

An apparatus and a method for peeling boiled eggs

Technical field

The present invention relates to an apparatus for peeling boiled eggs
5 each having an eggshell, said apparatus comprising a peeling section having
an egg inlet and an egg outlet, and where an egg transport direction of the
apparatus extends from the egg inlet to the egg outlet, where the peeling sec-
tion comprises: at least two elongated peeling elements each extending along
10 the respective longitudinal axis, where the at least two elongated peeling ele-
ments are arranged so that their respective longitudinal axis extends in the
same direction as the egg transport direction, where the two elongated peeling
elements are configured for supporting eggs travelling in the egg transport di-
rection and for removing the eggshells from the eggs, and where each of the
15 two elongated peeling elements has an egg contact surface; and at least one
elongated pushing element having a longitudinal axis extending in the same
direction as the egg transport direction and being arranged at a distance from
the elongated peeling elements measured perpendicular to the longitudinal
axes of the elongated peeling elements, said elongated pushing element hav-
20 ing an egg contact surface.

Background

An apparatus of this kind, which provides for an automatic industrial
scale peeling of eggs and which is capable of peeling up to 20000 eggs/hour,
25 is known from TWM555648. In addition to the peeling section, this apparatus
comprises a cracking section for cracking the eggshells before the eggs enter
the peeling section. By cracking the eggshells it becomes easier to peel the
eggs without breaking them.

A limitation of the apparatus described in TWM555648 and many other
30 prior art apparatuses is that due to natural variation in the size of eggs, shape
of eggs, and/or eggshell properties, such as thickness, some eggs are not
peeled completely, and others are broken. Particularly, the peeling of soft
boiled eggs has been found to cause problems.

Summary of the invention

It is therefore an object of the invention to provide an improved egg peeling apparatus and to provide an improved method for peeling boiled eggs,
5 where the risk of breaking eggs is reduced.

In a first aspect of the invention this and further objects are achieved with an apparatus as mentioned in the introduction, where the egg contact surface of the elongated pushing element is angled in relation to the egg contact surfaces of the elongated peeling elements so that a first shortest distance between the egg contact surface of the elongated pushing element and the egg
10 contact surfaces of the elongated peeling elements measured perpendicular to the longitudinal axes of the elongated peeling elements at the egg inlet is bigger than a second shortest distance between the egg contact surface of the elongated pushing element and the egg contact surfaces of the elongated peeling
15 elements measured perpendicular to the longitudinal axes of the elongated peeling elements at the egg outlet.

By angling at least the egg contact surface of the elongated pushing element in relation to the egg contact surface of the elongated peeling elements, the elongated pushing element and the elongated peeling elements together form a funnel, which narrows towards the egg outlet. The peeling of
20 large eggs starts at the beginning of the peeling section, whereas small eggs may not come into contact with the elongated pushing element until further into the peeling section, so that they become peeled closer towards the egg outlet. Even if small eggs are in contact with the elongated pushing element already
25 at the beginning of the peeling section, the pressure applied to them by the elongated pushing element at the egg inlet will be less than that applied to large eggs. Large eggs will not be broken when entering the narrower part of the funnel at the egg outlet as they have already been peeled. Boiled egg white is smoother than eggshell, particularly if wet, and consequently has a lower friction
30 against the egg contact surfaces. Furthermore, as the egg white and the egg yolk of a boiled egg is considerably more elastic than the eggshell, a peeled egg can better yield to the pressure at the narrow part of the funnel than an

unpeeled egg. The difference between the elasticity of the eggshell and the egg content, i.e. the egg white and the egg yolk, is particularly pronounced in soft boiled eggs, which are consequently at higher risk of breaking during peeling. A still further factor of importance to egg breakage is the attachment of the egg white to the eggshell membrane. When at least a part of the eggshell has been removed, the eggshell membrane is broken, and force applied to the egg may be distributed more evenly than when the eggshell is merely cracked.

The hardness of eggshells varies, for example due to differences in the thickness of the eggshell or to differences in density or structure, which may result from the eggs originating from different hen species or hens having been fed differently. This may result in that some eggs are harder to peel than others, even if they are of the same size. The gradual increase in the force applied in the peeling section results in that the peeling is begun using the least force necessary, which in turn results in a reduced risk of the egg breaking.

To further facilitate peeling, the apparatus preferably comprises a cracking section configured for cracking the eggshells before the eggs enter the peeling section. The cracking section, which is located before the egg inlet, may be located in continuation of the peeling section when seen in the egg transport direction, but it may also be located above, below, and/or to the side of the peeling section to make the apparatus compact.

It is noted that while the elongated pushing element and the elongated peeling elements are primarily described as continuous elements extending over substantially the entire length of the peeling section, i.e. from the egg inlet to the egg outlet, it is within the scope of the invention to use elongated pushing element and/or the elongated peeling elements composed of two or more separate members. As an example, a plurality of separate pushing members may be arranged in continuation of each other to function as elongated pushing element, possibly being interconnected, possibly being activatable independently of each other.

In one embodiment the elongated pushing element is placed at a vertical distance of 30-70 mm, preferably 40-50 mm, above the elongated peeling

elements measured at the egg inlet and measured from egg contact surface to egg contact surface.

It is presently considered advantageous that the distance between the egg contact surfaces of the elongated pushing element and the elongated peeling elements decrease with a constant gradient, but it is also possible to have a relatively low angling near the inlet and a steeper angling towards the end of the peeling section nearer the outlet or vice versa. A low angling at the beginning will mean that the initial peeling is relatively careful, and a subsequent steeper angling will ensure that even the smallest eggs are peeled, while larger eggs are only subject to a high pressure over a relatively short distance.

The angling of the egg contact surfaces in relation to each other may be provided in several ways, including making the elongated pushing element with a conical shape, while the elongated peeling elements are circular cylindrical. In another embodiment, which is presently considered advantageous, the longitudinal axis of the elongated pushing element is angled in relation to the longitudinal axes of the elongated peeling elements. This allows for both the elongated pushing element and the elongated peeling elements to have the overall shape of a circular cylinder, which in turn means that the mutual angling can be changed simply by changing the angle(s) of one or more of the longitudinal axes.

It is noted that references to the longitudinal axes of the elongated peeling elements and the elongated pushing element extending in the same direction as the transport direction are intended as an indication that they extend substantially in parallel to the egg transport direction, but not necessarily entirely parallel as one or more of them may be slightly angled to achieve the mutual angling of the egg contact surfaces.

If the egg peeling elements are angled in relation to a horizontal level, eggs may move forward in the egg transport direction under the influence of gravity only. In one embodiment, however, the apparatus comprises a carrier device for moving the eggs in the egg transport direction, said carrier device comprising a plurality of conveying elements extending transversely to the egg transport direction and between the elongated pushing element and the

elongated peeling elements. The carrier device is configured to move the conveying elements in the egg transport direction, and the conveying elements are configured for engaging with the eggs and carry them in the egg transport direction. The movement of the conveying elements may for example be achieved by the conveying elements being connected to a conveyor, such as a belt or a chain conveyor, extending along the elongated peeling elements.

An advantage of using a carrier device with conveying elements is that eggs may be moved in the egg transport direction with a controlled speed, allowing an optimization of the peeling by only keeping the eggs on the elongated peeling elements for as long as is necessary to achieve a satisfactory peeling. This may further contribute to a reduced risk of eggs breaking as unnecessary physical interaction with them is reduced. A reduction of unnecessary physical interaction may also lead to an improved quality of the egg product, as the risk of damages to the egg white of already peeled eggs is reduced.

A still further advantage of using a carrier device with conveying elements is that the conveying elements will hinder a backwards movement of the eggs, opposite to the eggs transport direction. Due to the funnel shape of the space between the elongated pushing element and the elongated peeling elements, a pressure on an egg in a direction perpendicular to the egg transport direction may result in the egg slipping backwards towards the egg inlet. This effect is particularly pronounced when the elongated pushing element and the elongated peeling elements are all of a continuous design with no projections. Conveying elements extending across the egg transport direction will limit such a backwards movement.

In one embodiment the conveying elements form compartments between them, each compartment being configured for accommodating a single egg. The use of such compartments allows the eggs to be peeled individually without interference from other eggs, which might for example result in the eggs not being able to roll freely on the elongated peeling elements or eggshell from other eggs sticking to the eggshells and preventing proper contact with the elongated peeling elements. It is, however, also possible to use larger compartments configured to accommodating for example two, three or more eggs.

In one embodiment the elongated pushing element has protrusions spaced apart from each other along the longitudinal axis of the elongated pushing element. The protrusions are configured to interact with the eggs and push them towards the egg peeling elements and may contribute to cracking the eggshells. The protrusions may further push the eggs along the egg transport direction, thereby contributing to moving the eggs forward. It may even be possible to move the eggs solely by means of the elongated pushing element, so that a separate carrier device is not necessary.

Such protrusions are included when measuring the distances between the egg contact surface of the elongated pushing element and the egg contact surfaces of the elongated peeling elements as far as these protrusions contribute to the peeling process.

Protrusions may vary in size over the length of the elongated pushing element, for example being larger at the egg inlet than at the egg outlet, thereby creating or contributing to the creation of the funnel.

If the space between protrusions is larger than the size of an egg, the eggs may experience an alternating impact from the elongated pushing element. This may facilitate peeling in that the eggs are first pushed against the elongated peeling elements, then released, then pushed again, and so forth. This may result in a section of eggshell being pressed firmly against the egg peeling elements during each push, possibly also cracking the eggshell, and then being peeled off, until no eggshell is left. It is noted that due to the rotation of the elongated peeling element(s) combined with the forward movement of the eggs in the egg transport direction, the eggs will usually also be rolling, and that this will result in different sides of the eggs facing the elongated pushing element at different times.

Protrusions on the elongated pushing element may for example be formed by a spiral member coiled about the longitudinal axis of the elongated pushing element, and the elongated pushing element may then advantageously be configured for rotating about its longitudinal axis. The spiral member may be an integral part of a main body of the elongated pushing element or applied as a separate member, such as for example a strip, rod, or tube made

from an elastic polymer, such polyurethan. The elasticity may be advantageous in that it may provide a relatively soft push on the eggs. If using a tube, it may be filled with air or another fluid, and the pressure applied by the elongated pushing element may then be adjusted by adjusting the pressure inside the tube.

If the elongated pushing element with a spiral member is rotated about its longitudinal axis, the positions of the protrusions will change during operation. If the elongated pushing element is not rotating, the eggs will pass underneath the protrusions, being pushed against them by the forwards movement in the egg transport direction, and in this case, it is particularly advantageous to provide a carrier device forcing the eggs forward. This applies also to embodiments, where stationary protrusions are formed by other means than by a spiral member.

Protrusions may be spaced along the longitudinal axis of the elongated pushing element with varying mutual distances. The varying mutual distance of the protrusions may for example be configured to impact and push the eggs from various angles and/or with varying intervals. In one embodiment the protrusions are closer to each other at the centre of the elongated pushing element than at the ends, closer to the egg inlet and the egg outlet. In another embodiment the distance becomes gradually smaller towards the egg outlet.

In one embodiment the position of the elongated pushing element relative to the elongated peeling elements is adjustable, thereby allowing a repositioning of the elongated pushing element and the elongated peeling elements in either a horizontal direction or a vertical direction or both. An advantage of being able to adjust the mutual position of the elongated pushing element and the elongated peeling element is that it is possible to adjust the position where the eggs first come into contact with the elongated pushing element, thereby potentially improving the peeling of eggs of varying sizes. Another advantage is that it is possible to do a general adaptation to the processing of smaller or larger eggs.

In one embodiment the angling of the longitudinal axis of the elongated pushing element in relation to at least one of the longitudinal axes of the

elongated peeling elements is adjustable, preferable within the interval of 0.1 - 15 degrees, 0.1 – 5, more preferably within the interval of 0.2 - 0.5 degrees both in a horizontal plane and in a vertical plane. This angling is configured to facilitate peeling of eggs that varies in size and in both a hard boiled and a soft
5 boiled state. The advantage of having a possibility for changing the mutual angling is that one and the same apparatus may be arranged in different configuration for the processing of different types or sizes of eggs. As an example, if the apparatus has been used for peeling hard boiled eggs and is subsequently to be used for peeling soft boiled eggs, the mutual angling may be reduced.

10 In one embodiment the elongated peeling elements are placed with a gap between them measured perpendicular to the longitudinal axes of the elongated peeling elements. This will allow eggshell to pass between them. If the elongated peeling elements are configured for rotating in opposite directions, towards each other at the sides facing the elongated pushing element, eggshell
15 may then be pulled inwards toward the gap and down between the two elongated peeling elements. An eggshell receptacle may be provided underneath the elongated peeling elements for receiving eggshells.

It is presently considered advantageous that the gap between the elongated peeling elements is 0 - 2 mm, approximately 0,5 mm, as this allows for a
20 quick removal of eggshell with a low risk of pinching peeled eggs.

Rotating the elongated peeling elements in opposite directions may have the further advantage that eggs are pushed inwards toward the gap between the elongated peeling elements, thereby reducing the risk of eggs falling off the elongated peeling elements.

25 In one embodiment the elongated peeling elements, which are preferably circular cylindrical, are placed in the same horizontal plane. This may reduce the risk that eggs tumble off the elongated peeling elements, in that they form a cradle between them. It is, however, also possible for a first of the elongated peeling elements to be located higher than a second elongated peeling
30 element, if the elongated pushing element is located on the opposite side of the second of the elongated peeling elements in such a way that the eggs are prevented from tumbling off the elongated peeling elements. This may result in the

eggs being kept in a particularly good contact with the second of the elongated peeling element and/or with the elongated pushing element under the influence of gravity, thereby potentially improving peeling.

In a still further embodiment, at least the elongated peeling elements are
5 inclined in relation to the transport direction, for example with an upwards inclination from the egg inlet towards the egg outlet. This may contribute to keeping the eggs in contact with the elongated peeling elements and/or with conveying elements of carrier device and may further facilitate integration with other apparatuses. A downward inclination may contribute to a forward movement of
10 the eggs under the influence of gravity.

In one embodiment the elongated peeling elements are provided with a friction promoting profiling, coating, or sleeve configured to provide the elongated peeling elements with a surface suitable for pulling eggshell off eggs. A coating or sleeve may for example be made from a polymer and allows a main
15 body of the elongated peeling elements to be made from a different material having other desired properties, such as stainless steel, which is strong and dimensionally stable.

A coating or a sleeve may promote cleaning of the elongated peeling elements, and a sleeve may be removeable, such that it can be changed when
20 worn down or to change the surface properties to adapt to a different type of eggs. The elongated peeling elements and/or the elongated pushing element may also be replaceable in its/their entirety.

In one embodiment, the elongated peeling elements and the elongated pushing element are controlled by separate actuators, such as motors rotating
25 them. If the apparatus comprises a carrier device, a separate actuator may also be provided for that. This allows for the individual components to be operated independently, for example at different speeds, in a technically simple manner, and if some parts need to be replaced, this may potentially be done without affecting the other components of the apparatus.

30 A second aspect of the invention relates to a method for peeling boiled eggs, where eggs each having an eggshell enters a peeling section of a peeling apparatus via an egg inlet and exits the peeling section via an egg outlet, and

where said eggs travel in an egg transport direction extending from the egg inlet to the egg outlet, said method further comprising:

arranging said eggs on at least two elongated peeling elements, where each of the elongated peeling elements extend along a respective longitudinal axis, where the two elongated peeling elements are arranged so that their respective longitudinal axis extend in the same direction as the egg transport direction, and where each of the two elongated peeling elements has an egg contact surface,

rotating at least one of the elongated peeling elements about its longitudinal axis, thereby removing the eggshells from the eggs;

pushing the eggs towards the elongated peeling elements using at least one elongated pushing element, having an egg contact surface and a longitudinal axis, where the elongated pushing element is arranged so that its longitudinal axis extends in the same direction as the egg transport direction, and where the elongated pushing element is arranged at a distance from the elongated peeling elements measured perpendicular to the longitudinal axes of the elongated peeling elements;

characterized in that

the push on the eggs resulting from the use of the elongated pushing element increases as the eggs are moving in the egg transport direction, due to the egg contact surface of the elongated pushing element being angled in relation to the egg contact surfaces of the elongated peeling elements, so that a first shortest distance between the egg contact surface of the elongated pushing element and the egg contact surfaces of the elongated peeling elements measured perpendicular to the longitudinal axes of the elongated peeling elements at the egg inlet is bigger than a second shortest distance between the egg contact surface of the elongated pushing element and the egg contact surfaces of the elongated peeling elements measured perpendicular to the longitudinal axes of the elongated peeling elements at the egg outlet.

As described above with reference to the first aspect of the invention, one of the advantages of the invention is that this method allows for a gradually increasing push on the eggs as they are moving in the egg transport direction.

This is done by the elongated pushing element being positioned angled and above the two elongated peeling elements, where the distance between them is being bigger at the egg inlet than at the egg outlet.

Advantages and embodiments described in relation to the first aspect of the inventive concept applies mutatis mutandis to the second aspect. As an example, the possibility for changing the mutual angling of the elongated peeling elements and the elongated pushing element will also apply to the second aspect of the invention.

The person skilled in the art realizes that the present invention is not limited to the preferred embodiments described above. On the contrary, many modifications and variations are possible within the scope of the appended claims.

Additionally, variations to the disclosed embodiments may be understood and effected by the skilled person in practicing the claimed invention, from a study of the drawings, the disclosure, and the appended claims. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. The mere fact that certain features are recited in mutually different dependent claims does not indicate that a combination of these features cannot be used to advantage.

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Brief description of the Drawings

The present invention will now be described in more detail with reference to the appended schematic drawing showing embodiment(s) of the invention.

Fig. 1 is a schematic sideview of an apparatus for peeling eggs;
Fig. 2 corresponds to Fig. 1, but showing a different embodiment,
Fig. 3 corresponds to Fig. 1 and Fig. 2, but showing a different embodiment,
Fig. 4 is a perspective view of an apparatus for peeling eggs,
Fig. 5 is a perspective view of parts of the apparatus in Fig. 4;
Fig. 6 corresponds to Fig. 5 but with parts removed;
Fig. 7 is a perspective view of a section of a peeling section corresponding to that marked VII in Fig. 6,

Fig 8 is another perspective view of the apparatus parts shown in Fig. 6;

Fig. 9 is a side view of components of the peeling section of the apparatus in Figs 4-8;

Fig. 10 is a top view of the peeling section shown in Fig. 9; and

5 Fig. 11 is a front view of the peeling section shown in Fig. 9.

Description of embodiment

In the figures, the sizes of components and regions may be exaggerated
10 for illustrative purposes and, thus, are intended to illustrate the general structures of embodiments of the present invention. Like reference numerals refer to like elements throughout, even though they may not be identical.

Referring initially to Fig. 1 an apparatus 1 for peeling boiled eggs is shown. The apparatus comprises a peeling section 10 for peeling eggshell off
15 eggs and a carrier device 20 for carrying eggs through the apparatus. In the embodiment shown, the apparatus further comprises a cracking section 30 for cracking eggshells prior to peeling, but it is to be understood that in some embodiment a satisfactory peeling may be achieved without a cracking section. Still further the apparatus shown comprises an eggshell receptacle 40 arranged
20 underneath the peeling section for receiving eggshell peeled off eggs.

In operation, eggs will travel through the apparatus 1 in an egg transport direction T, entering the peeling section 10 at an egg inlet 601 and exiting the peeling section at an egg outlet 602.

The cracking section 30 comprises a set of cracking rollers 31 on which
25 eggs travel and an upper retainer 32 preventing eggs for being thrown off the cracking rollers. Such cracking sections are well known to the skilled person and will therefore not be described in further detail.

The peeling section 10 comprises two elongated peeling elements 11 arranged side-by-side so that only one is visible in Fig. 1 and an elongated
30 pushing element 12. The two elongated peeling elements have a respective longitudinal axis L1 and the elongated pushing element has a longitudinal axis L2. The longitudinal axes L1 and L2 extend in the same overall direction as the egg transport direction T, and the longitudinal axes L1 are parallel to each

other, but slightly angled in relation to the longitudinal axis L2. This means that a first shortest distance D1 between the elongated pushing element 12 and the elongated peeling elements 11 measured perpendicular to the longitudinal axes L1 of the elongated peeling elements at the egg inlet 601 is bigger than a
5 second shortest distance D2 at the egg outlet 602. In other words, the space 14 available for the eggs between the elongated peeling elements 11 and the elongated pushing element 12 has the shape of a funnel, becoming gradually narrower towards the egg outlet 602.

The two elongated peeling elements 11 are rotatable about the longitudinal axes L1 and are configured for supporting eggs travelling in the egg
10 transport direction T and for removing the eggshells from the eggs. The elongated pushing element 12 is configured to push the eggs against the elongated peeling elements 11 to facilitate peeling. In some embodiments the elongated pushing element merely ensure that eggs are prevented from bouncing off the
15 elongated peeling elements, in others it exerts a pressure on the eggs pressing them against the elongated peeling elements, either constantly or intermittently.

The carrier device 20 shown in Fig. 1 is a belt conveyor where a belt 21 is guided over wheels 22, one of which is connected to a drive motor so that it
20 drives the belt forward.

Alternative embodiments of an apparatus 1 for peeling boiled eggs are shown in Fig. 2 and Fig. 3. Only differences with respect to the embodiment in Fig. 1 will be described.

In Fig. 2 the elongated pushing element 12 is conical rather than cylindrical as in Fig. 1 and the inclination of the egg contact surface 121 relative to the longitudinal axis L2 results in a funnel-shaped space 14 between the elongated pushing element 12 and the elongated peeling elements 11, even though
25 their longitudinal axis L1, L2 are parallel.

In Fig. 3 the elongated pushing element 12 is composed of three separate members 12a, 12b, 12c, each of which are arranged horizontally, but together they form an inclined longitudinal axis L2 and a stepped egg contact
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surface 121 forming a funnel-shaped space 14 above the elongated peeling elements 11.

A further embodiment of an apparatus 1 for peeling eggs is shown in Fig. 4-8. While this embodiment is considerably more complex, it comprises the same elements as described with reference to Fig. 1, i.e. a cracking section 30 and a peeling section 10 arranged in continuation of each other in the egg transport direction T and an eggshell receptacle 40 arranged underneath the peeling section. Furthermore, this apparatus comprises a water outlet 80 for wetting the eggs and a water supply system 81, which is preferably equipped for recycling water. The application of water may, in combination with the surface properties of the elongated peeling elements 11, be used for adjusting the friction between the peeling elements 11 and the eggshells. Water may also be used for rinsing the eggs to remove smaller eggshell fragments.

In Fig. 5 the cracking section 30, the peeling section 10, and the water outlet 80 of the apparatus in Fig. 4 is shown together with an apparatus frame 15 and a carrier device 20 for carrying eggs through the apparatus. The frame 15 and the carrier device 20 are not visible in Fig. 4 due to the presence of cover parts 16, which are attached to bushings 17 of the frame 15.

In Fig. 6 and Fig. 8, where the water outlet 80 and the frame 15 has been removed to improve visibility of the cracking section 30, the peeling section 10, and the carrier device 20.

As also described with reference to Fig. 1, the carrier device 20 comprises a belt conveyor, here comprising two belts 21 one on each side of the apparatus. The belts are guided over wheels 22 and guide tracks 25 and driven by a drive motor 54. While the wheels 22 and guide tracks 25 are slightly different than the wheel in Fig. 1, resulting in a slightly different path of the belts 21, the function is the same.

Other motors 51, 52, 53 are provided for rotating the elongated peeling elements 11, the elongated pushing element 12, and the cracking rollers 31, respectively.

The carrier device 20 seen in Fig. 5-8 further comprises a plurality of rod-shaped conveying elements 23 extending transversely to the egg transport

direction T between the elongated pushing element 12 and the elongated peeling elements 11. In Fig. 5, 6 and 8 most of the conveying elements 23 have been removed to allow other components to be seen more clearly, but the arrangement of the conveying elements is shown in detail in Fig. 7, showing the section marked VII in Fig. 6. In this embodiment, the conveying elements are attached to the two belts 21, but other conveying means including for example a single belt or one or more chain conveyors may also be employed. The belts 21 drive the conveying elements 23 in the transport direction T, and the conveying elements in turn push the eggs 60 forward over the peeling elements 11. Only a few eggs and a few conveying elements are shown in Fig. 5, 6 and Fig. 8, but it is to be understood that conveying elements 23 are distributed evenly over the entire extend of the belts 21, so that evenly sized compartments 24 are formed between the conveying elements. In this embodiment the size of the compartments 24 corresponds to the size of one egg, but bigger compartments are possible.

As best seen in Fig. 7 and Fig. 11, the conveying elements 23 in this embodiment are steel rods 231 provided with a thickening 232 at the centre, where they contact the eggs. The thickening reduces the risk of eggs being pinched between the conveying element and the egg peeling elements 10. A similar thickening could also be achieved by providing the rods with a sleeve, such as a polymer sleeve, and other embodiments are also possible, as long as they are able to transport the eggs in a safe manner.

As is also seen in Fig. 5, 6, and 8, the elongated pushing element 12 is mounted on fixtures 71, 72 allowing the position of the elongated pushing element relative to the elongated peeling elements 11 to be adjusted. In the embodiment shown, this is achieved by the ends 122, 123 of the elongated pushing element 12 being provided with brackets 711, 721 riding on rods 74 in a manner allowing horizontal displacement. It is also within the scope of the invention to allow a vertical displacement of one or both ends 122, 123 of the elongated pushing element 12 by mounting one or both of the rods 74 so that it/they is/are moveable in a vertical direction. The rods 74 are connected to the apparatus frame 15 by mechanical connections, which may be moveable,

extendable and retractable, or releasable to allow repositioning of the rods. The adjustment of the position of the elongated pushing element 12 relative to the elongated peeling elements 11 may be used for adjusting both the mutual distances and relative angling.

5 If moving the end 123 of the elongated pushing element 12 located at the egg outlet 602, it may be necessary to shorten or extend the belt 521 of the motor 52 or moving the entire motor.

Turning now also to Fig. 9 and Fig. 10, showing only components of the peeling section 10, the elongated pushing element 12 is angled in relation to
10 the elongated peeling elements 11 both in vertical plane and in a horizontal plane as indicated by angles A1 and A2, respectively. This is also seen in Fig. 11, which is a view from the egg inlet 601 towards the egg outlet 602. Here the egg contact surfaces 111 of the elongated peeling elements 11 are visible due to the vertical angling, and the egg contact surface 121 of the elongated push-
15 ing element 12 is visible due to the horizontal angling. The elongated peeling elements 11 are here placed in the same horizontal plane H, but this need not be the case.

In this embodiment the elongate peeling elements 11 are circular cylindrical and may be provided with a surface covering suitable for pulling eggshell
20 off the eggs 60, but other embodiments are possible. Elongated peeling elements 11 are well-known to the skilled person and will therefore not be described in further detail.

In the embodiments in Fig. 5-11, the elongated pushing element 12 has protrusions 120 spaced apart from each other along the longitudinal axis L2.
25 The elongated pushing element 12 is here configured for rotating about its longitudinal axis L2, and the protrusions 120 are formed by a spiral member 124 coiled about the longitudinal axis L2 of the elongated pushing element 12. In operation, this means that the positions of the protrusions 120 pushing the eggs 60 towards the elongated peeling elements 11, i.e. the active parts of the spiral
30 member 124, will move along the longitudinal axis L2. In addition to the egg contact surface 121 formed by the cylindrical rod forming the main body of the

egg pushing element 12, this embodiment includes an egg contact surface 127 formed by the spiral member.

When the protrusions 120 are formed by a spiral member 124, their movement may contribute to moving the eggs forward and may potentially even
5 render the carrier device 20 superfluous.

In an alternative embodiment (not shown) the spiral member may have alternative dimensions, such as the spiral member being formed by many smaller protrusion at a distance from each other, or protrusions not forming a spiral may be used.

10 With the presence of protrusions 120 arranged at a distance from each other as shown in Fig. 5-10, eggs 60 travelling between the elongated pushing element 12 and the elongated peeling elements 11 will encounters two states: In one state an egg will be underneath a protrusion, which pushes on it and creates one or more impact points on the eggshell, and in another state it is
15 located between protrusions 120 and subject to no or only a reduced push. This intermittent pressure against the elongated peeling elements may facilitate peeling in that a new section of the eggshell may be contacted in each cycle and may further urge the egg to turn so that all surfaces eventually get into contact with the egg peeling elements. Furthermore, an intermittent release or
20 reduction of pressure may reduce the risk of damages to the egg white as the egg becomes free to roll on the elongated peeling elements when the pressure is removed or reduced.

In the embodiments in Fig. 5-10 the protrusions 120 are spaced along the longitudinal axis L2 of the elongated pushing element 12 with varying mutual distances, where the mutual distances decrease from the egg inlet 601
25 towards the centre of the peeling section 10 and increasing again towards the egg outlet 602. This has been found to result in a good peeling in that the pressure applied by the protrusions 120 becomes still more frequent towards the centre, resulting in the peeling of all eggs being initiated, but decreasing towards the egg outlet thereby reducing the risk of breaking larger eggs. Other
30 embodiments may, however, be advantageous depending on the nature of the eggs to be peeled.

The spiral member 124 shown in Fig. 5-11 is massive and made from rubber, but it could also be embodied as an air-filled tube made from another elastic polymer. The spiral member here has a cross-sectional diameter of 12 mm and a hardness of Shore 60 and is wound about a rod made from stainless steel having a diameter of 20 mm. To retain the spiral member in its intended position on the rod, the rod may be provided with a track or separate indentation in which the spiral member rests.

In the embodiment shown in Fig. 8-11, the elongated pushing element 12 is placed at a vertical distance above the elongated peeling elements 11 measured from centre to centre of 50-70 mm. In one setting the centre to centre distance is 63 mm at the egg inlet and 52 mm at the egg outlet, resulting in the distance D1 between egg contact surfaces 111, 127 at the egg inlet being approximately 35 mm and approximately 22 mm at the egg outlet, but these dimensions may vary depending for example of the size of the eggs to be peeled.

In Fig. 11 the elongated peeling elements 11 are configured for rotating in opposite directions as indicated by the arrows C. This allows for the egg contact surfaces 111 of the peeling elements 11 to grip onto the eggshell of the eggs 60 and thereby pull the eggshell down in between the elongated peeling elements 11. The elongated peeling elements 11 are here placed with a distance D3 between the rotational centres of 28.5 mm and with a mutual distance of 0.5 mm measured perpendicular to the longitudinal axes, making it possible for the eggshells to move in between the elongated peeling elements 11. These distances may vary depending on the type or state of the eggs being processed as well as other factors, such as the surface properties of the elongated peeling elements.

All dimensions mentioned relate to the peeling of hen's eggs. When peeling e.g. duck's eggs the distance D1 will need to be increased by approximately 30%, resulting for example in that the distance centre to centre between the elongated pushing element 12 and the elongated peeling elements 11 will be approximately 90 mm at the egg inlet 601 and 65 mm at the egg outlet 602. In this context, hen's eggs are assumed to be on average 43 mm diameter and duck's eggs to be on average 47 mm -diameter.

In the embodiment shown in the Fig. 9 and Fig. 10, the angling A2 of the elongated pushing element 12 in the horizontal direction in relation to the elongated peeling element is 0.37° and the angling A1 in the vertical direction 0.2° . These angles too may be changed to adapt the apparatus to the processing of
5 a particular type of eggs.

As described above with reference to Fig. 1-3, the mutual angling creating the funnel shaped space between the elongated peeling elements 11 and the elongated pushing element 12 may be achieved in by shaping the elongated peeling elements and the elongated pushing element in different ways.
10 A similar effect may be achieved by providing the elongated pushing element 12 with protrusions with varying dimensions along the longitudinal axis L2.

Claims

1. An apparatus (1) for peeling boiled eggs (60) each having an eggshell, said apparatus comprising a peeling section (10) having an egg inlet (601) and
5 an egg outlet (602), and where an egg transport direction (T) of the apparatus extends from the egg inlet (601) to the egg outlet (602), where the peeling section comprises:
- at least two elongated peeling elements (11) each extending along a respective longitudinal axis and at least one of them being rotatable about the
10 respective longitudinal axis, where the at least two elongated peeling elements (11) are arranged so that their respective longitudinal axis extends in the same direction as the egg transport direction (T), where the two elongated peeling elements (11) are configured for supporting eggs (60) travelling in the egg transport direction (T) and for removing the eggshells from the eggs (60), and
15 where each of the two elongated peeling elements (11) has an egg contact surface (111); and
- at least one elongated pushing element (12) having a longitudinal axis extending in the same direction as the egg transport direction (T) and being arranged at a distance from the elongated peeling elements (11) measured
20 perpendicular to the longitudinal axes of the elongated peeling elements (11), said elongated pushing element (12) having an egg contact surface (121, 127);
- c h a r a c t e r i z e d in that the egg contact surface (121) of the elongated pushing element (12) is angled in relation to the egg contact surfaces (111) of the elongated peeling elements (11) so that a first shortest distance
25 (D1) between the egg contact surface (121) of the elongated pushing element (12) and the egg contact surfaces (111) of the elongated peeling elements (11) measured perpendicular to the longitudinal axes (L1) of the elongated peeling elements (11) at the egg inlet (601) is bigger than a second shortest distance (D2) between the egg contact surface (121) of the elongated pushing element
30 (12) and the egg contact surfaces (111) of the elongated peeling elements (11) measured perpendicular to the longitudinal axes (L1) of the elongated peeling elements (11) at the egg outlet (602).

2. Apparatus for peeling eggs (60) according to claim 1, where the longitudinal axis of the elongated pushing element (12) is angled in relation to the longitudinal axes of the elongated peeling elements (11).

5

3. Apparatus for peeling eggs (60) according to claim 1 or 2, further comprising a carrier device (20) for moving the eggs (60) in the egg transport direction (T), said carrier device (20) comprising a plurality of conveying elements (23) extending transversely to the egg transport direction and between the elongated pushing element (12) and the elongated peeling elements (11).

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4. Apparatus for peeling eggs (60) according to claim 3, where the conveying elements (23) form compartments (24) between them, each compartment being configured for accommodating a single egg.

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5. Apparatus for peeling eggs (60) according to one or more of the preceding claims, where the elongated pushing element (12) has protrusions (120) spaced apart from each other along the longitudinal axis (L2) of the elongated pushing element (12).

20

6. Apparatus for peeling eggs (60) according to one or more of the preceding claims, where protrusions (120) are formed by a spiral member coiled about the longitudinal axis of the elongated pushing element (12).

25

7. Apparatus for peeling eggs (60) according to claim 5 or 6, where the protrusions (120) are spaced along the longitudinal axis of the elongated pushing element (12) with varying mutual distances.

8. Apparatus for peeling eggs (60) according to one or more of the preceding claims, where the position of the elongated pushing element (12) relative to the elongated peeling elements (11) is adjustable.

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9. Apparatus for peeling eggs (60) according to one or more of the preceding claims, where the elongated peeling elements (11) are placed with a mutual distance of 0,5 mm measured perpendicular to the longitudinal axes of the elongated peeling elements (11).

5

10. Apparatus for peeling eggs (60) according to one or more of the preceding claims, where the elongated peeling elements (11) are configured for rotating in opposite directions.

10

11. Apparatus for peeling eggs (60) according to one or more of the preceding claims, where the elongated peeling elements (11) are placed in the same horizontal plane.

12. Apparatus for peeling eggs (60) according to one or more of the preceding claims, where the elongated peeling elements (11) are provided with a friction promoting coating or sleeve, where said coating or sleeve may be a polymer.

13. Apparatus for peeling eggs (60) according to one or more preceding claims, where the elongated pushing element (12) is placed at a vertical distance of 30-70 mm, preferably 40-50 mm, above the elongated peeling elements (11) measured at the egg inlet (601).

14. Apparatus for peeling eggs (60) according to one or more of the preceding claims, where the angling of the longitudinal axis of the elongated pushing element (12) in relation to at least one of the longitudinal axes of the elongated peeling elements (11) is adjustable, preferably within the interval of 0.1-1 degrees, more preferable within the interval of 0.2-0.5 degrees.

15. Apparatus for peeling eggs (60) according to one or more of the preceding claims, where the elongated peeling elements (11), the elongated

pushing element (12), and the carrier device (20) each have individual actuators (51, 52, 53, 54).

16. Apparatus for peeling eggs (60) according to one or more of the preceding claims, further comprising a cracking section (30) configured for cracking the eggshells, said cracking section being located before the egg inlet (601).

17. A method for peeling boiled eggs, where eggs (60) each having an eggshell enters a peeling section (10) of a peeling apparatus via an egg inlet (601) and exits the peeling section (10) via an egg outlet (602), and where said eggs (60) travel in an egg transport direction (T) extending from the egg inlet (601) to the egg outlet (602), said method further comprising:

arranging said eggs (60) on at least two elongated peeling elements (11), where each of the elongated peeling elements (11) extend along a respective longitudinal axis, where the two elongated peeling elements (11) are arranged so that their respective longitudinal axis extend in the same direction as the egg transport direction (T), and where each of the two elongated peeling elements (11) has an egg contact surface (111),

rotating at least one of the elongated peeling elements (11) about its longitudinal axis, thereby removing the eggshells from the eggs (60);

pushing the eggs (60) towards the elongated peeling elements (11) using at least one elongated pushing element (12) having an egg contact surface (121) and a longitudinal axis, where the elongated pushing element (12) is arranged so that its longitudinal axis extends in the same direction as the egg transport direction (T), and where the elongated pushing element (12) is arranged at a distance from the elongated peeling elements (11) measured perpendicular to the longitudinal axes of the elongated peeling elements (11);

characterized in that

the push on the eggs (60) resulting from the use of the elongated pushing element (12) increases as the eggs (60) are moving in the egg transport direction (T), due to the egg contact surface (121, 127) of the elongated pushing element (12) being angled in relation to the egg contact surfaces (111) of the

elongated peeling elements (11) so that a first shortest distance between the egg contact surface (121) of the elongated pushing element (12) and the egg contact surfaces (111) of the elongated peeling elements (11) measured perpendicular to the longitudinal axes of the elongated peeling elements (11) at the egg inlet (601) is bigger than a second shortest distance between the egg contact surface (121) of the elongated pushing element (12) and the egg contact surfaces (111) of the elongated peeling elements (11) measured perpendicular to the longitudinal axes of the elongated peeling elements (11) at the egg outlet (602).