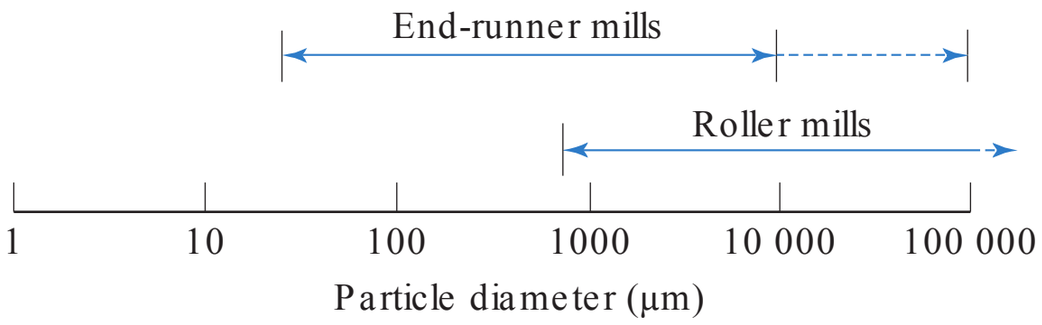


**Fig. 10.7** • Size reduction range for compression methods.

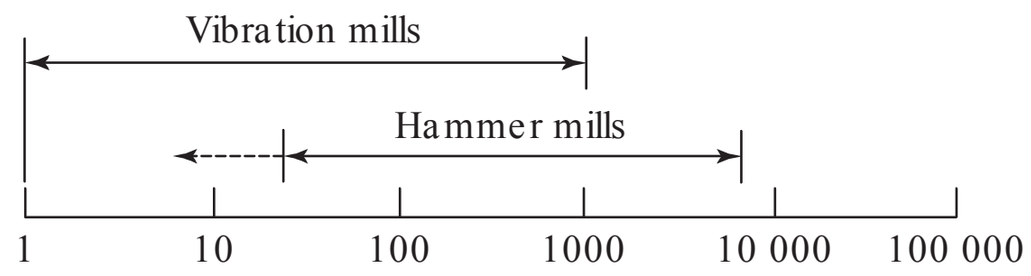


**Fig. 10.8** • Size reduction range for impact methods.

### Roller mill

A form of compression mill uses two cylindrical rollers mounted horizontally and rotated about their long axes. In roller mills, one of the rollers is driven directly while the second is rotated by friction as material is drawn through the gap between the rollers.

## Impact methods

### Size reduction range

This is shown in Figure 10.8.

### Hammer mill

Size reduction by impact can be carried out using a hammer mill (Fig. 10.9). Hammer mills consist of a series of four or more hammers, hinged on a central shaft which is enclosed within a rigid metal case. During milling the hammers swing out radially from the rotating central shaft. The angular velocity of the hammers produces a strain rate up to 80 $s^{-1}$, which is so high that most particles undergo brittle fracture. As size reduction continues, the inertia of particles hitting the hammers reduces markedly (as particle mass is reduced) and subsequent fracture is less probable, so that hammer mills tend to produce powders with narrow size distributions. Particles are retained within the mill by a screen that allows only adequately comminuted particles to pass through. Particles passing through a given mesh can be much finer than the mesh apertures, as particles are carried around the mill by the hammers and approach the mesh tangentially. For this reason, square, rectangular or herringbone slots are often used. Depending on the purpose of the operation, the hammers may be square-faced, tapered to a cutting edge or have a stepped form.

### Vibration mill

An alternative to hammer milling which produces size reduction is vibration milling (Fig. 10.10). Vibration mills are filled to approximately 80% total volume with porcelain or stainless steel balls. During milling the whole body of the mill is vibrated and size reduction occurs by repeated impact. Comminuted particles fall through a screen at the base of the mill. The efficiency of vibratory milling is greater than that for conventional ball milling described below.

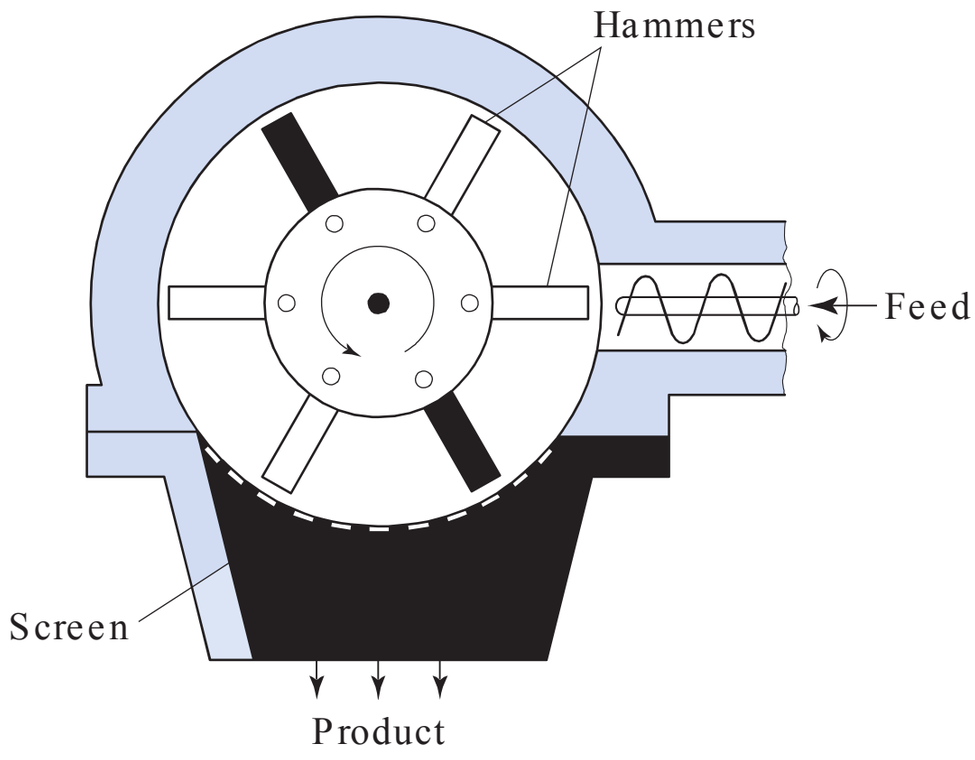


**Fig. 10.9** • Hammer mill.

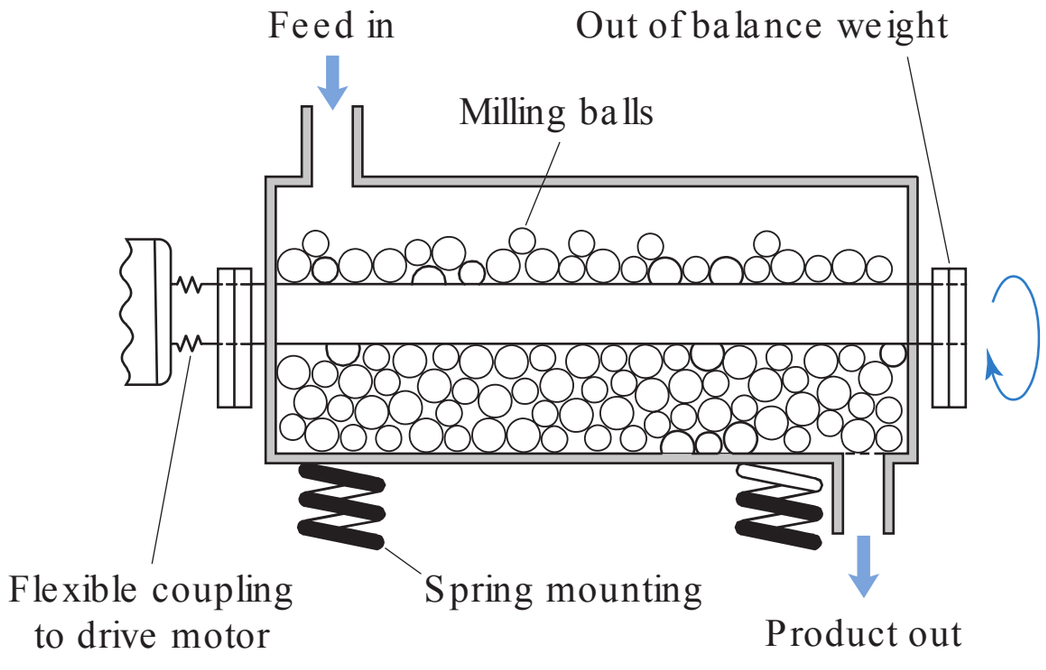


**Fig. 10.10** • Vibration mill.