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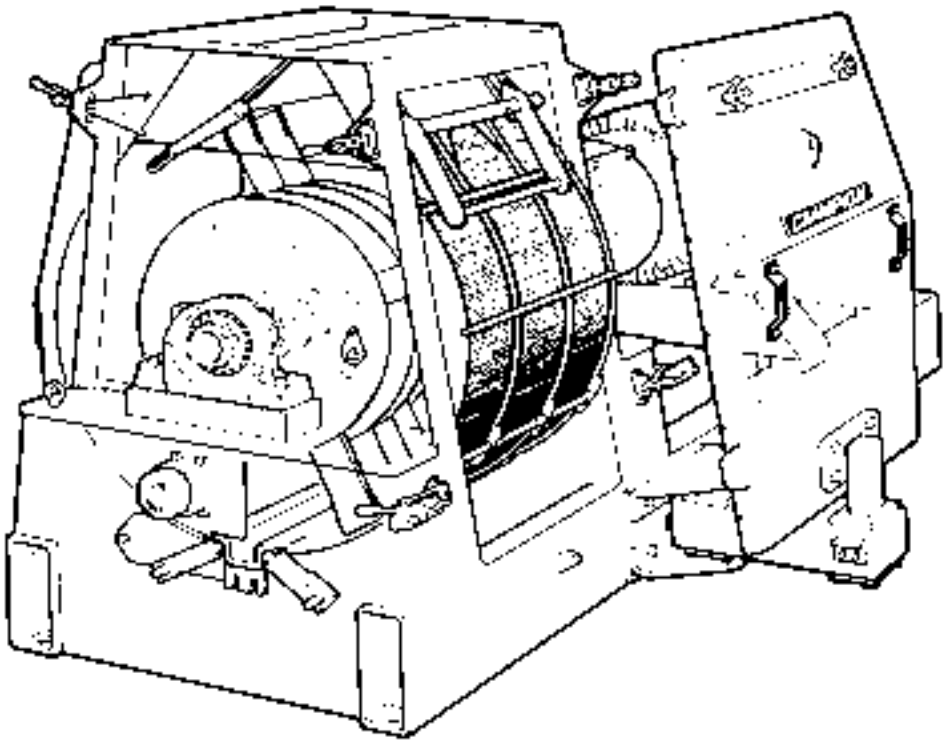
Hammermill Maintenance



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Hammermill Maintenance

Hammermills can be used to grind a variety of materials used in the manufacture of feeds for livestock, pet foods, and aquaculture. Furthermore, hammermills are widely used in the processing of oil seeds such as soybeans, sunflower, Canola, etc. to grind hulls and meal (high protein material left after the oil has been removed). In every case the hammermill performance and lowest maintenance costs will depend on a properly sized and equipped hammermill that is correctly operated. For maximum performance a hammermill must operate with the correct tip speed, have sufficient screen area for the applied horsepower, the proper hammer pattern, and hammers in the correct position in relation to the screen.

Tip Speed Use higher tip speeds for fine grinding with small hole screens (8/64" or less). High tip speeds will be more efficient for producing finer grinds, and permit the hammers to do more of the work, minimizing wear on the screens. Use lower tip speeds for producing coarser, more uniform grinds.

Tip Speed Ranges

> 18,000 FPM = High

13,000 to 18,000 FPM = Intermediate

< 13,000 FPM = Low

Screen Area For most applications a hammermill should have at least 14 In2 of screen area per horsepower. Too little screen area makes a hammermill inefficient and can cause significant heating of the material being ground. When using very fine screens (less than 5/64") it may be necessary to have more than 14 In2 of screen area per horsepower since the screen has less true open area.

Hammer Pattern The number and arrangement of hammers in the hammermill is called the hammer pattern. For most large diameter hammermills using hammers that are over 10" long, a ratio of 2.5 – 3.5 HP per hammer is fine when using screens larger than 8/64". For smaller screens it may be necessary to increase the number of hammers used in the hammer pattern to prevent rocking of the hammers on the hammer pins. To produce finer grinds, heavier hammer patterns should be used.

Hammer Position The clearance between the hammer tip and screen has a minor influence on hammermill performance in most cases. Setting the hammer tip near the screen can be beneficial with making fine grinds on fibrous or other tough to grind materials like meat and bone meal. For most grinding applications, a coarse hammer pattern with the hammers further from the screen will provide the greatest capacity and efficiency.

Hammermill Maintenance Basics

There are three basic areas of hammermill maintenance:

1) Routine replacement items such as screen, hammers, and pins

2) Regular long term maintenance items such as flow directors, regrind chamber, and bearings
3) Long term maintenance items such as screen carriage, wear liners, and couplings

Maintenance vs. Operating Costs

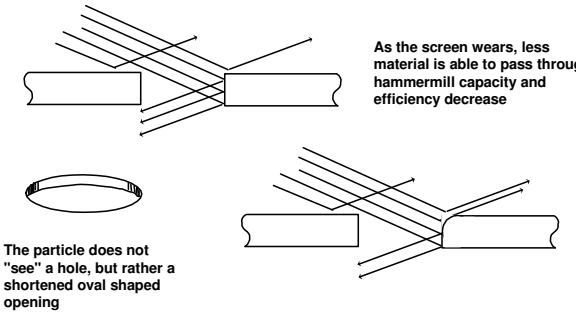
The energy cost to operate a hammermill is typically 5 to 10 times more expensive per ton than maintenance parts. Frequent replacement of the screens and hammers will insure the hammermill continues to produce the highest quality products at the lowest cost per ton. Using high quality parts that process more tons before replacement will maintain peak hammermill performance and actually lower the total operating cost.

Hammermill Operating Costs

Consider this

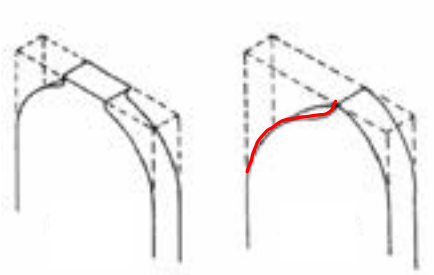
- **Maintenance parts costs are low**
  - **$0.01 to $0.05 per ton**
- **Energy costs are high**
  - **$0.25 to $0.70 per ton**
- **100 H.P. hammermill grinding corn, #8 screen will achieve 15 TPH = $0.29 per ton @ $0.06 KwH**
- **With worn parts, grinding 10 TPH = $0.45 per ton**

Replace screens frequently



Screens should be replaced whenever the hammermill capacity decreases or product quality begins to deteriorate. A drop of 15-20% in capacity is a good indicator that the screens should be replaced. Replacement screens should have an equal percentage of open area as new screens and the screen hole stagger should correct. Low cost screens will often have less open area (more space between the holes) and can reduce hammermill capacity by 20-40%.

Hammers should be replaced whenever the wear extends about 25% along the width of the hammer. In addition to loss in capacity and efficiency, excessive wear can lead to severe unbalance in a set of hammers causing extreme hammermill vibrations. Single holed flared hardfaced hammers are preferred for most tasks in animal feed and oil seed operations. “Cheap” hammers will often have inconsistent heat treatment and little or no hardfacing to protect the working surfaces. Consequently the hammers will wear unevenly (more vibration) and require more frequent replacement, reducing the efficiency and increasing the cost of operating the hammermill.

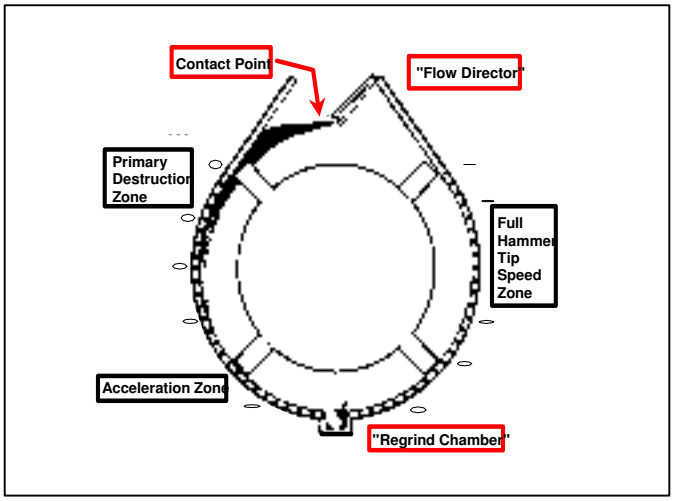


Normal wear Excessive wear

Hammer pins should be replaced whenever changing the hammers to prevent wear from becoming excessive and causing a pin failure. If a hammer pin must be reused, it should be rotated end for end to make sure the hammers are located in a new spot on the hammer pin.

Excessive wear of the hammer holes or grooving of the pins generally indicated an inconsistent feed (surges that cause the hammers to rock on the pins) or the need for a heavier hammer pattern. This is especially true on machines with lower tip speeds such as 38" diameter mills with 1800 RPM motors. As hammer manufacturers improve the quality of the hardface edge treatments available, hammers last longer and exaggerate any problems with hammers rocking on the pins. In some cases it may be necessary to change the hammer pattern by adding more hammers to prevent excessive hammer pin hammer hole wear. Always consult with the hammermill manufacturer when increasing the number of hammers in the pattern to avoid any danger of overloading the rotor plates.

Long Term Maintenance Items Any component in the grinding chamber of a hammermill is subject to wear, and should be designed for ease of replacement. Of course screens and hammers are the most obvious wear items, but other component should be check on a regular basis as well.



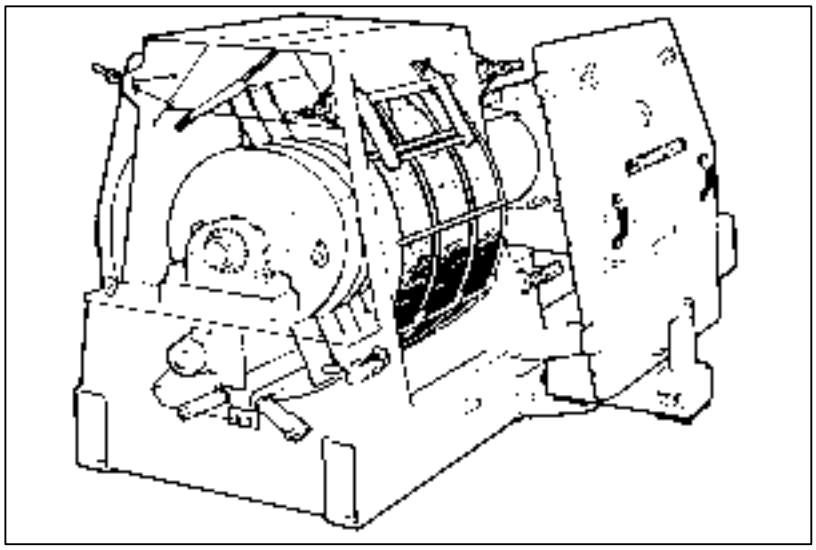
At the top of most modern hammermills is a flow director that guides material into the path of the moving hammers. Material circulating in the grinding chamber will constantly abrade the back side of the flow director eventually leading to the need for replacement. At the bottom of the hammermill is a regrind chamber designed to interrupt the flow of materials within the hammermill, directing them back into the path of the moving hammers. This unit will also be subject to constant abrasion by the material being ground and will eventually need to be replaced. Depending on the material(s) being ground and the tons processed on a daily basis, the inlet flow director and regrind chamber may require replacement between 18 and 48 months. Failure to replace these wearing items in a timely fashion can lead to catastrophic failures within the hammermill if the inlet flow director or regrind chamber fail and enter the path of the moving hammers.

Hammermill bearings require good maintenance in order to provide long term trouble free service and lubrication is the key. Unless a bearing has a leaking seal hammermill bearings do not require frequent lubrication. In many cases, the grease fittings are removed from hammermill bearings to prevent over lubrication. If the bearing is too full of grease, the friction within the bearing can cause excessive heating and can easily destroy a bearing. At least every 6 to 12 months the covers should be removed from the bearing and all of the old grease carefully cleaned out. The bearing should be repacked to 1/3 to ½ full with new grease, and the bearing monitored closely for the first 8-12 hours of operation after that. When a bearing must be replaced, the new bearing must be properly

positioned on the rotor shaft to prevent thrust loads, and the clearances adjusted to the precise tolerances recommended by the manufacturer.

Long Term Maintenance Considerations Other common long term maintenance items on the hammermill are the screen carriages, wear liners, and the motor coupling.

Over a long period of time, the screen carriage assembly that holds the screens in the hammermill can be subject to wear and impact causing it to lose the proper form. This can be especially troublesome in hammermills fine grinding for pet food or aquaculture applications since a small percentage of material leaking past the screens can create big problems with extrusion equipment. Factory fresh screen carriages can restore hammermill performance by eliminating these small leaks.



The wear liners within the hammermill form the interior surfaces of the grinding chamber, and provide a convenient sealing surface for the edges of the screens. Because these wear liners are constantly subject to wear and abrasion, they should be manufactured from abrasion resistant steel such as AR235 plate. This manganese steel material actually increases in hardness and wear resistance with use (work hardens). Mild steel does not offer the same level of protection and will require more frequent replacement. The sections at the top of the grinding chamber (primary destruction zone) should be designed so they may be easily replaced since they receive the greatest amount of impact and abrasion.

Hammermills in operation are a dynamic system and are constantly changing. Each time the hammermill is started (and stopped with electronic motor brakes) the motor coupling is flexed and stressed. Add to this mechanical stress the hostile environment around the hammermill and to no surprise the coupling elements will eventually fatigue and fail. One common source of hammermill vibration is a motor coupling out of alignment, or with a badly fatigued flexible element. Periodically (at least ever 6-12 months) check the alignment of the motor coupling after first verifying the motor mounting bolts and the coupling bolts and bushing are properly tightened and the coupling elements are sound.