METHOD AND APPARATUS FOR MAKING A CONFECTIONERY PRODUCT

Figure 1

Abstract: A method and apparatus for making a confectionery product. The method comprises depositing molten or semi-solid confectionery into a mould (23) and shaping the confectionery by applying a gas jet (36) thereto. The temperature of the gas jet (36) is lower than that of the molten confectionery. The confectionery may be chocolate. The system for shaping confectionery comprises a shaping apparatus (10) having a body (12). The body (12) comprises a gas inlet (14) and at least one depositor (16). The gas inlet (14) is in fluid communication with at least one gas outlet (18) for providing at least one gas jet. The at least one depositor (16) is for depositing confectionery and/or filling material.
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Method and Apparatus for Making a Confectionery Product

The present invention relates to a method and apparatus for making a confectionery product. In particular, the invention relates to a method of shaping a confectionery product using a gas jet, and apparatus for use in the method.

Popular confectionery products include confectionery shells containing a filling, for example, a chocolate shell containing a caramel or other contrasting filling. Chocolate shells are typically produced either by shell moulding or by cold stamping.

In shell moulding (also referred to as mould inversion), a mould cavity in a mould tray is completely filled with molten chocolate then partially cooled so that the chocolate which is in contact with the mould cavity sets. The mould is then inverted and shaken so that the molten chocolate in the centre of the mould pours out, leaving behind a chocolate shell. This process is not efficient since it requires a large amount of excess chocolate which must be re-used. The resulting shell may not be uniform, and the process is very messy.

Cold stamping is more efficient since it requires only a small amount of excess chocolate mass, and the resulting shells are often very uniform. In this process, molten chocolate is deposited into a mould and then pressed into shape using a chilled stamp or die, which also functions to solidify the chocolate. The stamp is then removed, leaving a solid or semi-solid chocolate shell. However, this method relies on strengthened moulds and dies, thus requiring a high initial investment. Another problem is the risk of liquid condensing on the surface of the stamp, which can be extremely detrimental to the final product. To avoid this, the process must be carried out in a low-humidity atmosphere. Maintaining the stamp at a low temperature (e.g. 0°C or less) also consumes large amounts of energy.

The present invention seeks to mitigate some of the problems described above.

According to a first aspect of the present invention, there is provided a method of forming a confectionery product, the method comprising:

- depositing molten or semi-solid confectionery into a mould and
- shaping the confectionery while at least semi-solid by applying a gas jet thereto, wherein the temperature of the gas jet is lower than that of the confectionery.
According to a second aspect of the present invention, there is provided the use of a gas jet to shape molten or semi-solid confectionery.

By "shaping", it will be understood that the gas jet applies a force to the confectionery that is sufficient to displace the confectionery within the mould. In other words, the gas jet changes the overall 3-dimensional shape of the confectionery material within the mould. Since the temperature of the gas jet is lower than that of the confectionery, the confectionery is simultaneously cooled.

The gas jet is applied to the confectionery until the confectionery is solidified to an extent that is sufficient for it to retain the shape imparted by the gas jet once the gas jet is no longer applied. In some embodiments, the gas jet is applied until the confectionery is partially solidified (i.e. semi-solid). Alternatively, the gas jet may be applied until the confectionery has completely solidified.

By using a gas jet to shape the confectionery, no equipment comes into contact with the confectionery other than the mould. The method avoids the need for a large excess of confectionery material, as is required by shell moulding. It also overcomes the problem of providing a low-humidity atmosphere and is more energy-efficient since it does not rely on a low-temperature stamp, as required by cold stamping.

It will be understood that the following statements may apply equally to the first and second aspects of the invention as appropriate, unless otherwise stated.

In some embodiments, the method comprises depositing molten confectionery into the mould. In these embodiments, the gas jet is applied to the confectionery until the confectionery is at least partially solidified.

In some embodiments, the method comprises depositing confectionery in a semi-solid state. As used herein, "semi-solid" will be understood as meaning that the confectionery is not entirely molten and that some solid crystals have formed in the confectionery mass, but that the confectionery is still flowable (for example, having similar flow properties to a tempered chocolate mass at 28 °C).

In some embodiments, the method comprises applying at least 2, at least 4, at least 6, at least 10 or at least 15 gas jets to the confectionery. It will be appreciated that the number, strength and direction of the gas jets, and the length of time for which
they are applied, will be selected according to factors including the desired shape of the confectionery product and the mass of the confectionery deposited. The use of two or more gas jets facilitates the shaping of the confectionery by providing a more even flow of gas, and by providing multi-directional forces on the confectionery. It will also be appreciated that multiple gas jets may be applied to a confectionery mass within a single mould cavity, or that each of a plurality of gas jets may be applied to a different mould cavity.

The gas jet(s) produces a gas bed, i.e. a 3-dimensional region of increased pressure (relative to ambient pressure), the force of which is sufficient to displace the confectionery within the mould cavity and cause it to be shaped. The force imparted by the gas jet on the confectionery must be sufficient to shape the confectionery but not so high that it entirely displaces the confectionery out of the mould or creates holes in the confectionery.

In some embodiments, the pressure of the gas jet(s) is at least 1.5 bar (150000 Pa), at least 2 bar (200000 Pa), at least 3 bar (300000 Pa) or at least 4 bar (400000 Pa). In further embodiments, the pressure is no more than 10 bar (1000000 Pa), no more than 8 bar (800000 Pa) or no more than 6 bar (600000 Pa). In preferred embodiments the pressure is from 2 to 6 bar (200000 to 600000 Pa).

In some embodiments, the velocity of the gas in the gas jet(s) as measured at the point of exit of a gas outlet, aperture or nozzle is at least 2, 4, 6, 8, 10, 12, 14, 16, 18 or 20 m/s. In further embodiments the flow rate is no more than 25, 20, 15 m/s, 12 or 10 m/s. In some embodiments the velocity is from 8 to 20 m/s or from 15 to 20 m/s.

It will be appreciated that the gas jet is applied to the confectionery for a length of time which is sufficient to form the confectionery into the desired shape (without de-tempering the mass in the case of chocolate), and to solidify the confectionery to an extent which allows the confectionery to retain that shape. Thus, the length of time the gas jet is applied will depend on the type and mass of the confectionery, the temperature of deposition of the confectionery (i.e. whether the confectionery is molten or semi-solid), the velocity/temperature of the gas jet and the shape required. In some embodiments, the gas jet is applied to the confectionery for at least 0.5 seconds, at least 1 s, at least 2 s, at least 3 s, at least 5 s or at least 8 s. In further embodiments, the gas jet is applied to the confectionery for no more than 15, 10, 7,
5, 3, 2.5 or 2s. In one embodiment the gas jet is applied to the confectionery for from 1 to 3s.

The gas jet may be applied continuously to the confectionery during the shaping process, or it may be pulsed with intervals of from 0.1 to 3 or from 0.5 to 1 seconds. For example, the gas jet may be applied in bursts of from 0.5 to 5 seconds, with intervals of from 0.1 to 1 second.

The force applied to the confectionery during the shaping process may be constant, or it may be variable. In some embodiments, the pressure of the gas jet remains constant during the shaping process. In other embodiments, the pressure of the gas jet is increased or decreased during the shaping process, in order to vary the force applied to the confectionery until the desired shape is achieved. For example, a gas jet may be applied in 5 second bursts, the gas jet having an initial pressure of 6 bar (600000 Pa), which is linearly decreased to a pressure of 4 bar (400000 Pa).

The gas jet(s) may be provided by an apparatus comprising one or more gas outlets. It will be appreciated that the position of the gas outlets relative to the confectionery may be adjusted according to the type of confectionery, the pressure of the gas and the shape required. The force applied to the confectionery by the gas jets may be varied by changing (increasing or decreasing) the distance between the mould/confectionery and the gas outlets, and/or by changing the pressure of the gas, as described above. In some embodiments, after the confectionery has been deposited into the mould, the method comprises increasing the force applied to the molten confectionery by the gas jet(s). This may be achieved by reducing the distance between the gas outlets and the confectionery within the mould, or by increasing the velocity of the gas. In one embodiment the distance between the confectionery and the gas outlets is from 5 to 100mm, from 10 to 50mm, from 15 to 30mm or approximately 20mm.

In some embodiments, a predetermined mass of confectionery is deposited into the mould. The mass deposited will depend on the size and shape of the desired product. The mass of confectionery deposited may be equal to the mass required to form the product. In some embodiments, an excess mass of confectionery is deposited into the mould. This takes into account the displacement of a small amount of confectionery out of the mould during the shaping process.
It will be appreciated that a "mould" may comprise a single cavity, or it may comprise multiple cavities. For example, a typical 620mm x 320 mm mould may comprise 12 cavities for moulding 100 g confectionery tablets.

To form an individual centre-filled product, the mass deposited into the mould (or a mould cavity of a multi-cavity mould) may be from about 2 to about 10 grams, or from about 3 to about 7 grams (e.g. about 6 grams). Alternatively, the mass deposited into the mould cavity may be from 15 g to 150 g, from 30 g to 100 g or from 50 g to 75 g (e.g. to form confectionery tablets). It will be appreciated that for such relatively large confectionery products, multiple gas jets may be applied to shape the confectionery mass. These gas jets may be combined in order to form a single shape (e.g. a single hollow) in the confectionery mass, or the multiple gas jets may be applied to form multiple shapes (e.g. a plurality of hollows) in the confectionery mass.

The gas may be any gas which is compatible with the confectionery, for example air, carbon dioxide or an inert gas such as nitrogen or argon. As used herein "inert" will be understood as meaning that the gas is unreactive with the confectionery under the conditions used. In particular embodiments, the gas is air.

The temperature of the gas jet is lower than that of the confectionery in order to cool and at least partially solidify the confectionery. In some embodiments, the gas jet is applied to the confectionery until the confectionery has partially solidified. In such embodiments, the method may further comprise cooling the shaped confectionery until it has completely solidified. The cooling may be carried out at ambient temperature or under reduced temperature, for example in a cooling tunnel. In alternative embodiments, the gas jet is applied to the confectionery until the confectionery has completely solidified. Partial (or complete) solidification of the confectionery in the mould allows the confectionery to retain its shape in the absence of the gas jet, and also prevents backflow of the confectionery caused by the force of the gas jet.

As will be appreciated by the skilled person, the temperature of the gas jet must be selected according the type of confectionery, the temperature of the confectionery at the moment of deposition, the shape formed and the extent of solidification required. For example, in embodiments wherein the gas jet is used to form a confectionery shell, the temperature of the gas jet will also depend on the shell thickness.
However, the temperature of the gas jet should not be so low that the confectionery solidifies before it is shaped by the gas jet. In some embodiments, the temperature of the gas jet is from 0 °C to 25 °C, from 2 °C to 20 °C, from 3 °C to 15 °C or from 5 °C to 10 °C.

In some embodiments the gas jet has a humidity of no more than 80%, no more than 70% or no more than 60%. In further embodiments, the gas jet has a humidity of less than 60%. Controlling the humidity of the gas jet helps to prevent the formation of condensation on the gas outlet or the mould.

In some embodiments, the gas jet is applied to the confectionery so as to form a hollow in the confectionery. This may be achieved by applying one or more gas jets towards the centre of the confectionery mass in the mould (or mould cavity) such that the confectionery is displaced outwardly and up the sides of the mould. In this way, a confectionery shell is formed.

In some embodiments, the method comprises shaping the confectionery by applying two or more gas jets in sequence. For example, a first gas jet (or a first group of gas jets) may be applied to the confectionery followed by a second gas jet (or second/further group of gas jets). The second gas jet(s) may have a different temperature, pressure and/or application time to the first gas jet(s). In some embodiments, the method comprises applying a series of gas jets to the confectionery, wherein each subsequent gas jet has a lower temperature, a higher or lower pressure, and/or is applied to the confectionery for a greater or lesser amount of time.

The method may further comprise depositing a filling into the hollow or shell. The filling may be deposited after the confectionery has been completely solidified. Alternatively, the filling may be deposited while the confectionery is still partially solid. In some embodiments, the filling is deposited less than 10 seconds, less than 5 seconds, less than 3 seconds or less than 2 seconds after the shaping of the confectionery (i.e. after the gas flow is stopped). The filling may be deposited by a depositor which forms part of an apparatus comprising the gas outlets. The use of an apparatus which both provides the gas jets and deposits the filling allows the filling to be deposited almost immediately after the gas flow stops, thereby improving the efficiency of the process.
The filling may be a solid (e.g. fruit, nuts), a liquid (e.g. liqueur) or a paste (e.g. fondant). It may be savoury or sweet. In particular, the filling may be a sweet material such as, but not limited to, marshmallow, caramel, toffee, chocolate, fudge, praline, mousse, fondant, nougat, Turkish delight, jelly, candy or honeycomb.

Some fillings, such as aerated fillings, form peaks when deposited into confectionery shells or hollows. Fillings of moulded confectionery products are conventionally flattened using vibration. However, vibration can cause aerated fillings to lose aeration. The present inventors have found that a gas jet can also be used to flatten fillings. Thus, in further embodiments, the method comprises applying a gas jet to a filling deposited in the shaped confectionery hollow so as to even out or flatten the filling. This is particularly advantageous for aerated fillings since the use of a gas jet avoids a loss of aeration.

In some embodiments, the method further comprises depositing molten or semi-solid confectionery onto the filled confectionery hollow or shell to form a back or lid. The confectionery which forms the back/lid may be the same as that which forms the shell, or it may be different. For example, the shell may be formed from white chocolate and the back/lid may be formed from dark chocolate. In a further embodiment, a gas jet is applied to the confectionery in order to flatten or smooth the back/lid. This avoids the need for depositing an excess amount of confectionery and scraping away the excess to provide a smooth surface. The gas jet may also serve to at least partially solidify the back/lid.

In some embodiments, the filling and the confectionery which forms the lid of the product are deposited simultaneously using one-shot depositing. One-shot depositing is a commonly used technique in the art and will be known to a skilled person.

In some embodiments, the confectionery is chocolate. As used herein, the term 'chocolate' is intended to refer to chocolate compositions based on cocoa butter, as well as to chocolate-like compositions in which some or all of the cocoa butter is replaced by cocoa butter equivalent (CBE), cocoa butter substitute (CBS), cocoa butter replacer, a non-metabolisable fat, or a non-fat ingredient. Such compositions are well known in the art. Typically, the chocolate will be milk, plain or white chocolate.
In some embodiments, the method is carried out using an apparatus in accordance with the third aspect of the invention, or a system in accordance with the fourth aspect of the invention.

According to a third aspect of the present invention there is provided a system for shaping confectionery, the system comprising a shaping apparatus having a body comprising:
a gas inlet in fluid communication with at least one gas outlet for providing at least one gas jet; and
at least one depositor for depositing confectionery and/or filling material.

The shaping apparatus is capable of shaping deposited confectionery through the force of one or more jets of gas without any physical contact between the confectionery and the apparatus. The shaping apparatus may thus be described as a "gas stamp". In use, the shaping apparatus may be positioned over a mould tray comprising one or more mould cavities containing confectionery so that the gas jets produced by the outlets contact the surface of the confectionery. Such a "gas stamp" is advantageous in that it reduces the amount of equipment that comes into contact with the confectionery, thereby reducing cleaning and reducing the possibility of contamination of the confectionery. The gas stamp also operates at ambient temperatures, and does not require cooling like a conventional stamp for use in cold stamping. The energy requirements of the system of the invention are therefore reduced compared to a conventional cold stamp.

The body may comprise a plurality of gas outlets. In some embodiments, the body comprises at least 2, at least 4, at least 6, at least 8, at least 10 or at least 15 gas outlets.

The gas outlet(s) may be connected to the gas inlet via one or more conduits which pass through the body of the shaping apparatus. In some embodiments, the body comprises a pressure chamber situated between the gas inlet and the gas outlet(s). This helps to homogenize the velocity of the gas across the body of the shaping apparatus so that the velocity of the gas jet produced by each gas outlet is substantially the same. The gas inlet may directly lead into the pressure chamber.

Each gas outlet may be connected to the pressure chamber by a conduit.
In some embodiments, the gas outlets are positioned in an exterior surface of the body. In some embodiments, the exterior surface of the body has a convex or a concave shape. A convex or a concave surface may conveniently angle the gas jets relative to the confectionery in the mould to aid shaping of the confectionery. In other embodiments, the exterior surface of the body in which the gas outlets are located is substantially planar.

In some embodiments, the at least one depositor is constituted by a pipe having at least one opening through which confectionery and/or filling material is released. The body may comprise at least 2, at least 4, at least 6, at least 8, at least 10 depositors. Alternatively, the body may comprise a depositor having at least 2, at least 4, at least 6, at least 8, at least 10 depositor openings therein.

The depositor opening(s) may be positioned in an exterior surface of the body. For example, the gas outlets and the opening(s) of the depositor may be flush with, or recessed in, the body of the apparatus.

In alternative embodiments, the gas outlets, and/or the depositor, may comprise nozzles which project beyond the exterior surface of the body.

In some embodiments, the exterior surface of the body comprises two or more zones or sectors, each of which comprises at least one depositor or depositor opening, and at least one gas outlet. The number and arrangement of zones may be arranged according to the number and arrangement of mould cavities within the mould tray. For example, for each mould cavity there may be provided a corresponding zone in the exterior surface of the body. Alternatively, a single zone may serve two or more mould cavities.

It will be appreciated that the arrangement of the gas outlets in the exterior surface of the body will also be selected according to the shape of the confectionery product required. For example, where it is desired to produce a confectionery shell, the gas outlet(s) may be positioned in the body to align with the centre of the mould cavity, so that the gas jet produced is applied to the centre of the confectionery mass.

In some further embodiments, the shaping apparatus comprises at least two bodies, at least 4 bodies, at least 6 bodies, or a plurality of bodies (i.e. a collection of individual "gas stamps"), each comprising a gas inlet in fluid communication with at
least one gas outlet for providing at least one gas jet and at least one depositor for
depositing confectionery and/or filling material. The number, size and arrangement
of the bodies may be selected in accordance with the design of the mould tray. For
example, each body may be configured to shape a mass of confectionery within a
single mould cavity. Alternatively, a single body may be configured to shape the
confectionery deposited in multiple mould cavities. The bodies may be arranged in
series in order to provide sequential gas jets which may have different temperatures,
pressures or application times. For example, the apparatus may comprise a first
body for providing a first gas jet at a first temperature, pressure or for a first amount
of time, and a second body for providing a second gas jet at a second temperature,
pressure or a second amount of time.

The gas outlets may have a cross section of any shape. For example, the cross
section of the gas outlets may be circular, square, rectangular, triangular, elongate or
irregular in shape. In some embodiments, the gas outlets are circular. It will be
appreciated that the diameter of the gas outlets, in addition to the flow rate of the
gas, will influence the pressure of the gas jets provided by the outlets. In some
embodiments, the diameter of the gas outlets is from 1 mm to 10 mm, from 2 mm to
7 mm or from 3 mm to 5 mm.

The angle at which the gas jet is applied to the confectionery will influence the shape
of the confectionery. In some embodiments, the or each gas outlet is parallel to, or
aligned with, the exterior surface of the body (i.e. the angle of the outlet is 0° relative
to the exterior surface of the body). Thus, when in use the body is held substantially
horizontally and positioned directly above (and parallel to) a mould, the gas jet will be
applied perpendicularly to the surface of the confectionery. In further embodiments,
the or each gas jet is angled relative to the exterior surface of the body. Thus, when
the body is held horizontally and positioned vertically above (and parallel to) a mould,
the gas jet will be angled relative to the surface of the confectionery. The angle of
the outlet may be from 0° to 90° relative to the exterior surface of the body. In some
embodiments, the angle of the outlet is at least 10°, at least 20°, at least 30° or at
least 40°, relative to the exterior surface of the body. In other embodiments, the
angle of the outlet is 0°. Where at least two gas outlets are provided, the gas outlets
may be angled differently to each other. For example, one or more gas outlets may
have an angle of 0° relative to the exterior surface of the body, while one or more
other gas outlets has an angle of more than 0° relative to the exterior surface of the
body. The use of multiple outlets with different angles results in the application of
gas jets to the confectionery from slightly different directions. This facilitates shaping of the confectionery.

In some embodiments, the shaping apparatus and/or the system comprises a temperature control means for controlling the temperature of the body. Controlling the temperature of the body may be useful to prevent a change in the temperature of the gas as it passes through the body between the gas inlet and outlets.

In some embodiments, the shaping apparatus and/or the system comprises a temperature control means for controlling the temperature of the gas. It may be desirable to heat the gas (for example, if the gas is very cold at the point of supply) so that the gas jet does not solidify the confectionery before it has been shaped. Alternatively, it may be desirable to cool the gas to accelerate solidification of the confectionery. The temperature control means may thus comprise a heater and/or a chiller. The use of a gas jet to both shape and solidify the confectionery is particularly advantageous since it mitigates the need for an additional cooler. Thus, in some embodiments, the gas jet also constitutes a cooler. The temperature control means may further comprise a thermometer for measuring the temperature of the gas, and/or a controller for controlling the heater and/or the cooler. For example, the temperature control means may be provided on a line between the source of gas and the stamp.

The system may further comprise a source of a confectionery and/or filling material in fluid communication with the depositor(s) of the body of the shaping apparatus, for example via at least one pipe. For example, the confectionery/filling may be supplied to the depositor via one or more lines which connect the depositor to a tank in which the confectionery/filling is stored. In embodiments wherein the confectionery is chocolate, the chocolate may pass through a temperer prior to being supplied to the depositor. The mass of confectionery/filling deposited may be regulated either by valves or by a valve/piston combination, as is conventional in the art.

The system may additionally comprise a source of gas in fluid communication with the gas inlet of the body of the shaping apparatus, for example via at least one gas line. The flow of gas between the source of gas and the body may be controlled by at least one valve. The source of gas may be pressurised. The velocity of the gas in the gas jet(s) may be controlled by one or more valves.
The system may further comprise a mould. The mould may be any standard mould tray used in the industry, comprising at least one mould cavity. The mould tray may be made from any suitable material, for example polycarbonate. In some embodiments the mould tray comprises a plurality of mould cavities. The mould tray may comprise at least 10, at least 20, at least 50 or at least 100 cavities.

The depositor may be arranged to deposit confectionery and/or filling material into the mould. For example, the body of the shaping apparatus may be positioned so that the or each depositor is directly above the mould, or that the opening(s) of the or each depositor corresponds to the position of the mould cavities.

Similarly, the gas outlets may also be arranged to direct a gas jet towards the mould cavity. In some embodiments, the body of the shaping apparatus is arranged so that the gas outlets are positioned directly above the mould, or so that one or more gas outlets is positioned directly above each mould cavity. The gas outlets may be positioned at a distance of from 5 mm to 300 mm, from 10 mm to 200 mm, or from 25 mm to 50 mm from a top surface of the mould. In further embodiments, the body of the shaping apparatus is arranged so that the gas outlets are positioned below a top surface of the mould (i.e. within the mould cavity).

In some embodiments, the system further comprises a moveable support on which the shaping apparatus is mounted. This allows vertical and/or horizontal movement of the shaping apparatus, so that the distance between the gas outlets and the mould can be adjusted. The moveable support allows the shaping apparatus to be moved (e.g. lowered/raised) towards or away from the mould tray before and/or during the application of the gas jets to the confectionery. Lowering of the shaping apparatus towards the mould during the shaping process increases the control over the shaping process by gradually increasing the force/pressure applied to the confectionery by the gas jets. This is particularly advantageous where the confectionery is being shaped into a shell since it enables gradual building of the hollow.

The mould itself may also be movable. In some embodiments, the system further comprises a conveyor on which the mould, or a plurality of moulds, is positioned. In use, the conveyor may transport the moulds until they are positioned beneath the shaping apparatus and the mould cavities are aligned with the gas outlets. After the confectionery has been shaped by the gas jets, the conveyor may transport the moulds to the next stage of the process, for example filling, further coating or cooling.
The system may further comprise a cooler. A cooler may be required to complete the solidification of the confectionery in embodiments where the gas jets only partially solidify the confectionery. In some embodiments the cooler is a cooling tunnel. However, as mentioned above, the gas jet(s) may also function to cool and solidify the confectionery, in which case an additional cooler may not be required. Thus, in some embodiments, the shaping apparatus does not comprise a separate cooler (other than the gas jets themselves).

Embodiments of the invention will now be described with reference to the accompanying figures in which:

Figure 1 is a schematic side cross-sectional of a system comprising a shaping apparatus and a mould tray;

Figure 2 is a schematic underside view of the shaping apparatus of Figure 1;

Figure 3-6 show the system of Figures 1 and 2 in use;

Figure 3 is a schematic side cross-sectional view of the system of Figure 1, prior to shaping a chocolate mass deposited in the mould tray;

Figure 4 is a schematic side cross-sectional view of the system of Figure 1, being used to form a hollow in the chocolate, thereby providing a shell;

Figure 5 is a schematic side cross-sectional view of the system of Figure 1, during deposition of a filling material into the chocolate shell; and

Figure 6 is a schematic side cross-sectional view of the system of Figure 1, after deposition of the filling material into the shell.

Figures 1 and 2 show an embodiment of a system in accordance with the present invention comprising a shaping apparatus 10 and a mould tray 23. The shaping apparatus 10 has a body 12 comprising a gas inlet 14, two depositors 16 and a plurality of gas outlets 18. The depositors 16 are constituted by tubes 20 which pass through the body 12 and which are connected to a source of confectionery and filling material (not shown). The depositors 16 have terminal openings 22 from which confectionery or filling material is deposited into a mould tray 23. Gas entering the body 12 through the gas inlet 14 is received into a pressure chamber 24. The pressure chamber is connected to the gas outlets 18 via a series of conduits 26.

The body 12 has a planar lower surface 28 in which the gas outlets 18 and the depositor openings 22 are located. As shown in Figure 1, the gas outlets 18 and the
depositor openings 22 are flush with the lower surface 28 of the body 12, although it will be appreciated that it alternative embodiments the openings 22 and/or gas outlets 18 may protrude from, or be recessed into, the body 12. As can be seen from Figure 2, the lower surface 28 of the body 12 comprises two identical zones 30, each zone 30 containing a central depositor opening 22 and half of the gas outlets 18, which are arranged in a regular pattern around the depositor opening 22.

In the embodiment shown in Figure 1, molten or semi-solid chocolate 32 is deposited through the openings 22 of the depositors 16 and into the empty mould cavity 34 of the mould tray 23. In alternative embodiments, chocolate (or other confectionery) may be deposited into the mould cavity 34 prior to the mould tray 23 being positioned beneath the apparatus 10.

A method of forming a confectionery product, using the system described herein, may be carried out as follows. Once the chocolate 32 has been deposited into the mould cavity 34 and is positioned directly beneath the shaping apparatus 10, the shaping apparatus 10 is moved downwardly towards the mould 23 (in the direction of the arrow, A1), as shown in Figure 3. At the same time, gas jets 36 are produced from the gas outlets 18. In the embodiment shown, the direction of the gas flow is perpendicular to the lower surface 28 of the body 12, and perpendicular to an upper surface 38 of the mould 23.

The shaping apparatus 10 is moved downwardly until the body 12 is partly is received within the mould cavity 34 but the lower surface 28 of the body 12 is not in contact with the chocolate 32 therein, as shown in Figure 4. This results in the formation of a gas bed 38, i.e. a region of increased pressure between the surface of the chocolate 32 and the lower surface 28 of the body 12, which displaces the chocolate outwardly and up the sides of the mould cavity 34. Since the temperature of the gas jets 36 is lower than the temperature of the chocolate 32 at the time of deposition, the chocolate 32 is cooled by the gas and starts to solidify. The chocolate is thus shaped into a shell 40 by the shaping apparatus 10, which acts as a gas stamp, without physical contact between the chocolate 32 and the surface 28 of the stamp.

After shaping of the chocolate shell 40, filling material 42 is released into the chocolate shell 40 through the depositors 16, as shown in Figure 5. The shaping apparatus 10 is moved away from the mould tray 23, in the direction of the arrow A2.
The shaping apparatus 10 may be moved before, after, or at the same time as deposition of the filling material 42. A chocolate shell 40 containing a filling material 42 is thereby produced, as shown in Figure 6.

Example 1: Proof of concept
The use of a gas jet to form a chocolate shell was tested. Molten milk chocolate was deposited into one of a plurality of hemispherical mould cavities within a mould tray, until the cavity was approximately half filled. An air tube providing a stream of air (i.e. a gas jet), having a pressure of 6 bar and a temperature of 20 °C, was positioned directly above the centre of the chocolate mass. The air tube was then lowered by hand towards the mould until the pressure of the air was sufficient to cause displacement of the chocolate within the mould cavity. At this point the distance between the tip of the tube and the top surface of the mould was 5 mm. The stream of air was applied for 3 seconds, until the chocolate was displaced up the sides of the mould cavity, forming a hollow, and until the chocolate was partially solidified. After the air tube was lifted away from the mould, the chocolate retained the shape imparted by the gas jet, thereby providing a chocolate shell into which filling material could subsequently be deposited.

Example 2
An air rig was employed to provide compressed air (6 bar, 20°C) at controlled pressure and flow rates. Tempered chocolate was deposited into hemi-spherical moulds and an air jet was applied from a nozzle having a single central hole held 2cm from the chocolate. The speed to the air jet was increased to determine when the chocolate began to yield.

<table>
<thead>
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<th>Comparative example 1</th>
<th>Example 2</th>
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<td>Volumetric flow</td>
<td>0.000385 (=23 litres per minute)</td>
<td>0.000667 (=40 litres per minute)</td>
</tr>
<tr>
<td>Nozzle radius (m)</td>
<td>0.0035</td>
<td>0.0035</td>
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<tr>
<td>Nozzle area (m²)</td>
<td>0.0000385</td>
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<tr>
<td>Distance (m)</td>
<td>0.02</td>
<td>0.02</td>
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<tr>
<td>Mould radius (m)</td>
<td>0.02</td>
<td>0.02</td>
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<tr>
<td>Speed (m/s)</td>
<td>10</td>
<td>17.3</td>
</tr>
<tr>
<td>Comment</td>
<td>Chocolate does not yield</td>
<td>Yielding starts</td>
</tr>
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</table>

It can be seen that a speed of 17m/s for 2s allowed the chocolate to yield. The chocolate was displaced up the sides of the mould, forming a hollow. The shape
remained after the jet was removed and thereby formed a chocolate shell into which filling material could subsequently be deposited.

It was noted that the single hole nozzle displaced the chocolate in the centre of the cavity quickly and pushed the rest of the chocolate up the sides of the mould. Hence the resulting shell was thinnest at its midpoint and thicker at the walls.

**Example 3**

Example 2 was repeated but instead of holding the nozzle at a fixed distance from the chocolate, the nozzle was moved upwards (away from the chocolate) during shaping. In this way the speed impact at the centre was reduced and the air-flow spread more to the sides creating a more even thickness of shell.

**Example 4**

Example 2 was repeated with a different nozzle in place of the single hole nozzle. The new nozzle has 8 holes arranged to form the circumference of a circle. This nozzle created a more equal pressure on the surface of the chocolate leading to a shell of more even thickness.

**Example 5**

Example 2 was repeated with a mould having a rectangular cross-section instead of a circular cross-section. Although a shell was obtained, the shell thickness was uneven; the sides nearest to the nozzle were thicker than those further away. The inventors propose an elongated slot nozzle to match the shape of the mould.
Claims

1. A method of forming a confectionery product, the method comprising:
   depositing molten or semi-solid confectionery into a mould; and
   shaping the confectionery by applying a gas jet thereto,
   wherein the temperature of the gas jet is lower than that of the molten confectionery.

2. The method according to claim 1, wherein at least two gas jets are applied to the molten confectionery.

3. The method according to claim 1 or claim 2, wherein the pressure of the gas jet is at least 1.5 bar.

4. The method according to any one of claims 1 to 3, wherein the velocity of the gas jet is at least 8 m/s.

5. The method according to any preceding claim, wherein the gas jet is applied to the confectionery for at least 0.5 seconds.

6. The method according to any preceding claim, wherein the gas jet is applied to the confectionery in bursts having intervals between the bursts of from 0.1 to 0.3 seconds.

7. The method according to any preceding claim, wherein the gas jet applies a force to the confectionery which is varied during the shaping process.

8. The method according to claim 7, wherein the force is varied by increasing or decreasing the pressure and/or velocity of the gas jet.

9. The method according to claim 7, wherein the gas jet is provided by a gas outlet and the force is varied by increasing or decreasing the distance between the mould and the gas outlet.

10. The method according to any preceding claim, wherein the confectionery deposited into the mould, or into each cavity of the mould, has a mass of from 2 to 10 grams, or from 15 to 150 grams.
11. The method according to any preceding claim, wherein the gas is air, nitrogen, argon or carbon dioxide.

12. The method according to any preceding claim, wherein the temperature of the gas jet is from 0 °C to 25 °C.

13. The method according to any preceding claim, wherein the gas jet is applied to the confectionery so as to form a hollow in the confectionery.

14. The method according to claim 13, wherein the method further comprises depositing a filling into the hollow formed in the confectionery.

15. The method according to claim 14, further comprising applying a gas jet to the filling deposited in the confectionery hollow so as to flatten the filling.

16. The method according to claim 14 or claim 15, further comprising depositing molten or semi-solid confectionery onto the filled confectionery hollow to form a lid.

17. The method according to claim 16, further comprising applying a gas jet to the lid to provide a flat or smooth surface.

18. The method according to any preceding claim, wherein the confectionery is chocolate.

19. The use of a gas jet to shape molten or semi-solid confectionery.

20. A system for shaping confectionery, the system comprising a shaping apparatus having a body comprising:

a gas inlet in fluid communication with at least one gas outlet for providing at least one gas jet; and

at least one depositor for depositing confectionery and/or filling material.

21. The system according to claim 20, wherein the body comprises at least two gas outlets.
22. The system according to claim 20 or claim 21, wherein the body comprises a pressure chamber between the gas inlet and the gas outlet(s).

23. The system according to any one of claims 20 to 22, wherein the at least one depositor is constituted by a pipe having at least one opening through which the confectionery and/or filling material is released.

24. The system according to claim 23, wherein the body has an exterior surface comprising two or more zones, each zone comprising at least one depositor opening and at least one gas outlet.

25. The system according to any one of claims 20 to 24, wherein the diameter of the gas outlets is from 1mm to 10 mm.

26. The system according to any one of claims 20 to 25, wherein the shaping apparatus comprises a plurality of bodies.

27. The system according to any one of claims 20 to 26, wherein the system and/or the apparatus comprises a temperature control means for controlling the temperature of the gas and/or the body.

28. The system according to any one of claims 20 to 27, further comprising a source of confectionery and/or filling material in fluid communication with the depositor.

29. The system according to any one of claims 20 to 28, further comprising a source of gas in fluid communication with the gas inlet.

30. The system according to any one of claims 29 to 31, further comprising a mould.

31. The system according to any one of claims 20 to 30, wherein the body of the shaping apparatus is arranged such that the or each depositor and/or the gas outlet(s) are positioned directly above the mould.

32. The system according to any one of claims 20 to 31, further comprising a moveable support on which the shaping apparatus is mounted.

33. The system according to any one of claims 20 to 32, further comprising a cooler.
34. A method of forming a confectionery product substantially as described herein with reference to Figures 3 to 6.

35. A system for forming a confectionery product substantially as described herein with reference to Figures 1-6.
# INTERNATIONAL SEARCH REPORT

## A. CLASSIFICATION OF SUBJECT MATTER

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According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

- A23G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>DE 36 09 522 A1 (BAHLSENS KEKSFABRIK [DE])</td>
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* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
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- "A" document member of the same patent family

**Further documents are listed in the continuation of Box C.**

**See patent family annex.**

Date of the actual completion of the international search

9 December 2014

Date of mailing of the international search report

17/12/2014

Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016

Authorized officer

Gaiser, Markus
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<td>JP S63 273438 A (KOYAMA KAZUYA; YOKOYAMA YOSHIMASA) 10 November 1988 (1988-11-10)</td>
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abstract; figures 1, 11, 12

page 1, line 59 - page 3, line 6; claims 1, 3, 5; figure 1

col umn 7, line 35 - col umn 9, line 32; claims 11, 15, 16; figures 1-8

abstract; figures
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