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(54) SYSTEM FOR MAKING POUCHES

(57) A system for making water-soluble pouches containing a composition, comprising: a) a platen conveyer unit, b) a heating unit, c) a dispensing unit, d) a composition supply unit, e) a sealing unit, and f) one or more cutting units.

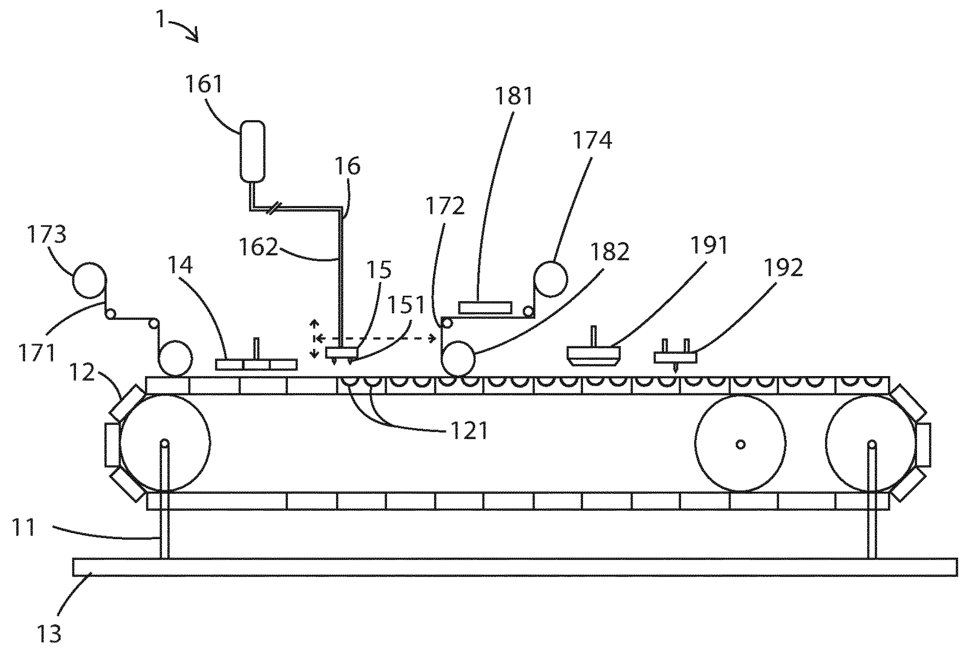

Fig. 1

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a system for making water-soluble pouches, wherein the water-soluble pouches contain a composition.

BACKGROUND OF THE INVENTION

[0002] Cleaning compositions nowadays come in a number of forms, such as granules, liquids and unit dose forms, including water-soluble or water-permeable pouches.

[0003] There are some known processes and systems for making water-soluble pouches with compositions such as cleaning compositions, e.g. vertical filling process, circular drum filling process and platen conveyor belt filling process. However, these processes still have some disadvantages. For example, the problem associated with the vertical filling machine is that the process is not very efficient; the process is intermittent and very slow. The circular drum process overcomes some of the disadvantages of the first vertical filing process, because it does not need speed changes (no acceleration/ deceleration). However, the spillage from the pouches is quite substantial, due to the circular movement, which causes composition to spill onto the sealing area, and this causes problems with the sealing (leaking seals). Also, this process has even more significant problems when used for liquid compositions, which are more likely to cause large spillage, due to the circular motion. Moreover, the filling and sealing has to be done around the highest point of the circle movement of the drum, and thus hugely reducing the overall speed and the output of the pouch formation process. Also, there are more constraints compared to horizontal filing machines due to small operating window, bringing limitations on possible pouch shapes, especially in the cases of dosing a larger number of compartments independently filled with different compositions as well as dosing different forms of compositions including powder forms. The platen conveyor filling process in which the formation and the filing of pouches occur in the platen conveyor can overcome disadvantages of the circular drum filling process to some extent, but it also has some disadvantages. Particularly, a reciprocating-motion-filling unit is commonly used in the platen conveyor belt filling system, but it can usually move only in the horizontally direction (i.e., it has a fixed distance from the open pouches to be filled). When different compositions (e.g. compositions in different forms, compositions with different viscosities) are filled, the fixed vertical position of the reciprocating-motion-filling unit may cause some problems, e.g. splashing and/or stringing. Also, when the line is stopped, there is still a tendency for small volumes of composition to leak from the ends of the nozzles. Therefore, it would be advantageous to allow vertical movement to position the nozzles over spill trays or the like in order to avoid unwanted leakage on the platens. Further, the common platen conveyor belt filling system comprises a very long conveyor belt which is not compact and lack of flexibility.

[0004] Thus, alternative and more efficient systems to produce water-soluble pouches are desirable.

[0005] The present invention provides a system for horizontal, continuous making of water-soluble pouches, which is preferably high-speed. Particularly, the system allows great flexibility in film size used, pouch sizes, pouches shapes, composition forms and properties, time required per step (by changing the constant speed, for example) without impacting much on the overall output of the pouch making process.

SUMMARY OF THE INVENTION

[0006] A first aspect of the present invention is a system for making water-soluble pouches containing a composition, comprising:

a) a platen conveyer unit comprising a conveyer and a supporting base of the conveyer, in which said conveyer comprises a plurality of moulds and said conveyer is configured to form a continuously moving, horizontally positioned web of open water-soluble pouches by feeding a first water-soluble film onto the conveyer and drawing the first water-soluble film into the moulds,

b) a heating unit which is configured to heat the first water-soluble film after feeding the first water-soluble film onto the conveyer,

c) a dispensing unit which is configured to fill the continuously moving, horizontally positioned web of open water-soluble pouches with a composition, in which the dispensing unit comprises a plurality of nozzles wherein the nozzles are capable of moving horizontally with the same speed as the pouches and in the same direction such that each open pouch is under the same nozzle or nozzles for the duration of the dispensing and the nozzles are capable of moving vertically such that the distance between the open pouches and the nozzles is adjustable,

d) a composition supply unit which is configured to store the composition and supply the composition to the dispensing unit,

e) a sealing unit which is configured to form a web of closed water-soluble pouches by feeding a second water-soluble film onto the web of open water-soluble pouches after filing and then sealing the first and second water-soluble films together, and

f) one or more cutting units configured to cut the web of closed water-soluble pouches in machine direction and in cross-machine direction to obtain a plurality of separated water-soluble pouches.

[0007] A second aspect of the present invention is a process of making water-soluble pouches using the system of the present invention, comprising the steps of:

a) continuously feeding a first water-soluble film onto a horizontal portion of a continuously and rotatably moving endless surface (e.g. a platen conveyer belt), which comprises a plurality of moulds, or onto a non-horizontal portion thereof and continuously moving the film to said horizontal portion;
b) forming from the film on the horizontal portion of the continuously moving surface, and in the moulds on the surface, a continuously moving, horizontally positioned web of open pouches, by heating the film and applying vacuum;
c) filling the continuously moving, horizontally positioned web of open pouches with a composition, to obtain a horizontally positioned web of open, filled pouches;
d) continuously sealing the web of open pouches, by feeding a second water-soluble film (preferably, on which a sealing composition is applied) onto the horizontally positioned web of open, filed pouches, to obtain a horizontally positioned web of closed pouches; and
e) cutting the web of closed pouches into a plurality of individual pouches which comprises MD cutting and CD cutting.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

Figure 1 illustrates an exemplary system for making water-soluble pouches containing a composition according to the present invention.
Figure 2 illustrates an exemplary cutting unit of a system for making water-soluble pouches containing a composition according to the present invention.
Figure 3 illustrates an exemplary film feeding unit of a system for making water-soluble pouches according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0009] A first aspect of the present invention relates to a system for making water-soluble pouches containing a composition, comprising:

a) a platen conveyer unit comprising a conveyer and a supporting base of the conveyer, in which said conveyer comprises a plurality of moulds and said conveyer is configured to form a continuously moving, horizontally positioned web of open water-soluble pouches by feeding a first water-soluble film onto the conveyer and drawing the first water-soluble film into the moulds,
b) a heating unit which is configured to heat the first water-soluble film after feeding the first water-soluble film onto the conveyer,
c) a dispensing unit which is configured to fill the continuously moving, horizontally positioned web of open water-soluble pouches with a composition, in which the dispensing unit comprises a plurality of nozzles wherein the nozzles are capable of moving horizontally with the same speed as the pouches and in the same direction such that each open pouch is under the same nozzle or nozzles for the duration of the dispensing and the nozzles are capable of moving vertically such that the distance between the open pouches and the nozzles is adjustable,
d) a composition supply unit which is configured to store the composition and supply the composition to the dispensing unit,
e) a sealing unit which is configured to form a web of closed water-soluble pouches by feeding a second water-soluble film onto the web of open water-soluble pouches after filing and then sealing the first and second water-soluble films together, and
f) one or more cutting units configured to cut the web of closed water-soluble pouches in machine direction and in cross-machine direction to obtain a plurality of separated water-soluble pouches.

[0010] Preferably, the platen conveyer is capable of continuously moving in horizontal position, until the platen conveyer rotates around an axis perpendicular to the direction of motion, preferably about 180 degrees, to then move in opposite direction which is also a horizontal motion.

[0011] The first water-soluble film may be drawn into the moulds by using vacuum. Preferably, the first water-soluble film is kept within the moulds on the belt by using vacuum. Particularly, vacuum may be applied through holes in the moulds. The holes in the moulds can be arranged in any appropriate manner. One or more holes (e.g. 2, 3, 5, 10, 100 or 1000) may be arranged in each mould. The holes may be in any shape, preferably circular. Particularly, the holes may be sized such that at the temperature of deformation, plastic deformation or thermoforming, the water-soluble film is not pulled into the holes to such an extent that the structural integrity of the finished pouch is compromised.

[0012] The moulds may have a chamfered edge (e.g. with 45 degrees) or rounded edge. Such configuration may help to prevent weak point creation near corners. The moulds may be made from aluminum which may preferably have a protective anodization treatment to prevent corrosion.

[0013] The conveyor and/or the platens may further comprise a plurality of apertures which are located at both edges of the conveyor and/or the platens along the machine direction, in which vacuum may be applied through the plurality of apertures. The vacuum applied to the plurality of apertures may help to hold the side edges of the first water-soluble film to the side margins of the conveyor and/or the platens. Particularly, the apertures may be sized such that at the temperature of deformation, plastic deformation or thermoforming, the water-soluble film is not pulled into the apertures to such an extent that the structural integrity of the finished pouch is compromised.

[0014] The plurality of moulds may be arranged in an array having 2 to 20, preferably 3 to 15, moulds in the direction of width and 1 to 10, preferably 2 to 5, moulds in the direction of length.

[0015] The supporting base may comprise a series of processing stations, including heating, forming, filling, sealing, and Machine Direction (MD) cutting stations. Particularly, two or more of the processing stations may be combined. For example, the heating station and the forming station may be combined into a heating/forming station.

[0016] The heating unit may comprise an infrared lamp which is preferably capable of heating the first water-soluble film to temperatures of 50 to 150°C, or even 80 to 120°C. Preferably, the infrared lamp is capable of heating the first water-soluble film after the first water-soluble film is fed on the conveyer. Compared to heating prior to feeding the water-soluble film, the above arrangement may allow the coordination between the heating and the application of vacuum, and allow heating/vacuum in multiple steps, resulting in a lower failure rate. More preferably, the infrared lamp comprises at least two sections (for example, two or three sections) which are capable of independently working. Most preferably, the plurality of sections is capable of heating the first water-soluble film to same or different temperatures, e.g. room temperature, 50°C, 70°C, 90°C, 110°C, or 120°C, 150°C. The infrared lamp may comprise two sections. The heating unit may further comprise a protection mechanism which is configured to be inserted beyond the infrared lamp when the system stops so as to protect the system from heat damage.

[0017] Each of the water-soluble pouches may comprise a plurality of compartments which may be preferably arranged in a manner of side-by-side. Preferably, each compartment contains a different composition. In this aspect, the dispensing unit comprises a plurality of groups of nozzles in which each group is configured to dispense one of the compositions to be filled.

[0018] The dispensing unit may further comprise a servo motor which may actuate the moving of the dispensing unit (or the nozzles). The dispensing unit may further comprise a suck-back pump which is capable of preventing stringing and/or leakage of the composition to be filled.

[0019] The composition supply unit may comprise a reservoir containing said composition and a fluid channel which is in fluid communication with said plurality of nozzles and said reservoir. In the aspect in which the dispensing unit comprises a plurality of groups of nozzles, said composition supply unit comprises a plurality of reservoirs containing different compositions to be filled into different compartments of the pouches and a plurality of fluid channels each of which is respectively in fluid communication with one of said groups of nozzles and one of said plurality of reservoirs.

[0020] The sealing unit may comprise a wetting mechanism which is configured to wet the first water-soluble film and/or the second water-soluble film by applying a sealing composition prior to sealing as well as a sealing roller which is configured to compress the first and second water-soluble films together to form the seal. The sealing roller may be capable of heating water-soluble films or not. When the sealing roller heats the films, the heating temperature may be 30°C, 50°C, 70°C, 90°C, 110°C, 120°C, or any ranges therebetween. Furthermore, the sealing roller can be motor driven or rotating based on contact with the platen conveyor. The roller may have a metal core with an outer silicone based softer surface layer to enable better film compliance upon pressure across entire seal area. The wetting mechanism may comprise a wetting roller which is made of absorbing material (e.g. felt made of a natural material such as wool or a shrinkable synthetic material) in which a sealing composition comprising water (preferably comprising >90% of water, more preferably >95% of water or most preferably consisting of water) is loaded within the absorbing material in which the wetting roller is configured to apply the sealing composition onto the second water-soluble film when the second water-soluble film is fed on the wetting roller before being fed onto the web of open water-soluble pouches after filing. Preferably, the wetting mechanism comprises a sprayer which is configured to apply a sealing composition comprising water (preferably comprising >90% of water, more preferably >95% of water or most preferably consisting of water) onto the second water-soluble film before the second water-soluble film being fed onto the web of open water-soluble pouches after filing.

[0021] The system may further comprise a collecting unit which is configured to collect the plurality of separated water-soluble pouches. Particularly, the collecting unit may comprise a conveyer or a bucket. Furthermore, the system may further comprise an intermediate line in which the water-soluble pouches may be preferably stored for between 1 minute and 3 months. The system may further comprise a packing line in which the water-soluble pouches may be preferably transferred from the intermediate line onto the packing line after storage.

[0022] The at least one cutting unit may comprise:

a machine direction (MD) cutting mechanism which is configured to cut the web of closed water-soluble pouches in machine direction,

a cross-machine direction (CD) cutting mechanism which is configured to cut the web of closed water-soluble pouches after MD cutting in cross-machine direction,

a first transfer drum which is configured to draw the closed water-soluble pouches after MD cutting by application of a vacuum and then to transfer the closed water-soluble pouches to the CD cutting mechanism, and

a second transfer drum which is configured to draw the closed water-soluble pouches after CD cutting by application of a vacuum and then to transfer the closed water-soluble pouches to the collecting unit.

[0023] There may be two cutting units in which a first cutting unit provides a machine direction (MD) cut and a second cutting unit providing a cross-machine direction (CD) cut. Alternatively, there may be two cutting units in which a first cutting unit provides a cross-machine direction (CD) cut and a second cutting unit providing a machine direction (MD) cut.

[0024] The machine direction (MD) cut and the cross-machine direction cut (CD) may occur simultaneously or sequentially.

[0025] The platens may have grooves in the direction of MD which may facilitate MD cutting. The platens may have grooves in the direction of CD which may facilitate CD cutting. The platens may have grooves in the direction of CD and MD which may facilitate CD and MD cutting. The platens may have grooves surrounding the cavities which may facilitate across cavity surrounding cutting. In a preferred embodiment, the platens have grooves in the direction of MD which may facilitate MD cutting.

[0026] The MD cutting mechanism and/or the CD cutting mechanism may comprise a flexible curvilinear knife. In a preferred embodiment the CD cutting mechanism comprises a flexible curvilinear knife and a rotary knife is used for MD cutting. Preferably, the flexible curvilinear knife is formed from a flexible blade cutting element, a blade holder element, and optionally a plurality of spring elements. A first, proximal end of each spring element of the plurality of spring elements is operably and fixably attached to a discrete location of the cutting element and a second, distal end of each spring element of the plurality of spring elements is fixably attached to a discrete location of the blade holder element. Alternatively, the flexible blade cutting element is directly attached to the blade holder element.

[0027] Preferably, the CD cutting mechanism comprises a rotating anvil and a rotating knife roll in which a plurality of knives is arranged on the rotating knife roll. Particularly, the rotating anvils may have cavities to hold pouches to be cut. More preferably, the CD cutting mechanism is configured so that the knives intermittently contact the web of pouches and cut the web of pouches in cross-machine direction. In order to achieve more accurate cutting, the CD cutting mechanism may be configured to rotate at a variable speed in which the rotating knife roll rotates faster than line speed between two cuts and then slows down when cutting, e.g. to be in line with line speed.

[0028] The system may further comprise a first film feeding unit comprising at least one roller from which the first water-soluble film unwinds and a second film feeding unit comprising at least one roller from which the second water-soluble film unwinds. Preferably, the first film feeding unit comprises two rollers from which the first water-soluble film unwinds which are configured so that when the first film is being fed, one of the two rollers is operating and the other of the two rollers is standby, and wherein the second film feeding unit comprises two rollers from which the second water-soluble film unwinds which are configured so that when the second film is being fed, one of the two rollers is operating and the other of the two rollers is standby. More preferably, the two rollers in the first film feeding unit are configured to automatically switch between operating and standby when the first water-soluble film on the roller in operation runs out, and wherein the two rollers in the second film feeding unit are configured to automatically switch between operating and standby when the second water-soluble film on the roller in operation runs out.

[0029] The first film feeding unit and/or the second film feeding unit may comprise a splicer which is configured to automatically switch the two rollers between operating and standby. One exemplary splicer may comprise a heating welder which is capable of splicing water-soluble films. Another exemplary splicer may comprise an ultrasonic welder which is capable of splicing water-soluble films. A further exemplary splicer may comprise an adhesive tape. The ultrasonic welder may comprise a welding head which reciprocates at an ultrasonic speed that is to say of the order of 20,000 reciprocations a second. The heat generated by the frictional forces between two water-soluble films induced by the ultrasonic head welds them together. In an embodiment, the splicing between two water-soluble films by an ultrasonic welding means comprises locating the ends of two water-soluble films horizontally so that the ends overlay in register over and adjacent to the length of an elongate working surface of a shaped welding horn which is adapted to reciprocate or vibrate ultrasonically, causing the welding horn to reciprocate or vibrate ultrasonically and simultaneously traversing a wheel over the overlapping film along the line of overlap, the wheel being biased towards the welding horn but being prevented from approaching closer to the welding horn than a predetermined distance, the traversing movement of the wheel causing the ends of the film at the line of overlap to be forced down against the reciprocating or vibrating end of the welding horn. The splicer may comprise an ultrasonic welding mechanism useful for the splicing of a pair of ends of a film. Particularly, the ultrasonic welding mechanism may comprise a welding horn, a wheel and an ultrasonic energy generator element.

[0030] The first film feeding unit and/or the second film feeding unit may comprise a stretching device (e.g. a plurality of rollers having different speed) which is configured to stretch the first water-soluble film and/or the second water-soluble film so as to control the tension of the film. The stretching device may comprise an accumulator (also called dancer). The stretching device may comprise S-wrap to control the tension of films. The water-soluble films upon unwinding and throughout web handling may be kept under a tension of from about 20 N/m to about 80 N/m, preferably from about 40 N/m to about 60 N/m (force per unit of film width). The optimum range of tension indeed depends on the film composition and thickness.

[0031] The system may further comprise a vacuum-pumping unit which is configured to apply vacuum. Preferably, the vacuum-pumping unit is configured to apply at least two different under-pressures comprising a first under-pressure (e.g. a low under-pressure) and a second under-pressure (e.g. a high under-pressure) to moulds. More preferably, the low under-pressure is less than 80%, preferably less than 70% of the high under-pressure. Most preferably, the first under-pressure is between Ombar and -400mbar, preferably between -10 and -100mbar and the second under-pressure is between -200mbar and -700mbar, preferably between -250 and -500mbar. Preferably, the at least two different under-pressures correspond to at least two sections of the infrared lamp. More preferably, a first section of the infrared lamp is configured to heat the first water-soluble film to a first temperature after the first water-soluble film is fed onto the conveyer and a first under-pressure (e.g. a low under-pressure) is applied to the moulds after the first water-soluble film is heated by the first section of the infrared lamp, and a second section of the infrared lamp is configured to heat the first water-soluble film to a second temperature after the first water-soluble film moves to the second section on the conveyer and a second under-pressure (e.g. a high under-pressure) is applied to the moulds after the first water-soluble film is heated by the second section of the infrared lamp.

[0032] The system may further comprise a temperature and humidity control unit, and/or an air extraction unit. Preferably, the temperature and humidity control unit is configured to maintain a temperature of from 15°C to 30°C, preferably from 18°C to 27°C, more preferably from 20°C to 25°C, and a humidity of from 20% to 50%, preferably from 25% to 40%.

[0033] The system may further comprise a dusting unit which is configured to dust the outer surface of the water-soluble pouches with a dusting composition comprising an absorbent material which is preferably selected from the group consisting of zeolite, talc, starch, zinc stearate, calcium stearate, calcium carbonate, sodium carbonate, sodium sulphate and combinations thereof. Preferably, the dusting composition may further comprise a silica flow aid.

[0034] The composition may be a liquid or particulate composition, preferably a liquid fabric cleaning or surface cleaning composition, more preferably a liquid laundry detergent or automatic dish washing detergent.

[0035] The system may further comprise a printing unit which is configured to print a pattern onto the first and/or the second water-soluble film, preferably the first water-soluble film before heating. A preferred printing unit comprises a printing roller or a combination of printing rollers, each printing roller for example printing a different colour on the water-soluble film. Alternatively, noncontact printing techniques can be applied. Preferably, the print is present on the inside of the water-soluble film, e.g. the side in direct conduct with the enclosed composition. As such the print is less vulnerable to damage by external exposure such as rubbing actions or smearing action as a consequence of accidental exposure to water.

[0036] The system may further comprise a trim collection unit which is configured to collect side trim of films and transfer the same to a collecting container. Automated collection and/or transfer can be enabled through use of vacuum.

[0037] The system may further comprise a registration sub-system which is configured to facilitate registration or positioning of the film and/or the pouches. Such registration sub-systems could, for example, be used to ensure correct registration of printed areas with respect to deformation areas, or registration of the pouch with respect to cutting units, or registration of the cavity with respect to filling nozzles. The registration sub-system may comprise a time-based counting unit. Preferably, the registration sub-system may ensure proper pouch location.

[0038] The system may further comprise a tote-based buffer unit which is located between the pouch making line and the packing line. Such tote-based buffer unit is useful in temporarily storing pouches which has been made but not packed. This disconnection between the making and packing lines enables the two to run independently of each other, allowing maximum line speed in each of them accordingly, e.g. a making line does not need to be slowed down if a packing line has to run at lower speeds for example when packing smaller counts, while a packing line does not need to be slowed down, for example when packing larger counts, when a making line has to run at slower speeds for example due to capacity constraints. A packing line might fill pouches into bags, tubs, or combinations thereof.

[0039] The term "machine direction" as used herein refers to the direction of motion of the platen conveyer belt. The term "cross-machine direction" as used herein refers to the direction which is perpendicular to the machine direction in the horizontal plane.

[0040] The operation of the system according to the present invention involves continuously feeding a water-soluble film onto an endless surface (e.g. a platen conveyer belt), preferably onto a horizontal portion of an endless surface, or otherwise, on a non-horizontal portion of this surface, such that it moves continuously towards the horizontal portion and thus eventually onto the horizontal portion. Preferred is that it is fed directly onto the horizontal portion.

[0041] The operation of the system according to the present invention comprises the following steps:

a) continuously feeding a first water-soluble film onto a horizontal portion of a continuously and rotatably moving endless surface (e.g. a platen conveyer belt), which comprises a plurality of moulds, or onto a non-horizontal portion thereof and continuously moving the film to said horizontal portion;

b) forming from the film on the horizontal portion of the continuously moving surface, and in the moulds on the surface, a continuously moving, horizontally positioned web of open pouches, by heating the film and applying vacuum;

c) filling the continuously moving, horizontally positioned web of open pouches with a composition, to obtain a horizontally positioned web of open, filled pouches;

d) continuously sealing the web of open pouches, by feeding a second water-soluble film (preferably, on which a sealing composition is applied) onto the horizontally positioned web of open, filed pouches, to obtain a horizontally positioned web of closed pouches; and

e) cutting the web of closed pouches into a plurality of individual pouches which comprises MD cutting and CD cutting.

[0042] Typically, the horizontal portion of the surface will move continuously in horizontal position, until it rotates around an axis perpendicular to the direction of motion, typically about 180 degrees, to then move in opposite direction, which may also be a horizontal motion; eventually, the surface will rotate again to reach the initial horizontal position and movement (when or where after the working process starts again).

[0043] As used herein, 'endless surface' means that the surface is endless in one dimension at least, preferably only in one dimension. For example, the surface is preferably part of a rotating platen conveyer belt or chain comprising moulds, as described below in more detail. Without wishing to be bound by theory, there may be gaps between the moulds on the belt/chain. The moulds maybe positioned onto platens (each platen comprising one or more moulds) and these platens may have gaps between one another.

[0044] The horizontal part of the surface can have any width, typically depending on the amount of lanes of moulds along the dimension of the width and the size of the moulds and the size of the space between moulds required. The horizontal part of the endless surface can have any length, typically depending on the amount of process steps required to take place on this portion of the surface (during the continuous horizontal motion of the surface), on the time required per step and on the optimum speed of the surface needed for these steps.

[0045] Preferred may be that the width of the surface is up to 1.5 meters, or even up to 1.0 meters or preferably between 30 and 80 cm.

[0046] Preferred may be that the horizontal portion of the endless surface is from 2 to 20 meters, or even 4 to 12 meters for example, 4, 5, 6, 7, 8, 9, 10, 11, 12 or any ranges therebetween.

[0047] Preferably, filling, sealing and MD cutting are done on a horizontal portion of the surface, while the surface is in continuous motion, but CD cutting is not done on the horizontal portion of the surface. Particularly, CD cutting may be done in a CD cutting mechanism which is separated from the surface (e.g., platen conveyer belt).

[0048] Thus, the process is preferably done on an endless surface which has a horizontal motion for such a time to allow formation of the web of pouches, filling of the pouches and preferably sealing and preferably even cutting to separate the pouches from each other (as described below, with the option that two or more are still attached to another in MD or to get the web into individual pouches). Then, preferably after the sealing step or after MD cutting step, the endless web of pouches or pouches is/ are removed from the surface and the surface will rotate around an axis perpendicular to the direction of motion, typically about 180 degrees, to then move in opposite direction, typically also horizontally, to then rotate again, where after step a) starts again.

[0049] Preferably, the surface is part of and/ or preferably removably connected to a moving, rotating belt or chain, for example a conveyer belt or chain or platen conveyer belt or chain. Alternatively, the surface may be discrete platens moving on a magnetic conveyor (e.g. Rockwell's iTrack). Then preferably, the surface can be removed and replaced with another surface having other dimensions or comprising moulds of a different shape or dimension. This allows the equipment to be cleaned easily and more over to be used for the production of different types of pouches. This may for example be a belt having a series of platens, whereof the number and size will depend on the length of the horizontal portion and diameter of turning cycles of the surface, for example having 30 to 200, for example, 50, 70, 90, 120, 150 or any ranges therebetween, for example each having a length (direction of motion of platen and surface) of 4 to 50 cm, for example, 4, 5, 10, 15, 20, 30, 40, 50 cm or any ranges therebetween.

[0050] The platens then form together the endless surface or part thereof and typically the moulds are comprised on the surface of the platens, for example each platen may have a number of moulds, for example up to 20 moulds in the direction of the width, or even from 2 to 15 or even 3 to 13, and for example up to 15 or even 1 to 10 or even 2 to 6 or even 2 to 5 moulds lengthwise, i.e. in the direction of motion of the patens.

[0051] The surface, or typically the belt or chain connected to the surface, can be continuously moved by use of any known method. Preferred is the use of a zero-elongation chain system, to which the individual platens/molds are attached.

[0052] If a platen conveyer is used, this preferably contains a) a main belt and b) series of platens, which comprise 1) a surface with moulds, such that the platens form the endless surface with moulds described above, and 2) a vacuum chute connection and 3) preferably a base plate between the platens and the vacuum chute connection. Then, the platens are preferably mounted onto the main belt such that there is no air leakage from junctions between platens. The platen conveyer belt as a whole moves then preferably along (over; under) a static vacuum system (vacuum chamber).

[0053] It should be understood that thus all platens and the main belt move continuously, typically with the same constant speed.

[0054] The moulds can have any shape, length, width and depth, depending on the required dimensions of the pouches. Per surface, the moulds can also vary of size and shape from one to the other, if desirable. For example, it may be preferred that the volume of the final pouches is between 5 and 300ml, or even 10 and 150ml, e.g. 10ml, 12ml, 15ml, 20ml and that the mould sizes are adjusted accordingly.

[0055] The feeding of the film to, and typically onto or on top of the surface and preferably onto the horizontal portion thereof, is done continuously, and thus typically with a constant speed throughout the process. This can be done by any known method, preferably by use of rollers from which the film unwinds.

[0056] The open pouches can be formed in the moulds by any method, and as described above, preferred methods include the use of (at least) a vacuum or under-pressure to draw the film into the moulds Other preferred methods include heating the film and thereby making the film more flexible or even stretched, so that it adopts the shape of the mould; preferably, combined with applying a vacuum onto the film, which pulls the film into the moulds, or combinations of all these methods.

[0057] Preferred is thus that each mould comprises one or more holes which are connected to a system which can provide a vacuum through these holes, onto the film above the holes, as described herein in more detail. Preferred is that the vacuum system is a vacuum chamber comprises at least two different units, each separated in different compartments, as described herein.

[0058] Heat can be applied by any means, for example directly, by contact heating (e.g. running the film over a heated roller), passing the film under a heating element or through hot air, prior to feeding it onto the surface or once on the surface, or indirectly, for example by heating the surface or applying a hot item onto the film, for example to temperatures of 50 to 150°C, or even 80 to 120°C, preferably for example with infrared light. Any suitable IR lamps may be used, including infrared quartz tube lamps. Particularly, the temperature of the IR emitting surface in the IR lamps may be 150 to 1000°C, e.g. 200°C, 300°C, 400°C, 500°C, 700°C, 1000°C.

[0059] The film can be wetted by any mean, for example directly by spraying a wetting agent (including water, solutions of the film material or plasticisers for the film material) onto the film, prior to feeding it onto the surface or once on the surface, or indirectly by wetting the surface or by applying a wet item onto the film.

[0060] The filling of the web of open pouches while it moves horizontally with continuous motion, can be done by any known method for filling (moving) items. The exact most preferred method depends on the product form and speed of filling required.

[0061] Generally, preferred methods include continuous motion in line filling, which uses a dispensing unit with nozzles positioned above the open pouches, which typically moves reciprocately with continuous motion, whereby the nozzles move with the same speed as the pouches and in the same direction, such that each open pouch is under the same nozzle or nozzles for the duration of the dispensing step. After the filling step, the nozzles rotate and return to the original position, to start another dispensing/ filling step.

[0062] Every nozzle or a number of nozzles together, is preferably connected to a device which can accurately control that only a set amount or volume of composition is dispensed during one rotation per nozzle, e.g. thus in one pouch. Optionally, flowmeters are employed to control accurate filing. Further, positive displacement pumps (e.g. screw pump, sliding vane pump, flexible impeller pump, roots pump, rotary piston pump and gear pumps) can be employed in the dispensing unit. In an embodiment, gear pumps are employed.

[0063] A highly preferred method for filling the open pouches is a reciprocating-motion-filling method. This process preferably uses a moving filling station which is returnable (changes direction of motion) and variable in speed. The filling station has typically a series of nozzles which each move with the same speed as the open pouches (to be filled) and in the same direction for the period that composition needs to be dispensed into the open pouches. Then, typically when a pouch is full, the nozzle or nozzles which filled the pouch stop their movement along with the pouch and return in opposite direction, to then stop again, such that it is positioned above another open pouch(es) which is (are) still to be filled, and to then start moving again in opposite direction, with the same speed and direction as the open pouches, until it reaches the speed of the pouches, to then continue with this speed and start dispensing and filling of the pouch(es), as in the previous filling cycle. The speed of the returning movement may be higher than the speed of the movement during filling.

[0064] More preferably, the system according to the present utility model comprises a dispensing unit which is capable of moving in vertical direction (i.e. Z direction). It may adjust the height of nozzles so as to be suitable for different composition to be filed, preferably to maximize the filing speed and/or minimize the splashing and/or stringing. In some embodiments, the dispensing unit moves in vertical direction when the filing stops. Particularly, the height of nozzles in the dispensing unit is adjustable within a range of 50cm (i.e., the difference between the highest position of nozzles and the lowest position of nozzles is 50cm), 40cm, 30cm, 20cm, 10cm, or 5cm. Furthermore, the height of nozzles may be adjusted by any appropriate means, such as air cylinders, screws and the like. The nozzles may be configured so that the height thereof can be adjusted all together or separately.

[0065] The filled, open pouches are then closed, which can be done by any method. Preferably, this is also done while in horizontal position and in continuous, constant motion, and preferably on the horizontal portion of the endless surface described above.

[0066] Preferred is that the closing is done by continuously feeding a second material or film, preferably water-soluble film, over and onto the web of open pouches and then preferably sealing the first film and second film together, typically in the area between the moulds and thus between the pouches and in between the individual separate compartments of an individual pouch. Preferred is that the closing material is fed onto the open pouches with the same speed and in moving in the same direction as the open pouches

[0067] The sealing can be done by any method. The sealing may be done in a discontinuous manner, for example by transporting the web of pouches to another sealing area and sealing equipment. However, the sealing is preferably done continuously and preferably with constant speed whilst the closed web of pouches moves continuously and with constant speed, and it may also preferably be done in horizontal position, preferably also on said horizontal portion of the surface.

[0068] Preferred methods include heat sealing, wet sealing, and the combination thereof. The heat or solvent can be applied by any method on the closing material. The closing material (e.g. the second water-soluble film) may be wetted by spraying a solvent (e.g. water) on the closing material or contacting a solvent-containing article (e.g. water-containing sponge) with the closing material. Preferred may be that when heat sealing is used, a roller with cavities of the size of the part of the pouch, which is not enclosed by the mould, and having a pattern of the pouches, is (continuously) rolled over the web pouches, passing under the roller. Hereby, the heated roller contacts only the area which is to be the sealing area, namely between the moulds, around the edges of the moulds. Typically sealing temperatures are from 30°C, 50°C, 70°C, 90°C, 110°C, 120°C, or any ranges therebetween. depending on the film material of course. Also useful is a movable, returnable sealing device, operating as the returnable, movable filling / dosing device above, which contacts the area between the moulds, around the edges, for a certain time, to form the seal, and then moves away from the sealing area, to return backwards, to start another sealing cycle.

[0069] The closed and preferably sealed web of pouches can then be cut by a cutting unit, which cuts the pouches from one another, in separate pouches or such that two or more pouches are still attached to another, which ever may be required. The cutting can be done by any known method. It may be preferred that the cutting is also done in continuous manner, and preferably with constant speed and preferably while in horizontal position. Preferably, the web of closed (sealed) pouches can be MD cut on the horizontal portion of the continuously and rotatably moving endless surface, and then transported to a CD cutting device (i.e. another surface) where the CD cutting occurs.

[0070] The cutting device can for example be a sharp item or a hot item, whereby in the latter case, the hot item 'burns' through the film/ sealing area. With respect to MD cutting, preferred may be when the web of pouches is moving in one direction (e.g. continuously and/ or horizontally, for example still on the endless surface herein) a device (e.g. a slitter of circular slitting blade) contacting the area between the pouches along the direction of movement can be used, to cut the pouches in the direction of movement in a continuous manner. With respect to CD cutting, preferred may be an intermittent cutting, for example by applying a cutting device for a brief period onto the area, removing the cutting device and repeating this action with the next set of pouches. Preferred intermittent cutting device for CD cutting may be a hot wire, a heated blade, or a roller having knives on the surface thereof. In the aspect of the roller having knives, as the roller rotates, the knives intermittently contact the moving web of pouches and cutting in the direction of width. Alternatively, a laser can be used to cut pouches.

[0071] The system may further comprise one or more drums (e.g., a first transfer drum and/or a second transfer drum) which are capable of carrying and conveying pouches (either open pouches or closed pouches). Particularly, the drums may have a plurality of moulds on the surface thereof. Such moulds are configured to draw the pouches through vacuum. The shape and size of such moulds may be designed in accordance with the pouches to be processed.

[0072] The system may further comprise a coating unit which is configured to apply a coating composition onto the pouch. Particularly, the coating unit may comprise an atomizer and a sprayer. Alternatively, the coating unit may comprise a rotating brush.

[0073] The coating composition may be a suspension in a non-aqueous solvent. Alternatively, the coating composition may be a powder. Preferably, the coating composition may comprise from about 50% to about 99.95%, by weight of the coating composition, of absorbent material which is preferably selected from the group consisting of: zeolite; over-dried zeolite; zeolite loaded with perfume and/or other actives; talc; starch; zinc stearate; calcium stearate; micronized calcium carbonate; sodium carbonate; micronized sodium sulphate; and mixtures thereof.

[0074] The system may further comprise a quality control unit for detecting leakage from a composition-containing pouch during the high-speed manufacturing process. The quality control unit may comprise: an imaging mechanism which monitors the platen and/or the conveyer and an image processing mechanism. The imaging mechanism can be positioned at any appropriate location including on the platen or on the conveyer. The imaging mechanism can be a camera, e.g. black and white camera, color camera, fluorescence detection system, white light camera, ultraviolet camera or a mixture thereof. The method may be performed along a production line one or more times. The composition-containing pouch is located in the cavity of a platen disposed in a pouch converting line.

[0075] The pouch, when used herein can be of any form, shape and material which is suitable to hold the composition prior to use, e.g. without allowing the release of the composition from the pouch prior to contact of the pouched composition to water. The exact execution will depend on for example the type and amount of the composition in the pouch, the characteristics required from the pouch to hold, protect and deliver or release the compositions.

[0076] Preferred films are made of polymeric materials. The film can for example be obtained by casting, blow-molding, extrusion or blow extrusion of the polymer material, as known in the art.

[0077] Preferred polymer copolymers or derivatives thereof are selected from polyvinyl alcohols, polyvinyl pyrrolidone, polyalkylene oxides, (modified) cellulose, (modified)cellulose-ethers or - esters or -amides, polycarboxylic acids and salts including polyacrylates, copolymers of maleic/acrylic acids, polyaminoacids or peptides, polyamides including polyacrylamide, polysaccharides including starch and gelatine, natural gums such as xanthum and carragum. Preferably, the polymer is selected from polyacrylates and acrylate copolymers, including polymethacrylates, methylcellulose, sodium carboxymethylcellulose, dextrin, maltodextrin, ethylcellulose, hydroxyethyl cellulose, hydroxypropyl methylcellulose,; most preferably polyvinyl alcohols, polyvinyl alcohol copolymers and/ or hydroxypropyl methyl cellulose(HPMC).

[0078] The polymer may have any weight average molecular weight, preferably from about 1000 to 1,000,000, or even form 10,000 to 300,000 or even form 15,000 to 200,000 or even form 20,000 to 150,000.

[0079] The water-soluble film may comprise polyvinyl alcohol homopolymer or polyvinyl alcohol copolymer, for example a blend of polyvinylalcohol homopolymers and/or polyvinylalcohol copolymers, wherein the polyvinyl alcohol copolymers preferably are selected from sulphonated and carboxylated anionic polyvinylalcohol copolymers especially carboxylated anionic polyvinylalcohol copolymers, for example a blend of a polyvinylalcohol homopolymer and a carboxylated anionic polyvinylalcohol copolymer, alternatively a blend of two or more preferably two polyvinyl alcohol homopolymers. Alternatively, the polyvinylalcohol comprises an anionic polyvinyl alcohol copolymer, most preferably a carboxylated anionic polyvinylalcohol copolymer. In some examples water soluble films are those supplied by Monosol under the trade references M8630, M8900, M8779, M8310. In some examples the film may be opaque, transparent or translucent. The film may comprise a printed area. The area of print may be achieved using techniques such as flexographic printing or inkjet printing. The film may comprise an aversive agent, for example a bittering agent. Suitable bittering agents include, but are not limited to, naringin, sucrose octaacetate, quinine hydrochloride, denatonium benzoate, or mixtures thereof. Example levels of aversive agent include, but are not limited to, 1 to 5000ppm, 100 to 2500ppm, or 250 to 2000ppm. The water-soluble film or water-soluble unit dose article or both may be coated with a lubricating agent. In some examples, the lubricating agent is selected from talc, zinc oxide, silicas, siloxanes, zeolites, silicic acid, alumina, sodium sulphate, potassium sulphate, calcium carbonate, magnesium carbonate, sodium citrate, sodium tripolyphosphate, potassium citrate, potassium tripolyphosphate, calcium stearate, zinc stearate, magnesium stearate, starch, modified starches, clay, kaolin, gypsum, cyclodextrins or mixtures thereof.

[0080] The composition contained in the pouch is preferably a liquid or solid cleaning composition or care composition, preferably a laundry or automatic dish washing composition, hard-surface cleaner and/ or a fabric or surface care composition, such as conditioners, rinse additives, pretreatment and/or soaking compositions.

[0081] The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as "40 mm" is intended to mean "about 40 mm."

EXAMPLES

[0082] Figure 1 illustrates a system for making water-soluble pouches **1** according to an embodiment of the present invention. Particularly, the system for making water-soluble pouches **1** comprises a platen conveyer unit **11** comprising a conveyer **12** and a supporting base **13,** a heating unit **14,** a dispensing unit **15** comprising a plurality of nozzles **151,** a composition supply unit **16** comprising a reservoir **161** and a fluid channel **162** which is in fluid communication with the plurality of nozzles **151** and the reservoir **161,** a first film feeding unit **173** which feeding a first water-soluble film **171** onto the conveyer **12,** a second film feeding unit **174** which feeding a second water-soluble film **172** onto the open water-soluble pouches after filing, a sealing unit comprising a wetting mechanism **181** and a sealing roller **182,** and a cutting unit comprising a MD cutting mechanism **191** and a CD cutting mechanism **192.** The conveyer **12** comprises a plurality of platens in which a plurality of moulds **121** are arranged on the surface of the platen. When the system **1** is operating, the first film feeding unit **173** is continuously feeding a first water-soluble film **171** onto the conveyer **12.** After fed on the conveyer **12,** the first water-soluble film **171** is heated by heating unit **14** to facilitate the formation of open pouches, and the first water-soluble film **171** is drawn into the moulds **121** by application of a vacuum to the moulds so as to form a continuously moving, horizontally positioned web of open pouches. Then, the continuously moving, horizontally positioned web of open pouches is filled with a composition through the plurality of nozzles **151** during which the plurality of nozzles **151** is continuously, horizontally moving at the same speed with the continuously moving, horizontally positioned web of open pouches. After filling, the plurality of nozzles **151** stops the movement along with the pouch and returns in opposite direction, to then stops again, such that it is positioned above another web of open pouches which is to be filled. Further, the plurality of nozzles **151** is capable of moving vertically. The second water-soluble film **172** is unwind from second film feeding unit **174** and fed to the wetting mechanism **181.** The wetting mechanism **181** applies (e.g. by spraying) a sealing composition (e.g. water) onto the surface of the second water-soluble film **172** which is then fed onto the open water-soluble pouches after filing. The sealing roller **182** combines the first water-soluble film **171** and the second water-soluble film **172** so as to seal the open water-soluble pouches. After sealing, the MD cutting mechanism **191** and the CD cutting mechanism **192** cut the web of closed water-soluble pouches in turn so as to provide individual pouches.

[0083] Figure 2 illustrates a cutting unit **20** of a system for making water-soluble pouches according to the present invention. The cutting unit **20** comprises a MD cutting mechanism **21** comprising a plurality of circular slitters **211** which is arranged in parallel along the machine direction and configured to rotatingly cut the web of closed water-soluble pouches, a CD cutting mechanism **22** comprising a rotating anvil **220** and a rotating knife roll **221** in which a plurality of knives **222** is arranged on the rotating knife roll **221,** a first transfer drum **23,** and a second transfer drum**24.** The plurality of knives **222** is configured to cut the web of closed water-soluble pouches in CD direction to provide individual pouches. In this example, a web of closed water-soluble pouches on a conveyer **25** is cut in MD direction by the MD cutting mechanism **21** after sealing. Then, the pouches are extracted through vacuum by the extraction drum **23** and then transferred to the CD cutting mechanism **22.** In the CD cutting mechanism **22,** as the rotating knife roll **221** rotates, the knives **222** intermittently contact the moving web of pouches and cutting in the direction of width. Then, the pouches are extracted through vacuum by the rejection drum **24** and then transferred to a collection unit **26.** This exampleis more compact and more flexible compared to the example in which the whole cutting unit is arranged in the same platen conveyer belt with the filling and sealing units.

[0084] Figure 3 illustrates a film feeding unit of a system for making water-soluble pouches according to the present invention. The film feeding unit comprises a roller in operation **31,** a roller in stand-by **32,** a splicer **33,** and a stretching device **34.** When the water-soluble film is being fed, the roller in operation **31** is operating and the roller in stand-by **32** is standby. The film feeding unit may further comprise a sensor which is configured to monitor the amount of the water-soluble film on the roller in operation **31.** When the sensor detects that the water-soluble film nearly run out (e.g., the rest amount of water-soluble film being less than 5%), the sensor may communicate with the splicer **33.** Then, the splicer **33** may switch the feeding of water-soluble film from the roller in operation **31** to the roller in stand-by **32.** Particularly, the splicer **33** may cut the water-soluble film unwind from the roller in operation **31,** and attach the water-soluble film unwind from the roller in stand-by **32** to the end of the feeding water-soluble film. As such, the roller in stand-by **32** becomes a new roller in operation, and the roller in operation **31** becomes a new roller in stand-by after the provision of new water-soluble film. Furthermore, the stretching device **34** stretches the water-soluble film before it is fed onto the conveyer **35.** Particularly, the stretching device **34** may comprise a plurality of rollers having different rotary speed.

Claims

1. A system for making water-soluble pouches containing a composition, comprising:

a) a platen conveyer unit comprising a conveyer and a supporting base of the conveyer, in which said conveyer comprises a plurality of moulds and said conveyer is configured to form a continuously moving, horizontally positioned web of open water-soluble pouches by feeding a first water-soluble film onto the conveyer and drawing the first water-soluble film into the moulds,
b) a heating unit which is configured to heat the first water-soluble film after feeding the first water-soluble film onto the conveyer,
c) a dispensing unit which is configured to fill the continuously moving, horizontally positioned web of open water-soluble pouches with a composition, in which the dispensing unit comprises a plurality of nozzles wherein the nozzles are capable of moving horizontally with the same speed as the pouches and in the same direction such that each open pouch is under the same nozzle or nozzles for the duration of the dispensing and the nozzles are capable of moving vertically such that the distance between the open pouches and the nozzles is adjustable,
d) a composition supply unit which is configured to store the composition and supply the composition to the dispensing unit,
e) a sealing unit which is configured to form a web of closed water-soluble pouches by feeding a second water-soluble film onto the web of open water-soluble pouches after filing and then sealing the first and second water-soluble films together, and

f) one or more cutting units configured to cut the web of closed water-soluble pouches in machine direction and in cross-machine direction to obtain a plurality of separated water-soluble pouches.

2. The system according to Claim 1, wherein the platen conveyer is capable of continuously moving in horizontal position, until the platen conveyer rotates around an axis perpendicular to the direction of motion, preferably about 180 degrees, to then move in opposite direction which is also a horizontal motion.

3. The system according to any preceding claims, wherein the first water-soluble film is drawn into the moulds through vacuum.

4. The system according to any preceding claims, wherein the plurality of moulds is arranged in an array having 2 to 20 moulds in the direction of width and 1 to 10 moulds in the direction of length.

5. The system according to any preceding claims, wherein the supporting base comprises a series of processing stations, including heating, forming, filling, sealing, and Machine Direction (MD) cutting stations.

6. The system according to any preceding claims, wherein the heating unit comprises an infrared lamp which is capable of heating the first water-soluble film to temperatures of 50 to 150°C, preferably, wherein the infrared lamp comprises a plurality of sections which are capable of independently working and said plurality of sections are capable of heating the first water-soluble film to different temperatures, preferably wherein the infrared lamp comprises two sections which are capable of independently working and said plurality of sections are capable of heating the first water-soluble film to different temperatures.

7. The system according to any preceding claims, wherein the sealing unit comprises a wetting mechanism which is configured to wet the first water-soluble film and/or the second water-soluble film by applying a sealing composition prior to sealing as well as a sealing roller which is configured to compress the first and second water-soluble films together to form the seal.

8. The system according to any preceding claims, wherein the system further comprises a collecting unit which is configured to collect the plurality of separated water-soluble pouches.

9. The system according to any preceding claims, wherein the cutting unit comprises:

a machine direction (MD) cutting mechanism which is configured to cut the web of closed water-soluble pouches in machine direction,
a cross-machine direction (CD) cutting mechanism which is configured to cut the web of closed water-soluble pouches after MD cutting in cross-machine direction,
a first transfer drum which is configured to draw the closed water-soluble pouches after MD cutting by application of a vacuum and then to transfer the closed water-soluble pouches to the CD cutting mechanism, and
a second transfer drum which is configured to draw the closed water-soluble pouches after CD cutting by application of a vacuum and then to transfer the closed water-soluble pouches to the collecting unit,
preferably, wherein the CD cutting mechanism comprises a rotating anvil and a rotating knife roll in which a plurality of knives is arranged on the rotating knife roll,
wherein the CD cutting mechanism is configured so that the knives intermittently contact the web of pouches and cut the web of pouches in cross-machine direction.

10. The system according to any preceding claims, wherein the system further comprises a first film feeding unit comprising at least one roller from which the first water-soluble film unwinds and a second film feeding unit comprising at least one roller from which the second water-soluble film unwinds,
preferably, wherein the first film feeding unit comprises two rollers from which the first water-soluble film unwinds which are configured so that when the first film is being fed, one of the two rollers is operating and the other of the two rollers is standby, and wherein the second film feeding unit comprises two rollers from which the second water-soluble film unwinds which are configured so that when the second film is being fed, one of the two rollers is operating and the other of the two rollers is standby, and
wherein the two rollers in the first film feeding unit are configured to automatically switch between operating and standby when the first water-soluble film on the roller in operation runs out, and wherein the two rollers in the second film feeding unit are configured to automatically switch between operating and standby when the second water-soluble film on the roller in operation runs out.

11. The system according to any preceding claims, wherein the system further comprises a vacuum-pumping unit which is configured to apply vacuum,

preferably, wherein the vacuum-pumping unit is configured to apply at least two different under-pressures comprising a first under-pressure and

a second under-pressure,
more preferably, wherein the first under-pressure is between 0mbar and -400mbar, preferably between -10 and -100mbar and the second under-pressure is between -200mbar and -700mbar, preferably between -250 and -500mbar.

12. The system according to any preceding claims, wherein the system further comprises a temperature and humidity control unit, and/or an air extraction unit.

13. The system according to any preceding claims, wherein each of the water-soluble pouches comprises a plurality of compartments in which each compartment preferably contains a different composition.

14. The system according to any preceding claims, wherein the system further comprises a dusting unit which is configured to dust the outer surface of the water-soluble pouches with a dusting composition comprising an absorbent material which is preferably selected from the group consisting of zeolite, talc, starch, zinc stearate, calcium stearate, calcium carbonate, sodium carbonate, sodium sulphate and combinations thereof.

15. A process of making a water-soluble pouch using the system of according to any preceding claims, comprising the steps of:

a) continuously feeding a first water-soluble film onto a horizontal portion of a continuously and rotatably moving endless surface (e.g. a platen conveyer belt), which comprises a plurality of moulds, or onto a non-horizontal portion thereof and continuously moving the film to said horizontal portion;
b) forming from the film on the horizontal portion of the continuously moving surface, and in the moulds on the surface, a continuously moving, horizontally positioned web of open pouches, by heating the film and applying vacuum;
c) filling the continuously moving, horizontally positioned web of open pouches with a composition, to obtain a horizontally positioned web of open, filled pouches;
d) continuously sealing the web of open pouches, by feeding a second water-soluble film (preferably, on which a sealing composition is applied) onto the horizontally positioned web of open, filed pouches, to obtain a horizontally positioned web of closed pouches; and
e) cutting the web of closed pouches into a plurality of individual pouches which comprises MD cutting and CD cutting.

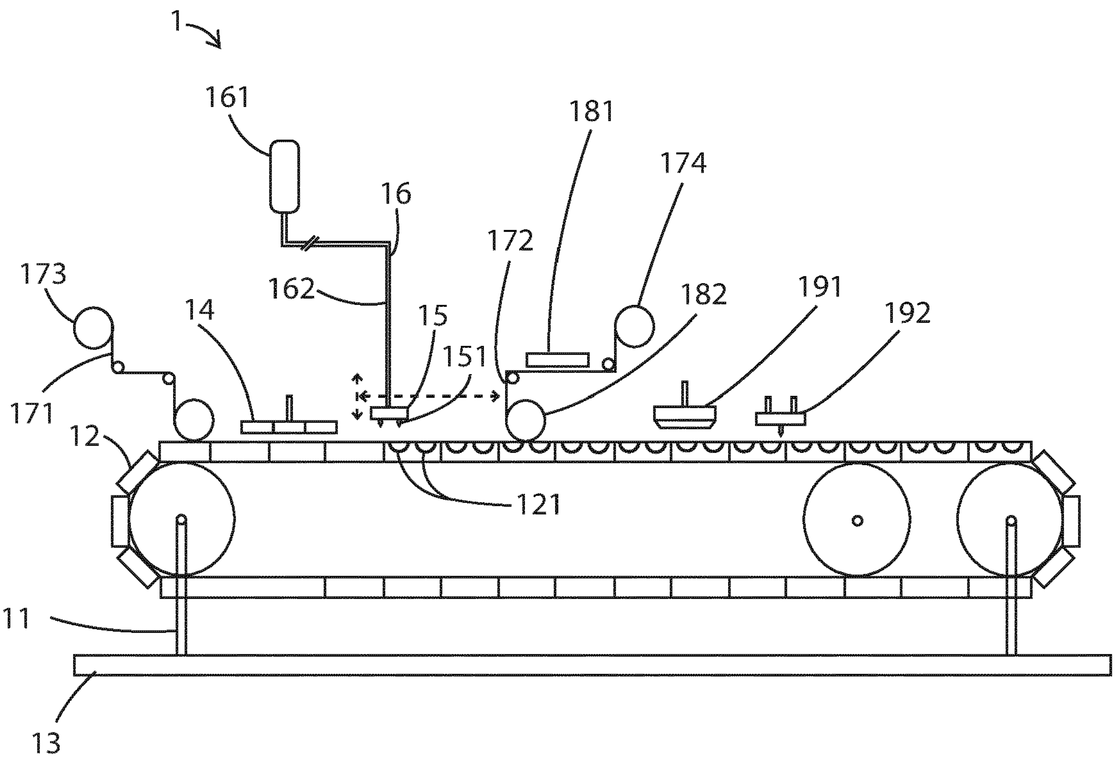

Fig. 1

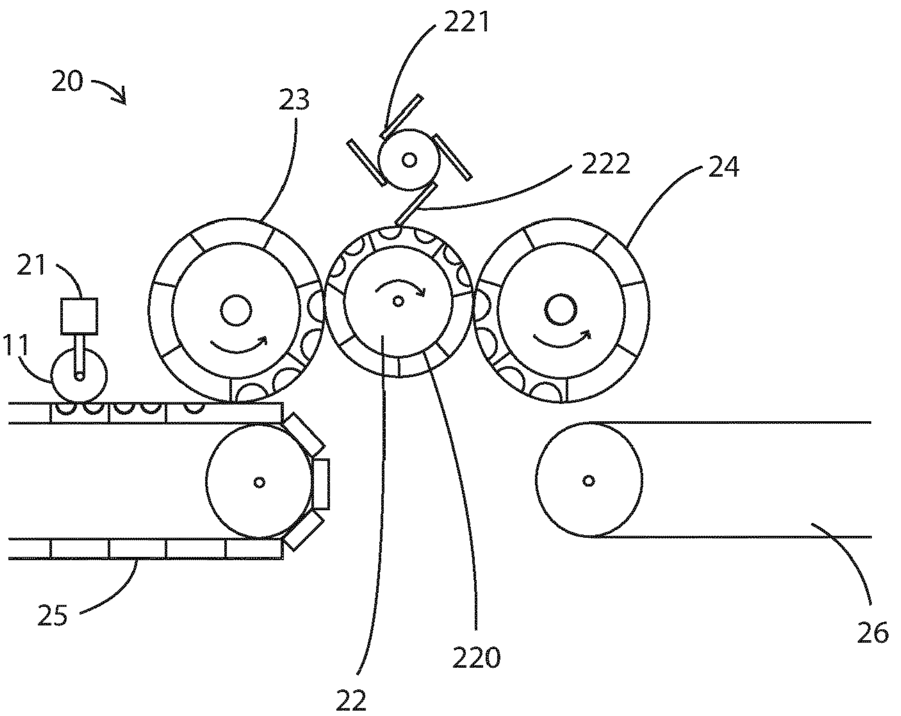

Fig. 2

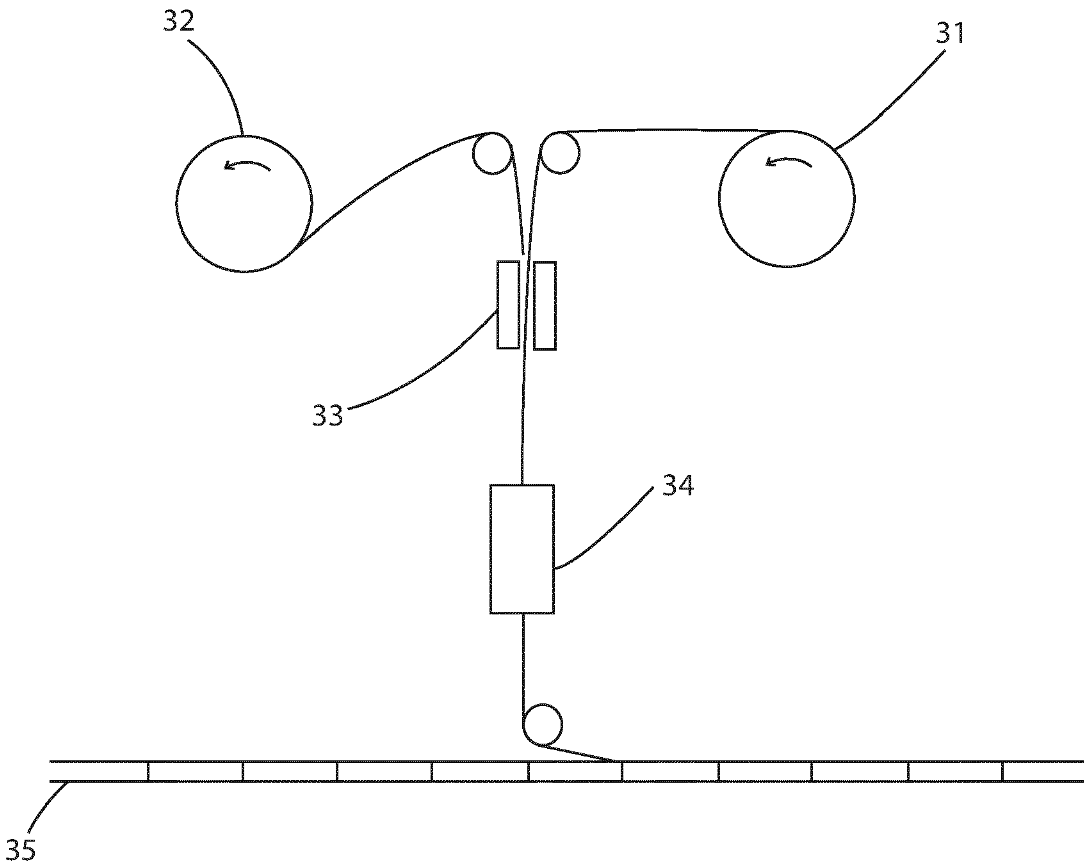

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 21 21 2483

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	EP 1 504 994 B1 (PROCTER & GAMBLE [US]) 11 July 2007 (2007-07-11) * the whole document * -----	1,2,8, 10,12-15	INV. B65B9/02 B65B9/04
Y	WO 2015/179584 A1 (PROCTER & GAMBLE [US]) 26 November 2015 (2015-11-26) * the whole document * -----	1,2,8, 10,12-15	
X	US 2017/088298 A1 (MCLENITHAN THOMAS M [US] ET AL) 30 March 2017 (2017-03-30) * the whole document * -----	1,15	

TECHNICAL FIELDS SEARCHED (IPC)

B65B

~~The present search report has been drawn up for all claims~~

1

Place of search	Date of completion of the search	Examiner
Munich	19 May 2022	Ungureanu, Mirela

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons
& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

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Application Number
EP 21 21 2483

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1, 2, 8, 10, 12-15

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION SHEET B

Application Number
EP 21 21 2483

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1, 2, 8, 10, 12-15

a system and a process of making water-soluble pouches, defining a conveyor, a collecting unit, a feeding unit, a control unit and a dusting unit

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2. claims: 3, 11

a system of making water-soluble pouches defining the first water-soluble film

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3. claim: 4

a system of making water-soluble pouches defining the moulds

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4. claim: 5

a system of making water-soluble pouches defining the base

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5. claim: 6

a system of making water-soluble pouches defining the heating unit

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6. claim: 7

a system of making water-soluble pouches defining the sealing unit

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7. claim: 9

a system of making water-soluble pouches defining the cutting unit

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