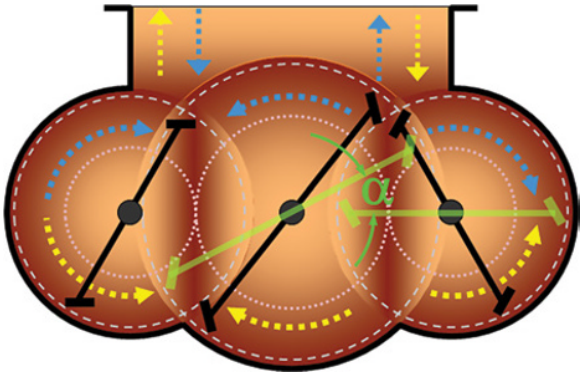

Figure 10.10 Illustration of triple shaft conche mode of operation depicting the movement of the conching paddles and the direction of the air flow. Source: Reproduced with permission of Bühler AG, Switzerland.

the mass appears to exhibit a breathing action as it changes to a pasty consistency. Intense shearing takes place between the conching paddles and against the vessel wall.

10.4.6 Single shaft conches

TNCE 13 (BSA Schneider-Industrie and Vetriebs GmbH) is an example of a single shaft conche. Specially designed conching paddles provide improved drying, plasticising and liquefying. The conche is frequency-controlled and is equipped with a water-cooled three phase motor with an efficient belt drive. The hollow shaft drive is directly connected to the conching shaft. The process is further optimised by incorporating a ventilation hood with a pneumatic flat slide to automatically adjust the ventilation throughout the conching process. Last, the speed of the rotor changes automatically with the load on the motor enabling it to run as fast as possible.

Carle and Montanari-OPM has also introduced a single horizontal shaft conche under the commercial name ALPHA. It has a capacity of 6000 kg. The drive system is electromechanically controlled for the main movements and the product discharge valve is pneumatically controlled. The rotation speed of the stirrer is adjusted by an inverter and it is automatically managed by the PLC in order to keep constant the absorbed power to the set limit value.

Thouet (Royal Duyvis Wiener Company) is an established chocolate machinery manufacturer making a single shaft dry conche type RC where the shaft is placed horizontally in the conching vessel which is made of thick walled tubular steel. Six specially profiled conching elements are mounted on the conching rotor at a fixed distance from the front wall of the vessel (Figure 10.11). This concept is claimed to work without pre-charging fats and surfactants/emulsifiers (e.g. lecithin, PGPR etc.). The agitator arm scrapes off the mass and distributes it evenly inside the vessel. Good final flow properties are achieved by using this dry concept followed by shear forces during the later stages. As agglomerates are broken and fat is released, a well dispersed suspension with a rich flavour is developed. The single shaft conche type RC can dry conche at both slow and

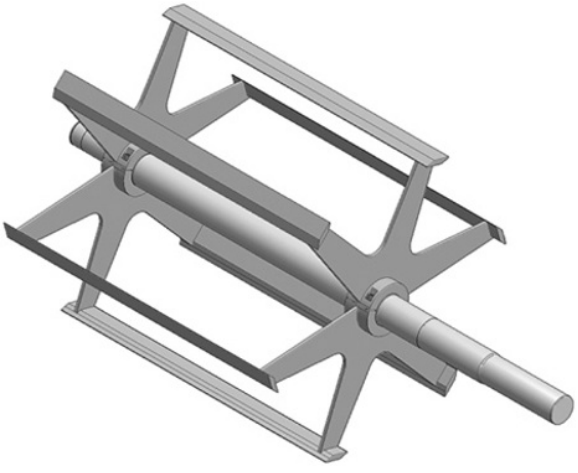

Figure 10.11 Conching paddle of type RC conche (Thouet, part of the Royal Duyvis Wiener Company).

high speeds. Different batch sizes are commercially available (1000–12 000 kg) and vessels are equipped with main drives with different power outputs (30–250 kW), depending upon the size.

The rotor of the single shaft conche Type RC has the same design and operation as the rotors of the two- and three-shaft conches of Thouet (Figures 10.17 and 10.19). Since there is only one large conching rotor, the drying phase may last longer than in the two-shaft execution. There are no significant differences in liquefaction times.

The Frisse-ELK single shaft conche (Bühler AG) has a unique design of conching paddles that can carry out the three key operations of mixing, shearing and aeration/drying.

As the mass is subjected to different conching phases the conching paddle's mode of operation changes. For instance, whenever the paddle or tool moves forward with the pointed part (R-tip) ahead, then mass is subjected to a kind of fluidisation due to the geometry of the ELK shovel design. Consequently, good drying and aeration takes place leading to a reduction of moisture and the stripping of unwanted volatile components. If the paddle or tool moves backwards with the wide curved part (L-tip) backwards, then shearing and plasticising are the main effects between the tool and the vessel wall (with strong particle–particle interactions) ensuring a good energy transfer irrespective of mass consistency (Figure 10.12).

During the process, several parameters are continuously monitored, for example the drive current, mass and water temperatures, motor speed and so on. During the feeding/filling phase, powder chocolate is conveyed into the vessel and then fat and/or emulsifier/surfactant additions such as lecithins, ammonium phosphatide and so on are added. The motor current is used to control the speed of the shaft in order to maintain a given mass consistency (providing a constant energy intake over time). As conching progresses, fat is eventually