APPARATUS FOR MAKING, HANDLING, AND FILLING POUCHES

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ABSTRACT

A conveyor for a pouch-filling machine has an endless track with a working stretch and a return stretch extending from a downstream end of the working stretch to an upstream end of the working stretch. A plurality of carriages each carrying at least one permanent magnet and a clamp ride on the track for movement through the stations on the working stretch and for movement from the downstream end of the working stretch along the return stretch back to the upstream end of the working stretch. An array of electromagnets on the track only along the working stretch and an electronic controller connected to the electromagnets together constitute a frequency-controlled linear direct drive that advances the carriages downstream through the working stretch while varying the travel speeds of at least half of the carriages in the working stretch. A mechanical or frequency-driven conveyor is provided in the return stretch.
APPARATUS FOR MAKING, HANDLING, AND FILLING POUCHES

FIELD OF THE INVENTION

The present invention relates to an apparatus for making, handling, and filling pouches.

BACKGROUND OF THE INVENTION

A typical apparatus for producing packages each comprising a mass of granules or particles in a sealed plastic pouch typically has, spaced apart along a production path, an intake station, a pouch-puckering station, a pouch-depuckering station, a filling station, a sealing station, and a discharge station at a downstream end of the path.

The intake station can simply receive premade pouches. Alternately at least partially thermoplastic synthetic-resin film is formed with a longitudinal fold then subdivided by pairs of transverse welds into a succession of normally rectangular pouches that are joined together and advanced longitudinally downstream as described in U.S. Pat. No. 6,272,815 whose entire disclosure is herewith incorporated by reference. The film constituting the pouches is typically made of polypropylene, polyethylene, multilayer film or the like that is inexpensive, easily printed, weldable, and sufficiently dense to form a hermetic package. Each pouch thus has normally identical front and back panels joined together at the bottom at a unitary fold and side edges each formed by a respective one of the transverse welds. This intake station also has a pouch-separating function where a transverse cut is made through the folded film between two immediately adjacent side welds. Before this is done the pouches are typically gripped by conveyor clamps at the upper ends of the side edges so that, when separated, they are held, normally in an upright position with the open end of the pouch directed upward.

In the puckering station the two clamps that grip the two upper corners of each pouch are moved longitudinally toward each other, which can be done when both clamps are moving by momentarily slowing the leading clamp or speeding up the trailing clamp, or after stopping the pair of clamps by moving one toward the other or both toward each other. With either method of puckering suction grippers can pull the front and back panels is transversely away from each other at the top so that the result is an upwardly open pouch presenting a relatively wide opening. The grippers can be two-part clamps that open and close or they can be vacuum-actuated suction cups. It is possible to grip two pouches with only three clamps, with the middle clamp holding the trailing edge of the downstream pouch and the leading edge of the upstream pouch.

In the filling station the material is loaded into the upwardly open pouch, whether this is a granular material like kitty litter or sugar, or a single object, or even a number of objects like, for instance potato chips, dry soup, mts, or the like.

In the depuckering station the two clamps that grip the two upper corners of each filled pouch are then moved apart, again by momentarily accelerating the leading clamp or braking the trailing clamp, so that upper edges of the panels forming the pouch engage each other. It is also possible to form a slide fastener or other releasable strip-type closure below the upper pouch edge so that, after the upper edge is opened by for instance tearing it off, the pouch can be resealed.

In the sealing station the upper edges are welded together, producing a hermetically closed container holding whatever contents were inserted into it in the filling station.

At the discharge station the finished sealed pouches are dropped into a chute leading to a packaging station, or directly into a carton or the like.

All these steps typically take place at high speed, with the film being fed in and folded at the upstream end of the normally straight path, the contents being moved in transversely of the path. As part of a high-volume mass-production plant, speed must be maximized.

It is standard practice for the production path for the above-described system to extend horizontally, and for there to be a fairly complex conveyor that transports the pouches along the path from the time they are cut free from the folded and welded film. In view of the puckering/depuckering steps before and after the filling step, it is necessary to for the pair of clamps gripping each pouch at its upper corners to not only move along the transport path, but also for the two clamps to move relative to one another for the puckering and depuckering.

This can be done by mechanical systems such as multiple clamp machines as disclosed in U.S. Pat. No. 6,050,061, U.S. Pat. No. 6,276,117, and US 2010/0269458, whose disclosures are herewith incorporated by reference. Other mechanical systems use walking-beam conveyors, or as disclosed in DE 20 201 006 222 a timing-screw system. All such equipment is very expensive, very complex, very hard to maintain and operate and, above all, extremely difficult to adjust to pouches of different sizes.

A significant improvement is made with the system of U.S. Pat. No. 6,876,107 of Jacobs, whose disclosure is herewith incorporated by reference. This system uses individual clamp-carrying carriages that can travel around a track having a working stretch extending through the cutting, puckering, filling, depuckering, welding, and discharge stations through which pairs of carriages carry respective pouches and a return stretch via which the carriages are returned empty to the upstream end of the working stretch.

Each carriage rides via rollers on the track and carries a plurality of permanent magnets. The track is provided internally with a succession of small individually energizable electromagnets that can be energized by an electronic and programmable controller so as to control the movements of the carriages along the track and also their spacing from one another. Thus pairs of the carriages are set at a spacing corresponding to a length of an unpuckered flat pouch at the cutting station when their clamps are clipped onto a respective pouch as it is being cut free from the film, then as the pairs of clamps are moved by their carriages downstream their relative spacings are decreased to pucker the pouch for filling, and again increased to depucker it for welding closed, and at the downstream end of the working stretch the clamps are released so that the carriages can be returned upstream.

This system has the considerable advantage that it is mechanically relatively simple and that it can be programmed electronically for a change in pouch format. It has the considerable disadvantage that it is very expensive in that track with its row of coils is a very pricey item and each electromagnet coil must be connected to the controller.
OBJECTS OF THE INVENTION

[0015] It is therefore an object of the present invention to provide an improved transport system for a pouch-making and -filling system.

[0016] Another object is the provision of such an improved transport system for a pouch-making and -filling system that overcomes the above-given disadvantages, in particular that is of relatively simple construction but that can be readily reprogrammed for a change in pouch size or format.

SUMMARY OF THE INVENTION

[0017] This object is attained in a machine having a production path provided with an upstream intake where individual pouches are made from a weldable film or individual premade pouches are loaded in and oriented with mouths of the pouches directed upward, a filling station downstream therefrom where contents are inserted into the open pouches through the upwardly open mouths of the pouches, and a sealing station downstream therefrom where the open mouths of the pouches are closed. A transport system for the machine has according to the invention an endless track having a working stretch extending along the path and a return stretch extending from a downstream end of the working stretch to an upstream end of the working stretch and a plurality of carriages each carrying at least one permanent magnet and a clamp. The carriages ride on the track for movement through the stations on the working stretch and for movement from the downstream end of the working stretch along the return stretch back to the upstream end of the working stretch. According to the invention an array of electromagnets on the track only along the working stretch and an electronic controller connected to the electromagnets together constitute a frequency-controlled linear direct drive such as the PowerFlex® adjustable-frequency AC drive produced by Rockwell Automation. This electromagnetic drive advances the carriages downstream through the working stretch while varying the travel speeds of at least half of the carriages in the working stretch so as to pucker and depucker pouches held in the clamps of the carriages. Furthermore a simple drive of the mechanical or electronic frequency-controlled system shifts the carriages at a generally constant speed downstream in the return stretch from the downstream end of the path to the upstream end of the path.

[0018] Thus the transport system for the pouch-making and -filling machine is significantly simplified. In the critical working stretch the electronic drive such as described in above-U.S. Pat. No. 6,876,107 is used. As a result it is possible from a simple input station to vary the spacing and speed of the carriages as they travel through the pucker, filling, depucker, and sealing stations. If any of these stations is not needed, for instance the pucker station might be unnecessary when the pouches are being filled with a liquid, the machine can consist only of a pouch pucker filling section to which are fed premade pouches. Similarly when pouch size is changed, the critical clamp spacing is easy to vary. On the other hand in the return stretch a simple conveyor, for instance a toothed belt engaging upstanding pins atop the individual carriages or a simple frequency-controlled conveyor, can move the carriages back to the upstream end.

[0019] According to a feature of the invention the return stretch includes arcuate upstream and downstream turnaround regions at the upstream and downstream ends of the working stretch and a straight region extending generally parallel to the working stretch between the turnaround regions. The simple return conveyor can comprise respective upstream and downstream wheels at the turnaround regions. Alternately, each of the turnaround regions has a respective arcuate array of electromagnets forming part of a simple frequency-controlled return conveyor.

[0020] With the system of this invention the simple conveyor displaces the carriages along the return stretch at a higher average speed than an average speed at which the carriages are moved by the controller in the working stretch. The considerable advantage of this is that the simple return conveyor can operate at a very high speed, thereby reducing the return time of a carriage to a small fraction of the time it takes to traverse the working stretch, so that a significantly smaller number of the carriages is needed.

[0021] In accordance with the invention, the machine further has downstream of the intake station and upstream of the filling station a puckering station where individual pouches made from a weldable film are opened for filling. Downstream therefrom is a depuckering station where the upwardly directed mouth of the puckered pouch is opened.

BRIEF DESCRIPTION OF THE DRAWING

[0022] The above and other objects, features, and advantages will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

[0023] FIG. 1 is a small-scale view of a pouch-making and -filling machine according to the invention;

[0024] FIG. 2 is a partly schematic perspective view of the FIG. 1 machine;

[0025] FIG. 3 is a side view of a portion of the track of the transport system of this invention;

[0026]FIG. 4 is a section taken along line IV-IV of FIG. 3;

[0027]FIG. 5 is a perspective view of a pouch transfer mechanism according to the invention;

[0028] FIG. 6 is a perspective view of the puckering station at the upstream end of the working stretch;

[0029] FIG. 7 is a perspective view of the upstream end of the upstream ends of the working and return stretch according to the invention;

[0030] FIG. 8 is a side view of the transfer carriage that loads the pouches into the grippers at the upstream end of the working stretch; and

[0031] FIG. 9 is another perspective view of a pair of pouch grippers.

DETAILED DESCRIPTION

[0032] As seen in FIGS. 1 and 2 a machine according to the invention extends in a longitudinal travel direction 10 and has a folding station A, a welding station B, and a cutting station C as described in US 2010/0255372, whose disclosure is herewith incorporated by reference, together forming an intake station in which a sheet of plastic film is folded in half, then given a series of transversely throughgoing welds, and then cut into individual pouches P between the welds as is well known in the art. The individual pouches P are then oriented with their mouths directed upward and are each gripped between two longitudinally spaced carriage clamps 11 on a track 12 to proceed downstream in the direction 10.

[0033] As also indicated in FIGS. 7 and 8, in the puckering station D the trailing clamp 11 of each pair of pouch-suspending clamps 11 is accelerated slightly or the leading clamp 11
is decelerated, or both, so that the clamps 11 of each pair get closer together. At the same time unillustrated grippers, for instance suction cups, engage opposite faces of each pouch P to pull them apart so that in the filling station F an apparatus such as shown in U.S. Pat. No. 5,709,194 of Shalit, whose disclosure is herewith incorporated by reference, fills the puckered pouches P by dispensing a dosed quantity of bulk material into the pouch P, although it is of course within the scope of the invention for a single object to be the contents that are inserted into the pouch, or even liquids.

0034. Subsequently in the depuckering station 17 the clamps 11 of each pouch P are moved apart in the direction 10 to flatten the open mouth of the pouches P, which are then welded shut in the closing sealing station G. Finally the filled sealed pouches are released by the clamps 11 in the discharge station H to be packaged and prepared for shipping.

0035. FIGS. 2, 7, and 8 clearly shows how the track 12 is annular, that is an endless loop having a straight working stretch 12a, a straight return stretch 12b extending parallel to the stretch 12a, and a semicircular upstream and downstream turnaround regions 12a and 12b that respectively connect together the upstream and downstream ends of the stretches 12a and 12b.

0036. According to the invention the carriages/clamps 12 are advanced in the working stretch 12a by an electronic conveyor of the type described in above-cited U.S. Pat. No. 6,876,107 comprising a row of electromagnets operated by a programmable controller. More particularly as shown in some detail in FIGS. 3 and 4, the track 12 is formed in the stretch 12a as a rigid rail 18 carrying two rows of electromagnetic or coils 19 that can be energized individually or groupwise by the controller 17.

0037. The carriage clamps 11 each have a body 20 that surrounds most of the rail 18 and that carries level with each row of coils or electromagnets 19 a respective pair of permanent magnets. Rollers 21 support the carriage bodies 20 on the rail 20 and brackets 22 support a standard two-finger clamp of the type described in several of the above-cited references.

0038. This structure shown in FIGS. 3 and 4 allows the carriages 11 to be advanced along the working stretch 12a at spacings and speeds that can easily be controlled at such a level that adjacent carriages 11 can be moved at different speeds and the spacings between carriages can be changed as they move along the stretch 11a, thereby allowing the puckering and depuckering to be done, and to, when necessary, adjust for pouches P of different sizes.

0039. In the return stretch the carriages 11 are advanced by the simple mechanical conveyor 14 that operates continuously and that can be as simple toothed belt engaging the carriages and moving them back opposite the direction 10 at high speed, such as described in WO 2009/0152249 whose entire disclosure is herewith incorporated by reference. In practice the speed at which the conveyor 14 works is much greater than the average speed the conveyor 13 moves the carriages 11 at in the working stretch 12a. This makes it possible to operate with only a few more clamp carriages 11 than are actually being used in the working stretch 11a since the return time is so quick. Alternately a simple frequency-controlled electromagnet-type conveyor can serve to speed the carriages 11 back to the upstream end of the return stretch 12b.

0040. At the two turnaround regions 12c and 12d it is possible to provide arcuate electronic drives such as used in the stretch 12a. It is however more advantageous to advance the carriages 11 by simple toothed wheels or sprockets 15 and 16 that engage the pins atop the carriages 11. The downstream sprocket 15 rotates continuously at a peripheral speed equal to that of the return conveyor 14, so that the carriages 11 are accelerates up to the return speed by the sprocket 15. The upstream sprocket 16 can also operate at this high speed, or at a lower speed to slow the carriages down to the speed at which they must enter the working stretch 12a.

0041. FIG. 5 shows an example of a pouch gripper according to the invention that is mounted to the machine frame. It has a body 24 that is fixed to the frame of the machine. It also has an actuator connected via a linkage 26 to a pair of gripper arms 27.

0042. Another system is shown in FIG. 9 where a gripper adapted to fit around the rail 12 and be secured to a respective carriage 11 has a body 28 that carries a pivotal gripper arm 29 carried on a bracket 29 so that an edge of a pouch P can be pressed against the body 28 and held in place. The grippers are in pairs and one of the arms 29 reaches from the left and the other from the right so they are out of the way when holding a pouch.

We claim:

1. In a machine having a production path provided with an upstream intake where individual pouches are made from a weldable film or individual premade pouches are loaded in and oriented with mouths of the pouches directed upward, a filling station downstream therefrom where contents are inserted into the open pouches through the upwardly open mouths of the pouches, and a sealing station downstream therefrom where the open mouths of the pouches are closed, a transport system comprising:

an endless track having a working stretch extending along the path and a return stretch extending from a downstream end of the working stretch to an upstream end of the working stretch;

a plurality of carriages each carrying at least one permanent magnet and a clamp, the carriages riding on the track for movement through the stations on the working stretch and for movement from the downstream end of the working stretch to the upstream end of the working stretch;

an array of electromagnets on the track only along the working stretch;

an electronic controller connected to the electromagnets to advance the carriages downstream through the working stretch while varying the travel speeds of at least half of the carriages in the working stretch so as to pucker and depucker pouches held in the clamps of the carriages; and

a mechanical or frequency-driven conveyor for displacing the carriages along the return stretch from the downstream end of the path to the upstream end of the path at a generally constant speed.

2. The transport system defined in claim 1 wherein the return stretch includes arcuate upstream and downstream turnaround regions at the upstream and downstream ends of the working stretch and a straight region extending generally parallel to the working stretch between the turnaround regions.

3. The transport system defined in claim 2 wherein the simple conveyor includes respective upstream and downstream wheels at the turnaround regions.

4. The transport system defined in claim 2 wherein each of the turnaround regions has a respective arcuate array of elec-
tromagnets connected to the controller, the mechanical conveyor extending only along the straight stretch.

5. The transport system defined in claim 1 wherein the simple conveyor displaces the carriages along the return stretch at a higher average speed than an average speed at which the carriages are moved by the controller in the working stretch.

6. The transport system defined in claim 1 wherein the machine further has downstream of the intake station and upstream of the filling station:
   a puckering station where individual pouches made from a weldable film are opened for filling, and downstream therefrom
   a depuckering station downstream where the upwardly directed mouth of the puckered pouch is opened.

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