(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 270 417 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
02.01.2003 Bulletin 2003/01

(51) Int Cl.[7]: **B65B 9/20**, B65B 57/12, B65B 57/14

(21) Application number: **02254194.0**

(22) Date of filing: **14.06.2002**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **27.06.2001 JP 2001194161**

(71) Applicant: **Ishida Co., Ltd.**
Kyoto-shi, Kyoto 606-8392 (JP)

(72) Inventors:
- **Nakagawa, Yukio, c/o Ishida Co., Ltd.**
Ritto-shi, Shiga 520-3026 (JP)
- **Yamaguchi, Yasushi, c/o Ishida Co., Ltd.**
Kyoto-shi, Kyoto 606-8392 (JP)

(74) Representative: **Skone James, Robert Edmund**
GILL JENNINGS & EVERY
Broadgate House
7 Eldon Street
London EC2M 7LH (GB)

(54) Vertical bag manufacturing and packaging apparatus

(57) The longitudinal-type bag manufacturing and packaging apparatus is an apparatus for packaging batches of articles being dropped. The longitudinal-type bag manufacturing and packaging apparatus includes a bag manufacturing and packaging unit (120), a film supply unit (128), photoelectric sensors (27) and a controller (30). The photoelectric sensors detect a bottom end and a top end of batches of articles being dropped. The controller obtains a gap distance based on detected results detected by the photoelectric sensors. The gap distance is a distance between the top end of a preceding batch and the bottom end of a subsequent batch. Then, the controller (30) compares the obtained gap distance with a predetermined value to automatically adjust the cycle time or to reduce the processing speed of the weighing unit.

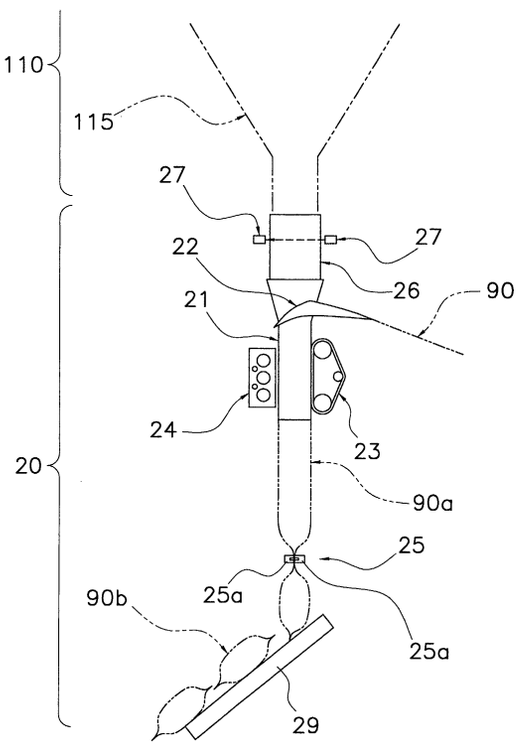


Fig. 3

EP 1 270 417 A1

Description

[0001] The present invention generally relates to a longitudinal-type bag manufacturing and packaging apparatus. More specifically, the present invention relates to a bag manufacturing apparatus that packages articles that are dropped in batches.

[0002] There are many articles such as candies, fresh produce, and processed foods which are distributed and sold after being packaged, with each package having a predetermined weight or quantity. Generally, such articles are weighed by a weighing apparatus to obtain the predetermined weight of the article before a packaging apparatus packages the articles. A system that performs such weighing and packaging of the articles mainly includes a weighing apparatus, and a bag manufacturing and packaging apparatus. The weighing apparatus performs a combination weighing, by which a predetermined weight or quantity of the articles is obtained. The bag manufacturing and packaging apparatus manufactures bags from a film, and then packages the predetermined amount of articles that are weighed by the weighing apparatus.

[0003] An example of an apparatus including the weighing, bag manufacturing and packaging system and the preceding and subsequent processes of such weighing, bag manufacturing and packaging system are shown in Figure 1. In this case, articles are conveyed by a supply conveyor 101 to a position above a weighing unit 110. Then, the articles are placed on dispersion feeders 111 to be dispersed radially by vibration of the dispersion feeders 111. The articles are then conveyed to a plurality of circumferentially disposed pool hoppers 113 via radial troughs 112 that continue from the dispersion feeders 111. The articles are temporarily pooled in the pool hoppers 113, and discharged into weighing hoppers 114 that are positioned below each of the pool hoppers 113. The weights of the articles discharged into the weighing hoppers 114 are obtained by load cells (weight detectors) that are provided in each of the weighing hoppers 114. Then, a combination calculation is performed. The combination calculation outputs, based on the measured weights of articles in each of the weighing hoppers 114, a combination of weighing hoppers 114 whose articles, once discharged, add up to a weight or quantity that is within a permitted range. Based on the result of the combination calculation, some of the weighing hoppers 114 discharge the articles into collection discharge chutes 115.

[0004] On the other hand, a bag manufacturing and packaging apparatus 120 that is positioned below the weighing unit 110 is an apparatus that both manufactures bags, and then packages the articles discharged from the weighing unit 110 in the manufactured bags. A main structure of the bag manufacturing and packaging apparatus 120 is shown in Figure 2. This is a structure of an apparatus known as a longitudinal pillow packaging apparatus. In this bag manufacturing and packaging apparatus 120, a sheet of a film 90 that is pulled from a film roll 128 (see Figure 1) is shaped into a tubular shape by a tube 121 and a former 122. The film 90 is conveyed downward by a pull down belt mechanism 123. Overlapping longitudinal edges of the tubular film 90a are heat-sealed (sealed by heat) by a longitudinal seal mechanism 124. Then, once the weighed articles are inserted into the tubular film 90a via the tube 121, a transverse seal mechanism 125 that is disposed below the tube 121 seals the upper portion of the bag and the bottom portion of the preceding bag in a transverse direction. At the same time, the center portion of the transversely sealed portion is cut with a cutter that is provided inside the transverse seal mechanism 125.

[0005] Bags 90b which have been filled with articles are placed on a conveyor 130 via an inclined guiding board 129. Then, the bags 90b are conveyed to a weight checker 140 and a seal checker (not shown in figures) downstream thereof.

[0006] In the bag manufacturing and packaging apparatus described above, it is important to keep articles from being caught in the sealing portion during the transverse sealing of the bags. If articles are caught in the sealing portion, the bag has to be discarded because it has been improperly sealed. Accordingly, production efficiency decreases. If there are too many occurrences of improper sealing, it may be necessary to stop the production line. Therefore, based on the number of occurrences of improper sealing and data provided by the bag manufacturing and packaging apparatus, an operator will normally manually adjust the timing in which articles are discharged from the weighing unit, or the cycle time of the bag manufacturing and packaging apparatus.

[0007] Japanese Laid-Open Patent Application 10-77002 discloses detecting means that detects the discharge (dropping) of the articles from the weighing unit in order to automatically adjust the transverse sealing operation. However, since the detecting means only detects the discharge of the articles, changes in the articles that occur after the articles are discharged cannot be reflected in the adjustments. Therefore, depending on the type of articles for which the bag manufacturing and packaging operation is performed, these adjustments may not work effectively. For instance, when the bag manufacturing and packaging is performed at a high speed on articles such as potato chips that are processed in batches, the gap between the batch of articles dropped first and the batch of articles dropped subsequently needs to be set such that the articles do not get caught during the transverse sealing. Occasionally, however, the articles become dispersed within each batch, and the gap between the batches of articles becomes too short during the sealing operation. This dispersion of articles occurs due to factors such as a change in temperature or a change in the thickness or size of the chips. When such dispersion of articles occurs, a seal check detector provided in a seal checker or the transverse seal mechanism could show deterio-

ration in the rate of proper sealing. However, it is difficult to take appropriate measures unless the operator has a great deal of experience in dealing with this problem. In particular, it takes a certain amount of experience to determine whether the improper sealing is occurring because the timing at which the articles are dropped is not set properly, or because the cycle time of the bag manufacturing and packaging apparatus is too short. Where the gap reaches the point where it is constantly short, the cycle time of the bag manufacturing and packaging apparatus needs to be adjusted. Conventionally, however, only very experienced operators have been able to perform this type of adjustment.

[0008] In view of the above, there exists a need for a bag manufacturing and packaging apparatus which overcomes the above mentioned problems in the prior art. This invention addresses this need in the prior art as well as other needs, which will become apparent to those skilled in the art from this disclosure.

[0009] It is an object of the present invention to enable an operator to quickly take appropriate measures when articles are likely to be caught in the sealing portion. It is also an object of the present invention to provide a bag manufacturing and packaging apparatus that automatically avoids situations in which the articles tend to get caught in the sealing portion.

[0010] The longitudinal-type bag manufacturing and packaging apparatus according to a first aspect of the invention is an apparatus for packaging batches of articles that are dropped. The longitudinal-type bag manufacturing and packaging apparatus includes detection means and comparison means. The detection means detects a bottom end and a top end of batches of articles being dropped. The comparison means obtains a gap distance based on the results detected by the detection means. The gap distance is a distance between the top end of a preceding batch and the bottom end of a subsequent batch. Then, the comparison means compares the gap distance obtained with a predetermined value.

[0011] Here, the detecting means detects the bottom end and the top end of the batches of the articles. Accordingly, it is possible to obtain a gap distance between batches that are dropped intermittently. Upon obtaining the gap distance, the comparing means compares the gap distance with a predetermined value.

[0012] Therefore, it is possible to determine whether the batches of articles are likely to get caught in the packaging portion based on the result of the comparison. Accordingly, it is possible to issue a warning to the operator or perform a control to increase the gap distance when the articles are likely to get caught. Where a warning is issued to the operator, the operator can quickly become aware of the likelihood of any deficiency in the packaging and take appropriate measures. When the gap distance is increased, it is possible to prevent the articles from getting caught in the packaging portion.

[0013] As the detecting means, ones such as photoelectric sensors that detect passage of the batches of articles directly can be utilized. Vibration sensors, which are provided on a member that contacts the batches of articles and detect the top and bottom ends of the batches of articles indirectly can also be utilized.

[0014] The longitudinal-type bag manufacturing and packaging apparatus according to a second aspect of the invention is the longitudinal-type bag manufacturing and packaging apparatus according to the first aspect, further comprising a controller. The controller issues a control signal to a processing device used in the preceding process based on the comparison results by the comparison means.

[0015] Here, the controller that performs a control based on the comparison results from the comparison means. The controller issues a control signal to a processing device used in the preceding process relative to the longitudinal-type bag manufacturing and packaging apparatus. In this way, where the gap distances between the batches of articles reach the point where they are constantly short due to a change in surrounding environment such as temperature, or a change in the situation of the articles, it is possible to control the processing device used in the preceding process such as a weighing unit. Accordingly, it is possible to change the frequency with which the longitudinal bag manufacturing device receives the articles being supplied, which would otherwise not be changeable by simply controlling the longitudinal-type bag manufacturing and packaging apparatus.

[0016] The longitudinal-type bag manufacturing and packaging apparatus according to a third aspect of the invention is the longitudinal-type bag manufacturing and packaging apparatus according to the second aspect of the invention, wherein the controller issues a control signal to the processing device used in the preceding process in order to reduce the processing speed of the processing device when the gap distance is smaller than a predetermined minimum value.

[0017] When the gap distance is shortened, there is an increase in the occurrence of improper bag manufacturing. Accordingly, the actual operation rate of the production line decreases. Therefore, a predetermined minimum value is established for the gap distance here. When the gap distance becomes shorter than the minimum value, a control signal is issued in order to decrease the processing speed of the preceding process. Due to the decrease in the processing speed of the preceding process, the number of bags being manufactured by the bag manufacturing and packaging apparatus decreases. However, since the rate of occurrence of improper bag manufacturing decreases, the actual operation rate of the production line increases overall.

[0018] The longitudinal-type bag manufacturing and packaging apparatus according to a fourth aspect of the invention is the longitudinal-type bag manufacturing and packaging apparatus according to the third aspect of the invention, wherein the controller issues a control signal to the processing device used in the preceding process

in order to increase the processing speed of the processing device, and to increase the processing speed of the longitudinal-type bag manufacturing and packaging apparatus when the gap distance is greater than a predetermined maximum value.

[0019] When the gap distance is unnecessarily large, it is possible to increase the bag manufacturing speed of the longitudinal-type bag manufacturing and packaging apparatus, while maintaining a favorable rate of improper bag manufacturing that is caused by articles being caught. In view of this function, here, when the gap distance is greater than a predetermined maximum value, the processing speed of both the processing device used in the preceding process and the longitudinal-type bag manufacturing and packaging apparatus can be increased, such that the processing capacity can be increased as a whole.

[0020] The longitudinal-type bag manufacturing and packaging apparatus according to a fifth aspect of the invention is an apparatus that is adapted to package articles by sealing top and bottom ends of a manufactured tubular bag while batches of the articles are dropped in the bag. The longitudinal-type bag manufacturing and packaging apparatus includes detection means and a controller. The detection means detects a discharge of the articles from a processing device used in a preceding process. The controller automatically adjusts the cycle time of a bag manufacturing and packaging operation based on the results detected by the detection means, such that the articles are not caught in the sealed portions of the bags. The cycle time is a predetermined period of time, between the time when one bag is manufactured and packaged and the time when the next bag is manufactured and packaged. In other words, the cycle time is a predetermined period of time that is necessary to manufacture and package one bag.

[0021] Conventionally, minor adjustments in the bag manufacturing operation of the bag manufacturing and packaging operation, and adjustments to the timing in which articles are discharged from the processing device used in the preceding process, have been performed based on the detection of batches of articles being dropped. There has been, however, no control that takes into account the constant change in the shape of the batch of articles being dropped.

[0022] On the other hand, in the longitudinal-type bag manufacturing and packaging apparatus of this aspect of the present invention, the cycle time of the bag manufacturing and packaging operation is adjusted automatically based on the results from the detection means, taking into consideration the constant change of the state of the dropped articles that occurs due to factors including a change in the state of the articles and a change in environmental factors such as temperature.

[0023] Accordingly, the adjustment of the cycle time, which an operator has conventionally performed based on his experience by looking at the increase in the rate of improper packaging, can now be performed automatically and more properly. In this manner, it is possible to automatically prevent situations in which articles are caught in the sealing portion. Accordingly, the burden on the operator is reduced. In addition, since bag manufacturing and packaging defects decrease, the actual operation rate of the production line increases.

[0024] The longitudinal-type bag manufacturing and packaging apparatus according to a sixth aspect of the invention is the longitudinal-type bag manufacturing and packaging apparatus of the fifth aspect, wherein the detection means detects the top and bottom ends of batches of articles being dropped. The controller obtains a gap distance based on the results detected by the detection means. The gap distance is a distance between the top end of a preceding batch and the bottom end of a subsequent batch. When the gap distance is determined to be too small, the controller lengthens the cycle time of the bag manufacturing and packaging operation and issues a control signal to the processing device used in the preceding process in order to reduce the processing speed of the processing device.

[0025] Here, the focus is on the constant change in the gap distance between the batches of articles, which occurs because of constant change in the state of articles being dropped. The change in the gap distance occurs, even when the cycle time does not change, due to factors including a change in the articles and a change in environmental factors such as temperature.

[0026] More specifically, the gap distance between batches of articles, which has a great impact on whether the articles get caught in the bag manufacturing portion, is obtained from the result of detection from the detection means. When the gap distance is too small and the articles are likely to get caught, the cycle time of the bag manufacturing and packaging operation is lengthened, and the processing speed of the processing device of the preceding process is decreased. In this manner, although the number of bags that are manufactured by the bag manufacturing and packaging apparatus decreases, the ratio of improper bag manufacturing due to articles getting caught decreases. Accordingly, the actual operation rate of the production line increases overall.

[0027] The longitudinal-type bag manufacturing and packaging apparatus according to a seventh aspect of the invention is the longitudinal-type bag manufacturing and packaging apparatus of the sixth aspect of the invention, wherein the controller shortens the cycle time of the bag manufacturing and packaging operation and issues a control signal to the processing device of the preceding process in order to increase the processing speed of the processing device when the gap distance is determined to be too large.

[0028] Here too, the focus is on the constant change in the gap distance between the batches of articles that occurs because of constant change in the state of articles being dropped. As described above, the change in the gap distance occurs even when the cycle time does

not change due to factors including a change in the state of the articles and a change in environmental factors such as temperature.

[0029] More specifically, when the gap distance between batches of articles which is obtained by the detection means becomes too large, the processing speed of the processing device of the preceding process is increased, while shortening the cycle time. In this manner, the number of bags manufactured by the bag manufacturing and packaging apparatus per a given period of time is increased.

[0030] The longitudinal-type bag manufacturing and packaging apparatus according to an eighth aspect of the invention is the longitudinal-type bag manufacturing and packaging apparatus of the fourth, sixth, or the seventh aspect of the invention, wherein the controller determines whether the gap distance is too large or too small by comparing a plurality of the gap distances with a predetermined minimum value or a predetermined maximum value.

[0031] In order to properly determine whether the gap distance between batches of articles is changing only temporarily or constantly, an appropriate lower limit or an upper limit to the gap distance is established. Here, whether the gap distance is too large or too small is determined based on comparison of several measurements of gap distance.

[0032] These and other objects, features, aspects and advantages of the present invention will become apparent to those skilled in the art from the following detailed description, which, taken in conjunction with the annexed drawings, discloses a preferred embodiment of the present invention.

[0033] Referring now to the attached drawings which form a part of this original disclosure:

Figure 1 is a view of an example of the weighing, bag manufacturing and packaging system and the preceding and subsequent processes of such weighing, bag manufacturing and packaging system;

Figure 2 is a schematic structural view of the conventional longitudinal-type bag manufacturing and packaging apparatus;

Figure 3 is a schematic structural view of the longitudinal-type bag manufacturing and packaging apparatus in accordance with an embodiment of the present invention;

Figure 4 is a block view of the controller of the bag manufacturing and packaging apparatus in accordance with an embodiment of the present invention; and

Figure 5 is a view showing the charge length and the separating length.

[0034] Selected embodiments of the present invention will now be explained with reference to the drawings. It will be apparent to those skilled in the art from this disclosure that the following description of the embodiments of the present invention is provided for illustration only, and not for the purpose of limiting the invention as defined by the appended claims and their equivalents.

Overall Structure

[0035] Figure 3 shows a schematic view of the structure of a longitudinal-type bag manufacturing and packaging apparatus 20 in accordance with the first embodiment of the present invention. This longitudinal-type bag manufacturing and packaging apparatus 20 is a device for inserting food articles (potato chips in this embodiment) into bags. The longitudinal-type bag manufacturing and packaging apparatus 20 mainly includes a bag manufacturing and packaging unit 20a, a film supply unit 20b, and a controller 30 (see Figure 4). The bag manufacturing and packaging unit 20a performs the insertion of the articles. The film supply unit 20b supplies a film 90 to the bag manufacturing and packaging unit 20a that will become bags.

<Structure of the Film Supply Unit>

[0036] The film supply unit 20b supplies the the film 90 to a tube 21 and a former 22 of the bag manufacturing and packaging unit 20a, which will be described later. A roll, in which the film 90 is wound, is set in the film supply unit 20b so that the film 90 is unreeled from the roll.

<Structure of the Bag Manufacturing and Packaging Unit>

[0037] The bag manufacturing and packaging unit 20a mainly includes a film forming mechanism, a pull down belt mechanism 23, a longitudinal seal mechanism 24, a transverse seal mechanism 25, and a discharge guiding plate 29. The film forming mechanism includes the tube 21 and the former 22.

[0038] The tube 21 is a cylindrical member having top and bottom ends that are open. The tube 21 is made integral with the former 22 through a bracket. The weighed potato chips are inserted into the opening of the top end of the tube 21 from a weighing unit 110. The former 22 is disposed so as to surround the tube 21. The former 22 is shaped such that the film 90 conveyed from the film supply unit is formed in a tubular shape when the tube 90 passes through the tube 21 and the former 22.

[0039] The pull down belt mechanism 23 is a mechanism for transferring downward the film 90 that is wrapped around the tube 21. The pull down belt mechanism 23 mainly includes a driving roller and a driven roller, as well as a belt that functions as a suction device.

[0040] The longitudinal seal mechanism 24 is a mechanism that presses the overlapping portions of the film 90 wrapped around the tube 21 against the tube 21 with

a predetermined pressure while heating the overlapping portions, thereby sealing the film 90 in a longitudinal direction. The longitudinal seal mechanism 24 includes a heater and a heater belt that is heated by the heater, and contacts the overlapping portions of the film 90.

[0041] The transverse seal mechanism 25 is placed beneath the forming mechanism, the pull down belt mechanism 23, and the longitudinal seal mechanism 24. The transverse seal mechanism 25 includes a pair of seal jaws 25a, which is symmetrical on the left and right sides. The two seal jaws 25a rotate in the shape of the letter D, drawing trajectories T that are symmetric relative to each other. The seal jaws 25a are pressed against each other when the tubular film 90a, which is formed by the longitudinal sealing, is transversely sealed. The transverse seal mechanism 25 has a cutter inside, which is not shown in the figures. The cutter severs the bag from the tubular film 90a that follows the bag, at the center of the part sealed by the seal jaws 25a.

[0042] The transverse seal mechanism 25 sandwiches the tubular film 90a to press the part to be transversely sealed. In order to seal the bag, however, it is necessary to apply heat as well as pressure. Therefore, in order to heat the adjacent surfaces of the seal jaws 25a that contact the tubular film 90a, a heater with a thermocouple are provided in each of the seal jaws 25a.

<Structure of the Controller>

[0043] The controller 30 shown in Figure 4 controls the operations of each driving portion of the longitudinal-type bag manufacturing and packaging apparatus 20. The controller 30 also controls the timing at which articles are discharged from the weighing unit or the article supplier 110, which is a preceding process.

[0044] The controller 30 preferably includes a microcomputer with a control program that controls the bag manufacturing and packaging portion 20a as discussed below. This controller 30 includes a CPU 31, a ROM 32, a RAM 33, a display 34, and an input portion 35. The ROM 32, the RAM 33, the display 34, and the input portion 35 are operatively coupled to the CPU 31. The display 23 and the input portion 35 are placed on the front side of the longitudinal-type bag manufacturing and packaging apparatus 20.

[0045] The controller 30 is operatively coupled with the devices that it controls, including the pull down belt mechanism 23, the longitudinal seal mechanism 24, the transverse seal mechanism 25, and a driving device of the film supply unit 20b, as well as the photoelectric sensors 27. It will be apparent to those skilled in the art from this disclosure that the precise structure and algorithms for controller 30 can be any combination of hardware and software that will carry out the functions of the present invention. In other words, "means plus function" clauses as utilized in the specification and claims should include any structure or hardware and/or algorithm or software that can be utilized to carry out the function of the "means plus function" clause.

[0046] As seen in Figure 3, the photoelectric sensors 27 are disposed above the tube 21. More specifically, an transparent tubular member 26 formed from an acrylic material is inserted between the tube 21 and a discharge outlet of a collection discharge chute 115 of the weighing unit 110, which is disposed above the tube 21. The pair of photoelectric sensors 27, which emits and receives light, is disposed so as to be able to monitor the articles passing through the tubular member 26 (See Figure 3). The photoelectric sensors 27 constantly send to the controller 30 a signal indicating whether or not the batch of potato chips, which is dropped form the collection discharge chute 115 of the weighing unit 110 to the tube 21 through the tubular member 26, is passing between the photoelectric sensors 27. In this manner, the photoelectric sensors 27 function as detection means.

<The Controller's Master Control of the Bag Manufacturing and Packaging Apparatus and Slave Control of the Weighing Unit>

Overall Control

[0047] The longitudinal-type bag manufacturing and packaging apparatus 20 of the present embodiment can manufacture and package twenty to two hundred bags or articles in one minute. The controller 30 calculates the cycle time, which is the length of time necessary to manufacture one bag and package one bag of articles, based on the number of bags to be manufactured in a given period of time inputted for configuration. Then, the controller 30 controls the speed with which the pull down belt mechanism 23 feeds the tubular film 90a downward and the speed with which the seal jaws 25a of the transverse seal mechanism 25 rotate, such that these speeds correspond to the cycle time. In this manner, the controller 30 functions as an adjusting means. Based on the cycle time, the controller 30 sends to a controller 130 of the weighing unit 110 a request signal requesting a discharge of the articles. In other words, the controller 30 also functions as a signal issuing means. Once the controller 130 of the weighing unit 110 receives a request signal, the controller 130 performs the weighing discharge operation, dropping a batch of potato chips to the longitudinal-type bag manufacturing and packaging apparatus 20, and returns a discharge completion signal to the controller 30 of the longitudinal-type bag manufacturing and packaging apparatus 20.

Automatic Adjustment *Control of Dropping Timings*

[0048] The controller 30 obtains from the photoelectric sensors 27 data on the time at which the bottom end (first end) of the batch of potato chips passes the position of the photoelectric sensors 27. Based on this data, the controller 30 automatically adjusts the timing at which the batch of potato chips is dropped and the timing

at which the seal jaws 25a of the transverse seal mechanism 25 perform the transverse sealing. As is graphically depicted in Figure 5, the controller 30 recognizes the timings at which the potato chips 71a and 72a, which are the bottom ends of the batches of potato chips 71 and 72, pass the height position of the photoelectric sensors 27.

Automatic Adjustment Control of Cycle Time

[0049] Furthermore, the controller 30 here calculates a separating length L2 for adjustment of the cycle time, in order to prevent the potato chips from getting caught in the transverse sealing portion of the bag 90b. The separating length L2 is, as seen in Figure 5, a gap distance (opening) in the vertical direction between the preceding batch of potato chips 71 and the subsequent batch of potato chips 72, which are discharged from the weighing unit 110 and fall on their weight. More specifically, the separating length L2 is the gap distance between the potato chip 71b that is at the top end of the first dropped batch of potato chips 71 and the potato chip 72a that is at the bottom end of the subsequently dropped batch of potato chips 72. The vertical length of the batch of potato chips 71 is a charge length L1, which is shown in Figure 5.

[0050] In a given cycle time, the separating length L2 becomes shorter as the charge length L1 becomes longer. The charge length L1 varies at each cycle. The charge length L1 can also vary due to changes in the surrounding environment or changes in the production process of the potato chips. For instance, when the temperature surrounding the longitudinal-type bag manufacturing and packaging apparatus 20 goes up, the charge length L1 of the batch of the potato chips tends to increase due to an increased dispersion of the potato chips. The charge length L1 can also change constantly due to changes in the size of the potatoes from which the potato chips are made, the thickness of the slices, or the seasonings applied to the surfaces of the potato chips. When the charge length L1 changes due to such reasons, the controller 30 changes the frequency of discharges from the weighing unit 110 by adjusting the cycle time, so as to optimize the separating length L2.

[0051] More specifically, the controller 30 calculates the charge length L1 and the separating length L2 based on the results of detection by the photoelectric sensors 27. Then, the controller 30 compares the separating length L2 with the predetermined maximum value and the predetermined minimum value. In this manner, the controller 30 functions as comparison means.

[0052] When the separating length L2 is shorter than the predetermined minimum value, the controller 30 changes the configuration to make the cycle time longer, thereby reducing the processing capacity. At the same time, the controller 30 issues a request signal to the controller 130 of the weighing unit 110 in such a manner that the articles are discharged in accordance with the cycle time. Due to the longer cycle time, the frequency of the request signal to the controller 130 requesting discharge of the articles decreases. In other words, as the controller 30 changes the configuration to lengthen the cycle time, the controller 30 is effectively sending a command to the controller 130 to reduce the processing speed of the weighing unit 110 (in other words, to reduce the number of batches of potato chips that are discharged in a given period of time).

[0053] Where the average of several separating lengths L2 is greater than the predetermined maximum value, the controller 30 changes the configuration to shorten the cycle time (for instance by increasing by 5 the number of bags to be manufactured and packaged in one minute). Accordingly, the processing speeds of the film supply unit 20b and each of the mechanisms 23-25 increase. Also, the controller 30 issues the request signal requesting the discharge of the articles to the controller 130 of the weighing unit 110 such that the articles are discharged in accordance with the cycle time. Due to the shortened cycle time, the frequency of the request signal to the controller 130 requesting discharge of the articles increases. In other words, as the controller 30 changes the configuration to shorten the cycle time, the controller 30 is effectively sending a command to the controller 130 to increase the processing speed of the weighing unit 110 (in other words to increase the number of batches of potato chips that are discharged in a given period of time).

[0054] The predetermined minimum value and the predetermined maximum value should be set low enough and high enough such that the separating length L2 will not reach them due to variances in each cycle.

<Features of the Longitudinal-type Bag Manufacturing and Packaging Apparatus of the Present Embodiment>

[0055] Conventionally, minor adjustments to the bag manufacturing operation of the bag manufacturing and packaging operation, and adjustments to the discharge timing of the articles from the processing device used by the preceding process, have been performed based on the detection of batches of articles such as potato chips being dropped. There has been, however, no control that takes into account the constant change in the shape of the batch of articles being dropped.

[0056] On the other hand, the longitudinal-type bag manufacturing and packaging apparatus 20 of the present embodiment detects the change in the state of the dropped articles as the change occurs due to changes in the state of the articles or changes in the surrounding environment such as temperature. Then, the cycle time of the bag manufacturing and packaging operation is automatically adjusted based on the result of the detection by the photoelectric sensors 27.

[0057] More specifically, the longitudinal-type bag manufacturing and packaging apparatus 20 calculates the separating length L2, which has a great impact on

whether the articles are likely to be caught in the transverse sealing portion. When the separating length L2 is too small and the articles are very likely to get caught, the longitudinal-type bag manufacturing and packaging apparatus 20 lengthens the cycle time and reduces the processing speed of the weighing unit 110, which is the preceding process. In this manner, although the number of bags that are manufactured by the longitudinal-type bag manufacturing and packaging apparatus 20 in a given period of time decreases, the ratio of improper bag manufacturing due to articles getting caught decreases. Accordingly, the actual operation rate of the production line increases overall.

[0058] When the gap distance is unnecessarily large, on the other hand, it is possible to increase the speed of bag manufacturing of the longitudinal-type bag manufacturing and packaging apparatus 20, while maintaining the low rate of improper bag manufacturing from articles being caught. Similarly, when the separating length L2 is too large, the cycle time is shortened and the processing speed of the weighing unit 110 is increased. Accordingly, the number of bags manufactured by the longitudinal-type bag manufacturing and packaging apparatus 20 in a given period of time increases. In this manner, the overall processing capacity increases.

[0059] In this manner, in the longitudinal-type bag manufacturing and packaging apparatus 20 of the present embodiment, even when the charge length L1 and the separating length L2 change due to a change in the state of the potato chips or a change in the surrounding environment such as temperature, the separating length L2 is automatically adjusted in accordance with the change. Therefore, the articles are prevented from being caught in the transverse sealing portion, and the number of bags manufactured and packaged is optimized to the highest possible level.

Other Embodiments

(A)

[0060] In the above embodiment, when the separating length L2 becomes shorter than the predetermined minimum value, the controller 30 changes the configuration to lengthen the cycle time. However, in view of the variances in the separating length L2 in each cycle, it is possible to set a condition such as that the separating length is shorter than the minimum value for several consecutive times, or that the average value of several recent measurements of separating length L2 is shorter than the minimum value.

(B)

[0061] The above embodiment utilizes photoelectric sensors 27. However, it is also possible to fix a vibration sensor to the collection discharge chute 115 or the tubular member 26, with which the batches of potato chips collide. In this case, the controller 30 detects the top and bottom ends of the batches of potato chips by analyzing the vibration waves sent from the vibration sensor.

(C)

[0062] In the above embodiment, the cycle time is adjusted automatically by comparing the separating length L2 with the predetermined values. Alternatively, it is possible to adjust the cycle time automatically by establishing a parameter called separating time, which is a length of time between the time when the top end of the preceding batch passes and the time when the bottom end of the subsequent batch passes. Then, the separating time is compared with an upper limit time and a bottom limit time.

(D)

[0063] In the above embodiment, the automatic adjustment to lengthen the cycle time is performed when the separating length L2 is shorter than the predetermined minimum value. It is also possible to only issue a warning to the operator, instead of performing such automatic adjustment. In other words, the controller functions as alert means. For instance, the time-series variances of the separating length L2 can be displayed to the operator. Also, a screen that alerts the operator to the possibility of articles getting caught can be displayed. It is also possible to display a screen indicating a change in the configuration of the cycle time that needs to be made, thereby affirmatively urging the operator to take appropriate measures. In this manner, the operator can immediately recognize that improper packaging is occurring. Accordingly, even an inexperienced operator can take appropriate measures.

[0064] In this invention, the gap distance between the batches of articles that are dropped intermittently is obtained, and the gap distance is compared with the predetermined values. Therefore, it is possible to determine, based on the result of the comparison, whether the articles are likely to get caught in the packaging portion. Accordingly, it is possible to issue a warning to the operator or perform a control to enlarge the gap distance when the articles are likely to get caught. Where a warning is issued to the operator, the operator can quickly become aware of the likelihood of the packaging deficiency and take an appropriate measure. Where the control to enlarge the gap distance is performed, it is possible to automatically prevent the articles from getting caught in the packaging portion.

[0065] As used herein, the following directional terms "forward, rearward, above, downward, vertical, horizontal, below and transverse" as well as any other similar directional terms refer to those directions of a device equipped with the present invention. Accordingly, these terms, as utilized to describe the present invention should be interpreted relative to a device equipped with

the present invention.

[0066] The terms of degree such as "substantially", "about" and "approximately" as used herein mean a reasonable amount of deviation of the modified term such that the end result is not significantly changed. These terms should be construed as including a deviation of at least ± 5% of the modified term if this deviation would not negate the meaning of the word it modifies.

Claims

1. A longitudinal-type bag manufacturing and packaging apparatus for packaging batches of articles that are dropped from an article supplier, said bag manufacturing and packaging apparatus comprising:

   a bag manufacturing and packaging unit that manufactures bags from a film;
   a film supply unit that supplies the film to said bag manufacturing and packaging unit;
   detection means for detecting a bottom end and a top end of batches of articles being dropped from the article supplier; and
   comparison means for obtaining a signal that indicates a gap distance, storing a predetermined value, and comparing the gap distance with the predetermined value, the gap distance being a distance between the top end of a preceding batch and the bottom end of a subsequent batch obtained based on results detected by said detection means.

2. The longitudinal-type bag manufacturing and packaging apparatus as set forth in claim 1, further comprising

   signal issuing means that is operatively coupled to said comparison means and the article supplier for issuing a control signal to the article supplier based on the result of comparison by said comparison means.

3. The longitudinal-type bag manufacturing and packaging apparatus as set forth in claim 2, wherein

   said signal issuing means issues a control signal to the article supplier in order to reduce a processing speed of the article supplier when said comparison means determines that the gap distance is smaller than a predetermined minimum value stored in said comparison means.

4. The longitudinal-type bag manufacturing and packaging apparatus as set forth in claim 2 or claim 3, wherein

   said signal issuing means issues a control signal to the article supplier in order to increase the processing speed of the article supplier and a processing speed of said bag manufacturing and packaging unit when said comparison means determines that the gap distance is greater than a predetermined maximum value stored in said comparison means.

5. The longitudinal-type bag manufacturing and packaging apparatus as set forth in claim 2, wherein

   said signal issuing means issues a control signal to the article supplier in order to reduce a processing speed of the article supplier when said comparison means determines that the gap distance is smaller than a predetermined minimum value for at least two consecutive times, said predetermined minimum value being stored in said comparison means.

6. The longitudinal-type bag manufacturing and packaging apparatus as set forth in claim 2, wherein

   said signal issuing means issues a control signal to the article supplier in order to reduce a processing speed of the article supplier when said comparison means determines that an average of at least two gap distances is smaller than a predetermined minimum stored in said comparison means.

7. A longitudinal-type bag manufacturing and packaging apparatus according to any of the preceding claims, wherein the detection means comprises a sensor disposed between the article supplier and said bag manufacturing and packaging unit, the apparatus further comprising a controller operatively coupled to the article supplier, said bag manufacturing and packaging unit, and said sensor, said controller incorporating said comparison means.

8. A longitudinal-type bag manufacturing and packaging apparatus that is adapted to package articles by sealing top and bottom ends of a manufactured tubular bag while batches of the articles are dropped in the bag from an article supplier, said longitudinal-type bag manufacturing and packaging apparatus comprising:

   a bag manufacturing and packaging unit that seals a portion of a film to manufacture bags from the film and stuffs the articles in the bags;
   a film supply unit that supplies the film to said bag manufacturing and packaging unit;
   detection means for detecting a discharge of the articles from the article supplier; and
   adjusting means operatively coupled to said detection means and said bag manufacturing and packaging unit for automatically adjusting a cycle time based on the detected result detected by said detection means such that the articles are not caught in the sealed portion of the bags, the cycle time being a period of time

necessary for said bag manufacturing and packaging unit to manufacture and package one bag of articles.

9. The longitudinal-type bag manufacturing and packaging apparatus as set forth in claim 8, further comprising

comparison means for obtaining a signal that indicates a gap distance, storing a predetermined value, and comparing the gap distance with the predetermined value,

said detection means detecting top and bottom ends of batches of articles being dropped, the gap distance being a distance between the top end of a preceding batch and the bottom end of a subsequent batch obtained based on detected results detected by said detection means,

said adjusting means obtaining a gap distance from the detected results detected by said detection means and lengthening the cycle time of said bag manufacturing and packaging unit while issuing a control signal to the article supplier in order to reduce a processing speed of the article supplier when said comparison means determines that the gap distance is smaller than a predetermined minimum value stored in said comparison means.

10. The longitudinal-type bag manufacturing and packaging apparatus as set forth in claim 9, wherein

said adjusting means shortens the cycle time of said bag manufacturing and packaging unit and issues a control signal to the article supplier in order to increase the processing speed of the article supplier when the gap distance is determined to be greater than a predetermined maximum value stored in said comparison means.

11. The longitudinal-type bag manufacturing and packaging apparatus as set forth in claim 9, wherein

said adjusting means adjusts the cycle time of said bag manufacturing and packaging unit when said comparison means determines that the gap distance is smaller than the predetermined minimum value for at least two consecutive times.

12. The longitudinal-type bag manufacturing and packaging apparatus as set forth in claim 10, wherein

said adjusting means adjusts the cycle time of said bag manufacturing and packaging unit when said comparison means determines that the gap distance is greater than the predetermined maximum value for at least two consecutive times.

13. The longitudinal-type bag manufacturing and packaging apparatus as set forth in claim 9, wherein

said adjusting means adjusts the cycle time of said bag manufacturing and packaging unit when said comparison means determines that an average of at least two gap distances is smaller than the predetermined minimum stored in said comparison means.

14. The longitudinal-type bag manufacturing and packaging apparatus as set forth in any of the preceding claims, wherein

said detection means is a photoelectric sensor.

15. The longitudinal-type bag manufacturing and packaging apparatus as set forth in any of the preceding claims, wherein

said signal indicates a separating time, which is a length of time between the time when the top end of a preceding batch passes and the time when the bottom end of a subsequent batch passes.

16. The longitudinal-type bag manufacturing and packaging apparatus as set forth in any of the preceding claims, further comprising

alert means that is operatively coupled to said comparison means for issuing an alert signal based on the result of comparison by said comparison means, and

a display that is operatively coupled to said comparison means and said alert means and displays said alert signal.

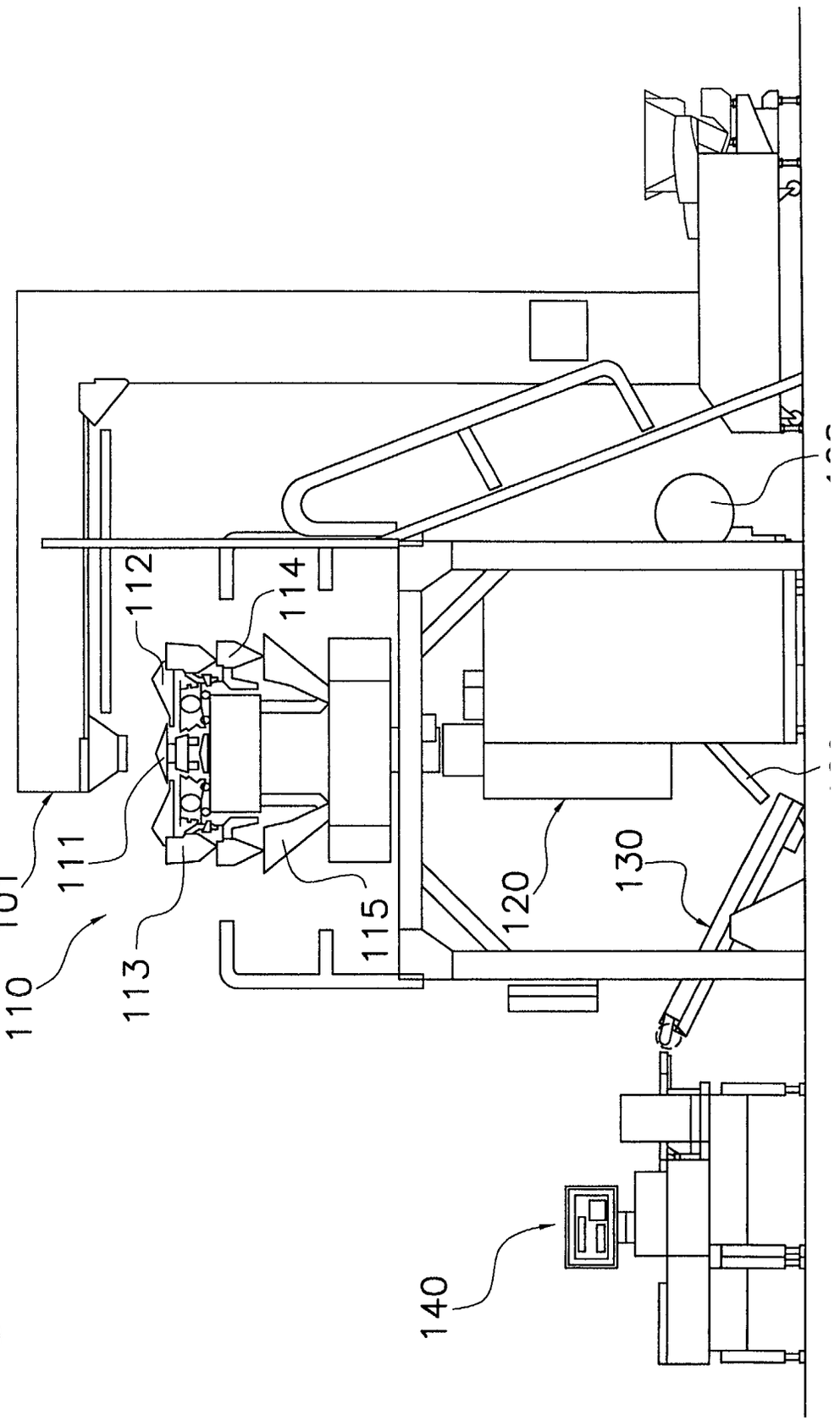


Fig. 1

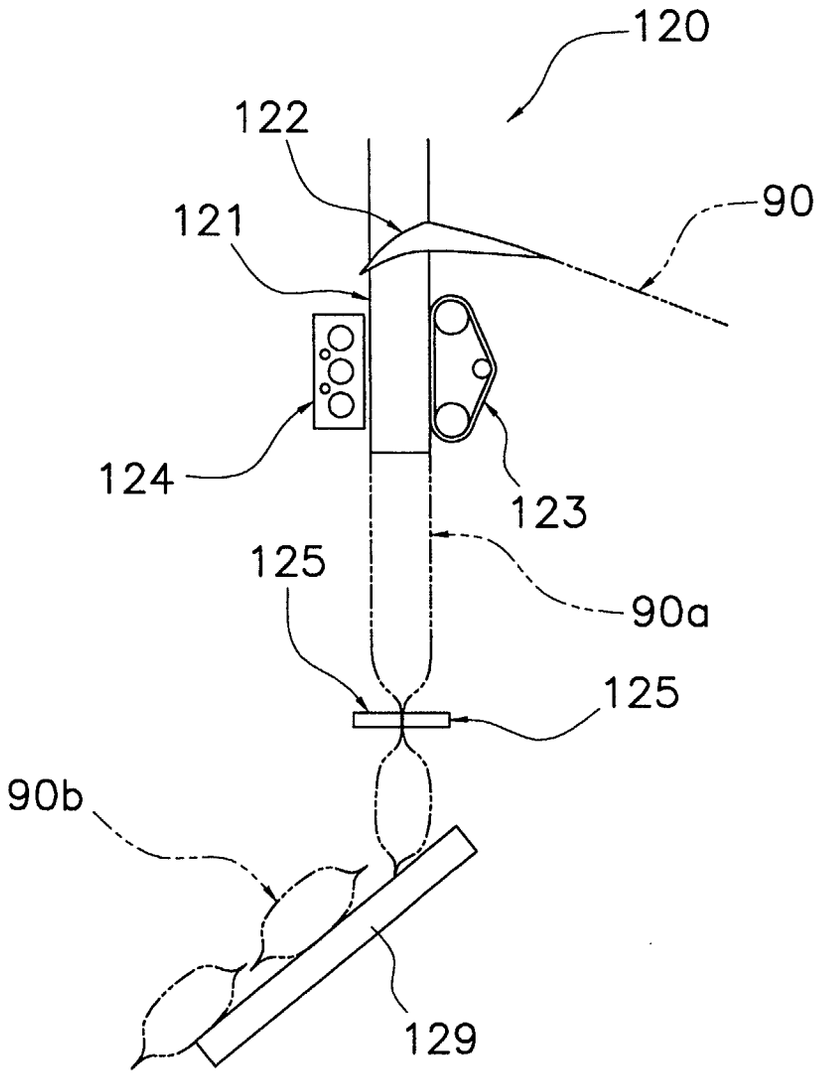


Fig. 2

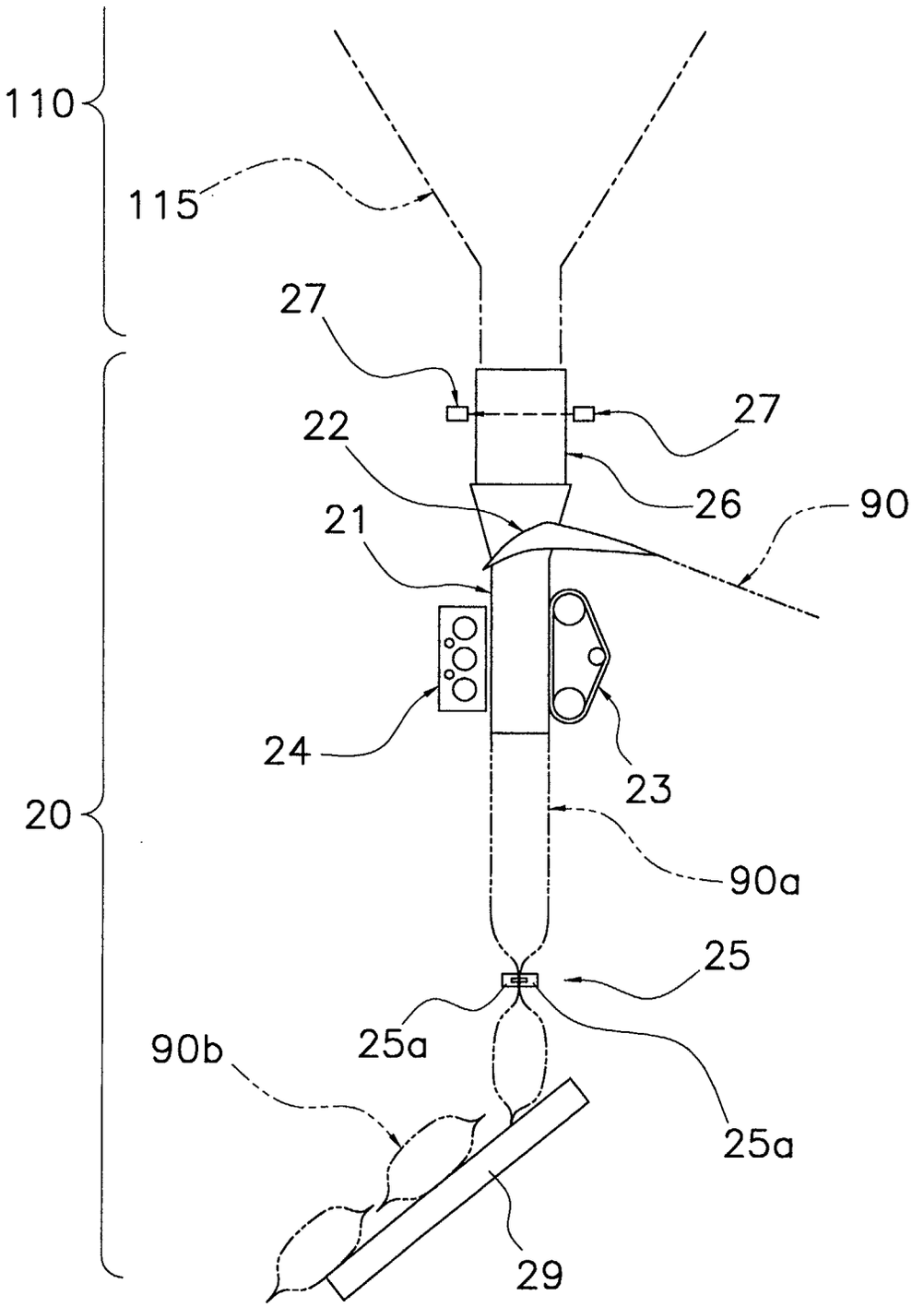
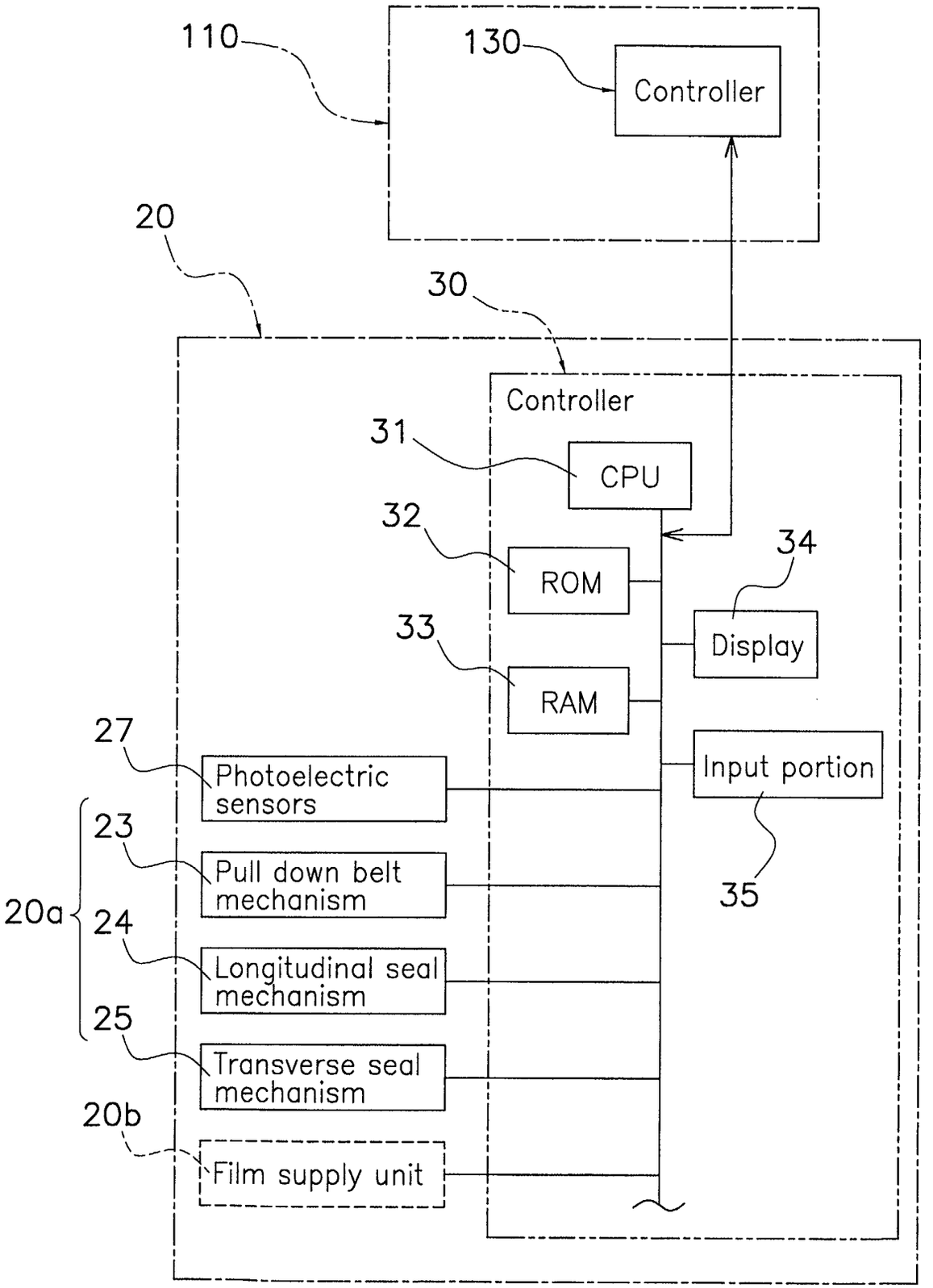


Fig. 3

Fig. 4


110
130
Controller
20
30
Controller
31
CPU
32
ROM
34
Display
33
RAM
27
Photoelectric sensors
Input portion
23
Pull down belt mechanism
35
20a
24
Longitudinal seal mechanism
25
Transverse seal mechanism
20b
Film supply unit

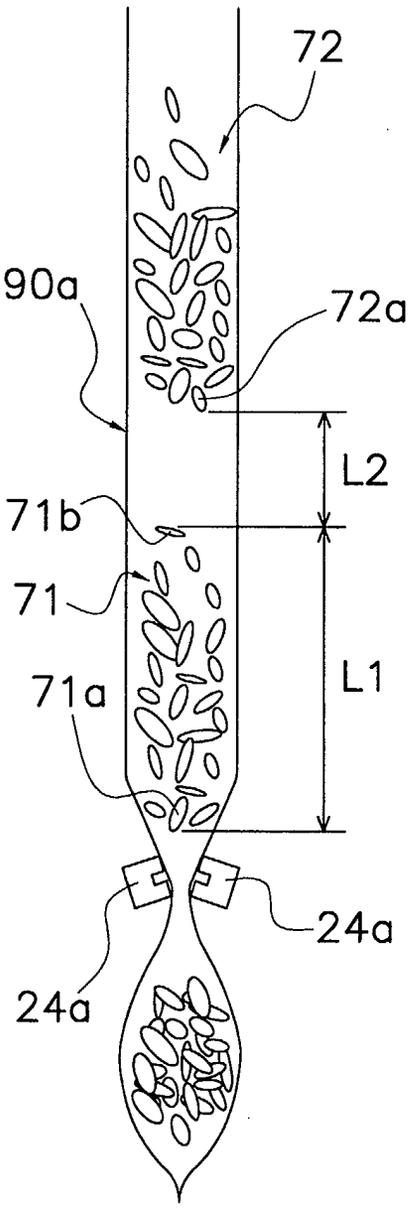


Fig. 5

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 25 4194

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 6 119 438 A (HIGHBERGER GARY G ET AL) 19 September 2000 (2000-09-19) * the whole document *	1-16	B65B9/20 B65B57/12 B65B57/14
D,A	JP 10 077002 A (ISHIDA CO LTD) 24 March 1998 (1998-03-24) * the whole document *	1,8	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	25 September 2002	Grentzius, W

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)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 02 25 4194

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

25-09-2002

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6119438 A	19-09-2000	AU 693034 B2	18-06-1998
		AU 6397096 A	05-02-1997
		CA 2225723 A1	23-01-1997
		DE 69618464 D1	14-02-2002
		EP 0842087 A1	20-05-1998
		WO 9702179 A1	23-01-1997
JP 10077002 A	24-03-1998	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82