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Separating Unit

Abstract

A separating unit for a packaging machine for packing food products is disclosed. The separating unit may be used in a molding station, a heating station, or a combined heating and molding station. The separating unit may be configured to process a material web that is moved through the packaging machine in a transport direction. The processing of the material web may be performed by a plurality of separating elements that may be of the same type or of different types to produce perforations and/or peel corner cuts in the material web.

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Background/Summary

RELATED APPLICATION [0001] The present application is a national stage application under 35 U.S.C. § 371 of International Application No. PCT/EP2023/059800, filed 14 Apr. 2023, which claims priority from German Patent Application No. 10 2022 111940.8, filed 12 May 2022 and German Patent Application No. 10 2022 118988.0, filed 28 Jul. 2022. The above-referenced applications are incorporated by reference.

SUMMARY

[0002] The invention relates to a separating unit for a packaging machine for packaging food products, in particular for arrangement in a molding station, in a heating station or in a combined heating and molding station of the packaging machine, wherein the separating unit is configured to process a material web, which is moved in the packaging machine along a transport direction, by means of a plurality of separating elements of the same type or of different types, in particular to produce perforations and/or peel corner cuts in the material web.

[0003] The invention furthermore relates to a station for a packaging machine for packaging food products, said station comprising at least one separating unit as disclosed herein and a counter-unit that, during operation, is arranged at the other side of the material web to be processed opposite the separating unit. This station can be a molding station, a heating station or a combined heating and molding station.

[0004] The invention further relates to a packaging machine for packaging food products comprising at least one station as disclosed herein.

[0005] The invention furthermore relates to a separating unit, a station or a packaging machine, in each case as disclosed herein, wherein the material web comprises at least one fibrous material layer that comprises or consists of fibrous material.

[0006] The invention also relates to a method for operating a packaging machine for food products for producing packages at least from a bottom material web and a top material web that enclose at least one product region of a respective package, wherein the bottom material web passes through a molding station as disclosed herein of the packaging machine, wherein recesses of the product regions are formed in the molding station in the bottom material web, and wherein, after the insertion of food products into the recesses, the material webs are connected to one another to close the product regions.

[0007] Devices for cutting through areal workpieces are generally known. Reference is for example made to DE 39 35 625 A1.

[0008] One possible application in the field of packaging machines for packaging food products is to form holes in marginal regions of the bottom material web, said holes being used in a subsequent sealing station to evacuate and gas the product regions before the closing. Such a punching of a bottom material web in a packaging machine is generally known. Another, equally well-known application is forming so-called peel corner cuts in the bottom material web. In this respect, slots are formed in the bottom material web, and indeed in each case in the region of one corner of a respective recess. After the separation of the packages, they are each provided with a peel corner, which peel corners make it easier for the consumer to open the package and can furthermore help the consumer to separate individual layers of the material web from one another more easily, e.g. to

separate a plastic layer, also called a liner, more easily from a paper layer. In practice, such separating processes can be performed mechanically using knives or blades, wherein circular blade edges are used for the perforations and straight blade edges for the peel corner cuts.
[0009] Known separating units are relatively large, have a complicated structure and are often designed as separate devices that consequently require a relatively large amount of space and thus enlarge the packaging machine, wherein known separating units are furthermore cumbersome to maintain and clean and, moreover, a conversion for different applications of the packaging machine is often not possible or involves a great deal of effort.
[0010] In the field of packaging machines for packaging food products, the object of the invention is to improve the necessary processing of the material webs by means of separating elements and the handling of apparatuses provided for this purpose.
[0011] This object is in each case satisfied by the features of the independent claims.
[0012] The separating unit according to the invention is inter alia characterized in that it defines a separating plane that is in parallel with the material web during operation, a working direction perpendicular to the separating plane and a working width that is in parallel with the separating plane and perpendicular to the transport direction and that corresponds to the width of a respective material web, wherein the separating unit comprises a plurality of separate assemblies, which are arranged above one another in the working direction and which can in particular be mounted without tools, namely a base part, in particular a cover-like base part; a support frame which is fastened to the base part and at whose side facing away from the base part the separating plane is disposed; between the support frame and the base part, at least one holding plate which is movably supported at or in the support frame in the working direction and at whose side facing away from the base part at least one and preferably a plurality of separating elements projecting in the working direction are attached, wherein the support frame is provided with apertures for the separating elements; and between the holding plate and the base part, at least one pressure plate that acts as a drive for the holding plate, that can be acted on by compressed air connectable to the separating unit and that is configured to adjust the holding plate between a passive position with separating elements retracted into the apertures of the support frame and an active position with separating elements extended out of the apertures and through the separating plane.
[0013] Despite the arrangement of the individual assemblies above one another, it can be achieved that the separating unit only has a low construction height. The separating unit can be integrated into a molding station, a heating station or a combined heating and molding station of the packaging machine without increasing the construction height of the respective station to a relevant degree.
[0014] The separating unit can have an at least partly integrated design with respect to the working direction. In particular, the total construction height of the separating unit can be less than the sum of the construction heights of all or a subset of the assemblies. This can be realized by a nested arrangement with respect to the working direction of the or individual assemblies of the separating unit in the assembled state.
[0015] The separating stroke, i.e. the required movement for adjusting the separating elements, i.e. the movement for adjusting the holding plate provided with the separating elements, is integrated into the separating unit. This means that the separating unit as a whole does not need to be moved for the separating process. It is therefore possible, although not mandatory, to integrate the separating unit into a stationary part of a respective station that is not moved when opening or closing the station.
[0016] If, on the other hand, the separating unit is moved as a whole, for example, if it is integrated into a non-stationary part of a respective station that is moved when opening or closing the station, provision can then be made that one or more separating elements are attached to the support frame or integrated into the support frame. Furthermore, an attachment or integration of at least one separating element at or into the support frame is possible even if the separating unit is stationary.

In this case, a drive is provided for the separating element and is configured to adjust the separating element relative to the support frame.
[0017] It is further of advantage that the separating unit is easy and safe for a user to handle since, in the passive position, the separating elements are in the retracted passive position. There is therefore no risk of injury.
[0018] Since the assemblies of the separating unit are separate assemblies, in particular modular assemblies, they can be easily replaced. This is in particular of advantage for a conversion of the separating unit. The holding plate comprising the separating elements can be replaced with another holding plate comprising other separating elements or comprising separating elements positioned differently at the holding plate in order to perform other separating functions at a respective material web. The support frame itself can also be replaced, for example, to enable the use of other holding plates that do not match every support frame. Provision can further be made that the separating elements can be completely removed.
[0019] The use of compressed air as a drive for the pressure plate makes the operation of the separating unit simple and reliable. In practice, compressed air is usually available at packaging machines anyway. Furthermore, the compressed air can be advantageously used for additional purposes, as explained in more detail elsewhere.
[0020] The integration of the separating unit into a molding station or into the molding section of a combined heating and molding station is particularly advantageous. The separating unit can in particular form a component of a molding station, in particular the upper part of a molding station. As a component of a molding station, the separating station can be configured to form recesses in the material web by reshaping the latter in that a molding pressure is built up in the separating unit by means of compressed air and drives the material web into negative molds of a lower molding tool, also called a counter-unit. This will be discussed in more detail below.
[0021] However, this integration of the separating unit into a molding station or the formation of a part of a molding station by the separating unit according to the invention is not mandatory. It is also possible to provide the separating unit at another station of the packaging machine, for example at a heating station that is arranged upstream of a molding station and that serves to heat the bottom material web before the molding process. It is also possible to provide the separating unit at a combined heating and molding station of a respective packaging machine, wherein the separating unit can then be arranged either at a heating section or at a molding section, as explained above, of this combined heating and molding station. Furthermore, the separating unit can be used to process material webs that are used in the production of so-called skin packs, i.e. material webs in which no recesses are formed, i.e. for which no molding station serving to form recesses is used. The separating unit can then e.g. be used to produce peel corner cuts in the material web, which is also advantageous for skin packs.
[0022] If the separating unit according to the invention is a component of a molding station, the integrated drive for the holding plate in the form of the pressure plate that can be acted on by compressed air has the advantage that the process of processing the material web by means of the separating elements, i.e. the actual separating process by adjusting the holding plate, can be adapted in terms of time to the sequence of the molding process in a manner that is optimal for the respective application.
[0023] For example, the separating process can take place when there is still sufficient molding pressure towards the end of the molding process or when sufficient molding pressure is already built up at the start of the molding process in order to use the built-up pressure to clean the separating points, which are produced in the material web by means of the separating elements, by a free blowing. Furthermore, the separating process can take place at a point in time at which the previously heated material web has already cooled down again to thus avoid unwanted effects such as deformations of the material web or adhesions of web material in the region of the separating elements.

[0024] Further possible embodiments of the separating unit according to the invention are explained below.
[0025] According to some embodiments, the separating unit can be connectable to a compressed air supply, wherein a molding pressure can be built up in a pressure space, which is bounded by the base part and the support frame, by means of supplied compressed air when, during operation, the support frame, with its side facing away from the base part, contacts the material web to form recesses in the material web by reshaping the material web by means of the molding pressure. In this embodiment, the separating unit can be integrated into a molding station of a packaging machine or can form a component of a molding station. The pressure space can be sealed with respect to the environment by a seal arranged between the base part and the support frame. Provision can in particular be made in this respect that the seal runs around a recess of the support frame, said recess serving to receive the holding plate.
[0026] According to some embodiment examples, provision can be made that the pressure plate and the holding plate are arranged within the pressure space. This enables a particularly compact design in the working direction and thus results in a relatively low construction height.
[0027] Furthermore, provision can be made that a plurality of separate holding plates, each comprising at least one and preferably a plurality of separating elements, are movably supported at or in the support frame. In this respect, it is possible, but not mandatory, that at least two separate holding plates are provided with separating elements of a different type in each case. In this way, the separating unit can be adapted to a respective application by providing appropriately designed holding plates and can be easily converted when the application is changed.
[0028] The holding plates can be assembled to form a total plate and can be jointly movably supported at or in the support frame.
[0029] The holding plates can be jointly adjustable by means of the pressure plate.
[0030] Furthermore, according to some embodiment examples, provision can be made that at least one holding plate has one or more separating elements of a first type and at least one further holding plate has one or more separating elements of a second type. The first type and the second type can be the same or different.
[0031] Furthermore, provision can be made that at least one holding plate is configured as a holder for at least one further holding plate. Provision can in particular be made in this respect that the one holding plate can be used without the further holding plate, but not vice versa.
[0032] According to some embodiment examples, provision can be made that the one holding plate fills the support frame in a plane in parallel with the separating plane and is provided with a receiver for the further holding plate. This constitutes a particularly easy-to-use option for combining a plurality of holding plates to form a total plate, to movably support them together at or in the support frame and to adjust them together by means of the pressure plate.
[0033] If a holding plate has a receiver for one or more further plates, this further plate can then—as explained above—likewise be a holding plate for one or more separating elements. If, in a respective application, no further separating elements are required in addition to the separating elements of the holding plate provided with the receiver, a dummy plate can be provided for this receiver, by which it is meant that this dummy plate merely closes the receiver, but does not itself contribute to the processing of the material web by means of separating elements, i.e. does not itself have any separating elements.
[0034] This concept of one or more dummy plates can also be used in conjunction with holding plates that each do not have a receiver for one or more further plates and do not fill the support frame, but that are each to be arranged by a side-by-side arrangement with the at least one further plate at or in the support frame in order to form a total plate.
[0035] Furthermore, provision can be made that the base part, the support frame, the holding plate and the pressure plate each extend across the working width and preferably each have a low construction height in the working direction compared to the working width.

[0036] The base part can have an end plate comprising two side walls spaced apart from one another in the direction of the working width and projecting towards the separating plane in the working direction, wherein the side of the end plate facing towards the separating plane and the side walls bound a receiving space for the support frame.
[0037] The support frame can be insertable into the receiving space of the base part. This enables a particularly simple and fast removal of the support frame, in particular together with the holding plate supported thereat, whereby maintenance and, if necessary, conversion can be simplified.
[0038] The end plate of the base part can have, at its side facing towards the separating plane, a recess for receiving the pressure plate.
[0039] Furthermore, provision can be made that the support frame has, at its side facing towards the base part, a recess for receiving the holding plate and an end plate in which the apertures for the separating elements of the holding plate are formed. Furthermore, provision can be made that openings corresponding to negative molds of a counter-unit are furthermore formed in the end plate.
[0040] In some embodiment examples, provision can be made that the total construction height of the separating unit in the assembled state is less than the sum of the individual construction heights of the base part and the support frame.
[0041] The holding plate and/or the support frame can be provided with one or more spring arrangements against whose return force the holding plate can be adjusted into the active position by means of the pressure plate and by which the holding plate is preloaded into the passive position. In the passive position of the holding plate, the separating elements are retracted into the apertures of the support frame. The spring arrangement therefore ensures that the arrangement of the support frame and the holding plate adopts a safe state in that there is no risk of injury to a user when handling this arrangement due to the separating elements.
[0042] Furthermore, provision can be made that the pressure plate and/or the base part is/are provided with one or more spring arrangements against whose return force the pressure plate, when acted on by compressed air, can be moved away from the base part in order to adjust the holding plate into its active position. This spring arrangement supports or effects the adjustment of the holding plate back into the passive position as soon as the application of compressed air has ended.
[0043] Instead of or in addition to spring arrangements, other devices that enable a resetting due to elastic deformation or to an active resetting can in each case also be provided, for example compressed air cylinders.
[0044] According to some embodiment examples, provision can be made that the pressure plate, at its side facing the base part, is provided with at least one flexible hollow body that can be connected to a compressed air supply and that can be inflated by applying compressed air. The drive for the holding plate can thus be realized in a particularly simple manner. Such a drive is in particular advantageous when compressed air is available at the packaging machine anyway or when the separating unit is operated with compressed air to carry out molding processes for forming recesses in the material web.
[0045] According to further possible embodiment examples, a set of different support frames that are mutually interchangeable at a base part and/or a set of different holding plates that are mutually interchangeable at a support frame or that can be used with different support frames can be provided. A conversion of the separating unit for different applications at a packaging machine can hereby take place in a particularly simple and time-saving manner. It is furthermore of advantage that, with the replaceable individual parts, significantly less weight has to be handled in each case than when removing or replacing a separating unit as a whole, irrespective of its specific design.
[0046] The station according to the invention is characterized, irrespective of whether it is a molding station, a heating station or a combined heating and molding station, in that the separating unit and the counter-unit can be moved relative to one another perpendicular to the separating plane in order to perform working strokes for closing and opening the station, and in that the adjustment

movements of the holding plate of the separating unit that can be effected by means of the pressure plate can be performed in addition to the working strokes. It is furthermore of advantage that the adjustment movements—when the material web is stationary, i.e. does not move in the transport direction—can generally be performed at any desired point in time.

[0047] The station is preferably configured such that the processing of the material web by means of the separating elements, in particular the production of perforations and/or peel corner cuts in the material web, takes place at a point in time when the material web is fixedly held between the separating unit and the counter-unit, in particular clamped between the separating unit and the counter-unit. Here, the material web is therefore not only held by laterally engaging transport devices, such as the clamping chains typically used in packaging machines, but additionally by the mutually facing surfaces of the separating unit and the counter-unit. It has been shown that particularly good processing results can hereby in particular be achieved with very thick or very thin material webs. In particular, a better cutting pattern can hereby be produced than in the prior art.

[0048] This procedure, i.e. the processing of the material web when it is held, in particular clamped, between the separating unit and the counter-unit, also represents a preferred further development of the method according to the invention disclosed herein.

[0049] It is generally possible that the working strokes for closing and opening the station are positively coupled to the adjustment movements of the holding plate, as to the separating processes. However, the station is preferably configured such that the working strokes and the separating processes are at least partly decoupled from one another and are in particular independent of one another. The station or the packaging machine comprising the station is in particular provided with a control device that is configured to control the operation of the station in dependence on the operation of the packaging machine as a whole in a respective desired manner, wherein this control in particular includes that the opening and closing of the station can be controlled independently of the separating processes, i.e. of the adjustment of the holding plate.

[0050] Provision can in particular be made that the station can be controlled such that a respective separating process takes place during a respective working stroke, at the end of a respective working stroke or following a respective working stroke.

[0051] As already mentioned, it is generally possible for the separating unit to be arranged below the separating plane, wherein the counter-unit is arranged above the separating plane. However, an arrangement is preferred such that the counter-unit is arranged below the separating plane and the separating unit is located above the separating plane. The relative movability of the separating unit and the counter-unit can be realized such that the separating unit is stationary with respect to the working direction, i.e. it is not raised or lowered to close and open the station, wherein only the counter-unit performs the working stroke, also called the lower stroke. However, it is generally possible to additionally provide an upper stroke for the separating unit. Whether an upper stroke is provided for the separating unit can be made dependent on the structural conditions at the respective packaging machine and on which respective application is to be performed with the packaging machine.

[0052] According to some embodiment examples, provision can be made that the station is a molding station or a combined heating and molding station that is configured to form recesses in the material web by reshaping the latter, wherein the counter-unit comprises a plurality of negative molds and the support frame comprises openings corresponding to the negative molds, wherein, when the station is closed, a molding pressure can be built up in the separating unit, at the side of the separating plane facing the base part, by means of compressed air in order to drive the material web into the negative molds and thus to form the recesses, and wherein, during or after completion of the build-up of the molding pressure, the holding plate of the separating unit can be adjusted into the active position to process the material web by means of the separating elements.

[0053] A respective separating process can take place, for example, during or after completion of

the build-up of the molding pressure. The separating process can in particular take place when recesses are each already at least partly formed. This inter alia has the advantage that a material web possibly heated before the molding process has already cooled down again when the separating elements come into contact with the material web.
[0054] As already mentioned elsewhere, it is not absolutely necessary for the separating unit to be a component of a molding station. Provision can also be made that the station is a heating station or a combined heating and molding station, wherein the counter-unit is a heating unit that is configured to heat the material web.
[0055] Irrespective of the specific design of the station, in some embodiment examples provision can be made that the counter-unit is provided with cut-outs that correspond to the separating elements of the separating unit and that are configured to receive the extended separating elements.
[0056] At least some of these cut-outs can be provided with escape and/or suction openings via which compressed air can escape after the processing of the material web has taken place and/or which can be acted on by negative pressure.
[0057] Impurities that arise due to the separating process, in particular so-called cutting dust that can accrue when cutting fibrous material, can be removed in this way, wherein it is particularly reliably prevented that such impurities enter the product regions.
[0058] Furthermore, provision can be made that the counter-unit is supported directly or via a lower part at a lifting apparatus that is configured to raise and lower the counter-unit in order to perform lower strokes, and thus to close and open the station or to contribute to these working strokes.
[0059] As mentioned elsewhere, an upper stroke can be provided for the separating unit. The lifting apparatus can then be configured to also perform this upper stroke. The use of lifting apparatuses that can be easily converted such that work can selectively take place with or without an upper stroke is particularly advantageous.
[0060] If the station is a combined heating and molding station, a common lower part can be provided at which the lifting apparatus engages and which carries, for example, one or more heating units of a heating station arranged upstream and a lower part of a molding station.
[0061] As already mentioned elsewhere, the invention furthermore relates to a packaging machine for packaging food products comprising at least one station as disclosed herein, wherein this station comprises at least one separating unit as disclosed herein.
[0062] According to some embodiments of this packaging machine, provision can be made that the support frame together with the holding plate can be removed from the separating unit with the base part remaining at the packaging machine. This removal can in particular take place by pulling the support frame out of the base part in parallel with the transport direction of the packaging machine.
[0063] In this respect, provision can be made according to some further developments that the support frame is supported on the packaging machine. This can take place via one or more sliding or rolling members that are in particular attached to the support frame.
[0064] It can hereby be achieved that the support frame slides or rolls along the packaging machine during a removal from the separating unit. For this purpose, the packaging machine can be equipped with rails or strips specifically provided for this purpose or other parts extending in the direction of the removability of the support frame.
[0065] This provides a conceivably convenient and quick option for removing the support frame, for example, for maintenance or cleaning purposes or for conversion by changing the support frame and/or by changing one or more holding plates. Consequently, only the weight of the holding plate needs to be handled by a user to change a holding plate since the support frame is supported at the packaging machine. The weight of a holding plate is unproblematic for a user so that this concept relieves the user.
[0066] The invention further relates to a separating unit for a packaging machine for packaging

food products, in particular for arrangement in a molding station, in a heating station or in a combined heating and molding station of the packaging machine, wherein the separating unit is configured to process a material web, which is moved in the packaging machine along a transport direction, by means of a plurality of separating elements of the same type or different types, in particular for producing perforations and/or peel corner cuts in the material web.

[0067] The separating unit can define a separating plane that is in parallel with the material web during operation, a working direction perpendicular to the separating plane and a working width that is in parallel with the separating plane and perpendicular to the transport direction and that corresponds to the width of a respective material web.

[0068] In some embodiments, provision can be made that the separating unit comprises a base at or in which the separating elements are movably supported relative to the base in a working direction. In particular, the separating elements can be adjustable by means of a drive between a passive position, in particular with separating elements retracted into apertures of the base, and an active position, in particular with separating elements extended out of apertures of the base and through a separating plane.

[0069] In some embodiments, provision can be made that the separating elements are arranged at the base in such a manner that they can be replaced individually or in groups or all together.

[0070] In some embodiments, provision can be made that the base comprises a base part, in particular a cover-like base part, and a support, in particular a support frame, which is fastened to the base part and at whose side facing away from the base part a separating plane is disposed, in particular wherein the support can be inserted into a receiving space of the base part.

[0071] According to some embodiments, the separating elements can be attached to at least one holding unit, in particular at least one holding plate, that is adjustable by means of a drive.

[0072] Such a holding unit can, for example, have one or more holding plates and can be arranged as shown in the embodiment example according to FIGS. **2** to **9**. Alternatively, the holding unit—irrespective of its specific design—can also be arranged at the lower side of the separating unit. This is particularly advantageous if the separating unit or an upper part of a molding station comprising the separating unit can be moved into a maintenance position, e.g. by pivoting upwards about an axis preferably extending in parallel with the transport direction of the respective packaging machine, so that the lower side of the separating unit is easily accessible to a user and a holding unit arranged there can be particularly easily removed and replaced. The upper part of a molding station is also called the upper tool or the upper molding tool.

[0073] The holding unit can be arranged at the side facing the base part or at the side of the support facing away from the base part.

[0074] According to some embodiments, the holding unit can be movably supported at the base, in particular at a support of the base, in a working direction.

[0075] In some embodiments, provision can be made that the holding unit can be received in a recess of the base, in particular of a support of the base.

[0076] Furthermore, provision can be made that the holding unit can be inserted into the base.

[0077] In some embodiments, provision can be made that the holding unit is arranged at a side of the base that, during operation, faces the material web to be processed, in particular at the lower side of the base when the separating unit is located above the material web during operation.

[0078] The holding unit can be a separate assembly, in particular a modular assembly, that is arranged at the base in a replaceable manner and that can in particular be mounted without tools.

[0079] Furthermore, provision can be made that the base part, the support and the holding unit form a plurality of separate assemblies, in particular modular assemblies, that are arranged above one another in the working direction and that can in particular be mounted without tools.

[0080] According to some embodiment examples, one or more individual drives, in particular one or more compressed air cylinders or one or more electric motors, preferably one or more servomotors, can be provided as a drive for adjusting the separating elements or a holding unit to

which the separating elements are attached. Alternatively, a pressure unit, in particular a pressure plate, can be provided as a drive for adjusting the separating elements or a holding unit to which the separating elements are attached, which pressure unit can be acted on by compressed air connectable to the separating unit and is configured to adjust the separating elements or the holding unit between the passive position and the active position.

[0081] The invention furthermore relates to a molding station or an upper part of a molding station or a lower part of a molding station for a packaging machine for packaging food products, said molding station or upper part or lower part thereof comprising a separating unit as disclosed herein.

[0082] The station is in particular a molding station or a combined heating and molding station that is configured to form recesses in the material web by reshaping the latter, in particular wherein the station is configured for a reshaping without the effect of heat or for a reshaping by thermoforming.

[0083] Such molding stations and methods for reshaping material webs at packaging machines are generally known to the skilled person. Thermoforming is understood as the reshaping of a respective semi-finished product—here the bottom material web—at an elevated temperature. Thermoforming is also called hot forming or deep drawing so that the molding station is also called a deep-drawing station. However, aspects of the invention that relate to or include a reshaping of the material web are not limited to a reshaping at an elevated temperature, i.e. to a reshaping under the effect of heat. The reshaping of the bottom material web can also take place without the effect of heat, i.e. not by thermoforming. Unless otherwise stated below, general terms such as "reshaping" and "molding station" refer to both variants, i.e. both to the thermoforming and to the reshaping without the effect of heat. A reshaping without the effect of heat can be, for example, achieved by compressed air forming, by vacuum forming, by a combined compressed air and vacuum forming or by die forming. In the case of thermoforming, the reshaping of the material web can also take place by compressed air forming, by vacuum forming, by a combined compressed air and vacuum forming or by die forming, but only at a previously heated material web.

[0084] Against this background, provision can be made that the station is configured to perform the reshaping of the material web by compressed air forming, by vacuum forming, by a combined compressed air and vacuum forming or by die forming.

[0085] Furthermore, provision can be made that the separating unit is a component of an upper part or of a lower part of the molding station or that the separating unit forms the upper part or the lower part of the molding station. In this respect, the separating unit can be configured as a tool or as a part of an overall tool for reshaping the material web, in particular for reshaping the material web by compressed air forming, by vacuum forming, by a combined compressed air and vacuum forming or by die forming, said part of an overall tool preferably cooperating with a counter-unit that, during operation, is arranged at the other side of the material web to be processed opposite the separating unit.

[0086] The invention further relates to a packaging machine for packaging food products comprising at least one station as disclosed above.

[0087] As also already mentioned elsewhere, the material web to be processed can comprise at least one fibrous material layer that that comprises or consists of fibrous material. In this case, according to some further developments of the invention, provision can be made that the packaging machine has a pretreatment device that is configured to subject the material web to a pretreatment in which the moisture content of the fibrous material layer is changed, in particular increased.

[0088] In connection with a method according to the invention for operating a packaging machine, provision can in particular be made that the packaging machine is operated in a clocked manner, wherein work cycles alternate with pre-drawing cycles serving to pre-draw the material webs. This is generally known to the skilled person. During a work cycle, for example, recesses are formed in the bottom material web at the molding station, products are inserted into the recesses at an insertion station arranged downstream, for example by means of a conveyor belt also called an inserter or by means of a robot, and the material webs are connected to one another at a sealing

station arranged further downstream in order to seal the product regions with the food products located therein. In practice, a packaging machine usually has further work stations that do not need to be discussed in detail here. A possible embodiment example of a packaging machine is described in more detail elsewhere.

[0089] In the method according to the invention, provision can in particular be made that the counter-unit cooperating with the separating unit according to the invention comprises a plurality of negative molds and the support frame of the separating unit comprises openings corresponding to the negative molds, wherein, in a respective work cycle, when the station is closed, a molding pressure is built up in the separating unit, at the side of the separating plane facing the base part, by means of compressed air in order to drive the bottom material web into the negative molds and thus to form the recesses, wherein the holding plate of the separating unit is adjusted into the active position to process the bottom material web by means of the separating elements.

[0090] Furthermore, according to some embodiment examples of the method, provision can be made that the regions at which the bottom material web is processed by means of the separating elements are freed from processing residues by a blowing out and/or by suction in that compressed air and/or negative pressure is applied to at least these regions.

[0091] In this respect, provision can in particular be made that an air flow is generated by means of compressed air and/or negative pressure through openings in the bottom material web that are produced during the processing by means of the separating elements.

[0092] As already initially mentioned, the processing of the bottom material web takes place by means of the separating elements, in particular for the purpose of providing side regions of the material web with a perforation, wherein the processing can alternatively or additionally take place to produce a peel corner cut in each case in particular in the region of a corner of a respective recess of the material web. Here, the separating elements therefore produce holes or cuts in the bottom material web. These openings can be used to remove processing residues that arise during their production.

[0093] A molding pressure used to produce the recesses by reshaping can be used for such a cleaning. In particular, provision can be made in the method according to the invention that the holding plate is adjusted into the active position at a point in time at which a molding pressure above the environmental pressure is built up. This can, for example, take place in an initial phase of a molding process when the molding pressure is already partly built up and is above the environmental pressure. Alternatively, the separating process can take place in a final phase of a respective molding process when the molding pressure has already been partly reduced, i.e. no longer has a maximum value, but is still above the environmental pressure. Optionally, this cleaning can be supported by applying a negative pressure.

[0094] The reducing of the molding pressure can, for example, take place by opening the molding station. In such a case, provision can be made that the holding plate is adjusted into the active position before the molding station is opened. At least a portion of the molding pressure can then escape through the openings produced in the bottom material web by means of the separating elements, and can thus remove processing residues.

[0095] As already mentioned elsewhere, it can be advantageous to only bring the separating elements into contact with the material web when it has already at least partly cooled down again in the event of a prior heating. In this connection, provision can be made in the method according to the invention that the holding plate is adjusted into the active position at a point in time at which the recesses have each already been at least partly formed.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0096] The invention will be described in the following by way of example with reference to the drawing. There are shown:

[0097] FIG. **1** schematically, in a side view, a packaging machine according to the prior art;

[0098] FIG. **2** in a perspective view, a possible embodiment example of a combined heating and molding station according to the invention with a separating unit according to the invention; and

[0099] FIGS. **3** to **9** different views of the separating unit according to the invention of FIG. **2**.

DETAILED DESCRIPTION

[0100] The packaging machine according to the prior art, which is described below with reference to FIG. **1**, can be equipped with a station according to the invention, which comprises a separating unit according to the invention, for example a combined heating and molding station **12** and a separating unit **51**, as described with reference to FIGS. **2** to **9**, instead of a conventional molding station (provided with the reference numeral **11** in FIG. **1**). Such a packaging machine can then be operated according to the method according to the invention.

[0101] The packaging machine V shown in FIG. **1** that operates in a transport direction T comprises a machine frame **47**. A transport chain **27**, which is only schematically shown here at the upstream end of the machine, is guided at a left side frame and at a right side frame of the machine frame **47** in each case. The two transport chains **27** together form a transport device for a bottom web **23** drawn from a supply roll **23***a*.

[0102] The machine comprises a plurality of work stations following one another in the transport direction T, namely a molding station **11** also called a deep-drawing machine or a thermoforming machine, an insertion station **13** for products **10** to be packaged, a feed station **14** for a top web **25** drawn from a supply roll **25***a*, a labeling and/or printing station **16**, a transverse separating station **17** and a longitudinal separating station **19**.

[0103] The products **10** to be packaged are, for example, food products, here in the form of so-called portions, that each comprise a plurality of slices that were previously cut off from a loaf-shaped or bar-shaped food, such as sausage, cheese, ham or meat, by means of a food slicer (not shown). The slicer and the packaging machine can form a continuous production line.

[0104] A central control device **41** controls the operation of the packaging machine V, including the work stations mentioned. It can also control the slicer or be connected to a control device of the slicer. Furthermore, the packaging machine V is preferably provided with an operating device **45** that e.g. comprises a touch screen at which all the necessary information can be displayed to an operator and the operator can make all the necessary settings before and during the operation of the machine.

[0105] The design and operation of said work stations are generally known to the skilled person so that they will not be discussed in detail here.

[0106] At the molding station **11** comprising an upper tool **11***a* and a lower part **11***b*, recesses **29**, also called depressions, are each formed in a deep-drawing process in the bottom web **23** and are each part of a product region **20** of the respective finished package **21**, wherein a finished package **21** can also comprise a plurality of product regions. The portions **10** mentioned are inserted into these recesses **29** at the insertion station **13**. The insertion station **13** here comprises a so-called feeder of which two endless conveyor belts **13***a*, **13***b* are shown. Alternatively or additionally, the insertion station **13** can comprise a robot **50**, e.g. in the form of a so-called “picker”, that is likewise schematically shown here and that can be configured as a delta robot having a gripper **52** that comprises two claws jointly holding a respective portion **10**. Such robots and their use in the handling of foods, in particular when inserting portions into recesses of packages, are generally known to the skilled person so that further statements are not necessary here.

[0107] The bottom web **23** provided with the filled recesses **29** and the top web **25** are subsequently fed to the sealing station **15** that comprises an upper part **15***a* and a lower part **15***b*.

The top web **25** and the bottom web **23** are connected to one another by means of these parts **15***a*, **15***b*. The recesses **29** and thus the packages **21**, which are formed by the top web **25** and the bottom web **23** and which each comprise a product region **20**, are hereby closed. Sealing points **43**, also called sealing seams, extending transversely to the transport direction T are schematically indicated in FIG. **1**.

[0108] Subsequent to the sealing station **15**, the packages **21** are still connected by the top web **25** and the bottom web **23** and therefore still have to be separated. In the embodiment example shown here, the packages **21** are provided with labels **54** and/or are printed at the labeling and/or printing station **16** before the separation. The labeling and the printing can also take place in separate stations.

[0109] Further conveyor belts and/or work stations, for example a scale for checking the weight of the packages **21**, can be provided downstream of the separating stations **17**, **19**.

[0110] Applications can e.g. differ from one another with respect to the kind of products **10** to be packaged, the size/shape of the recesses **29** in the longitudinal and/or transverse direction or with respect to a format set. A format set here generally refers to a group of items, here in particular both of portions **10** and recesses **29** or packages **21**, that are handled as a whole—i.e. format set-wise—and that in particular differ from one another by the number and distance of items in the longitudinal direction and transverse direction.

[0111] Thus, e.g. per work cycle of the packaging machine, a packaging format or format set of 3×4 (3 in the transverse direction and 4 in the longitudinal direction) recesses **29** or product receivers of other kinds can be formed in the molding station **11**, a format set of 3×4 correspondingly arranged products **10** can be inserted into a respective format set of recesses **21** at the insertion station **13**, and a respective format set of 3×4 recesses **29** filled with products **10** can be sealed at the sealing station **15**. The same analogously applies to the labeling and/or printing station **16**. An arbitrarily dimensioned N×M format set can generally be formed, where N>=1 and M>=1.

[0112] As FIG. **2** shows, the combined heating and molding station **12** comprises a common lower part **101** that, in the state installed in the packaging machine V, is supported at a lifting apparatus, not shown here, that is configured to raise and lower the lower part **101** in order to perform respective working strokes during the operation of the packaging machine V in order, in this way, to move the components, explained in more detail below, that are carried by the lower part **101** relative to a separating unit **51** according to the invention and an upper part **107**.

[0113] A lower molding tool **85**, which is also called a counter-unit to the upper separating unit **51** here, and two heating units **105**, which are arranged upstream of the molding tool **85** viewed in the transport direction T of the packaging machine V, are carried by the lower part **101**.

[0114] During the operation of the packaging machine V, the bottom material web **23** is located in a plane between the lower assemblies **85**, **105** and the upper assemblies **51**, **107**. The heating units **105** serve to heat the material web **23** before the molding process, which is performed using the separating unit **51**, also called the upper tool, and the lower molding tool **85**, in order to form recesses **29** in the material web **23**, as described with reference to FIG. **1**.

[0115] Such an approach is generally known to the skilled person. What is new here is, among other things, the separating unit **51**, which here forms a component of the combined heating and molding station **12**, and the associated operation of the packaging machine V for a user. The design and mode of operation of the separating unit **51** and also its cooperation with the counter-unit **85** are described in more detail below with reference to FIGS. **3** to **9**.

[0116] The material webs used, i.e. the bottom web **23** and the top web **25** (cf. FIG. **1**), can be the typical film webs that often comprise a plurality of layers of different plastic materials. In such a case, one also simply speaks of the bottom film **23** and the top film **25**. To produce more environmentally friendly packaging, it is already known to use material webs with a paper content. For example, it is possible to use a comparatively thick paper layer as a stability support and one or

more comparatively thin layers of plastic as a support for food products.
[0117] Against this background, provision can also be made with the invention that the bottom material web **23** comprises at least one fibrous material layer that comprises or consists of fibrous material. In this respect, the bottom material web **23** can be formed as a single layer, i.e. consist of exactly one layer, namely the fibrous material layer. Alternatively, the bottom material web can be multi-layered, i.e. have a plurality of material layers that are already connected to one another during the production of the material web. Each of the plurality of layers can be a fibrous material layer so that the bottom material web is a fibrous material web without a film web, i.e. without a layer of plastic. Depending on the nature of the respective fibrous material layers and the properties of the food products to be packaged, a fibrous material layer—at least after passing through the molding station—can be suitable for serving as a support for the food products. Alternatively, in the case of a multi-layer bottom material web, provision can be made that an upper layer can comprise one or more film layers of plastic and a lower layer comprises one or more fibrous material layers. The upper side of the plastic layer or of the uppermost plastic layer then serves as a support surface for the food products to be packaged, while the lower side of the fibrous material layer or of the lowest fibrous material layer forms the outer side of the bottom material web and thus the lower outer side of a respective finished package.
[0118] It is not a subject of the present invention, but the circumstance should be mentioned in connection with the present invention that packages of fibrous material or having a fibrous material content exhibit a high dimensional stability even after a long time and even after a comparatively more robust handling during transport and storage if, before the molding process, the respective material web is subjected to a pretreatment in which the moisture content of the fibrous material layer is influenced. The pretreatment can be a drying in order to reduce an initial moisture content of the fibrous material layer. In most cases, however, the bottom material web will be in an initial state in which the fibrous material layer has a moisture content whose increase results in an improvement in the dimensional stability after the molding process, i.e. after the recesses have been formed. Therefore, in preferred applications, provision can be made that the pretreatment increases the moisture content of the fibrous material layer compared to an initial state. Accordingly, a packaging machine according to the invention can have a pretreatment device that is arranged upstream of the respective molding station or that is at least partly integrated into the molding station and that is configured to subject the bottom material web to a pretreatment in which the moisture content of the fibrous material layer is changed, in particular increased.
[0119] This concept is of importance in connection with the present invention in that the separating unit according to the invention and a molding station comprising this separating unit can also be configured to process such above-explained material webs that comprise at least one fibrous material layer. This processing comprises both processing with the separating elements of the separating unit, i.e. in particular the production of perforations and/or peel corner cuts in the material web, and the molding process for forming the recesses in the material web.
[0120] FIG. **3** shows the separation unit **51** and the counter-unit **85**. The lower side of the separating unit **51** defines a separating plane S in which the bottom web **23** to be processed is located when the station is closed, i.e. when the distance between the separating unit **51** and the counter-unit **85** in the working direction W is at its smallest.
[0121] Recesses **83**, also called negative molds, are formed at the upper side of the counter-unit **85**. The separating unit **51**, more precisely a support frame **59** together with holding plates **61**, which are not shown and which will be discussed in more detail below, and the counter-unit **85** are configured here for an application in which eight recesses are formed in the material web per work cycle. An array of 2×4 recesses is therefore formed in one work cycle, namely four recesses in the direction of the working width B and two recesses in the transport direction T.
[0122] For separating elements of the separating unit **51** that are described in more detail below, the counter-unit **85** is provided with cut-outs **97** at its upper side. Rows of cut-outs **97** provided in the

lateral marginal regions and extending in the transport direction correspond to separating elements of the separating unit **51** that are provided for producing perforations in the material web. In addition, a slot-shaped cut-out **97** extending obliquely to the transport direction T is provided in the region of a corner of each recess **83** and serves to receive a separating element of the separating unit **51** that performs a peel corner cut in the material web.

[0123] For the cut-outs **97** in the lateral marginal regions of the counter-unit **85**, escape or suction openings **99** are formed that each open to the side and that are connected to a respective cut-out **97** so that compressed air, which is applied to the cut-outs **97**, can escape through the openings **99** or negative pressure can be applied to the cut-outs **97** via the openings **99**.

[0124] In addition to the support frame **59** already mentioned, the separating unit **51** comprises a base part **57** that is configured as an end cover of the separating unit **51** and comprises an end plate **73** having side walls **75**. The end plate **73** and the side walls **75** define a receiving space **77** (cf. FIG. **4**) for the support frame **59** that can be inserted into this receiving space **77**.

[0125] In the inserted state according to FIG. **3**, fixing screws **109** serve to fix the support frame **59** to the base part **57**. For this purpose, the support frame **59** is provided with threaded openings into which threaded rods of the fixing screws **109** can be screwed. The fixing screws **109** are adapted for a manual actuation.

[0126] FIG. **4** again shows the counter-unit **85** and the separating unit **51**, wherein the latter is shown with the support frame **59** removed from the base part **57**.

[0127] The receiving space **77**, which is downwardly open towards the counter-unit **85** and is bounded by the lower side of the end plate **73** and the two side walls **75**, can be seen at the base part **57**.

[0128] The support frame **59** is provided with two rollers **103** at each side; however, said rollers do not cooperate with the base part **57**, but rather, in the assembled state, with the packaging machine V, which will be discussed in more detail below.

[0129] At its upper side facing the base part **57** in the assembled state, the support frame **59** is provided with a recess **71** (cf. FIG. **5**) in which three holding plates **61** are arranged in the embodiment example shown here. A large, areal holding plate **61** fills the recess and serves as a support for two smaller, narrow elongated holding plates **61**, i.e. strip-shaped holding plates **61**. These holding plates **61** are described in more detail below. The holding plates **61** end flush with one another at their upper sides to be jointly acted on by a pressure plate **63** (cf. FIGS. **8** and **9**), not shown in FIG. **4**, arranged at the base part **57**. Due to this action, the holding plates **61** are pressed downwardly within the support frame **59**, whereby separating elements attached to the lower sides of the holding plates **61** are moved downwardly out of the support frame **59** and through the mentioned separating plane, and indeed into the cut-outs **97** at the upper side of the counter-unit **85** that are described in connection with FIG. **3**.

[0130] The separating elements mentioned are shown in FIG. **5** in which the holding plates **61** are shown in the state removed from the recess **71** of the support frame **59**.

[0131] The large, areal holding plate **61** is provided with two holders **111**, which are releasably connected to the holding plate **61**, at the marginal regions. The holders **111** carry the separating elements **53** that each have a circular cross-section, that are chamfered at their free ends and that are configured as blade edges here. These perforating blades **53** serve to produce perforations in the marginal regions of the material web **23**.

[0132] The separating elements **55**, which are configured as blades with slightly chamfered blade edges and which are each attached via a holder **111** to the two small, narrow holding plates **61**, serve for the peel corner cuts mentioned.

[0133] A replacement of the blades **53**, **55** is possible either by removing a respective blade **53**, **55** from its holder **111** or by removing the respective holder **111** together with the blades **53**, **55** from the respective holding plate **61**.

[0134] The large holding plate **61** is provided with receivers **62** for the small holding plates **61** into

which said small holding plates can be inserted so that (cf. FIG. **4**) the holding plates **61**, in the assembled state, form a total plate that has a continuous planar surface and is completely received within the recess **71** of the support frame **59**.

[0135] The recess **71** of the support frame **59** and the large holding plate **61** are geometrically matched to one another such that the holding plate **61** is received in the support frame **59** with a precise fit so that the blades **53** attached to the large holding plate **61** and the blades **55** of the small plates **61** inserted into the large plate **61** are aligned with apertures **53***a* and **55***a* (see FIG. **7**) that are formed in a lower end plate **81** of the support frame **57**. This end plate **81** downwardly bounds the recess **71**. The end plate **81** is not only provided with the mentioned apertures **53***a*, **55***a* for the blades **53**, **55**, but furthermore with openings **87** that correspond to the negative molds **83** of the counter-unit **85** in the assembled state of the station **12** (cf. FIG. **2**).

[0136] The end plate **81** of the support frame **59** thus comprises a plurality of webs that bound the openings **87**. Upwardly projecting spring arrangements **89** are attached to these webs and each comprise a compression spring. The large holding plate **61** rests on these spring arrangements in the state inserted into the support frame **59** (cf. FIG. **4**). The holding plates **61** can jointly be pressed downwardly against the return force of these spring arrangements **89**, i.e. in the direction of the end plate **81** of the support frame **59**.

[0137] At the upper side of the support frame **59**, a groove **67** is formed which runs around the recess **71** and in which a seal **69**, only partly and schematically indicated in FIG. **5**, is inserted that seals a pressure space **65** (cf. FIG. **7**) with respect to the environment when the support frame **59** (cf. FIG. **3**) is inserted into the base part **57**. This will be discussed in more detail elsewhere.

[0138] FIG. **6** shows the large holding plate **61** of FIG. **5** in an enlarged representation. It can in particular be seen here that, at each blade holder **111**, two blades **53** are designed differently from the other five blades **53**. This illustrates that the blade holders **111** and thus the holding plate **61** overall can be fitted with different blade configurations depending on a respective application.

[0139] FIG. **7** shows a perspective view of the lower side of the separating unit **51** with the support frame **59** inserted into the base part **57**. The lower side of the support frame **59** facing away from the base part **57** defines the already mentioned separating plane S in which the material web **23** extends when the station is closed. Thus, the material web **23** then lies between the openings **87** of the support frame **59** and the negative molds of the counter-unit **85** (cf. FIG. **3**). Consequently, in this state, the pressure space **65** between the separating plane S and the base part **67** is closed and is furthermore sealed with respect to the environment by means of the seal **69** mentioned (cf. FIG. **5**).

[0140] During the operation of the packaging machine, the separating unit **51** is connected to a compressed air source so that the pressure space **65** can be pressurized in order to drive the material web **23** into the negative molds **83** of the counter-unit **85** and thus to form the desired recesses **29** (cf. FIG. **1**) in the material web **23**.

[0141] In this way, the separating unit **51** according to the invention contributes to the reshaping process for forming recesses **29** in the material web **23**. For the further function of the separating unit **51**, namely the processing of the material web **23** with the blades **53**, **55** for producing the perforations and peel corner cuts in the material web **23**, a drive for the holding plates **61**, which are provided with the blades **53**, **55** and are movably supported in the support frame **59** in the manner described above, is integrated into the base part **87**. This drive comprises a pressure plate **63** (cf. FIGS. **8** and **9**) that, in the passive state according to FIG. **8**, is located in a recess **79** that is formed at the inner side of the end plate **73** of the base part **57**. Thus, the pressure plate **63** is located above the receiving space **77** for the support frame **59** not shown in FIG. **8**.

[0142] Proximity switches **113**, which can be fastened to the base part **57** or the pressure plate **63**, are likewise shown in FIGS. **8** and **9**. The proximity switches **113** are connected to the central control device **41** of the packaging machine (cf. FIG. **1**) and are configured to detect whether the support frame **59** is inserted into the receiving space **77**, or not, in order to provide a corresponding signal for the control device **41**. It can hereby be ensured by means of the control device **41**, for

example, that the packaging machine can only be put into operation when an intended support frame **59** is inserted into the base part **57**, i.e. when the separating unit **51** is complete and ready for use.

[0143] As FIG. **9** shows in the right-hand representation, the pressure plate **63** is provided with a flexible hollow body **93**, here in the form of a hose, at its upper side facing the inner side of the end plate **73** of the base part **57**. At both of its end regions, the hollow body **93** is fastened to the upper side of the pressure plate **63** by means of holders **117**. At the center, the hollow body **93** is connected to a compressed air port **115** via which the hollow body **93** can be acted on by compressed air and can thus be inflated to move the pressure plate **63** in the working direction W (cf. FIG. **3**) and thus to move the holding plates **61** relative to the support frame **59** fixedly connected to the base part **57**.

[0144] The activation of the pressure plate **63** by inflating the hollow body **93** thus means the triggering of a separating process that comprises the blades **53**, **55** attached to the holding plate **61** being extended out of the apertures **53***a*, **55***a* (cf. FIG. **7**) of the support frame **59** when the holding plate **61** is pressurized. During the extension, the blades **53**, **55** pierce the separating plane S and thus the material web **23** extending there so that, with this separating process, the perforations are made in the material web **23** by means of the circular blades **53** and the peel corner cuts are made by means of the straight blades **55**.

[0145] The pressure plate **63** is attached via spring arrangements **91** to the inner side of the end plate **73** of the base part **57** such that the downward movement of the pressure plate **63** takes place when inflating the hollow body **93** against the return force of compression springs of the spring arrangements **91**. When the application of compressed air to the hollow body **93** stops, the spring arrangements **91** consequently ensure the return movement of the pressure plate **63** back into the passive starting position within the recess **79** in the end plate **73** according to FIG. **8**. For a resetting of the pressure plate **63**, it is consequently not necessary to apply a negative pressure to the hollow body **93**.

[0146] The holding plates **61** also experience a return movement due to the spring arrangements **89**, explained above with reference to FIG. **5**, between the end plate **81** of the support frame **59** and the holding plates **61**. Consequently, when applying compressed air to the hollow body **93** of the pressure plate **63**, work is carried out against the return forces of both the spring arrangements **89** and the spring arrangements **91**.

[0147] Consequently, with the separating unit **51** according to the invention, two functions can be performed independently of one another in time, namely the reshaping of the material web **23** to form the recesses **29** (cf. FIG. **1**), on the one hand, and the production of perforations and peel corner cuts, i.e. generally the processing of the material web by means of separating elements, on the other hand.

[0148] Both functions can be performed by means of compressed air. The point in time at which the separating process takes place can, depending on the respective application, be selected independently of the point in time of the closing of the station **12** and independently of the time sequence of the molding process.

[0149] As already mentioned in the introductory part, the separating process takes place as late as possible so that the material web **23** previously heated by means of the heating units **105** of the station **12** (cf. FIG. **2**) has already cooled down again. The contact of the material web **23** with the lower side of the support frame **59** of the separating unit **51** and the upper side of the counter-unit **85** forming the lower molding tool causes this cooling. On the other hand, the separating process takes place at a point in time at which molding pressure is still built up within the mentioned pressure space **65** (cf. FIG. **7**) of the separating unit **51** so that impurities can be blown out in the initially explained manner. This is in particular important if the material web has one or more fibrous material layers since so-called cutting dust, which should not enter the product regions **20** of the packages **21** to be produced, can arise when processing such material webs by means of the

blades **53**, **55**.

[0150] One advantage of the separating unit **51** according to the invention, in particular with regard to the function of the reshaping of the material web **23**, is that a comparatively high pressure can be built up within the pressure space **65**. For example, an overpressure above atmospheric pressure can be built up that amounts to up to 5 bar, for example lies between 2 bar and 3 bar. Depending on the respective application, such a molding pressure makes it possible that the reshaping process can be performed without an additional application of negative pressure. This saves design effort and energy and has the further advantage that when using material webs comprising one or more fibrous material layers that are pretreated by increasing the moisture content, no unwanted vacuum drying of the fibrous material takes place.

[0151] As mentioned elsewhere, the application of negative pressure can be provided to remove processing residues such as in particular cutting dust. This suction can in particular take place coordinated in time such that suction only takes place when the station **12** is open again in order, in this way, to prevent an unwanted vacuum drying of the fibrous material.

[0152] With a view to a particularly easy removal of the support frame **59** and thus of the holding plates **61** when the support unit **51** is installed at the packaging machine, said support unit is designed such that, on the one hand, the support frame **59** is fixedly connected to the base part **57** and the pressure space **65** bounded by the support frame and the base part **57** is sealed with respect to the environment by means of the seal **69**, and such that, on the other hand, the support frame **59** simultaneously rests on the packaging machine V via the rollers **103**, in particular on running rails of the packaging machine V that are provided for this purpose and that extend in the transport direction T. Thus, the user only needs to loosen the fixing screws **109** by hand and then pull the support frame **59**—like a drawer—out of the base part **57** of the separating unit, wherein the support frame **59** rolls on the running rails. The support frame **59** together with the holding plates **61** or one or more of the holding plates **61** can then e.g. be removed for cleaning purposes or can, for example, be replaced to convert the separating unit **51** to another application.

REFERENCE NUMERAL LIST

[0153] **10** product [0154] **11** molding station [0155] **11***a* upper part of the molding station [0156] **11***b* lower part of the molding station [0157] **12** combined heating and molding station [0158] **13** insertion station [0159] **13***a* conveyor belt [0160] **13***b* conveyor belt [0161] **14** feed station [0162] **15** sealing station [0163] **15***a* upper part of the sealing station [0164] **15***b* lower part of the sealing station [0165] **16** labeling station [0166] **17** separating station (transverse direction) [0167] **19** separating station (longitudinal direction) [0168] **20** product region [0169] **21** package [0170] **23** bottom web [0171] **23***a* supply roll [0172] **25** top web [0173] **25***a* supply roll [0174] **27** transport device (transport chain for bottom web) [0175] **29** recess [0176] **41** control device [0177] **43** sealing seam [0178] **45** operating unit [0179] **47** machine frame [0180] **50** robot [0181] **51** separating unit [0182] **53** separating element, blade [0183] **55** separating element, blade [0184] **53***a* aperture [0185] **55***a* aperture [0186] **57** base part [0187] **59** support frame [0188] **61** holding plate [0189] **62** receiver [0190] **63** pressure plate [0191] **65** pressure space [0192] **67** groove for seal [0193] **69** seal [0194] **71** recess of the support frame [0195] **73** end plate of the base part [0196] **75** side wall of the base part [0197] **77** receiving space of the base part [0198] **79** recess of the end plate [0199] **81** end plate of the support frame [0200] **83** negative mold of the counter-unit [0201] **85** counter-unit, lower molding tool [0202] **87** opening of the support frame [0203] **89** spring arrangement of the support frame [0204] **91** spring arrangement of the pressure plate [0205] **93** inflatable hollow body [0206] **97** cut-out in the counter-unit [0207] **99** escape and/or suction opening [0208] **101** lower part [0209] **103** rolling member [0210] **105** heating unit [0211] **107** upper part [0212] **109** fixing screws [0213] **111** holder [0214] **113** proximity switch [0215] **115** compressed air port [0216] **117** holder [0217] V packaging machine [0218] T transport direction [0219] S separating plane [0220] W working direction [0221] B working width

Claims

1.-**54**. (canceled)

55. A separating unit for a packaging machine for packaging food products, wherein the separating unit is configured to process a material web, which is moved in the packaging machine along a transport direction, by a plurality of separating elements of a same type or of different types, wherein the separating unit defines: a separating plane that is in parallel with the material web during operation, a working direction perpendicular to the separating plane, and a working width that is in parallel with the separating plane and perpendicular to the transport direction and that corresponds to the width of a respective material web, and wherein the separating unit comprises a plurality of separate assemblies, that are arranged above one another in the working direction, the plurality of separate assemblies including: a base part; a support frame that is fastened to the base part and having a first side facing away from the base part the separating plane is disposed; at least one holding plate between the base part and the support frame that is movably supported at or in the support frame in the working direction and having a second side facing away from the base part with at least one separating element projecting in the working direction is attached, wherein the support frame is provided with apertures for the plurality of separating elements; and at least one pressure plate between the at least one holding plate and the base part that acts as a drive for the at least one holding plate, wherein the at least one pressure plate can be acted on by compressed air connectable to the separating unit, and wherein the at least one pressure plate is configured to adjust the at least one holding plate between a passive position with at least one of the plurality of separating elements retracted into the apertures of the support frame and an active position with at least one of the plurality of separating elements extended out of the apertures and through the separating plane.

56. A separating unit according to claim 55, wherein the separating unit is connectable to a compressed air supply and a molding pressure can be built up in a pressure space, which is bounded by the base part and the support frame, by supplied compressed air when, during operation, the support frame, with its side facing away from the base part, contacts the material web to form recesses in the material web by reshaping the material web by the molding pressure.

57. A separating unit according to claim 56, wherein the pressure space is sealed with respect to the environment by a seal arranged between the base part and the support frame.

58. A separating unit according to claim 56, wherein the at least one pressure plate and the at least one holding plate are arranged within the pressure space.

59. A separating unit according to claim 55, wherein a plurality of separate holding plates, each comprising one separating element or the plurality of separating elements, are movably supported at or in the support frame.

60. A separating unit according to claim 59, wherein the plurality of separate holding plates are configured to be assembled to form a total plate and are jointly movably supported at or in the support frame.

61. A separating unit according to claim 59, wherein the plurality of separate holding plates is jointly adjustable by the at least one pressure plate.

62. A separating unit according to claim 59, wherein a first holding plate has one or more separating elements of a first type and a second holding plate has one or more separating elements of a second type, wherein the first type and the second type are the same or different.

63. A separating unit according to claim 59, wherein at least one separate holding plate of the plurality of separate holding plates is configured as a holder for at least one other separate holding plate.

64. A separating unit according to claim 63, wherein the at least one separate holding plate fills the support frame in a plane in parallel with the separating plane and is provided with a receiver for the

at least one other separate holding plate.
65. A separating unit according to claim 55, wherein the base part, the support frame, the at least one holding plate and the at least one pressure plate each extend across the working width.
66. A separating unit according to claim 65, wherein the base part, the support frame, the at least one holding plate and the at least one pressure plate each have a low construction height in the working direction compared to the working width.
67. A separating unit according to claim 55, wherein the base part has an end plate comprising two side walls spaced apart from one another in the direction of the working width and projecting towards the separating plane in the working direction, wherein the side of the end plate facing towards the separating plane and the two side walls bound a receiving space for the support frame.
68. A separating unit according to claim 67, wherein the support frame is configured to be inserted into the receiving space of the base part.
69. A separating unit according to claim 67, wherein the end plate of the base part has, at a third side facing towards the separating plane, a recess for receiving the at least one pressure plate.
70. A separating unit according to claim 55, wherein the support frame has, at a third side facing towards the base part, a recess for receiving the at least one holding plate and an end plate in which the apertures for the plurality of separating elements of the at least one holding plate are formed.
71. A separating unit according to claim 55, wherein a total construction height of the separating unit in an assembled state is less than a sum of individual construction heights of the base part and the support frame.
72. A separating unit according to claim 55, wherein the at least one holding plate and/or the support frame is/are provided with one or more spring arrangements against whose return force the at least one holding plate is adjustable into the active position by the at least one pressure plate and by which the at least one holding plate is preloaded into the passive position.
73. A separating unit according to claim 55, wherein the at least one pressure plate and/or the base part is/are provided with one or more spring arrangements against whose return force the at least one pressure plate, when acted on by compressed air, is moved away from the base part in order to adjust the at least one holding plate into the active position.
74. A separating unit according to claim 55, wherein the at least one pressure plate, at a side thereof that faces the base part, is provided with at least one flexible hollow body connectable to a compressed air supply and that is inflatable by applying compressed air.
75. A separating unit according to claim 55, wherein a set of different support frames that are mutually interchangeable at the base part is provided and/or a set of different holding plates that are mutually interchangeable at the support frame or that can be used with different support frames is provided.
76. A separating unit according to claim 55, wherein the material web comprises at least one fibrous material layer that comprises or consists fibrous material.
77. A station for a packaging machine for packaging food products, said station comprising at least one separating unit according to claim 55 and a counter-unit that, during operation, is arranged at another side of the material web to be processed opposite the separating unit, wherein the separating unit and the counter-unit are movable relative to one another perpendicular to the separating plane in order to perform working strokes for closing and opening the station, and adjustment movements of the at least one holding plate of the separating unit that are affected by the at least one pressure plate are performed in addition to the working strokes.
78. A station according to claim 77, wherein, during operation, the separating unit is arranged above the separating plane and the counter-unit is arranged below the separating plane.
79. A station according to claim 77, wherein the station is a molding station or a combined heating and molding station that is configured to form recesses in the material web by reshaping the material web, wherein the counter-unit comprises a plurality of negative molds and the support frame comprises openings corresponding to the plurality of negative molds, wherein, when the

station is closed, a molding pressure can be built up in the separating unit, at a side of the separating plane facing the base part, by compressed air to drive the material web into the plurality of negative molds and thus to form the recesses, and wherein, during or after completion of a build-up of the molding pressure, the at least one holding plate of the separating unit can be adjusted into the active position to process the material web by the plurality of separating elements.

80. A station according to claim 77, wherein the station is a heating station or a combined heating and molding station, and wherein the counter-unit is a heating unit that is configured to heat the material web.

81. A station according to claim 77, wherein the counter-unit is provided with cut-outs that correspond to the plurality of separating elements of the separating unit and that are configured to receive the extended separating elements

82. A station according to claim 81, wherein at least some cut-outs are provided with escape and/or suction openings via which compressed air can escape after the processing of the material web has taken place and/or which can be acted on by negative pressure.

83. A station according to claim 77, wherein the material web comprises at least one fibrous material layer that comprises or consists of fibrous material.

84. A packaging machine for packaging food products comprising at least one station according to claim 77.

85. A packaging machine according to claim 84, wherein the support frame together with the at least one holding plate is removable from the separating unit with the base part remaining at the packaging machine.

86. A packaging machine according to claim 84, wherein the support frame is supported on the packaging machine.

87. A packaging machine according to claim 86, wherein the support frame is supported on the packaging machine via one or more sliding or rolling members.

88. A packaging machine according to claim 84, wherein the material web comprises at least one fibrous material layer that comprises or consists of fibrous material.

89. A packaging machine according to claim 88, further comprising a pretreatment device that is configured to subject the material web to a pretreatment in which a moisture content of the at least one fibrous material layer is changed.

90. A molding station for a packaging machine for packaging food products, said molding station comprising a separating unit according to claim 55.

91. A molding station according to claim 90, wherein the station is a molding station or a combined heating and molding station that is configured to form recesses in the material web by reshaping the material web.

92. A molding station according to claim 91, wherein the molding station is configured for a reshaping without heat or for a reshaping by thermoforming.

93. A molding station according to claim 92, wherein the molding station is configured to perform the reshaping of the material web by compressed air forming, by vacuum forming, by a combined compressed air and vacuum forming or by die forming.

94. A molding station according to claim 90, wherein the separating unit is a component of an upper part or of a lower part of the molding station, or wherein the separating unit forms the upper part or the lower part of the molding station.

95. A molding station according to claim 94, wherein the separating unit is configured as a tool or as a part of an overall tool for reshaping the material web.

96. A molding station according to claim 95, wherein a reshaping of the material web takes place by compressed air forming, by vacuum forming, by a combined compressed air and vacuum forming or by die forming.

97. A molding station according to claim 90, wherein the separating unit forming a component of an upper part or a lower part of the molding station or the separating unit forming the upper part or

the lower part of the molding station comprises a base that is stationary with respect to a working direction during operation and the plurality of separating elements can be adjusted relative to the base between the passive position and the active position in order to process the material web.