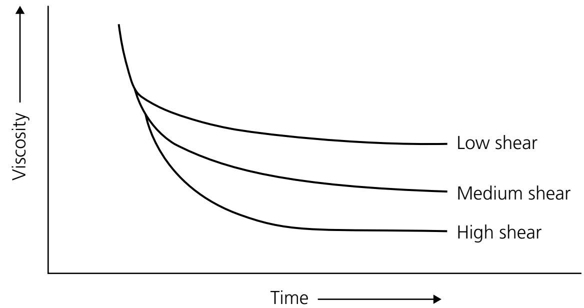

Figure 10.3 Illustration of the change of viscosity with time for conches with different energy inputs.

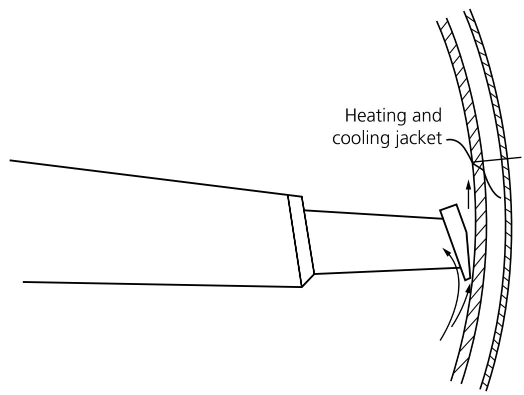

Figure 10.4 The chocolate mass being sheared by rotor arm wedge element against the conche wall.

Another property of high shearing systems is that they produce a lot of frictional heat within the material being mixed. This means that the temperature control system on high shearing conches becomes more critical, especially if a low temperature conching is needed for flavour reasons. In this case the ratio of the mass of the chocolate to the area of the conche wall being covered by it once again is important.

10.2.3.2 Elongational shearing

This action, which is a bit like buttering bread, is also important in that the particles are treated in a different way to that during the simple shearing (Figure 10.2). Some conches are designed to produce this type of shearing during the early part of conching in that they have wedge-shaped ends to their rotors (see Figure 10.4). At the beginning of conching the wedge cuts into the powdery material and smears it along the wall. Once the chocolate has become liquid the rotor is reversed, thus producing a higher shearing action within the mass. Other conches use extruder-type screw elements to smear the chocolate across the conche base.

10.3 The three phases of conching

Traditionally, conching is said to take place in three stages or phases, although not all occur for every recipe and all types of conche. The three phases are:
Dry phase: chocolate mass is crumbly, moisture is removed.
Pasty phase: chocolate is a thick paste, high work input required by the conche.
Liquid phase; high speed stirring to mix in the final fat and emulsifier additions.

The power and temperature curves of a traditional conching cycle are shown in Figure 10.5, together with the approximate times of the three phases.

10.3.1 Dry phase conching

The feed material normally enters the conche as a powdery material. Frequently a small amount of fat (approximately 1%) is placed in the conche at the beginning of filling. This together with the mixing action and rising temperature soon turn it into a crumbly mass.

At this stage it is relatively easy for moisture to escape provided that the conche is well ventilated. The initial moisture content of many milk chocolates is about 1.6% and if possible this must be lowered to less than 1%. Some authors (Ley, 1994) suggest that the viscosity continues to reduce even to a moisture content of 0.6%. Below about 0.8%, however, the moisture becomes very much harder to remove, and it may not be economically viable to do so.

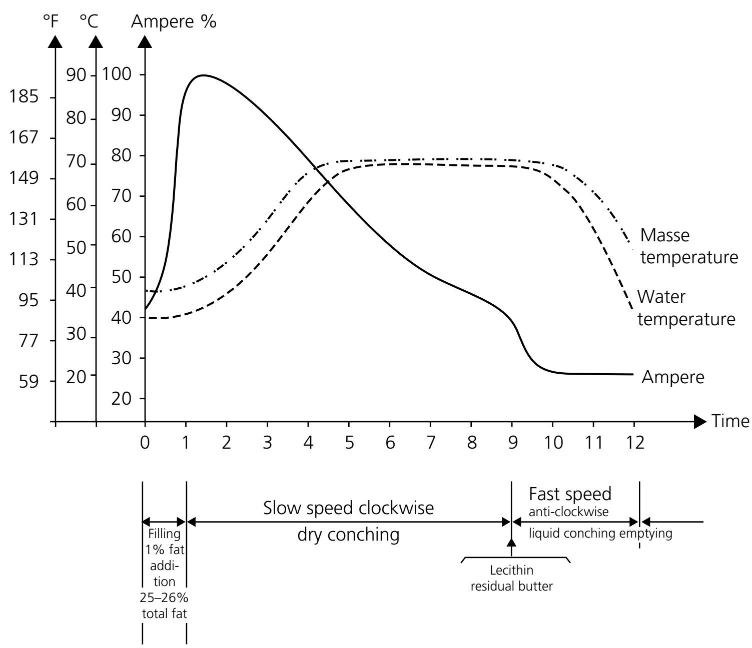

Figure 10.5 Graph showing the changes in conche amperage and water and chocolate mass temperature during a conche cycle (time in hours).