mould to improve the detection level is not an option as it weakens the mould and increases the risk of breakage.

Electronic chips have been sealed into moulds for various purposes:

- Measuring the hours the moulds have run,
- Counting the times the moulds have been washed,
- Signalling to the depositor the amount of chocolate to be deposited in each cavity when the next mould is different and requires more or less chocolate.

14.3 Enrobing

14.3.1 Background

Until the early l900s chocolates were coated by hand, or by automated batch techniques copying hand-dipping methods. The traditional hand-dipping of chocolate, with batch tempering, results in an attractive finish that is difficult to copy. The first enrober is credited to Magniez (1901) and was produced by A. Savy Jeanjean et Cie. This machine, the "Standard Enrober", was also supplied by the agents Baker Perkins and manufactured by the National Equipment Co. of America. Such was the advanced nature of the machine that many were sold throughout the world, and it became the basis for all future designs of enrober with the principles little changed to this day. The Savy enrober had many features, which are lacking on present-day enrobers, though often for reasons of simplicity. For example, all of the many rollers were driven and scraped, the blower to remove excess chocolate was of a turbo layout, the rotor in the blower being the same width as the belt and a sideways driven movement of the delivery belt produced zigzag decorative markings from a piping system.

Whilst the basic components of an enrober have not changed significantly over the years, the methods used to control their operation and the degree of precision possible have changed significantly, accompanied by a modest increase in throughput. Manufacturers are continually improving the hygiene aspects of their designs and the techniques to reduce chocolate build up inside the enrober, a common problem with this technology. Energy saving is now given serious attention by the end users, thus more efficient motors and better hood designs for temperature control are being developed (Bean, 2009).

Enrobers are provided for the smallest producer to the largest and there is a wide variety of different designs to meet all requirements. Belt widths from 125 to 2600 mm (5 to 110 in) are available and the variety of accessories that can be added both before and after the enrober is vast and increasing.

Many modern enrobers have two or more curtains, either from one hopper or two. As long as all the coats of chocolate are added whilst liquid, they will blend together as one.

However, double enrobing required two separate enrobers with a cooler in between them. This gives a discontinuity in the coating, which provides a better

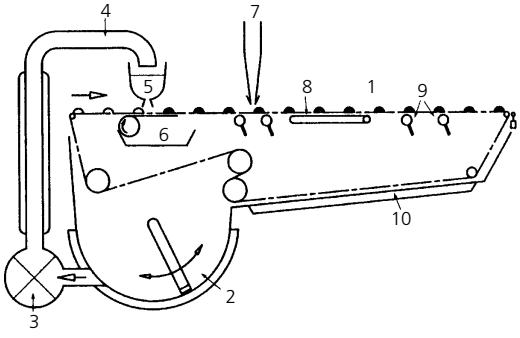

Figure 14.16 Components of an enrober (Sollich, Germany): 1. wire grid conveyor belt, 2. reservoir tank, 3. chocolate pump, 4. riser tank, 5. top flow pan, 6. bottoming trough, 7. air nozzle, 8. grid shaker frame, 9. licking rolls, 10. heated extension trough.

moisture or fat migration barrier. It also allows the second coat to bridge any discontinuities in the first, and gives the possibility of using different materials in the two layers, either having different colours, or different barrier properties.

14.3.2 Basic layout of an enrober

The sweets entering the enrober are transferred from a plastic feed belt onto a wire mesh belt and pass under one or more curtains of chocolate (Figure 14.16). There is a plate or a trough fitted with a roller underneath the belt to ensure controllable coating of the underside of the sweet. The excess masse from the curtain falls through the wire mesh belt into a sump, and is recirculated. Part of the masse is diverted through a de-temperer and is then re-tempered: blending of the freshly tempered and recirculated streams controls the overall level of temper in the enrober.

After the curtain, excess chocolate is forced off the product by an air blower and a licking roller is used to control the amount of masse left on the underside of the sweet. There is normally a vibrator after the blower to remove excess chocolate and to improve the appearance of the sweet; Finally there should be a de-tailing roller between the end of the wire belt and the start of the cooler belt.

14.3.3 Enrobers with inbuilt temperers

Until the 1980s, enrobers generally had a built-in temperer and indeed many units still incorporate such a device today, though usually only those with a lower throughput (Figure 14.17). The main advantages are compactness, lower capital cost plus simple and rapid installation.

Tempering and de-tempering are done by worm screws which tend to have a limited throughput and are more difficult to zone and control accurately than conventional modern high-shear temperers. Generally enrobers with internal temperers use a ratio of between 1:6 and 1:8 fresh to recirculated masse.