

## Replace your Hammermill?

Can a Slow-Speed Shredder Replace your Hammermill?

### **High-torque, slow-speed shredders offer scrap processors some advantages over high-speed hammermills, but they also have limitations.**

For many years, most scrap yards and recycling plants relied almost entirely on high-speed shredders - those that run at shaft speed above 600 RPM. In recent years, it has been proven rather conclusively that there are applications for slow-speed, high-torque shredders. Generally, slow-speed shredders employ cutter wheels fitted on two counter-rotating shafts that turn at a speed less than 60 RPM and speed variations from 30 to 50 percent between shafts (Figure 1). As scrap is fed into the low-speed machines, the intermeshing cutter wheels actually shear and tear it apart, because of the varying speeds of the shafts and the close clearances between the cutters.

Slow-speed shredders can be equipped with narrow or wide cutters. The narrow cutters produce a finer shred, and the wider cutters, yield a coarser finished product.

In high-speed shredders, which are primarily hammermills, the main shaft supports either discs or spiders. The hammers are attached to the spiders or the center discs and are held by hammer shafts at 90 degrees to one another (Figure 2). These shafts support a number of hammers which must be equally weighted. It is unimportant if there is a weight variation from one hammer to another on a given shaft. However, the total weight of hammers in rows set at 180 degrees to one another should weigh within one pound of the opposite row. In Figure 2 rows A and C should weigh the same and rows Band D should weigh the same. If opposing rows have substantially different weights, vibration will result. The amplitude of vibration will be directly proportional to the imbalance resulting from the different weights of the rows of hammers.

Some manufacturers refer to their machines, as ring mills, but these are essentially hammermills. Each ring in a ring mill mounted on a shaft considerably smaller than the inside diameter of the rings so centrifugal force holds them out in a position that delivers a striking action similar to a hammer in a conventional hammermill (Figure 3).

### **Slow Shredders Offer Less Vibration**

That's one advantage of slow-speed shredders - they require very small foundations or structural members to support them compared with hammermills. Hammermill structures must absorb vibration and motion caused by imbalance in the rotor or by forces in the shredding chamber when hammers or rings are forced out of their extended positions by unshreddable materials or and excessive input.

Scrap processors also may prefer a slow-speed machine because its high torque and slow speed allows it to start under load, whereas hammermills cannot be started under load. Typically, this is not a problem since the hammermill has enough stored inertia to run for several minutes or more once it has been shut down. Thus, the hammermill clears the shredding chamber before coming to a complete stop.

### **Explosion Hazard for Hammermills**

By their design, hammermills create ideal conditions for an explosion, because the speed of the rotor tends to atomize any liquid in the shredding chamber. Usually as the atomization occurs, hammers are throwing off sparks as they hit metal scrap. The combination of dust or atomized petrochemicals and sparks generated in the shredding chamber adds up to a potential explosion.

Normally manufacturers can outfit hammermills with a dust collecting system and an explosion suppression system and, most importantly, they will instruct users on how to avoid feeding petrochemicals or other explosives into the machines. Many people have operated hammermills for scores of years without an explosion.

On the other hand, the low-speed shredders create very little dust in operation because there are virtually no grinding forces between the counter-rotating shafts. Slow-speed machines are unlikely to produce explosions from gasoline or other petrochemicals inadvertently fed into the shredders.

### **Power Requirements Vary for Shredders**

Some manufacturers contend that hammermills require greater horsepower than slow-speed shredders, and therefore incur a higher operating cost. However, hammermills normally make a finer product and do more to the materials being processed. Consequently, the horsepower consumption is in a rather constant relationship with the amount of work done.

Hammermills are not ideally suited for reducing resilient materials such as certain plastics and rubber products because hammermills generate too much heat. Ideally, scrap fed to a hammermill shredder should offer some resistance to the hammers and should be impact sensitive.

Most of the work is done by the hammers, subjecting them to the greatest amount of wear. Other components suffer less wear, depending upon the materials and fineness of grind. Typically the grate bars and liners are changed less frequently. Grate bars are usually changed with every three or four sets of hammers; side liners have a much greater life expectancy.

Low-speed shredders eliminate the hammer replacement costs. They also operate at lower decibel levels, because they turn at fewer RPM and do not rely on impact as do the hammermills.

### **Shredder Output can be Varied**

Output size in hammermills is controlled by the size and configuration of the hammers, hammer speed and clearance between the hammers and the impact plates, and the size of the openings in the grate bars. Other variables include the type of material and the amount of free fall into the shredder. If consumers require a fine, consistent product, hammermills should be used.

By the very design of slow-speed machines - utilizing two shafts - it is almost impossible to make a consistently fine grind. As mentioned above, essentially they don't grind or impact the material but rather shear and tear it.

Hammermills typically have greater capacity in recycling plant use than do the slow-speed shredders. Hammermills are not damaged by the presence of small metallic foreign material. A two-inch diameter bar of steel eight to 10 inches long would typically not damage a hammermill with a main shaft 36 inches diameter or larger. It would either go through the grate bars or more likely into the metal trap in the upper rear section of the housing. But it would stop a slow-speed machine, cause it to reverse, and the bar would have to be removed.

Abrasive materials in which silica content exceeds 15 to 20 percent should not be processed in either type of machine, because abrasion of hammers, liners, and impact plates can be severe.

### **Safety Must Be Considered**

In terms of safety, neither type of machine is hazard-free. Both can be potential safety problems, particularly if proper guards are not installed around external moving parts (see "Shredder Safety" on page 52). Workers should wear safety equipment at all times and remain a safe distance from the machines during operation. Maintenance staff should never service a hammermill, a slow-speed unit, or any other heavy equipment unless the drive motor is powered down and locked out.

Either type of shredder can be used in many applications. However, if a small product size is required, the hammermill must be your choice. Sometimes the machines can be used in tandem, with the slow-speed machine performing the primary processing, and the hammermill doing secondary or fine grinding.

Both the hammermill and slow-speed shredder have rightfully earned their places in the recycling industry. But as analysis of their different characteristics shows, application engineering is critical when choosing which machine to install. Problems occur when a machine is used to shred material for which it wasn't designed.

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