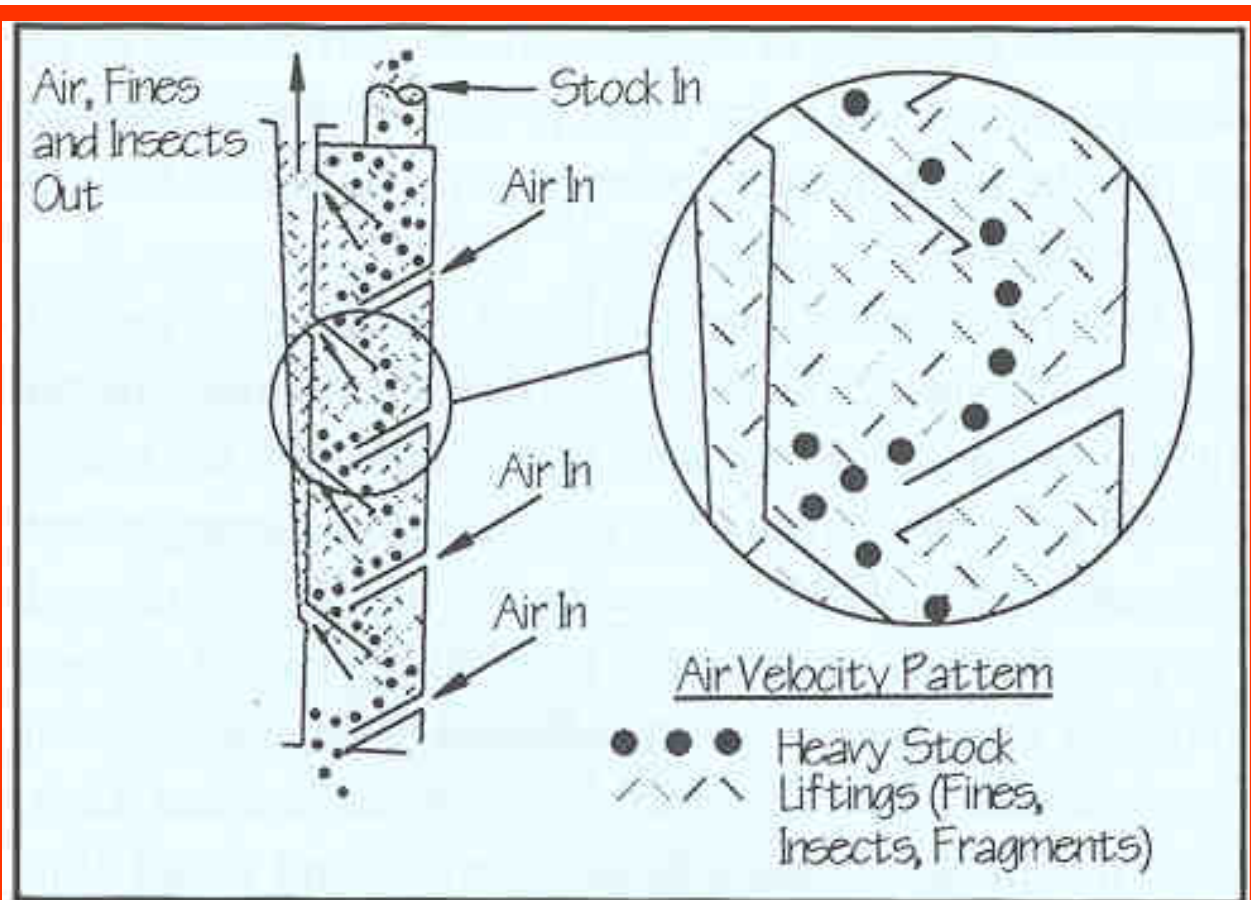


Figure 12-55 – Cross section of a typical multi-pass aspirator. Aspirators use air velocities to remove certain contaminants from various raw commodities while they are falling freely through the equipment.



<http://www.kice.com/Product-MultiAspirators.html#Application>