achieve an even roast for all beans. A great deal of energy is required to transfer heat through the insulating layer of the bean shell. Penetration of the shell with this heat may result in a less even roasted internal nib with more harsh, over-roasted outer sections. During this process as much as 0.2–0.3% fat can migrate to the shell and be lost.

23.5.2 Winnowing (separation of shell from nib)

Winnowing takes place after whole bean roasting (see Chapter 3). Cocoa bean shell is approximately 10–14% of the bean weight and contains adhering pulp with foreign material and fine sand. Winnowing relies on differences in density between the shell and the nib to separate them.

Warm beans are first subjected to an impact crusher where the beans are broken or cracked. It is more difficult to remove the shell from some beans than others so adjustments to process controls may be required. The key is to be as gentle as possible to create large pieces of nibs and not too many fine particles. A combination of sieves and air currents complete the separation. The light density shells are blown away leaving behind nibs of similar size. Aspiration removes any fine dust. Efficient cracking and winnowing results in acceptable quality of less than 1.75% of shell remaining in the nib. Continuous monitoring is required to prevent insufficient removal of shell or loss of nib and to properly control flavour, quality parameters, profitability and wear on equipment.

23.5.3 Nib roasting

In nib roasting, a pre-thermal treatment is given to the cocoa beans to remove some of the moisture and aid in removal of the shell without roasting the nib. By removing some of the moisture, the shell will loosen and detach from the nib, allowing its removal prior to the roasting process. Steam vapour developed causes the shell to burst, expand out and detach from the nib. An added benefit of this process is that foreign material on the outside of the shell is burnt off, resulting in reduced microbiological contamination. The beans then go through the winnowing process and on to nib roasting (Figure 23.5). Nibs travel to the nib roasters as gently as possible to avoid creation of fines. Roasting is performed through convection and conduction. Moisture can be introduced in varying stages for flavour and colour development and microbial sterilisation. This type of system can be continuous or a batch type and specific recipes with careful controls optimise flavour.

23.6 Cocoa nib grinding

Once the roasting process is complete, the cocoa nibs are ground into cocoa liquor which can be referred to as baking chocolate, unsweetened chocolate, bitter chocolate, cooking chocolate, chocolate coating, unsweetened chocolate

Figure 23.5 Cocoa nib roaster.

coating or chocolate according to 21 CFR Part 163.11. Chocolate liquor or cocoa mass is considered the solid or semi-plastic food prepared by finely grinding the kernel or nib of the cocoa bean.

Cocoa nib grinding is usually performed in two or three stages. Pre-grinding and final grinding by multiple mill types (see Chapter 9). The key quality needs in this area are to evaluate the degree of particle size reduction in each stage of the process. This can be done through particle size distribution utilising laser diffraction or by sieve analysis typically through a 75 µm sieve. Specifications will be set up based on the needs required for the specific liquor. The setup of machinery will greatly impact the final size distribution and milling efficiency. The resulting chocolate liquor can be used to manufacture chocolate, used in cocoa butter pressing to produce cocoa butter and cocoa cake or shipped to other chocolate manufacturers in liquid or solid form. Chocolate liquor will be evaluated for particle size (fineness), total fat, moisture, flavour, colour and microbiological testing. Monitoring of extraneous matter, heavy metals and pesticides is also critical to meet all regulatory requirements of the producing country.