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A method and a device for coating articles with a loose coating material

The present invention relates to a method and to a device for coating articles with a loose coating material which is intended to adhere to the surfaces of the articles.

The invention has been developed with particular attention to its possible use in the food sector, for example, for applying a coating of granular, edible material to a product constituted by a spherical wafer casing containing a creamy filling, possibly covered with chocolate or other alimentary creams. In this type of use, the loose material may be constituted by a granular material such as, for example, chopped hazelnuts or almonds, grated coconut, sugar crystals, etc.

The solutions currently used in the art for the automatic application of such a coating are derived from two basic courses of action, that is:

- solutions in which the products to be coated are introduced into a container containing the loose coating material, and

- solutions in which the coating material is dropped or thrown towards the products to be coated, which advance on a conveyor line.

In both cases, the coating usually takes place in several

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successive stages with intermediate rotation of the products to cause the coating to extend as homogeneously as possible over the entire surface of the products.

The adhesion of the coating material is usually achieved by virtue of the fact that the product to be coated is covered by a layer of material (for example, a so-called coating of chocolate or another edible cream) which is kept in a softened state during the application of the granular coating. After the application of the coating, the material sets (usually as a result of cooling) and thus keeps the particles of the granular coating fixed to the surface of the product coated.

In practice, various problems arise with the use of the solutions of the prior art.

In the first place, it may quite easily be found that the particles of the coating are held on the coated product inadequately; although the particles of the loose coating material adhere to the coated product initially, they tend to separate therefrom upon the slightest stress, for example, when the product is removed from the coating station. This leads, on the one hand, to an adverse effect on the appearance of the finished product (the product is coated insufficiently and/or unevenly in some parts) and, on the other hand, to the soiling of the product-handling lines by fragments of coating which have become detached from the product.

In the second place, the solutions according to the prior

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art cannot operate satisfactorily when the coating material is itself a generally delicate material, for example, a granular mass of fragments of so-called meringue (a product produced by the setting of an aerated, edible mass based on egg white and food flavourings). This occurs particularly when it is attempted to make the coating material adhere more firmly to the product in some way by a handling operation; in other words, when they are pressed, even extremely lightly, materials such as granules of meringue tend to crumble, giving rise to the adverse effects mentioned above, particularly as regards the soiling of the product-processing lines.

The object of the present invention is to provide a solution which can solve the problems mentioned above.

According to the present invention, this object is achieved by virtue of a method having the characteristics recited in Claim 1.

Advantageous developments of the method form the subjects of Claims 2 to 10. A further subject of the invention is a device having the characteristics recited in Claim 11. Advantageous developments of the device form the subjects of Claims 12 to 20.

The invention will now be described, purely by way of non-limiting example, with reference to the appended drawings, in which:

Figure 1 is a general perspective view of a device formed

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according to the invention,

Figure 2 is a schematic view, on an enlarged scale, showing, in greater detail, the operating principle of the portion of the device indicated by the arrow II in Figure 1,

Figure 3 is a plan view of the device according to the invention, observed along the arrow III of Figure I, and

Figures 4 to 6 are theoretical views sectioned on the line IV-IV of Figure 2, showing, in even greater detail, the general operating principle of the device according to the invention.

In Figures 1 and 3, a device which can be used for automatically applying a coating of loose material, typically constituted by an edible, granular material, to articles constituted, for example, by food products P, is generally indicated 1.

The products P may be constituted, for example, by products comprising spherical wafer casings with creamy and pasty fillings covered by a thin layer of chocolate or of a similar alimentary cream. A granular food product such as, for example, chopped hazelnuts or almonds, grated coconut, a mixture of meringue fragments, etc. is to be applied to the products as a coating material.

The food products P flow towards the device 1 on an upstream conveyor T constituted, for example, by a motor-

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driven belt conveyor of a type widely known in the art in systems for the automatic packaging of food products.

For an understanding of the invention, it suffices to record that the conveyor T supplies the device 1 with a flow of products P which advances generally from left to right with reference to the viewpoints of Figures 1 to 3.

An output conveyor, indicated O, and structurally similar to the input conveyor T, on the other hand, is intended to pick up the coated products at the output of the device 1 and then to advance them into a cooling tunnel F (also of known type). The adhesion of the loose coating material applied in the device 1 to the products P becomes firmer within the tunnel F. This result is usually achieved as a result of the cooling effect of the tunnel F: the products P are in fact supplied to the device 1 from a coating (covering) station in which a layer of an alimentary mass (chocolate cream, etc.) which is soft and creamy when the products P enter the device 1, is applied to the products P. The loose coating material therefore adheres to the alimentary mass which sets upon cooling in the tunnel F, anchoring the mass of coating firmly to the product P. This takes place according to general principles well-known in the art which do not therefore need to be recited herein and which, moreover, are not relevant for the purposes of an understanding of the invention.

The main element of the device 1 is constituted by a tubular duct 2 which is supported on the framework 3 of the

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device 1 so as to be generally inclined to the horizontal.

In practice, in the arrangement in which it is mounted in the device 1, the duct 2 is generally inclined at an angle of the order of about 15° to the horizontal so as to have an upper input opening 2a and a lower output or discharge opening 2b which is located in a generally lower position than the input opening 2a.

A conveyor, indicated 4, typically a motor-driven belt conveyor (of known type and structurally similar to the conveyors T and O, except for its smaller size), is disposed immediately below the output end To of the conveyor T.

As can best be seen in Figures 1 and 3, the upper pass of the conveyor 4 (which is constituted, as stated, by a motor-driven belt conveyor) extends with its direction of transportation perpendicular to the general direction of advance of the products P on the conveyor T, below the output end To. The conveyor 4 can therefore receive, on its conveyor pass, the products P which fall from the input conveyor T at the output end thereof.

The upper conveyor pass of the conveyor 4 extends horizontally between an input end 4a and an output end 4b, the terms "input" and "output" naturally referring to the direction of advance of the products P which fall onto the conveyor 4; from the viewpoints of Figures 1 and 3, this direction of advance is from left to right (Figure 1) and from top to bottom (Figure 3), respectively.

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Both of the ends 4a and 4b of the conveyor 4 project slightly relative to the sides of the conveyor T. In particular, the output end 4b of the conveyor 4 projects into the input end 2a of the duct 2. The products P which fall onto the conveyor pass of the conveyor 4 from the conveyor T are thus urged by the conveyor 4 into the duct 2. The latter constitutes a kind of chute along and within which the products P supplied to the input end 2a can fall until they emerge from the lower output end 2b.

As will be explained further below, the downward movement of the products P within the duct 2 is not a true rolling fall. In fact, a carpet of loose coating material is fed onto the upstream end 4a of the conveyor 4 from a channel-shaped duct 6 (which is supplied according to criteria which will become clearer from the following); this is in fact the granular material used for coating the products P.

This granular material forms, on the upper conveyor pass of the conveyor 4, a carpet of a certain thickness (for example, of the order of 0.5-1 cm) onto which the products P discharged from the output end To of the conveyor T fall. The granular material in question also falls into the duct 2 and, within the duct, forms a carpet M of loose granular material which, as it gradually slides towards the output end 2b, covers the lower portion of the cavity of the duct 2 according to criteria which will be described further below. It will suffice to note here that, because of the presence of the bed of granular material M on the lower portion of the duct 2, the products P do not roll/slide rapidly along the duct 2 but, on the contrary, perform a

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more regular downward movement.

At the output end 2b of the duct 2 the products, indicated P', which are already coated (in the manner which will be described below) with granular material, fall into a further tubular duct 7 which is mounted in a fixed position relative to the framework 3. The duct is intended to deposit the products P on the lower end of a bucket or shovel conveyor 8 which is mounted on the framework 3 in a position beside the duct 2 and also at an inclination corresponding approximately to the inclination of the duct 2. The deposition of the products P' on the conveyor 8 is usually made more precise and secure by the positioning of a deflector or channel 9 at the output of the duct 7. When the products P' have passed through both the duct 2 and the fixed duct 7, they are thus in the lower portion of the framework 3 at the lower end of the shovel or bucket conveyor 8. As a result of the general upward movement of the upper active pass of the conveyor 8, the coated products P' are returned to the upper portion of the device 1, near the input end of the output conveyor O.

The conveyor 8 is also of generally known type and is comparable to the bucket or shovel conveyors currently used, for example, for transporting loose materials such as sand, coal or even granular food products.

The coated products P' which emerge from the conveyor 7 fall onto the shovels of the conveyor 8 together with some of the bed of granular material M. The speed of operation of the device 1 is regulated - in dependence on the size of

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the device 1 - in coordination with the speed of operation of the conveyors T and O (number of products P per unit of time), in a manner such that two or three coated products P' fall onto each shovel of the conveyor 8.

At the upper end of the shovel conveyor 8, the products P' fall onto a duct or inclined plane 10 having a generally perforated or grid-like structure. The duct or plane 10 is situated (see Figures 1 and 3 in combination) immediately beneath the upper output end of the shovel conveyor 8 and immediately above the channel-shaped duct 6. The products P' which are discharged from the conveyor 8 are thus retained on the duct or plane 10 and transferred thereby, usually by gravity, towards the output conveyor O.

The granular material discharged from the conveyor 8 together with the products P', however, passes through the holes in the duct or plane 10 and falls onto the channel-shaped duct 6 so as to be transferred once more to the input end 4a of the conveyor 4 in a general recycling arrangement.

Naturally, it is useful periodically or continuously to replenish the mass of the bed of granular material M in the channel-shaped duct 6. This is to take account of the fact that a certain fraction of the granular material adheres to the products P as a coating layer and is therefore removed from the device 1.

This replenishment may be effected either by a periodic intervention by an operator or, possibly, by the provision

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of an automatically- or semiautomatically-operated hopper (not shown) above the channel-shaped duct 6 (or near the upstream end of the conveyor 4).

The main characteristic of the device according to the invention is that the duct 2 is not kept in a fixed position relative to the framework 3 but, on the contrary, can perform a general oscillatory rotational movement (back and forth) about its principal longitudinal axis X2 (see Figure 2).

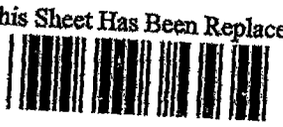
This is usually achieved (see Figure 1 in particular) by mounting the duct 2 on a cradle 11 which is supported at the envisaged angle of inclination on the framework 3, and by providing, at the two ends of the cradle, pairs of rollers 12 on which the outer surface of the duct 2 bears in a rolling arrangement.

The duct 2 is rotated, for example, by a motor 13 (such as an electric motor) disposed on the framework, with a pulley 14 mounted on its output shaft, which is oriented along an axis X13, parallel to the axis X2. A belt 15 extends around this pulley and also around the duct 2.

By bringing about an oscillatory rotational movement of the motor 15 it is thus possible to impart to the duct 2 a general rotational movement back and forth about the axis X2.

The amplitude and frequency of this oscillatory movement can be adjusted by means of the control device 13a of the

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motor 13 (Figure 1); naturally this is a control device of known type, the criteria for the production and operation of which are well-known to experts in the art, and do not therefore require a detailed description herein.

Preferably, (see also the sections of Figures 4 to 6), the duct 2 is constituted simply by a portion of tube of a material such as a plastics material suitable for contact with food products, for example, a crystalline PVC or polyethylene tube, etc.

The duct 2 is preferably formed in a manner such that it has transparent windows or - even better - is formed wholly of a transparent material, to enable continuous inspection of the coating of the products P which takes place within the duct 2.

Again with reference to Figures 4 to 6, it can be seen that longitudinal ribs 16 are preferably provided along the internal surface of the duct 2 and may extend along the generatrices of the duct 2 (which is cylindrical) or along helical paths, or may be of a different shape.

In order to describe the operating principle of the device according to the invention, reference may usefully be made to the sequence of drawings 4 to 6.

It is assumed, for example, that a product P is supplied to the inlet opening 2a of the duct 2 in the central position of Figure 4, that is, with the product P situated instantaneously in a central and symmetrical position

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relative to the generally arcuate, channel-shaped profile X which the bed of coating material M adopts within the duct 2 (also as a result of the continuous oscillatory movement described below). As it descends within the duct (Figure 5), the product P is exposed to the general oscillatory movement of the duct 2 back and forth about the axis X2 which causes the product P both to roll sideways relative to the channel formed by the bed M (thus moving from the central region towards the side edges thereof), and to be exposed to the effect of thrown granular material; because of the oscillatory movement of the duct 2, the material of the bed M in fact tends to be lifted and moved away from the walls of the duct 2 (particularly in the instantaneously uppermost region of the bed) in order to fall on the product P like rain.

The oscillatory nature of the movement (see Figures 5 and 6 in particular), together with the fact that the downward movement of each product P along the duct 2 takes place within a time interval comprising several cycles of oscillations back and forth about the axis X2, causes the product P to follow a zig-zag path such as that schematically indicated K in Figure 2, within the duct 2. Various loops or bends can thus be distinguished in the downward path of the products P along the duct 2. These loops or bends correspond to the fact that, during its descent, each product P rolls along the bed M generally transversely and tangentially of the duct 2 (the terms transverse and tangential should naturally be interpreted with reference to the theoretical section planes of the duct 2 perpendicular to the axis X2). This sideways

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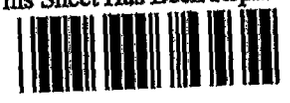
rolling movement is generally greatly predominant relative to the rolling movement which is generally very small and takes place along the generatrices of the duct 2; in effect, it may be said that, rather than rolling along the duct 2, the product P is entrained by the bed M of granular material which descends gradually along the duct.

Thus, and also because of the presence of the ribs 16, the bed of granular material M tends, in general, to retain its position within the duct, as can be seen from a comparison of Figures 4 to 6. Naturally, as already stated, this general position-retention effect does not exclude a portion of the bed M, which may even be quite a considerable portion, being detached from the walls of the duct 2 and being thrown onto the product P, completing the coating thereof.

Moreover, in order to throw the coating material onto the products P more effectively, it has been found advantageous to bring about the oscillatory movement of the duct 2 (and hence the movement of the motor 13) fairly abruptly so that the duct 2 reaches the limit positions of its oscillatory movement in the two senses, that is, the positions at which the sense of rotation is changed, at a fairly fast speed. Owing to the immediate stoppage of the movement, this encourages the material M to be thrown away from the wall of the duct 2 towards the products P by inertia.

Tests carried out by the Applicant have shown that, by using a duct 2 which has an axial length of the order of 60 cm, and a diameter of about 10 cm, and which is kept

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inclined at an angle of the order of 15° to the horizontal, and by operating the motor 13 in a manner such as toimpart to the duct 2 a rotational movement back and forth with an amplitude of about 90°, at a frequency of 100 oscillations/minute, it is possible to make the products P descend within a time interval of the order of about 3 - 4 seconds so that each product P is subjected to 100 cycles of the reversal of the movement of the duct 2 during its descent within the duct 2.

In these conditions, it has been found that the bed M extends through an angle of the order of 120° within the duct 2, relative to the principal axis X2. With reference to products with diameters of about 20 mm covered by an alimentary cream, the invention enables a firm and compact coating to be formed without appreciable detachment of the granular material M on the output conveyor O, with a coating material M constituted by granules. In particular, the granular component included in the coating of the product has always been found, upon visual inspection, to be intact without appreciable damage by compression.

Naturally, the principle of the invention remaining the same, the details of construction and forms of embodiment may be varied widely with respect to those described and illustrated, without thereby deprting from the scope of the present invention.

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CLAIMS

1. A method of coating articles (P) with a loose coating material (M) which is intended to adhere to the surfaces of the articles (P), characterized in that it comprises the steps of:

- feeding (4, 6) the loose material (M) into a duct (2) having a principal axis (X2) so as to form a bed of the loose material (M) in the duct (2),

- feeding (T, 4) the articles (P) to be coated into the duct (2) so that the articles (P) are disposed on the bed of loose material (M), and

- bringing about a rotational movement of the duct (2) about the principal axis (X2) so as to cause a rolling movement of the articles (P) on the bed (M) of loose material, and to throw the loose material of the bed (M) onto the articles (P).

2. A method according to Claim 1, characterized in that it comprises the step of keeping the duct (2) generally inclined with an input end (2a) and an output end (2b) of the duct disposed in upper and lower positions relative to each other, respectively, so that, during the rotational movement of the duct (2) about the principal axis (X2), the articles (P) also perform a forward movement in the duct (2) from the input end (2a) towards the output end (2b).

3. A method according to Claim 1 or Claim 2, characterized

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in that the rotational movement is a back and forth movement.

4. A method according to one of Claims 1 to 3, characterized in that it comprises the step of regulating the quantity of the loose material (M) in the bed in a manner such that, in use, the bed (M) extends over an angular portion of the duct (2) of the order of 120° with reference to the principal longitudinal axis (X2).

5. A method according to Claim 3 and Claim 4, characterized in that the back and forth angular movement has an amplitude of the order of ±45°.

6. A method according to Claim 3 or Claim 5, characterized in that the back and forth movement is brought about at a frequency of the order of 100 cycles/minute.

7. A method according to any one of Claims 1 to 6, characterized in that the duct (2) is produced in the form of a tubular duct.

8. A method according to any one of Claims 1 to 7, characterized in that it comprises the step of providing longitudinal ribs (16) on the internal wall of the duct (2) for achieving a certain entrainment effect on the material of the bed (M) during the rotational movement.

9. A method according to any one of Claims 1 to 8, characterized in that it comprises the step of forming the duct (2) with at least partially transparent walls.

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10. A method according to any one of Claims 1 to 9, characterized in that it also comprises the steps of:

- picking up the articles (P') coated with the loose material and the material of the bed (M) at the output (2b) of the duct (2),

- subjecting the articles (P') and the material of the bed (M) to a screening action (10) so as to separate the coated articles (P') from the material of the bed (M) in order to return the material into the duct (2).

11. A device for coating articles (P) with a loose coating material (M) which is intended to adhere to the surfaces of the articles (P), characterized in that it comprises:

- a duct (2) having a principal axis (X2) and defining a path (K) of advance of the articles (P),

- supply means (4, 6) for feeding the loose material (M) into the duct (2) so as to form a bed of the loose material (M) in the duct (2),

- further supply means (T, 4) for feeding the articles (P) to be coated into the duct (2) so that the articles (P) are disposed on the bed of loose material (M), and

- motor means (13, 14) acting on the duct in order to bring abut a rotational movement of the duct (2) about the principal axis (X2) so as to bring about a rolling movement of the articles (P) on the bed (M) of loose material, and

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to throw the loose material of the bed (M) onto the articles (P).

12. A device according to Claim 11, characterized in that it comprises a support structure (3, 11, 12) for keeping the duct (2) generally inclined with an input end (2a), associated with the further supply means (T, 4), and an output end (2b) of the duct, which are disposed in upper and lower positions relative to each other, respectively, so that, during the rotational movement of the duct (2) brought about by the motor means (13, 14), the articles (P) also perform a forward movement in the duct (2) from the input end (2a) towards the output end (2b).

13. A device according to Claim 11 or Claim 12, characterized in that the motor means (13, 14) impart a back and forth rotational movement to the duct (2).

14. A device according to any one of Claims 11 to 13, characterized in that the supply means (4, 6) regulate the quantity of loose material (M) in the bed in a manner such that, in use, the bed (M) extends over an angular portion of the duct (2) of the order of 120° relative to the principal longitudinal axis (X2).

15. A device according to Claim 13 and Claim 14, characterized in that the motor means (13, 14) impart to the duct (2) an oscillatory angular movement having an amplitude of the order of ±45°.

16. A device according to Claim 13 or Claim 15,

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characterized in that the motor means (13, 14) bring about the back and forth rotational movement of the duct (2) at a frequency of the order of 100 cycles/minute.

17. A device according to any one of Claims 11 to 16, characterized in that the duct (2) is tubular.

18. A device according to any one of Claims 11 to 17, characterized in that the internal wall of the duct (2) has longitudinal ribs (16) for achieving a certain entrainment effect on the material of the bed (M) during the rotational movement.

19. A device according to any one of Claims 11 to 18, characterized in that the duct (2) has at least partially transparent walls.

20. A device according to any one of Claims 11 to 19, characterized in that it also comprises:

- conveyor means (7, 8, 9) associated with the output (2b) of the duct (2) for picking up the articles (P') coated with the loose material and the material (M) of the bed,

- screening means (10) associated with the conveyor means (8) for receiving the coated articles (P') and the material of the bed (M) and separating the coated articles (P') from the material of the bed (M), and

- recycling means (6) for returning the material of the bed (M), from which the coated articles (P') are separated, from the screening means (10) to the supply means (4).

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