A method for printing indicia on bags interconnected in a continuous web. A bagging machine has a printer and a plurality of tensioning rollers, at least one of which is driven by a roller motor. The web is moved from an initial bagging machine station through a print station and to a load station in which goods are placed in the bags. A perforation sensor featuring a spring biased hemispherical tip indicates to the bagging machine controller that a perforation is present.

First roller motor control signals are received from a printer controller comprising a frequency modulated first motor speed signal and a first motor enable signal. The first roller motor control signals are transmitted to the roller motor to cause it to drive the roller to move bags through the print station. Second roller motor control signals are received from the bagging machine controller comprising a frequency modulated second motor speed signal and a second motor enable signal. These signals are transmitted to the roller motor to cause the motor to drive the roller to move bags to the final station. This cycle is repeated such that at any given time either first roller motor speed signal or the second roller motor speed signal, but not both simultaneously, are being transmitted to the roller motor. This is accomplished by providing a control signal to a multiplexer that provides a selected speed signal to the roller motor based on the control signal. The speed signals are generated by selecting resistor components that are coupled to a voltage controlled oscillator to provide a frequency modulated motor speed signal. A perforation sensor featuring a spring biased hemispherical tip indicates to the bagging machine controller that a perforation is present.
150

SOC FROM BAGGER 155

? 150

YES

TOGGLE FULL BIT TO PRINTER 160

GET MENA, MSTEP FROM PRINTER 165

SEND S_MSTEP, S_MENA TO CAB 170

MENA INACTIVE ? 175

NO

YES

GET ESTEP_CLK FROM BAGGING MACHINE 180

SEND S_MSTEP, S_MENA TO CAB 185

STEP_INH INACTIVE ? 190

NO

Fig.7
The present invention concerns a bagging machine having an integrated printer for printing indicia onto a bag just prior to loading the bag with one or more articles. The invention is particularly well suited for packaging quantities of pharmaceuticals to fill individual orders and the process of filling such orders as well as other mail order applications.

Machines that use webs of preopened bags to form packages are now well known. Such webs of bags are disclosed and claimed in the U.S. Pat. No. 3,254,828 entitled Flexible Container Strips (the Autobag Patent). A machine that is currently in wide usage commercially for forming packages from chains of preopened bags is described in U.S. Pat. No. 5,394,676 (the Excel Patent). Machines made in accordance with the teaching of the Excel Patent are supplied parts to be packaged by modular systems of counters and/or weighers and conveyors in order that packages can be formed automatically and at relatively high speeds.

The Excel machines are often equipped with printers as that described and claimed in U.S. Pat. No. 5,371,521 issued Dec. 6, 1994 to Rick S. Wehrmann (the Teeter-Totter Patent). The Teeter-Totter Patent is directed to a mechanism which tensions the film and feeds it past a print head in a section of a web of bags that is isolated from a section which feeds bags to a load station such that the two sections are independently tensioned. The Excel Patent teaches a dancer mechanism which independently tensions a web section upstream from the printer section so that there are three isolated individually tensioned sections along the feed path of an Excel machine equipped with a printer. While this system is efficient for printing multiple bags with the same information, the presence of a number of bags between the printer and bagging machine complicates the process of changing over the printed indicia and may result in a number of scrap bags if the bagging machine jams.

Relatively large "mail order" organizations with systems for filling pharmaceutical orders for home delivery require different printed information on each bag. To package their orders, these mail order organizations typically utilize so-called wicketed bags for packaging individual orders for shipment. Pressure sensitive labels are used to identify the contents of the given bag and to provide an address for shipment of the bag to the customer. The wicketed bag approach is slow and expensive. It is especially expensive in that only registered pharmacists can fill individual bags with pharmaceutical orders.

A machine that is a modified version of the Excel machine is currently being offered for sale. This modified machine has what features a "chill" to receive and accumulate bags after they have been printed but before they are fed to a load station. This accumulation of bags results in printing errors and wrinkling of bags resulting in finished packages that are not as attractive as they should be. Such wrinkling can make bar codes printed on the bags unreadable.

Accordingly it would be desirable to provide a machine which uses a web of preopened bags for packaging individual orders and which prints identifying information on each package immediately before it is loaded and sealed.
viding a control signal to a multiplexer that provides a selected speed signal to the roller motor based on the control signal. According to a feature the motor speed signal is provided by selecting resistor components that are coupled to a voltage controlled oscillator to provide a frequency modulated motor speed signal.

[0011] These and other objects, advantages, and features of the invention will be better understood from the accompanying detailed description of a preferred embodiment of the invention when reviewed in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. 1 is a perspective view of a bagging machine constructed in accordance with an exemplary embodiment of the invention;

[0013] FIGS. 2A-2C are block diagrams illustrating control components of the bagging machine of FIG. 1;

[0014] FIG. 3 is a side elevation view of a printer and feeder rolls that move a bag into a loading station;

[0015] FIG. 4 is an enlarged elevation view of the depiction of FIG. 3 showing a print head and perforation detecting device;

[0016] FIGS. 5A-5C are electrical schematics of a portion of a bagging machine controller for coordinating movement of a chain of bags with printing by the printer on those bags;

[0017] FIG. 6 is an exploded view of the perforation detecting device shown in FIG. 4; and

[0018] FIG. 7 is a flow diagram of a method employed by the bagging machine of FIG. 1.

EXEMPLARY EMBODIMENT OF THE PRESENT INVENTION

[0019] FIG. 1 illustrates a bagging machine 10 that includes a user interface 12 that allows a user or operator to adjust various bagging parameters such as seal temperature, bag length, time between cycles for an automated loading system and the like. The user interface is supported by pedestal support 14 which in turn is supported by a base 16 having generally horizontal support members 16a, 16b, 16c that include rollers for repositioning the bagging machine 10.

[0020] The bagging machine defines a bagging station indicated generally as 20 which is a position where articles can be dropped into the end most bag of a chain of interconnected bags. Just prior to the bagging station the machine 10 includes a pair of feed rollers 22, 24 (FIGS. 3 and 4) for driving an end most bag (not shown) of the chain of interconnected bags from a supply (not shown). The supply contains a coiled sequence of interconnected plastic bags separated from each other by perforation lines that extend across the width of the bags and allow easy separation of the bags once an endmost bag has been filled. The supply is mounted for rotation to a spindle 32 to dispense the outermost layer of bags from the supply.

[0021] During machine set up, an operator unwinds the chain of bags from the supply and routes the bags through a dancer roll assembly 34 underneath a printer 40 and into a nip 42 formed by the two drive rollers 22, 24 (FIGS. 3 and 4). The dancer roll assembly 34 similar to the dancer roll assembly shown in U.S. Pat. No. 5,541,625. A separate drive roll pulls the chain of bags from the supply during operation of the bagging machine and the dancer roll assembly 34 maintains a tension between the supply and the dancer assembly while allowing the nip of the drive rollers 22, 24 to intermittently pull bags through a region of printing to the bagging station. An orientation of the dancer roll assembly controls intermittent operation of this separate drive roll. After passing through the dancer assembly 34, the bags move upward away from the dancer roll along a bag path of travel past the printer 40 where indicia is applied to each bag under the control of an electronic circuit to be described in greater detail below.

[0022] At the bagging station, the bag is held open by a stream of air (not shown) so that the articles can be either manually dropped through a chute into a bag or brought to the bagging station by a conveyor (not shown) which drops the articles into a chute and into an opened end most bag that is still attached to the serial chain of interconnected bags. The filled bag is then sealed and separated from the chain for removal from the bagging station to a separate location.

[0023] One feature of the invention is an ability to print information onto the bag immediately before the bag is moved forward to the bagging station where articles are inserted into the bag. One application to which the bagging machine built in accordance with the invention has special utility is for bagging prescription drugs. Information specific to the end user such as an address and instructions for taking the drugs as well as the contents of the bag are printed on the bag immediately before the prescription drug is loaded into the bag. Practice of the present invention allows information to be printed onto the bag just prior to movement of the bag to a position for loading.

[0024] FIGS. 3 and 4 are side elevation views of the printer 40 that is located in close proximity to the bagging station to facilitate printing on bags immediately prior to their being filled. As is shown in FIG. 3, the printer includes a reel-to-reel type system for delivering print ribbon to a print station above the bag in a controlled manner. A supply roll 50 rotates in a clockwise direction to feed a printer tape (not shown) over a pulley 54 to the print station 56 where indicia is applied to a generally flat outer surface of the bag that is about to be filled. The spent print tape is reeled around a second pulley 60 at the location of the print station 56 and returned to a pick up roll 62, which rotates, in a counterclockwise direction and is located to the right of the supply roll 50 in FIG. 2.

[0025] A print head 70 is shown in greater detail in FIG. 3. The print head 70 includes a heating element. The heating element selectively applies heat to the tape and through a known thermal transfer process applies the indicia to the bag from the printing tape. Selective energization and thus heating of the print head element is controlled by a controller within the printer 40. The print head controller encodes the bag with information supplied to the printer from a separate data source. In the disclosed embodiment of the invention, the separate data source is a database stored on a separate computer, which is downloaded to the printer 40 by means of a serial communications port coupled between the separate computer and the printer 40. This serially transmitted information is received by a controller within the printer,
which then selectively energizes the thermal print head in a manner to encode the information onto a bag.

[0026] FIG. 3 also illustrates the feed rollers 22, 24 that defines a nip for moving the end most bag from the region of the printer and print head to the bagging station. As seen in the enlarged view of FIG. 4, there are two rollers, which define a nip 42 through which the bag is routed during setup. The bottom most roller 22 is a driver roller so that controller rotation of this roller moves the bag through the nip to the bagging station. The roller 22 is coupled by means of a transmission to a stepper motor (shown schematically as 140 in FIG. 2A) having an output shaft whose speed of rotation is controlled by a bagging machine controller (shown schematically as 130 in FIG. 2A). The top most roller 24 is spring loaded against the driver roller 22 by a spring 19 and is driven by the frictional engagement therebetween.

[0027] It is a feature of the invention that this driver roller 22 can be reverse activated to retract the bag through the nip after the preceding bag has been loaded, sealed and separated thereby allowing printing to occur over most of the bag’s surface. This backwards movement of the bag is accomplished in part by use of a new perforation sensor 100 (shown in detail in FIG. 6) for sensing bag location. A print roll 80 in immediate proximity to the print head is driven by a belt 81 connected to the driver roller 22 and supports the bag in the region the print head applies indicia to the bag. During reverse actuation of the driver roller 22, as will be discussed in greater detail later, the dancer roller assembly pulls the chain of bags backward by the weight of the dancer roller to maintain a tension in a region of the printer.

[0028] FIG. 6 is an exploded perspective view of a perforation sensor 100 which is shown in phantom in the side view of FIG. 3. The sensor 100 includes a metal semi-hemispherical tip 102 which engages the bag as it moves past the sensor 100. This tip is biased against the bag by a compressed spring 104 trapped within a cylindrical sleeve 110, which in turn is mounted to a flange 112 electrically coupled to high voltage source of power. The energization from the source occurs through a shaft which is spaced from the cylindrical sleeve 110. When supported within the sleeve, the tip 102 contacts the bag and as the bag moves, at periodic intervals, a transverse line of perforations passes over the sensor 100. When this occurs, there is a region of low dielectric constant i.e. the air between the sensor and a metal backing (not shown) against which the sensor is biased. This low dielectric results in a spark occurring, which is fed back through the high voltage input to the sensor to a sensing circuit. This causes a reduction in the voltage due to the periodic shorting of the perforation sensor 100, which in turn indicates to the drive control that the bag has reached a certain location with respect to the print head and the bagging station. During intervals in which the bag (without perforations) is between the sensor the metallic backing, the dielectric constant is higher and inhibits the sparking that occurs when the perforations are sensed.

[0029] Bagging Machine Controller

[0030] FIGS. 2A through 2C are block diagrams of the control system 130 for the bagging machine. The stepper motor 140 that drives the printer roller 22 (FIG. 3) is controlled by signals provided to a control adapter board 133b by a sequencer 131. The sequencer switches control of the stepper motor 140 between controls associated with the bagging machine 132 and controls associated with the printer 133. In doing so, the sequencer 131 causes the motor to be controlled by the device utilizing the motor at any given time. For example, during the printing interval of the cycle, the printer controls 133 cause the motor to rotate the printer roller 22 at a relatively slow speed. The printer controls 133 may also rotate the drive roller at an intermediate indexing speed to precisely position the bag for the next printing interval. After printing, the bagging machine controls cause the motor to rotate the drive roller at a relatively high speed to place the bag in loading position and to move the bag backward to tear the bag away from the web and, if necessary, move the web further back to position the next bag in its print position.

[0031] The sequencer 131 contains a microcontroller (U1 in FIG. 5A) designated PIC16C74B ~20/P (supplied by Microchip located in Arizona). An assembly language program is resident in memory on the microcontroller for controlling the stepper motor 140 based on signals from a bagger controller 132 and a printer controller 133a. The stepper motor 140 receives an enable signal, S_MENA, and a frequency modulated signal, S_MSTEP, that controls the speed and rate of acceleration of the stepper motor from a motor control board 133b that is resident on the printer controller. S_MENA is provided by an OR combination performed by a sequencer enable module 138. The motor enable signal from the bagging machine (STEP_INH) is combined with a motor enable signal from the printer (MENA) such that if either device is providing an enable signal, the motor 140 is enabled. S_MSTEP is derived from the sequencer and more specifically by a selection of resister components coupled to a voltage controlled oscillator (not shown in FIG. 5B) whose output is ESTEP_CLK. The sequencer 131 controls a multiplexer 138 that provides the signal S_MSTEP by switching between a signal provided by the bagging machine (ESTEP_CLK) and a signal provided by the printer (MSTEP).

[0032] Referring to FIGS. 2A-2C and also to FIG. 7 wherein a flow diagram of a bagging method 150 employed by the sequencer to control the operation of the bagging machine is depicted. The sequencer 131 is cued to begin a print portion of a bagging machine cycle by a start of cycle, SOC, signal from the bagger controller 132 in step 155. The sequencer signals the printer to start printing by setting an appropriate bit on the /FULL line in step 160. In step 165 the printer controller 133 then passes MSTEP and MENA, step motor and motor enable signals, respectively, back to the sequencer 131. The MSTEP signal is input to the multiplexer 138 that is used to generate the S_MSTEP signal sent to the motor control board 133b to control the speed and rate of acceleration of the stepper motor 140 in step 170. When the printer has finished printing, it sets the MENA bit to “inactive” to indicate that it is finished in step 175. The sequencer 130 then passes the ESTEP_CLK signal from the bagger controller 132 to the multiplexer 138 in step 180 to generate the S_MSTEP signal sent to the motor control board 133b in step 185. The bagger controller 132 signals it has positioned the printed bag in load position by setting the STEP_INH bit to “inactive” in step 190. After step 190, the sequencer waits for the SOC from the bagger and meanwhile the bagger controller causes the stepper motor 140 to reverse the web of bags to tear the printed bag off and position the next bag
for printing. The sequencer continues cycling stepper motor control between the printer and bagger controllers in this manner.

[0033] FIGS. 5A-5C are a detailed schematic of the circuitry, which is mounted to a board contained within the existing Excel bagger system. This circuit board implements functionality previously implemented on a printer circuit board so that there has been a modification to the control to the printer to accommodate different operation by the existing bagger. FIG. 5A depicts a programmable controller U1 that contains a memory having less than 256 bytes of control program for implementing the control function of the printer and a second programmable logic array U4, that interfaces with the microprocessor that controls printing. Several relevant signals referred to in FIGS. 2 and 7 are labeled in FIG. 5A for convenience. The source code (written in assembly language) for the programmable controller shown in FIG. 5A sits in an idle loop waiting for receipt of the start of cycle signal. Receipt of this signal causes the controller to perform one of its control functions depending upon the status of various bytes that are set and as outlined in the flow diagram of FIG. 7.

[0034] FIG. 5B illustrates schematically a phased lock loop circuit and specifically the phase lock loop circuit includes a voltage control oscillator U3 that is used during ramp up of the motor ramp down of the motor as the bag is driven from its position under the printer head to the bagging station. This occurs in a controlled fashion by means of the programmable controller U1 that outputs a signal correlating to the desired speed for the motor as ESTEP_CLK. U3 also feeds the ESTEP_CLK signal back to logic array U4. FIG. 5C is an interface diagram that includes an input, MENA, from the precision printer control processing unit 133a, indicating a motor enable signal. S_MENA, is appropriate since the print function has been completed.

[0035] While a detailed description of an exemplary embodiment of the present invention has been described with a degree of particularity, it is the intent that the invention include all modifications and alterations from the disclosed design falling within the spirit or scope of the appended claims.

we claim

1) A method for printing indicia on bags interconnected in a continuous web and being processed by a bagging machine having a printer and a plurality of tensioning rollers that move the web from an initial bagging machine station through a print station and to a final station, wherein at least one of the rollers is driven by a roller motor, the method comprising the steps of:

a) receiving first roller motor control signals from a printer controller;
b) transmitting the first roller motor control signals to the roller motor to cause the motor to drive the roller to move bags through the print station;
c) receiving second roller motor control signals from a bagging machine controller;
d) transmitting the second roller motor control signals to the roller motor to cause the motor to drive the roller to move bags to the final station; and
e) repeating steps a-d such that at any given time either first roller motor control signals or second roller control signals, but not both simultaneously, are being transmitted to the roller motor.

2. The method of claim 1 wherein the final station is a load station wherein bags are filled with goods.

3. The method of claim 1 wherein the bagging machine controller transmits third motor control signals to the roller motor after the bags reach the final station to cause the roller to move bags in a reverse direction away from the final station a predetermined distance to reposition a given bag for printing.

4. The method of claim 1 wherein the first roller motor control signals comprise a motor enable signal.

5. The method of claim 1 wherein the first roller motor control signals comprise a motor speed signal.

6. The method of claim 1 wherein the second roller motor control signals comprise a motor enable signal.

7. The method of claim 1 wherein the second roller motor control signals comprise a motor speed signal.

8. The method of claim 1 wherein the first roller motor control signals comprise a motor speed signal and the second roller motor control signals comprise a motor speed signal wherein the first motor speed signal corresponds to a slower roller speed than the second motor speed signal.

9. The method of claim 1 wherein the first and second roller motor control signals comprise frequency modulated signals wherein the frequency of the signal corresponds to a desired motor speed.

10. The method of claim 1 wherein the first roller motor control signal comprises a signal that corresponds to a rate of acceleration for the motor.

11. The method of claim 1 wherein the second roller motor control signal comprises a signal that corresponds to a rate of acceleration for the motor.

12. The method of claim 1 wherein step e is performed by forming a logical OR combination of motor enable signals from the printer controller and the bagging machine controller.

13. The method of claim 1 wherein step e is performed by providing a control signal to a multiplexer that provides a selected speed signal to the roller motor based on the control signal.

14. The method of claim 1 wherein one of the roller motor control signals comprises a motor speed signal and the motor speed signal is provided by selecting resistor components that are coupled to a voltage controlled oscillator to provide a frequency modulated motor speed signal.

15. A method for printing indicia on bags interconnected in a continuous web and being processed by a bagging machine having a printer and a plurality of tensioning rollers that move the web from an initial bagging machine station through a print station and to a load station in which goods are placed in the bags, wherein at least one of the rollers is driven by a roller motor, the method comprising the steps of:

a) receiving first roller motor control signals from a printer controller comprising a frequency modulated first motor speed signal and a first motor enable signal;
b) transmitting the first roller motor control signals to the roller motor to cause the motor to drive the roller to move bags through the print station;
e) receiving second roller motor control signals from a bagging machine controller comprising a frequency modulated second motor speed signal and a second motor enable signal;
d) transmitting the second roller motor control signals to the roller motor to cause the motor to drive the roller to move bags to the final station; and
e) repeating steps a-d such that at any given time either first roller motor speed signal or the second roller motor speed signal, but not both simultaneously, are being transmitted to the roller motor by providing a control signal to a multiplexer that provides a selected speed signal to the roller motor based on the control signal and wherein the speed signals are generated by selecting resistor components that are coupled to a voltage controlled oscillator to provide a frequency modulated motor speed signal.

16. The method of claim 15 wherein the first motor speed signal corresponds to a slower roller speed than the second motor speed signal.

17. The method of claim 15 wherein at least one of the roller motor control signals comprises a signal that corresponds to a rate of acceleration for the motor.

18. The method of claim 15 wherein step e is performed by forming a logical OR combination of motor enable signals from the printer controller and the bagging machine controller.

19. An apparatus for printing indicia on bags perforatedly interconnected in a continuous web comprising:
a) a bagging machine comprising an initial station for mounting a stock quantity of empty bags, a plurality of tensioning rollers for moving the web of bags from the initial station, through a print station, to a final station;
b) a motor connected to at least one of the tensioning rollers for driving the roller to move the web of bags;
c) a printer controller for providing first motor control signals for controlling the motor;
d) a bagging machine controller for providing second motor control signals for controlling the motor;
e) a sequencer for receiving the first and second motor control signals and passing one, but not both, of the signals to the motor according to a control algorithm.

20. The apparatus of claim 19 wherein the sequencer comprises a multiplexer that provides either the first or second motor control signal to the roller motor from either the printer controller or the bagging machine controller according to the control algorithm.

21. The apparatus of claim 19 wherein the sequencer comprises means for forming a logical OR combination of the first and second motor control signals.

22. The apparatus of claim 19 comprising means for selecting resistor components that are coupled to a voltage controlled oscillator to provide a frequency modulated motor speed signal.

23. The apparatus of claim 19 comprising a perforation detector for sensing perforations between bags in the web and transmitting a perforation signal that indicates a perforation is present to the bagging machine controller.

24. The apparatus of claim 23 wherein the bagging machine controller receives the perforation signal and uses the signal to monitor the position of the web of bags.

25. The apparatus of claim 23 wherein the perforation detector comprises:
a generally hemispherical sensing tip;
a biasing spring engaging the sensing tip and urging it toward a conducting plate;
a voltage source in electrical communication with the sensing tip for energizing the sensing tip to cause a potential difference between the sensing tip and the conducting plate; and
wherein the web of bags is fed between the sensing tip and the conducting plate and wherein perforations between the bags permit an arc to pass between the sensing tip and conducting plate to register a perforation signature and wherein in the absence of perforations, arcing is prevented.

26. An perforation sensing apparatus for sensing perforations between bags in an interconnected web and providing a signal indicative that a perforation is present comprising:
a generally hemispherical sensing tip;
a biasing spring engaging the sensing tip and urging it toward a conducting plate;
a voltage source in electrical communication with the sensing tip for energizing the sensing tip to cause a potential difference between the sensing tip and the conducting plate; and
wherein the web of bags is fed between the sensing tip and the conducting plate and wherein perforations between the bags permit an arc to pass between the sensing tip and conducting plate to register a perforation signature and wherein in the absence of perforations, arcing is prevented.

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