SPEED INDEPENDENT SEALING

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Abstract
The present invention concerns a method and a device for sealing packages (1) during continuous movement. A row of packages (1) is driven by means of a motor (8) through a sealing station comprising an inductor (4). The inductor (4) is driven in a pulse form by means of an IH (induction heating) inductor (5). A PLC system (6) is used to control the IH generator (5). The PLC system (6) receives information regarding speed and position of the packages (1) by means of a motor drive (9) and an encoder (7), respectively.
SPEED INDEPENDENT SEALING

TECHNICAL FIELD

[0001] The present invention concerns a method and a device for sealing packages during continuous movement. The method is normally to be used in a form and seal machine.

STATE OF THE ART

[0002] Packages are raised and sealed at one edge, normally the top in a first line of a form and seal machine. After the sealing the packages goes through one or more fillers. From the one or more fillers the packages are returned to a second line of the form and seal machine where the other edge of each package is sealed. In this description the two lines of the form and seal machine and the one or more fillers are commonly referred to as the filling machine.

[0003] Previously separate induction heating transformers were used for different speeds of the machine. Thus, application of induction heating was done with a continuous power for each speed during the package movement. It was necessary to have different combinations of transformers and capacitors to get the correct phase-shift of the signal for the different speeds. When the speed of the machine was changed, e.g. due to another type or sizes of packages, the transformers were to be changed. The earlier methods resulted in wasting of a large number of packages during acceleration and retardation.

SUMMARY OF THE INVENTION

[0004] There is a need for a speed independent sealing of packages. The sealing should be made during continuous movement of the packages.

[0005] As an example, a new form and seal machine has been developed to operate in a number (3-5) of fixed speeds. The machine is to fit in a packaging line for retortable food products. To improve the machine to work better together with existing filling technologies used in the business, demands have been raised to make the machine more flexible in terms of speed and, thus to be able to run in varying not pre-fixed speeds.

[0006] Thus, one object of the invention is to have a speed independent sealing.

[0007] Another object is to seal with the same equipment during different speeds and during acceleration and retardation.

[0008] In the method of the present invention packages are sealed during continuous movement. A transportation means drives a row of packages through a sealing station comprising an inductor. The inductor is driven in a pulse form. A PLC system is used to control the pulses of the inductor. The PLC system uses information from a motor drive and an encoder, respectively connected to the motor driving the transportation means.

[0009] As stated above the top of each package is normally first sealed and thus the package is fed upside down. The package is then filled with the goods, whereby the bottom of the package is sealed. The sealing of both the top and the bottom takes place in the form and seal machine. Thus, for each form and seal machine there will be two sealing stations, both normally controlled by the PLC system.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The invention will be described further below with reference to the enclosed drawings.

[0011] FIG. 1 is a principal view of a sealing station in which the present invention may be used.

[0012] FIG. 2 is a diagram showing an example of the pulses of the inductor affecting each package.

DETAILED DESCRIPTION OF THE INVENTION

[0013] In FIG. 1 a row of packages 1 are indicated. The row of packages 1 is fed at a constant speed in normal use. The speed may vary depending on the type of packages 1 and the goods to be filled in the packages 1. The packages 1 are arranged on some kind of transportation means (not shown) driven by a motor 8. The transportation means may be a chain having means for receiving each package 1. The motor 8 is controlled by a motor drive 9. Furthermore, an encoder 7 is connected to the motor 8. The encoder 7 and the motor drive 9 are connected to a PLC (programmable logic controller) system 6. The PLC system 6 is also connected to a generator 5 for induction heating (often referred to as IH generator 5 below). The IH generator 5 is feeding an inductor 4 at a sealing station for the packages 1. The inductor 4 normally consists of two inductor plates, one on each side of the package 1 in the sealing station.

[0014] In practice the encoder 7 normally comprises a disc rotating with the motor 8. In one embodiment an encoder 7 giving 256 pulses per rotation is used. The 256 pulses are set to correspond to 2 packages and the space between them. The position and speed of the packages 1 are given to the PLC system 6 by means of the encoder 7 and the motor drive 9, respectively. This information is used by the PLC system 6 to control the IH generator 5 and ultimately the inductor 4.

[0015] Depending on e.g. the capacity of the filler or fillers, the size of the packages 1 and the form of the goods to be filled in the packages 1 the transportation means will be driven at different speeds. Thus the same filling machine may be driven in varying speeds.

[0016] In FIG. 1 a row of packages 1 pass an inductor 4. Each package 1 has a lower edge 2 and an upper edge 3. Normally one of the edges are sealed first, then the package is filled and finally the other edge is sealed. The sealing is done by means of the inductor 4 heating up a metal, usually aluminium, in the edge area. When the aluminium is heated a plastic layer on each side of the edge area will be heated by the aluminium and melt. After the inductor 4 a number of pressure rolls (not shown) presses the edge together, whereby the heated plastic will melt together. The edge of each package 1 has a length l₁ and the packages 1 of the row are separated by a space of a length l₂. The inductor 4 has a length of l₁ in the feeding direction of the packages 1. The length l₁ of the inductor 4 is the sum of the length lₚ of one package 1 and the distance l₂ between two adjacent packages 1, i.e. l₁=lₚ+l₂.

[0017] The sealing system of the present invention is intended for a continuously moving row of packages 1. The
induction heating is applied in pulses given from the IH generator 5 to the inductor 4. The induction heating is applied in pulses with a fixed length. The time between the pulses vary depending on the speed of the row of packages 1. The applied power is also slightly adjusted according to the speed, i.e. the power is somewhat lower at higher speeds. This is done to compensate for the difference in cooling time between application of induction heating and the pressure rolls. The pulses are started by the PLC system 6. The position of the packages 1 is supervised by the encoder 7 connected to the PLC system 6.

[0018] In FIG. 2 the sealing of one package is shown in a diagrammatic form. At the first pulse (the uppermost curve) the package 1 has just come into the area of the inductor 4 and, thus, only the right part of the lower edge 2 (as shown in FIG. 1) will be affected by the inductor 4. In the pause between the first and second pulses the package 1 has moved further to the right and as shown by the second curve a larger part of the lower edge 2 will be affected by the inductor 4 in the sealing station. For the third and fourth pulses the package 1 has moved even further to the right for each pulse. It should be noted that in the position where the energy of the first pulse starts to increase the energy of the third pulse starts to decrease. The same is true for the second and fourth pulses. When the package 1 leaves the area of the inductor 4 the lower edge 2 will have been given a constant induction heating over its entire length l_p. This is reflected in the lowermost curve of FIG. 2 showing the total energy given by the four pulses shown in the four upper curves of FIG. 2. In this case the energy is applied to the package 1 by means of two pulses per inductor length l_p, i.e. each package 1 is affected by a number of partial pulses (pulses 1 to 4 of FIG. 2), the sum of which corresponds to two pulses over the entire length of the package 1. In the example of FIG. 2 the speed of the filling machine is set to 24 000 packages per hour, i.e. 24 000 packages are sealed in one hour. The pulse time is set to 64 ms and the pause between the pulses will become 11 ms.

[0019] A person skilled in the art realises that the number of pulses per inductor length l_p may be varied. For an encoder with 256 pulses per revolution the number of pulses per inductor length l_p is preferably 2, 4, 8, 16 etc, i.e. equally divisible with 256. The slope at the start or end of each curve depends on the speed and thus the distance travelled by the package during the duration of the pulse.

[0020] At start up the position of the first package 1 coming into the area of the inductor 4 is used to trigger the sealing system. As the starting point and the speed of the packages 1 are known the PLC system 6 will control the pulses to the inductor 4 based on this information. The pulse length is set in relation to the highest possible speed in such a way that the pulses do not interfere. As the frequency of the pulses are related to the speed of the packages 1 the sealing will work both during acceleration and retardation and if the speed is fluctuating. The sealing effect during acceleration and retardation is improved if the number of pulses per package is increased. In the example of FIG. 2 only two pulses are shown for the sake of simplicity. Normally, 4 to 16 pulses per package will be used.

1. A method of scaling packages (1) during continuous movement, in which a row of packages (1) is driven by means of a motor (8) through a scaling station comprising an inductor (4), characterized in that the inductor (4) is driven in a pulse form, that the pulses are of a fixed length and that the time between the pulses vary depending on the speed of the row of packages (1).

2. The method of claim 1, characterized in that a PLC system (6) is used to control the feeding of the inductor (4) by means of a IH (induction heating) generator (5).

3. The method of claim 2, characterized in that information regarding speed and position of the packages (1) is given to the PLC system (6).

4. The method of claim 3, characterized in that the information regarding speed and position of the packages (1) is given by means of a motor drive (9) and an encoder (7).

5. The method of any of the previous claims, characterized in that the applied power is adjusted depending on the speed.

6. The method of any of the previous claims, characterized in that each package (1) of the row of packages (1) has the same length (l_p) in the feeding direction and that the packages (1) are separated by a distance (l_x) from each other.

7. The method of claim 7, characterized in that the length (l_p) of the inductor (4) in the feeding direction of the packages (1) is the same as the length (l_x) of one package plus the length (l_y) of the space between two adjacent packages (1).

8. The method of any of the previous claims, characterized in that each package is given a constant sealing energy throughout the length (l_z) of the package (1).

9. The method of any of the previous claims, characterized in that the first package (1) of the row of packages (1) triggers the sealing system at start-up.

10. A device for continuous sealing of packages (1) in a scaling station comprising an inductor (4), whereby a row of packages (1) is driven by means of a motor (9) through the scaling station passing the inductor (4), consisting of two plates on each side of the row of packages (1), characterized in that an IH (induction heating) generator (5) is connected to the inductor (4) and that the IH generator (5) is controlled by a PLC system (6) connected to the IH generator (5).

11. The device of claim 10, characterized in that the PLC system (6) is connected to receive information from a motor drive (9) and an encoder (7), respectively, connected to the motor (8).

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