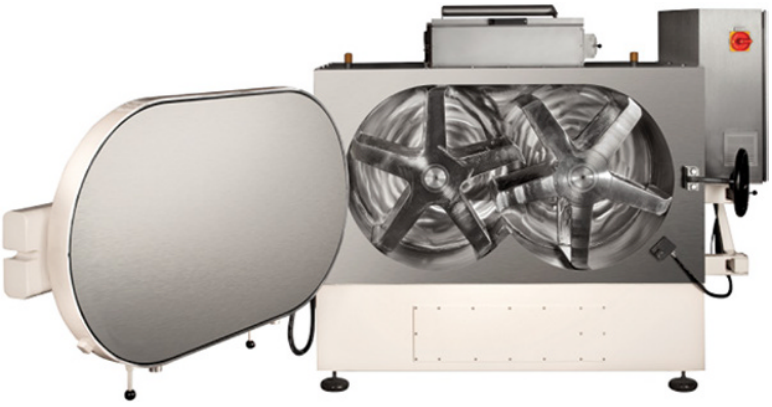

Figure 10.17 Laboratory type DRC2 conche (Thouet, part of Royal Duyvis Wiener Company). Source: Reproduced with permission of Royal Duyvis Wiener Company.

forces volatiles and undesired aromas to be removed. The motion of the two large conching rotors overlaps in the centre of the conche vessel giving very good mixing. The two conching elements are driven by a common gear box or by two geared motors (depending on the size of the conche). The discharge of the conche is situated at the deepest point of the vessel (two outlets) and the openings are closed by two special piston valves. Finally the louvres in the venting hood of the conche vessel can be turned by 90° using pneumatically operated drives. This machine comes in different batch sizes (from 3000 up to 12 000 kg) and the main drive power is between 90 and 250 kW, depending upon the loading.

In general, a twin-shaft design uses continuous movement of the chocolate mass to give a good aeration and drying efficiency. The moisture drops significantly and the unwanted volatile aromatic components are removed, provided that the conche is well ventilated with low relative humidity air. Together with de-agglomeration the process can produce low viscosity chocolate masses. Moreover contemporary conche design enables rotors to automatically slow down and avoid motor overload. At the same time the mass consistency or structure is maintained by the use of motors of multiple or continuously variable speeds. In the past, the risk of overload was managed by an experienced operator carefully adding fat or lecithin. This action often gave a high viscosity or high fat end-product due to moisture entrapment, inefficient de-agglomeration and incomplete phase transitions of amorphous structures and so on. As noted in Section 10.3, it is very important to maintain a given power intake/input over a long time. Once the initial power peak has started to decrease, servo-controlled machines increase the speed of rotation of the mixing shafts in order to obtain a constant power intake. This is aided by reversing the direction of movement of the rotors in combination with a novel paddle design.

10.4.8 Three shaft conches

One of the most widely used triple shaft conches is the Frisse-DUEC (Bühler AG; Figure 10.18). The abbreviation DUEC stands for Double-Overthrown Conche (Doppel-Ueberschlag Conche) whereas another variant is the so-called DUEC-G (Double-Overthrown Conche with synchronous gearing; Doppel-Ueberschlag Conche mit Gleichlaufgetriebe). The key difference between the two is the rotor tip speed. A higher tip speed reduces conching time and gives potential fat savings, due to optimal fat release producing better flow properties (viscosity and yield value, structural viscosity, viscosity at low and high shearing).

Both machines are based on three parallel rotors that run simultaneously and in opposed directions inside a triple vessel/trough. Specially designed conching tools perform mixing, aeration and shearing. The shearing effect is very efficient as it takes place both against the wall vessel and also within the meshing rotor tools. Intensive aeration and drying takes place as a result of an action similar to a gear pump (see Chapter 12) combined with a high power drive motor. Air is drawn into one shearing zone, forced through the mass and ejected in the other shearing zone. Due to this extensive shearing (impact on viscosity) and good aeration of the mass (impact on flavour), a substantial reduction of the actual conching time is possible.

The DRC-3 conche from Thouet (member of the Royal Duyvis Wiener Company) has a modified triple shaft design (Figure 10.19). Primarily, it is a

Figure 10.18 Conching paddles inside Frisse-DUEC conche. Source: Reproduced with permission of Bühler AG, Switzerland.