

CHOCOLATE FORMING

5 The present invention relates to the forming of chocolate into a desired shape more particularly to a process for forming of chocolate in a solid or semi-solid state.

10 One method of forming chocolate into a desired shape is by moulding. Moulding of chocolate is normally carried out in the liquid state by casting, i.e. pouring the molten chocolate into a mould followed by cooling. The moulded chocolate is usually demoulded quite easily after cooling, due to the thermal contraction of the chocolate as it sets,
15 giving a product with an attractive glossy surface. However, the disadvantages of conventional chocolate moulding are the requirement for cooling tunnels which consume space and time, the product cannot be wrapped directly because of the cooling step and it is not possible
20 to achieve exact weight control. The formation of the chocolate centres for "Smarties" (RTM), currently involves the use of rollers which also require a very high cooling capacity.

25 In our co-pending EP-A-93114251.7 we describe a process for plastically extruding a fat-containing confectionery material which comprises feeding the fat containing confectionery material into an extrusion device and applying pressure to the fat-containing confectionery
30 material in a substantially solid or semi-solid non-pourable form upstream of a flow constriction whereby the temperature, pressure, contraction ratio and extrusion rate are such that the fat-containing confectionery material is extruded substantially isothermally and remains in a
35 substantially solid or semi-solid non-pourable form to produce an axially homogeneous extruded product and which has a temporary flexibility or plasticity enabling it to be physically manipulated, cut or plastically deformed e.g. it

can be bent, twisted or forced into a mould. EP-A-93114251.7 also describes an injection moulding process where the temporarily flexible extruded product is injection moulded under pressure at a temperature below the normal melting point of chocolate. This injection moulding process is substantially isothermal and subsequent cooling is therefore unnecessary so that the product is suitable for demoulding immediately after the injection moulding is complete. However, because a subsequent cooling is not necessary, thermal contraction does not necessarily occur and, in some circumstances, demoulding and obtaining a high quality surface finish may be difficult to achieve.

We have now found, surprisingly, that it is possible to form the temporarily flexible solid or semi-solid non-pourable or non-flowable extruded chocolate into a variety of shapes having a high quality surface finish by compression moulding, pressing or deforming the extruded chocolate.

Accordingly, the present invention provides a process for forming an extruded fat-containing confectionery material which comprises feeding the fat containing confectionery material into an extrusion device and applying pressure to the fat-containing confectionery material in a substantially solid or semi-solid non-pourable or non-flowable form upstream of a flow constriction whereby the temperature, pressure, contraction ratio and extrusion rate are such that the fat-containing confectionery material is extruded substantially isothermally and remains in a substantially solid or semi-solid non-pourable or non-flowable form and which has a temporary flexibility or plasticity, characterised in that, while the extruded product exhibits the temporary flexibility, the extruded product is compression moulded, pressed, or deformed into the desired shape.

5 The compression moulded extruded solid product according to
the present invention may be prepared by placing a measured
amount (either a weighed amount or a cut length) of the
extruded solid product into the cavity of a compression
moulding tool, closing the tool under pressure to compress
10 the extruded solid product into the shape of the cavity
defined by the top and bottom halves of the compression
tool, and finally opening the mould to release the formed
product. If desired, the moulds may be cooled to assist
demoulding by hardening of the extruded solid product.
15 Advantageously, the moulds may be polished or surface
treated, e.g. Teflon coated, to assist demoulding and to
enhance the surface finish. Optionally, demould mechanisms
such as stripper plates, compressed air ejection, pins,
etc. may be employed to assist demoulding.
20 The compression moulded extruded solid product may be, for
instance, a solid 3-dimensional shape or a hollow shell,
especially a thin-walled shell such as an Easter Egg. The
product so formed may then, if desired, be wrapped or
further processed, e.g. filled with one or more other
25 foodstuffs, preferably a confectionery foodstuff such as a
dessert, wafer, caramel, fondant, ice cream, etc.

The present invention also provides a compression moulded
extruded solid product according to the present invention
30 in the form of a hollow shell filled with at least one
other foodstuff, e.g. one or more of ice cream, wafer,
caramel, fondant, biscuits, praline jelly, etc.

Some advantages of compression moulding a temporarily
flexible solid extruded product according to the present
35 invention over injection moulding and other forming
techniques are as follows:

- a) the production rate is high speed,
- b) there is no waste from feed runners as in injection moulding, and
- c) the equipment is relatively low cost - all that is required is an extruder and a simple pressing device.

The pressing device can be manually operated with levers, or pneumatically or hydraulically powered. The compression pressure will depend on the degree of plasticity of the extruded product which is controlled by the extrusion conditions, the number of pieces being formed (i.e. there could be a multi-cavity press), the complexity of the shape and the size of the piece. In some cases, hand pressure is sufficient to press the chocolate into the shape of the mould.

A further advantage of compression moulding a temporarily flexible solid extruded product according to the present invention is the possibility of using "in-mould packaging" where a food-grade lining material, e.g. a packaging film, such as described in co-pending GB-A-95 04686.8 can be placed in the compression moulding tool prior to addition of the piece of extruded solid product. When the mould is closed, the piece of extruded solid product is formed into the lining material and the advantages of in-mould packaging are:

- a) the product is ready-wrapped,
- b) thin-walled or delicate products can be easily removed because the packaging film supports them and prevents damage or deformation,
- c) the packaging film can be used to carry the product through further downstream operations such as filling with ice cream in which case the packaging film could then also be used as the primary packaging,

d) the compression moulded product can be removed and the food-grade lining material reused, recycled or discarded, and

e) if the packaging film is sufficiently ductile, pre-forming is not required since the compression moulding would force the film into the required shape.

10 The extruded solid product may also be pressed, for instance, by stamping or punching. The extruded solid product may be deformed by passing between the nip of a pair of counter-rotating rollers provided with
15 corresponding surface depressions to plastically form the extruded product into the shape conforming to the shape of the surface depressions and releasing the formed product from the nip of the pair of counter-rotating rollers.

20 Counter-rotating rollers suitable for deforming the extruded solid product in the process of the present invention are commonly used in the food and pharmaceutical industry for a range of products, e.g. boiled sweets, chocolate lentils (Smarties centres), biscuits and drug capsules. The cavity formed by the two corresponding
25 circumferential depressions of the rollers may be almost any desired shape, provided there are no "negative angles" which would prevent the shaped product from releasing from the cavity, e.g. spherical, ovoid, discoid or cubic. In addition, the surface of the cavity may be engraved or
30 embossed with any desired pattern which is to be imparted to the surface of the fat-containing confectionery material.

35 It should be understood that the temporary flexibility or plasticity of the extruded product enables the product to be physically manipulated or plastically deformed before it loses its flexibility or plasticity, so that it may

completely fill the cavity in one piece without leaving gaps or without crumbling in the cavity.

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The formed product emerges from the nip of the counter-rotating rollers as a series of shaped sweets which are normally and advantageously held together by a thin web of fat-containing confectionery material, e.g. having a
10 thickness of from 50 to 100 microns. The presence of this web helps to pull or demould the sweets from the cavity surface of the rollers. It is not essential to have a web holding the sweets together. However, if there were no web, in order to obtain separated sweets, the rollers would have
15 to be held together under a very high pressure and this would lead to increased wear of the rollers in a continuous operation.

The rollers may, if desired, be cooled, e.g. to -15°C , preferably to from 5° to 15°C , for instance by means of the
20 circulation of a cooling medium e.g. water or a water/glycol mixture through the central axis of each roller. However, because the fat-containing confectionery material is substantially solid or semi-solid and,
25 therefore, already at a relatively low temperature, e.g. below about 35°C , a high cooling capacity is not required. However, a slight cooling, e.g. to up to 5°C , may improve the release of the shaped product from the cavity by preventing sticking.

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After emerging from the nip of the counter-rotating rollers, the series of shaped sweets held together by the thin web is advantageously treated to remove the web, for
example, by feeding into a rotating cylindrical sieve to
35 remove the web by a tumbling action to leave separate sweets. The sweets may then be packed or fed to a further downstream process.

5 In contrast to most other chocolate moulding processes, the final product does not require cooling after the forming has occurred. In addition, the formation of chocolate centres for "Smarties" (RTM) may be carried out without the requirement for the high cooling capacity of the current roller system. Moreover, the use of continuous counter-rotating rollers is faster than injection moulding for a given shape because the the cavities at the nip are continuously opening to allow entry of the product, closing to mould the product and opening to allow release of the moulded product.

15 The rollers may be made of a suitable rigid material such as metal, e.g. steel or a plastics material, e.g. polycarbonate.

20 The final shape of the formed product depends on the shape of the cavity and its surface features.

25 The extruded solid product may be deformed, for instance, by bending such as passing around a rotating spindle to form a shape like a spring or a Swiss Roll: the Swiss Roll shaped product may, if desired, have a filling in which case the extruded solid product may be passed around the rotating spindle together with a layer of a different product such as fondant, praline or ice cream which forms the filling.

30 The details of the extrusion of the fat-containing confectionery material are described in our co-pending EP-A-931142251.7 whose disclosure is hereby incorporated into the present specification.

35 By "substantially isothermally" in this invention we mean that the temperature of the fat-containing confectionery material remains substantially unchanged under the

conditions of the extrusion from the input to the outlet of the flow constriction and during forming if there is no external heating or cooling means: the use of external heating or cooling means is not excluded as long as the material being extruded remains in a substantially solid or semi-solid non-pourable or non-flowable state throughout the extrusion and forming. In other words, the temperature of the fat-containing confectionery material is not caused to increase substantially by the extrusion or forming process itself.

The fat-containing confectionery material may be, for instance, plain, white or milk chocolate or chocolate substitutes containing direct cocoa butter replacements, stearines, coconut oil, palm oil, butter or any mixture thereof; nut pastes such as peanut butter and fat; praline; confectioner's coatings used for covering cakes usually comprising chocolate analogues with cocoa butter replaced by a cheaper non-tempering fat; or "Caramac" comprising non-cocoa butter fats, sugar and milk.

The forming temperature may be from as low as 0°C to about 35°C depending on the composition, particularly the amount and type of fat present. When plain chocolate is used as the extruded feed material, the forming temperature may be from 10° to 34°C, more usually from 15° to 32°C, preferably from 18° to 30°C and more preferably from 20° to 27°C. In the case of white chocolate, the forming temperature may be from 5° to 28°C, more usually from 15° to 27°C, preferably from 17° to 26°C and more preferably from 19° to 25°C. In the case of milk chocolate, the forming temperature may be from 5°C to 30°C, more usually from 15°C to 28°C, preferably from 18° to 27°C and more preferably from 20° to 26°C. It should be understood that, in this invention, when the chocolate is formed at a temperature from 28° to 34°C it is in a solid or semi-solid non-pourable or non-flowable

state after being previously set hard in contrast to chocolate which has not been previously set hard such as recently tempered chocolate which is usually still pasty and pourable or flowable at such temperatures.

The present invention will now be further described by way of example only with reference to the following drawings in which

Figure 1 illustrates an apparatus for deforming a product extruded by the process of the present invention,

Figure 2 illustrates the steps in the compression moulding of a product extruded by the process of the present invention, and

Figure 3 illustrates the steps in the compression moulding of a product extruded by the process of the present invention into a packaging material.

Referring to Figure 1, an extrusion device 10 comprises a hydraulically driven ram 11, a barrel 12 having an internal diameter of 25 mm, a hopper 13 containing chocolate buttons 14, a feed opening 15 and an extrusion die 16 with a nozzle 17 having a cross-section of 5 mm diameter. A pair of counter-rotating rollers 18 are provided with circumferential depressions 19 which correspond at the nip to form a cavity 20 downstream of which is a cylindrical sieve 21 rotating on its horizontal axis.

In operation, the chocolate buttons 14 are fed through the feed opening 15 into the barrel 12 and the hydraulic ram 11 is advanced at a pressure of 80 bars and at a temperature of 23°C. A semi-solid non-pourable rod 22 of chocolate of 5

mm diameter is extruded through the nozzle 17 which is then
5 fed into the nip of the counter-rotating rollers 18 where
it passes through the cavity 20 and is formed and then
released from the cavity as a series of shaped sweets 23
held together by a web 24 of chocolate. On passing through
the rotating sieve 21, the web 24 is removed by a tumbling
10 action and the chocolate sweets 25 are separated and
released for packaging or further processing.

Referring to Figure 2, solid chocolate buttons 40 are fed
into an extruder 41 and extruded in a similar manner to
15 that described for Figure 1 to produce a rod 42 of
temporarily flexible non-pourable or non-flowable solid
extruded chocolate. The rod 42 is cut into slugs 43 which
are placed in the tool cavity 44 of a compression tool 45.
The tool closes at 46 and compresses the slug 43 so that it
20 is moulded into the shape 48. The compression tool opens at
47 and the moulded shape 48 is ejected by tapping it out.

Figure 3 illustrates a similar process to that of Figure 2
except that a preformed packaging film of 400micron
25 polyvinyl chloride 44 is placed in the tool cavity before
the slug 43. In this case, when the mould is closed the
slug of chocolate is formed into the packaging material and
ejected together with the packaging material.

30 The ejected moulded product in either Figure 2 or 3 may, if
desired, be filled with one or more of ice cream, wafer,
caramel, fondant, biscuits, praline jelly, etc. before
closing with a layer of chocolate.

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CLAIMS

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1. A process for forming an extruded fat-containing confectionery material which comprises feeding the fat containing confectionery material into an extrusion device and applying pressure to the fat-containing confectionery material in a substantially solid or semi-solid non-pourable or non-flowable form upstream of a flow constriction whereby the temperature, pressure, contraction ratio and extrusion rate are such that the fat-containing confectionery material is extruded substantially isothermally and remains in a substantially solid or semi-solid non-pourable or non-flowable form and which has a temporary flexibility or plasticity, characterised in that, while the extruded product exhibits the temporary flexibility, the extruded product is compression moulded, pressed, or deformed into the desired shape.

2. A process according to claim 1 characterised in that the extruded solid product is compression moulded by placing a measured amount of the extruded solid product into the cavity of a compression moulding tool, closing the tool under pressure to compress the extruded solid product into the shape of the cavity defined by the top and bottom halves of the compression tool, and finally opening the mould to release the formed product.

3. A process according to claim 2 characterised in that a food-grade lining material is placed in the compression moulding tool prior to addition of the piece of the extruded solid product so that when the mould is closed, the piece of extruded solid chocolate is formed into the lining material.



- 5 4. A process according to claim 3 characterised in that the
compression moulded extruded solid product is in the form
of a hollow shell and is filled with one or more other
foodstuffs.
- 10 5. A compression moulded extruded solid product obtainable
by a process according to claim 1 in the form of a hollow
shell filled with at least one other foodstuff.
- 15 6. A compression moulded extruded solid product according
to claim 5 wherein the other foodstuff is a dessert, wafer,
caramel, fondant, praline, biscuit, jelly or ice cream.
- 20 7. A process according to claim 1 characterised in that the
extruded solid product is pressed by stamping or punching
to the desired shape.
- 25 8. A process according to claim 1 characterised in that the
extruded solid product is deformed by passing between the
nip of a pair of counter-rotating rollers provided with
corresponding surface depressions to form a cavity to
plastically form the extruded product into the shape
conforming to the shape of the surface depressions and
releasing the formed product from the nip of the pair of
rollers.
- 30 9. A process according to claim 8 characterised in that the
formed product emerges from the nip of the counter-rotating
rollers as a series of shaped sweets.
- 35 10. A process according to claim 9 characterised in that
the series of shaped sweets are held together by a thin web
of fat-containing confectionery material.
11. A process according to claim 8 characterised in that
the surface of the cavity formed by the two corresponding



5 circumferential depressions of the rollers is engraved with a pattern.

12. A process according to claim 8 characterised in that the rollers are cooled.

10 13. A process according to claim 8 characterised in that the rollers are cooled by means of the circulation of a cooling medium through the central axis of each roller.

15 14. A process according to claim 10 characterised in that the series of shaped sweets held together by the thin web is treated to remove the web.

20 15. A process according the claim 10 characterised in that the series of shaped sweets held together by the thin web is treated by feeding into a rotating sieve to remove the web by tumbling action.

25 16. A process according to claim 1 characterised in that the extruded solid product is deformed by passing around a rotating spindle to form a shape like a spring or a Swiss Roll.

30 17. A process according to claim 16 characterised in that the extruded solid product is deformed by passing around the rotating spindle together with a layer of a different product which forms a filling.

35 18. A process according to claim 17 characterised in that the different product is fondant, praline or ice cream.

19. A formed fat-containing confectionery material obtainable by a process according to any of the preceding claims.



5 20. An ice cream product comprising shapes made from a
formed fat-containing confectionery material obtainable by
a process according to any of the preceding claims.

10 21. A dessert product comprising shapes made from a formed
fat-containing confectionery material whenever prepared by
a process according to any of the preceding claims.

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