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(71) Applicant: **MINIPACK-TORRE S.p.A.**
I-24044 Dalmine (Bergamo) (IT)

(72) Inventor: **Torre, Fabio**
24044 Dalmine (BG) (IT)

(74) Representative: **Garavelli, Paolo**
A.BRE.MAR. S.R.L.
Via Servais 27
10146 Torino (IT)

(54) Eelctronic control system of the packaging process with bell-type packaging machines

(57) A machine is described for packaging products (7) in a heat-shrinking or non-heat-shrinking film (3) comprising: at least one coil (1) for supplying the film (3); at least one plane (5) for preparing the film (3), that opens it for winding the product (7) to be packaged; at least one belt or fixed support (9) for the product (7); at least one bell (11) adapted to close the packaging chamber containing the product (7) onto which the film (3) has been placed, in order to cut and weld the film to then transfer heat through a fan (V) and shrink the film (3) onto the product (7) to package it; heating means (14) for the film (3); unloading rollers (16) for the product (7), and at least one electronic control system of the packaging process equipped with sensors (20), adjusting and interface means (22) and at least one inverter (24) or control system (24').

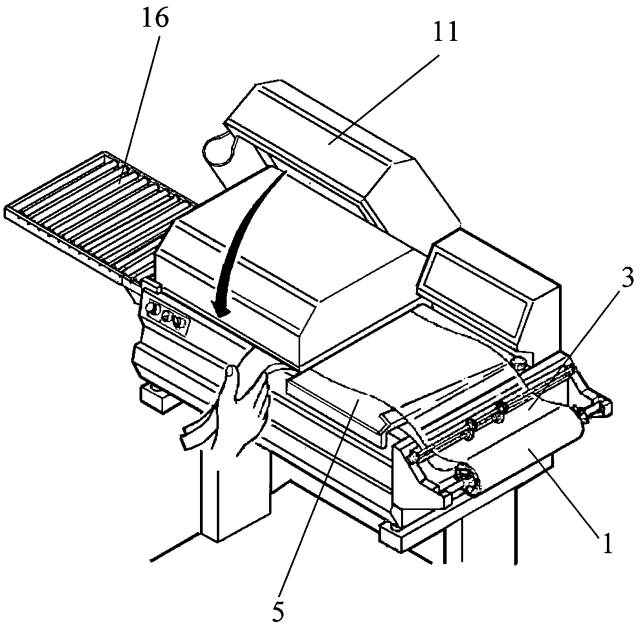

FIG. 1

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Description

[0001] The present invention refers to an electronic control system of the packaging process with bell-type packaging machines.

[0002] Packaging machines of this type are commonly equipped, as can be seen in Figure 1, with: a coil 1 for supplying a heat-shrinking, or not, plastic film 3; a plane 5 for preparing the film 3, adapted to open the single-bend film 3 itself to wind the product 7 to be packaged, a fixed belt or support 9 on which the product 7 to be packaged is placed, a bell 11 adapted to be closed onto the product 7 placed on the fixed belt or support 9 and on which the film 3 has been rested, in order to transfer heat from the heating element 14 to the film through the fan V and shrink the film 3 onto the product 7 to package it; and unloading rollers 16 of the packaged product 7.

[0003] This type of machine, in particular for the semi-automatic operation, requires the presence of an operator for loading the film 3 onto the product 7 and for actuating the bell 11 which can be automated and timed, and has various operating problems, among which the following can be mentioned:

- in the semi-automatic cycle, the drives lift and lower the bell 11 in its two fixed positions, pre-defined in factory upon its testing, obviously preventing the realisation of a different optimum opening position depending on the type of product to be packaged;
- heat that can be found in the bell 11 after a packaging operation is dispersed into the environment in case of excessive opening of the bell 11 and therefore implies a waste of energy;
- heat emanated by the bell 11 when opening is also fastidious for the operator that has to work in the immediate neighbourhood of the bell 11;
- the kinetic energy of fan V accumulated during its operation makes the fan never stop operating, or scarcely slows it down between a packaging operation and another, with a consequent amplification of heat dispersions and therefore energy. The fan V speed during the cycle is fixed and does not allow an optimum adjustment for products with different sizes;
- the film cutting and welding pressure is established by the electro-mechanical system and adjusted when testing by the mechanical factory setting, preventing an optimum adjustment depending on the type and thickness of the used film.

[0004] Object of the present invention is solving the above prior art problems by providing an electronic control system of the packaging process with bell-type packaging machines adapted to increase their productivity and to reduce the energy consumption of the machines, removing all above-mentioned problems.

[0005] The above and other objects and advantages of the invention, as will appear from the following description, are obtained with an electronic control system as described in claim 1. Preferred embodiments and non-trivial variations of the present invention are the subject matter of the dependent claims.

[0006] The present invention will be better described by some preferred embodiments thereof, provided as a non-limiting example, with reference to the enclosed drawings, in which:

Figure 1 shows a bell-type machine to which the present invention applies, in an operating bell-closing position;
Figure 2 shows a bell-type machine to which the present invention applies, in an operating bell-opening position;
Figure 3 shows a block diagram of a first embodiment of the electronic control system of the present invention; and
Figure 4 shows a block diagram of a second embodiment of the electronic control system of the present invention.

[0007] With reference in particular to Figure 3, a first preferred embodiment of the electronic control system of the packaging process with bell-type packaging machines of the present invention will be described.

[0008] Such machine control system stems from the need of having a machine with high productivity, which is flexible and capable to be adapted to the different types of packaged products.

[0009] Such electronic control system substantially comprises:

- at least one sensor 20 placed on the motor shaft (not shown) for controlling the closing automatism of the bell 11, in which such sensor 20 is adapted to control the position of the bell 11, and therefore of the angle α for the necessary and sufficient opening for inserting the particular product 7 to be packaged, and for controlling the necessary stroke to apply the pressure set by the adjusting means 22;
- adjusting and user interface means 22 adapted to adjust and store the various calibration parameters, among which speed of mixing fan V, and adapted to allow the operator to select the necessary speed for making the film 3 heat-shrink depending on the type and sizes of the product 7 to be packaged;
- at least one inverter 24 adapted to control accelerations and decelerations of every machine motor alternately, and adapted, at the end of the cycle, when the upper bell 11 rises up to a height that is necessary and sufficient for removing the product 7, to almost instantaneously decelerate the speed of the mixing fan V, further reducing the dispersion into the external environment of heat accumulated in the lower machine chamber and keeping it for the following cycle; such inverter 24 is further adapted to manage the movement of the transporting belt 9 defining the

transport speed of the packaged product 7 depending on parameters stored in the adjusting means 22; and

- at least one microprocessor or microcontroller 19, operatively connected to sensors 20, to adjusting and interface means 22 and to inverter 24 for their operating management.

[0010] Moreover, the sensors 20 can be directly applied onto the motor shaft for bell automation, amplifying the sensitivity of bell position reading and reducing error margins.

[0011] With reference now in particular to Figure 4, a second preferred embodiment of the electronic control system of the packaging process with bell-type packaging machines of the present invention will be described.

[0012] Such second embodiment is adapted to be applied to the "manual" configuration of the machine (not shown), namely one (with respect to the case shown in Fig. 1 and 2) without the unloading rollers 22 and without the closing automatism for the bell 11: in such manual type of machine, the use of an inverter 24 only to stop the retraction fan V would be inconvenient.

[0013] Therefore, in such case, the electronic control system substantially comprises:

- adjusting and user interface means 22 adapted to adjust and store the various calibration parameters, among which speed of mixing fan V, and adapted to allow the operator to select the necessary speed for making the film 3 heat-shrink depending on the type and sizes of the product 7 to be packaged;
- at least one control system 24' adapted, at the end of manual cycle, to disable the motor of the mixing fan V, further reducing the dispersion into the external environment of heat accumulated in the lower machine chamber and keeping it for the following cycle; such control system 24' is adapted to wait for the motor to discharge its magnetisation and to send a stationary current to the motor in order to create a stationary magnetic field, such magnetic field being maintained for a time sufficient to make the motor stop; and
- at least one microprocessor or microcontroller 19, operatively connected to adjusting and interface means 22 and control system 24' for their operating management.

[0014] Moreover, the adjusting means 22 can be composed of a display and a button-type keyboard:

by means of them, it is possible to display, store and modify data for customising the machine operating programs.

[0015] This control solution allows reducing "dead times" during the packaging cycle with respect to current system and to reduce the dispersion into the surrounding environment of heat accumulated during the previous cycle, consequently increasing the efficiency of the whole process.

[0016] With respect to current system, with this electronic arrangement, benefits are generated, in addition for the global process efficiency, also for the operator that uses the machine, who is not affected any more by the flow of hot and dry air generated by the inertial rotation of the mixing fan V and the motor itself (not shown) at the end of every cycle when opening the upper bell 11.

Claims

1. Machine for packaging products (7) in a heat-shrinking or non-heat-shrinking film (3) comprising: at least one coil (1) for supplying the film (3); at least one plane (5) for preparing the single-bend film (3), adapted to open the film (3) to take it onto the product (7) to be packaged; at least one belt (9) on which the product (7) to be packaged is placed; at least one bell (11) adapted to be closed on the product (7) placed on the belt (9) and on which the film (3) has been rested, in order to apply heat to the film through a fan (V) and to shrink the film (3) onto the product (7) to package it; heating means (14) for the film (3); and an unloading roller (16) for the packaged product (7), said packaging machine being **characterised in that** it is equipped with at least one electronic control system of the packaging process.

2. Packaging machine according to claim 1, **characterised in that** said electronic control system comprises:

   - at least one sensor (20) placed on the shaft of the motor which drives the closing automatism of the bell (11), said sensor (20) being adapted to control the position of the bell (11), and therefore the opening angle (α) that is necessary and sufficient for introducing the particular product (7) to be packaged and control the necessary stroke for applying the pressure set by adjusting means (22);
   - adjusting and user interface means (22) adapted to adjust and store the various calibration parameters, among which the speed of the mixing fan (V), and adapted to allow the operator to select the necessary speed to heat-shrink the film (3) depending on type and sizes of the product (7) to be packaged;
   - at least one inverter (24) adapted to control accelerations and decelerations of every machine motor alternately, and adapted, at the end of the cycle, when the upper bell (11) rises up to a height that is necessary and sufficient for removing the product (7), to almost instantaneously decelerate the speed of the mixing fan (V),

further reducing the dispersion into the external environment of heat accumulated in the lower machine chamber and keeping it for the following cycle, said inverter (24) being further adapted to manage the movement of the transporting belt (9) defining the transport speed of the packaged product (7) depending on parameters stored in the adjusting means (22); and
- at least one microprocessor or microcontroller (19) operatively connected to said sensors (20), said adjusting and interface means (22) and said inverter (24) for their operating management.

3. Packaging machine according to claim 2, **characterised in that** said sensors (20) are directly applied onto the shaft of the bell automatism motor, amplifying the sensitivity of the bell position reading and reducing error margins.

4. Packaging machine according to claim 1, **characterised in that** electronic control system substantially comprises:

- adjusting and user interface means (22) adapted to adjust and store the various calibration parameters, and adapted to allow the operator to select the necessary speed for making the film (3) heat-shrink depending on the type and sizes of the product (7) to be packaged;
- at least one control system (24') adapted, at the end of the manual cycle, to disable the motor of the mixing fan V, further reducing the dispersion into the external environment of heat accumulated in the lower machine chamber and keeping it for the following cycle, said control system (24') being adapted to wait for the motor to discharge its magnetisation and to send a stationary current to the motor in order to create a stationary magnetic field, such magnetic field being maintained for a time sufficient to make the motor stop; and
- at least one microprocessor or microcontroller (19), operatively connected to adjusting and interface means (22) and control system (24') for their operating management.

5. Packaging machine according to claim 2 or 4, in which the adjusting means (22) are composed of a display and a button-type keyboard to display, store and modify data for customising machine operating programs.

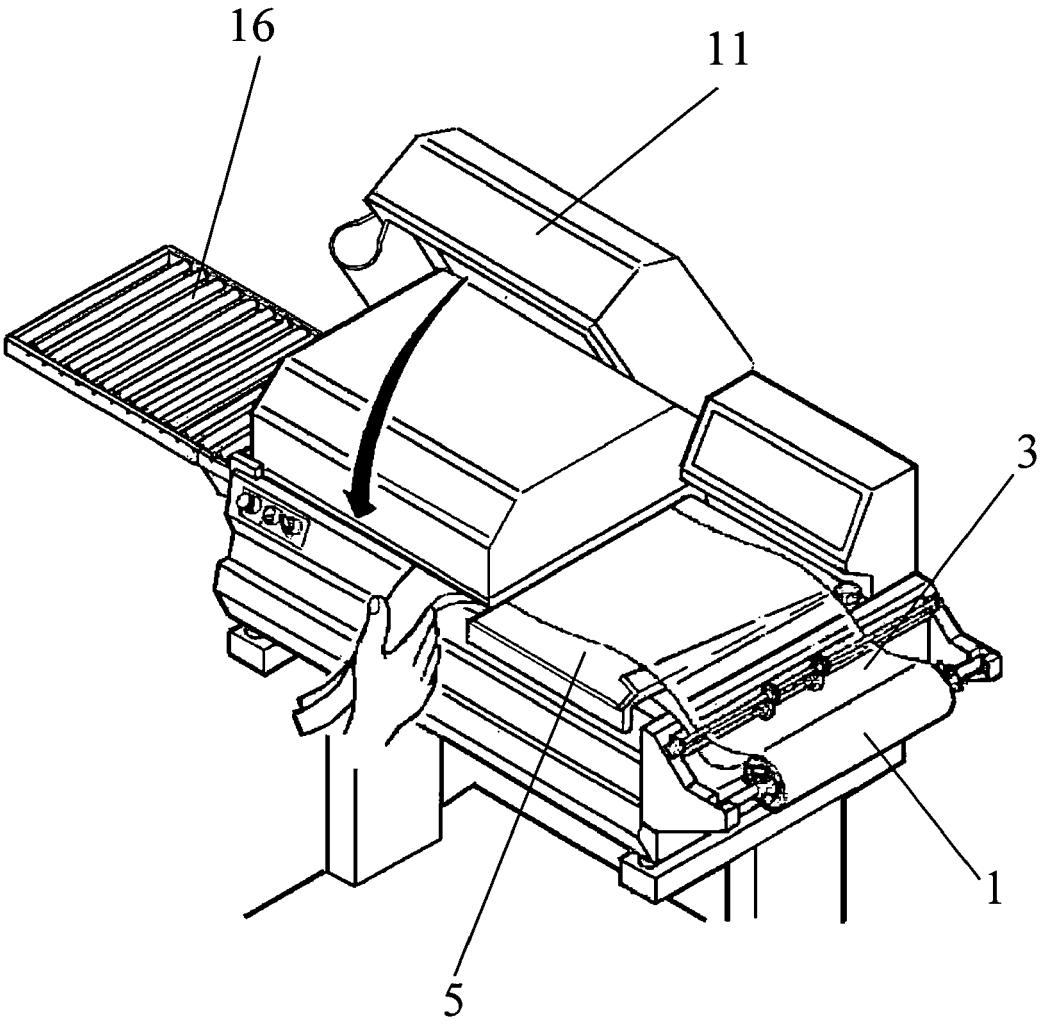

FIG. 1

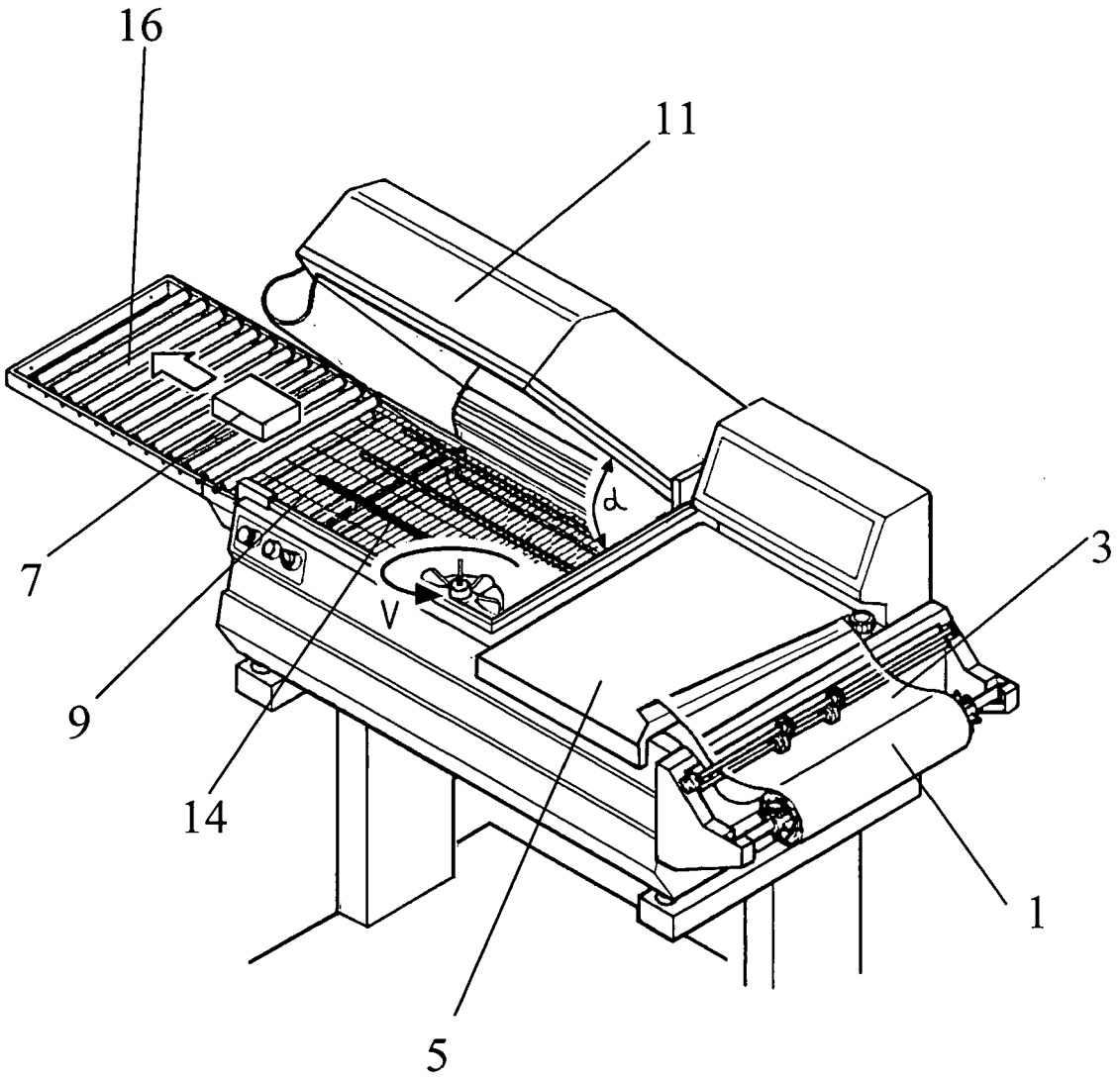

FIG. 2

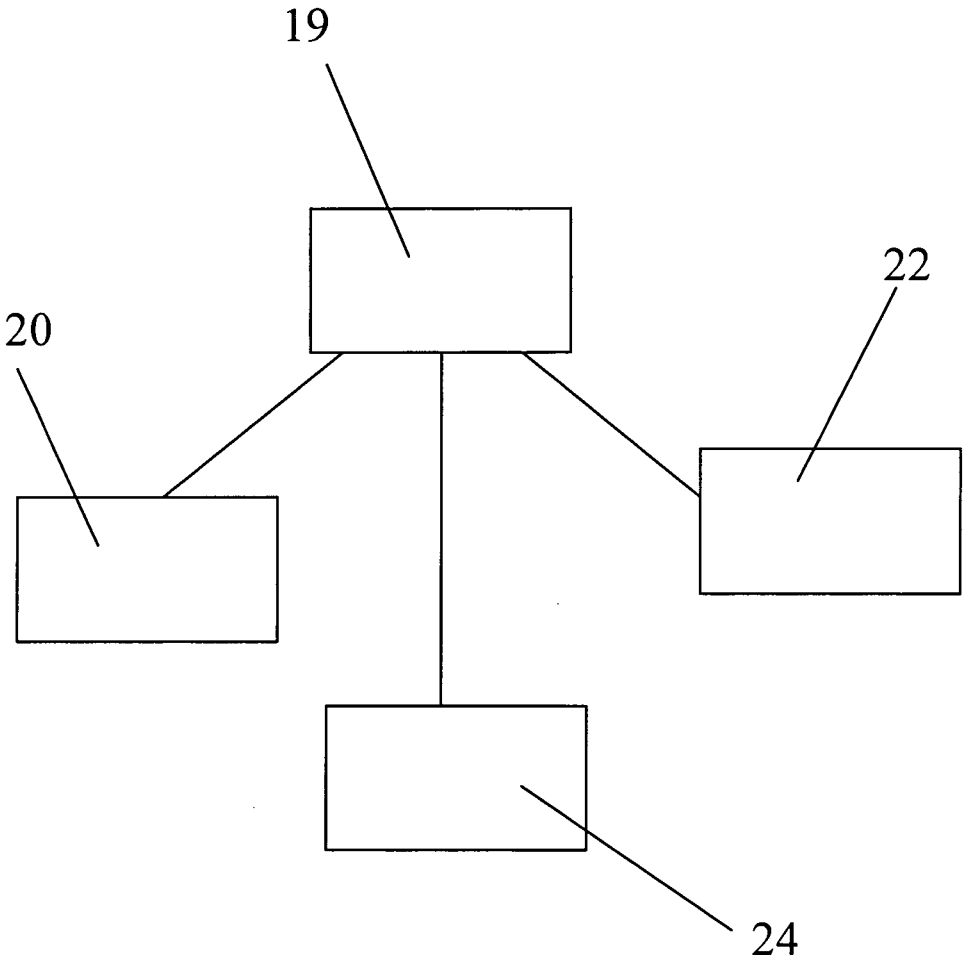

FIG. 3

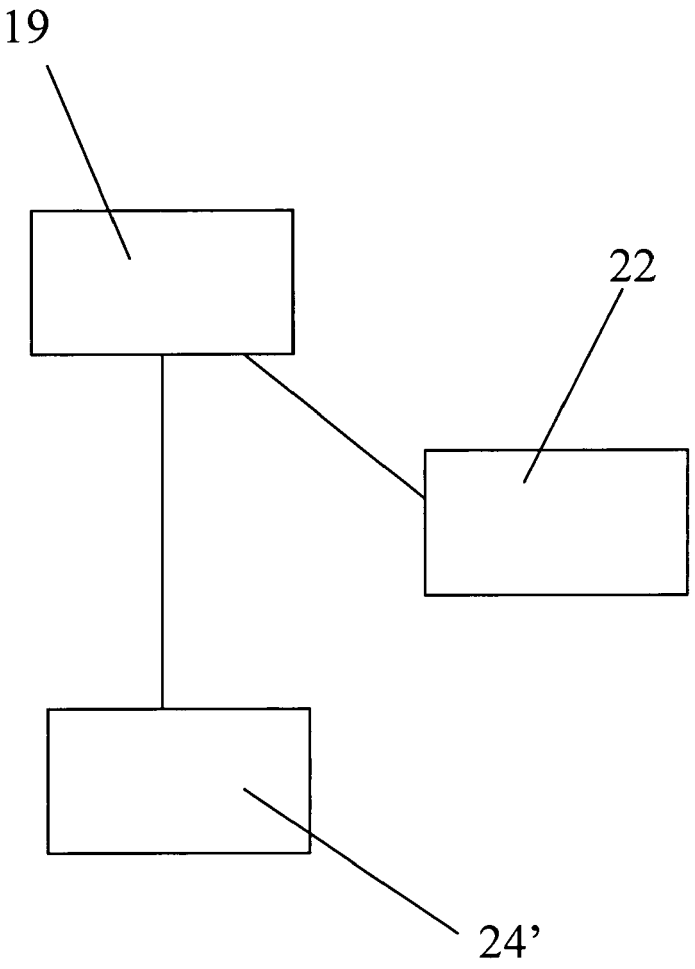

FIG. 4