sealed chamber through which the chocolate is conveyed. When the centre rotor is turned by the drive shaft these sealed chambers receive the chocolate to be pumped at the suction side of the pump and convey the medium in a uniform (non-pulsating) flow to the discharge port.

12.5.5 Pawl pumps

This type of pump is frequently used as a circulation pump in chocolate enrobers or to pump tempered chocolate. A gentle action is achieved by having a high conveying volume within the pump but operating at a very low speed. The central rotor is shaped so that two swept volumes of material are present within the pump. As the rotor turns, the material is pushed round the pump until it comes up against a scraper blade (Figure 12.7). This is forced against the rotor by a spring, which diverts the flow to the outlet and prevents the chocolate from re-circulating back in to the suction area.

These pumps are suitable for medium pressure applications with or without inclusions such as nuts and raisins.

12.5.6 Progressive cavity pump

The progressive cavity pump, often referred to by the specific makers name such as Moyno, has a single helical rotor rolling eccentrically in a double thread helix of twice the pitch length. When the rotor turns it forms a series of sealed cavities, 180° apart, these progress from suction to discharge as the single helix rotates. As one cavity diminishes, the opposing cavity is increasing at

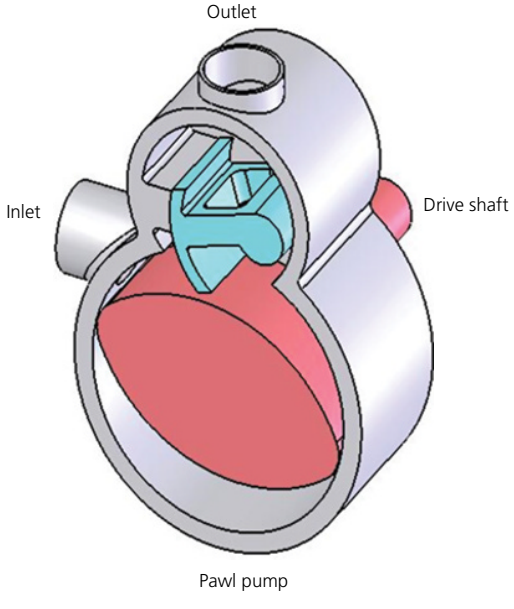

Figure 12.7 Operating principle of a pawl pump.

exactly the same rate: so the sum of the two is constant. This results in a pulsation-free flow which may contain particulate matter. The rotor is usually manufactured from hardened stainless steel and the stator from natural or synthetic rubber.

During continuous operation in a large-scale chocolate plant, wear of the stator may become a problem. This type of pump is versatile in small scale or pilot plants and it has been successfully used for metering applications. By increasing the length of the rotor–stator assembly it is possible to produce pumps for system pressures in excess of 30 bar.

12.5.7 Positive displacement piston and diaphragm pumps

The construction of this type of pump is illustrated in Figure 12.8. As the piston draws back, the lower valve lifts and liquid is pulled into the space created. On the return stroke, the lower valve is closed and the upper valve is opened, releasing the product in to the pipeline. By adjusting the rotational speed of the drive or the amount of eccentricity of the drive wheel, an accurate quantity of liquid can be displaced. This accuracy enables this type of pump to be used as a metering pump for cocoa mass and butter. In these cases the quantity of material to be moved is relatively small and the viscosity is low. However care should be taken when choosing this type of pump liquids that contain solid particulates such as nuts, which can catch in the valves.

Diaphragm pumps use positive displacement to move liquids. They are similar in construction to the piston pump, but are designed with a diaphragm that seals the pumping chamber from the piston. This eliminates the problem of sealing the reciprocating piston, minimising the possibility of leakage. The diaphragm is moved by means of a mechanical linkage, compressed air or a food grade liquid. Diaphragm pumps will stall if the outlet pressure becomes too great. They can also be used to pump chocolate with solid inclusions.

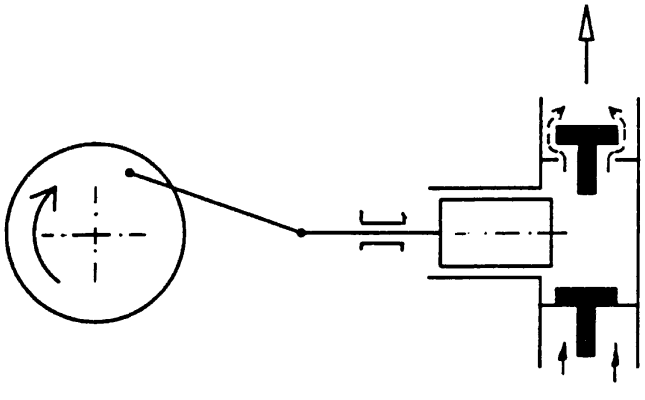

Figure 12.8 Positive displacement reciprocating plunger pump.