A pouch feeder pushes pouches located at the top of a storage portion sideways by a pusher to supply the pouches into a conveyance passage. A pouch aligner is moved in a reciprocating manner along the direction of the conveyance path so that the pouches delivered from the aforementioned conveyance passage and placed on another passage having a width smaller than the length of the pouch and greater than the width of the pouch, are moved toward the passage exit while being aligned into position with their length oriented along the direction of the passage. The pouches delivered in alignment from the passage exit are individually separated in the direction of conveyance and conveyed, one by one, into a loading chute, which in turn, loads the pouches, one by one, into packages.
FIG. 5 PRIOR ART
FIG. 17

Top pouches detecting means 64 in storing portion 10

Sensor (limit switch) 70c of lift plate-lifting means 68

Pouch detector 54(541,542) in conveyance passage 18

Exit side sensor 543 in conveyance passage 18

Passage-entrance side pouch detecting means 88, Passage-exit side pouch detecting means 114 in pouch aligning means 26

Entrance side pouch detecting means 110,112 stop sensors 100,102 confirmation sensors 104,106 in pouch separation/conveyance means 32

Loading chute pouch detecting means 124

Line package detecting means 126

Automatic operation switch 138 manual operation switch 140

Motor driver 52 for pouch feed means 20

Motor 68c for lift plate-lifting means 68

Drive motor for conveying means 72

Constraint rotating motor 74b of anti-overlap means 76

Electromagnetic air valve of aligner reciprocating means 28

1st and 2nd belt conveyor units 92,96 belt drive motors 92c, 96c

Shutter means 118 Actuation driver 122

Power supply unit 42b
FIG. 20A

Overlap removal

FIG. 20B

1 to 2 times of the pouch thickness
FIG. 21

Start

S1: Standby conditions established?

Y

S2: Input of the ON start signal?

Y

S3: Feedable state?

N

S4: Raise the lift plate

S6: Feed works

N

S5: Any work present on the conveyance passage?

Y

S8: Actuate the conveying means

N

S7: Any work present on the passage entrance side?

Y

S9: Any work present at the conveyance passage exit?

N

S10: 1st conveyor actuated?

Y

S11: Any work present on the 1st belt input side?

Y

S12: Actuate the vibration cylinder

N

S15: Any work at the 1st belt entrance side or in the passage?

N

S13: Any work present on the passage exit side?

Y

1

N

Y

N
FIG. 22

1. Has a pouch loading signal been received?

2. Load a work into a package by the loading chute

3. A work to be loaded present?
   - Y: Close the shutter and feed a work into the loading chute
   - N:-has the no-work state been detected by both the two sensors on the exit side of the 2nd conveyor unit?

4. Has the no-work state been detected by both the two sensors on the exit side of the 2nd conveyor unit?
   - Y: A work to be loaded present?
   - N: Actuate the 1st conveyor belt

5. Has the no-work state been detected by the sensor on the entrance side of the 2nd conveyor unit?
   - Y: Feed a work by the 2nd conveyor unit
   - N: Actuate the 1st conveyor belt

6. Has the no-work state been detected by both the two sensors on the exit side of the 1st conveyor unit?
FIG. 23

Start

S101

Have both the stop and confirmation sensors in the 2nd conveyor unit detected works at the same time?

Y

S102

Has the output from the confirmation sensor changed from the no-work state to the work-present state?

Y

S103

Stop the 2nd conveyor unit
POUCH LOADING MACHINE

BACKGROUND OF THE INVENTION

[0001] (1) Field of the Invention

[0002] The present invention relates to a pouch loading machine which performs automatic operation of loading package-type (bag-type) miniature pouches that contain drying agents, freshness-preserving agents, etc., and are small compared to the packages such as containers, bags, etc., in which the main products such as medicines, foods, or the like are packed, one by one or a predetermined number of pouches, into the packages.

[0003] (2) Description of the Prior Art

[0004] It is usual, conventionally, that products to be packaged, such as medicines, foods, etc., are encased and packed in packages such as containers, bags etc., from the viewpoint of improvement of cleanliness and the like during storage and during vending and display, etc.

[0005] In addition to the product to be packed, one or a predetermined number of miniature packets (to be referred to as “pouch”) are loaded into a package. When the product to be packed is, for example, noodles, the content of the pouch is seasoning, soup or the like.

[0006] In the pouch loading machines for automatic implementation of this pouch loading task, usually a continuous web of prepared pouches (packed connectedly) is cut, one by one, or every series of pouches, and each pouch or each series of pouches is loaded into a package (Japanese Patent Application Laid-open Hei 9 No. 278007).

[0007] In this case, the continuous web of pouches is prepared so that a wrapping such as a resin sheet or the like is sealed on one longitudinal seal side a to be cylindrically formed, and sectioned by lateral seals (joints) band b, forming pouches c. Further, in the pouch loading machine, this web of connected pouches are measured by pitch so as to detect a lateral seal b, and this lateral seal b is cut (along a cut line d), then a pouch c is loaded into the predetermined position.

[0008] Incidentally, among the machines that deliver relatively small articles which can be handled by hands, fingers and the like, there are some that convey small products by sliding them on a feed plate by ultrasonic actuation (Japanese Patent Application Laid-open No. 2000-77734). Of the ultrasonic-driven parts feeders of this kind, there is a configuration which uses a ball feeder e called a parts ball and a linear feeder f that linearly conveys works (parts) g, in combination, as shown in FIG. 2A.

[0009] In this parts feeder, works g, g, push each other and become aligned, as shown in FIG. 2B, around a final exit port Ω, so as to be picked out, one by one, by some separating mechanism that operates based on the length of the work.

[0010] As an example of a structure for picking out the works one by one, a cleated belt conveyor having lateral cleats h formed at regular intervals on the peripheral surface of a belt i, is used so as to convey parts while separating one from another, as shown in FIG. 3. In this case, the works collected in a storing portion such as a hopper, etc., are scraped out by the cleated belt conveyor so that the works can be conveyed while they are placed, one by one, between the cleats.

[0011] Also, pouches for drying agents, freshness-preserving agents, encased in packages, for keeping the humidity and/or freshness of the products to be packed, such as medicines, foods or the like, demands use of pillow type packets in order to minimize the package size. As shown in FIG. 4, this pillow type packet, namely, pouch j is as small as 30 mm long and 20 mm wide, and the seals k at the longitudinal ends are designed to be extremely short, about 0.5 to 2 mm due to the requirement for miniaturization. Further, a length-wise seal m is not positioned on the side of the pouch, but is located on one of the planes that define the thickness of the pouch.

[0012] The task of loading the pouches of this pillow type packet into a package also needs to be automated to improve work efficiency.

[0013] Concerning the pouches of this pillow type packet, if they are given in a connected form for continuous loading and loaded by using the aforementioned pouch loading machine of the prior art, the work, i.e., pouch j, should be fed by pinching it at both the bottom and top sides with respect to the thickness direction, by pinch rollers. In this case, since the pouch j of this type has no longitudinal seal along the sides, the body filled with its content will be pinched. On this account, depending on the strength of the pressing force of the rollers, there may occur such problems that the content is broken or pinholes are formed in the package by irregular projections of the content.

[0014] Accordingly, pouches with only short seals at the ends, such as the aforementioned pillow-type pouches, need to be loaded into the packages by handling them, one by one, independently, or in a disconnected condition.

[0015] As yet, no conventional technique has been proposed which enables such separated pouches to be properly aligned, conveyed and loaded, one by one, into packages, without causing any breakage.

[0016] To deal with the above situation, in a case where the aforementioned parts feeder is used for feeding, the pouches j could be conveyed from ball feeder e to linear feeder f, but the works, i.e., pouches j, push each other as they are conveyed. Accordingly, since each pouch has lateral seals at the front and rear ends with rounded wedge-like side edges, the edges or the works themselves will ride over each other as shown in FIG. 5, so that it is impossible to align the works in a state as shown in FIG. 2B where the works push each other compactly without their ends overlapping, so as to allow reliable separation of the works at their ends.

[0017] On the other hand, when the cleated belt conveyor shown in FIG. 3 is used to feed the works out from the hopper (storing portion), works are delivered from the bottom of the hopper by its own weight and scraped out by each cleat of the belt conveyor. Therefore, there is a fear that the work will be deformed by stresses when they are scraped out. Further, since new works are added into the hopper from the hopper top, there is a possibility that stale works are left over. Moreover, separation of works, supply control of the work quantity at the loading portion into the packages cannot be stabilized by setting of the height and width of the cleats of the cleated belt conveyor only, causing the prob-
lems of skipped loading of the pouches in a discrete manner and of double loading of the pouches in one section.

SUMMARY OF THE INVENTION

[0018] The present invention has been devised in order to solve the above problems, it is therefore an object of the present invention to provide a pouch loading machine that is able to feed out pouches from a storing portion without leaving stale pouches, align them efficiently clearing up overlaps, reliably separate and load them into packages.

[0019] The present invention is directed to pouch loading machines, and configured as follows:

[0020] In accordance with the first aspect of the present invention, a pouch loading machine which conveys single packed pouches from a storing portion and aligns them in an individually separated manner and loads a predetermined number of the pouches into a package such as a container, bag or the like, includes: a pouch feed means which pushes a pouch located at the top of the storage portion sideways by a pusher to supply the pouch into a conveyance passage; a pouch aligning means, having a passage formed on the top thereof and enclosed by walls that are formed along both sides of the passage, opposing each other with a distance smaller than the length of the pouch and greater than the width of the pouch apart, for aligning the pouches into position with their length oriented along the direction of the passage as the pouches pass through the passage; an aligner reciprocating means which moves the pouches delivered onto the passage from the conveyance passage, toward the passage exit by aligning them by reciprocating movement of the pouch aligner in the direction of the passage; a pouch separation/conveyance means which individually separates the pouches that are delivered in alignment from the passage exit of the pouch aligning means, in the direction of conveyance and conveys the pouches, one by one, to a loading chute means; and, a loading chute means for loading the pouches conveyed by pouch separation/conveyance means, one by one, into the package.

[0021] In accordance with the second aspect of the present invention, the pouch loading machine having the above first feature is characterized in that the pouch feed means includes: a belt having multiple plate-like pushers, arranged on the belt peripheral surface at intervals along the feed direction; support pulleys for supporting the belt circumferentially; a motor driver for rotationally driving the support pulleys; a conveyance path pouch detector for detecting the presence of pouches on the conveyance passage; and a drive controller which, when no pouch has been detected on the conveyance passage by the conveyance path pouch detector, supplies pouches by means of the pushers by causing the motor driver to drive support pulleys.

[0022] In accordance with the third aspect of the present invention, the pouch loading machine having the above second feature is characterized in that the belt and support pulleys are supported by a pivot that is provided on the top of the storing portion and on the side opposite to the conveyance passage, so as to open and close the top of the storing portion.

[0023] In accordance with the fourth aspect of the present invention, the pouch loading machine having the above first feature further includes: a top pouches detecting means for detecting the presence of pouches at the top inside the storage portion; and a lift plate-lifting means for raising a lift plate in the storing portion so that pouches will be positioned at the top of the storing portion when the top pouches detecting means detects the absence of pouches located at the top of the storing portion.

[0024] In accordance with the fifth aspect of the present invention, the pouch loading machine having the above first feature is characterized in that the conveyance passage includes: a conveying means for carrying the pouches supplied by the pouch feed means on a conveyance surface and conveys the pouches toward the pouch aligning means by movement of the conveyance surface; and an anti-overlap means having a constraint member disposed over the conveyance surface approximately one to two times the thickness of the pouch above the conveyance surface so as to prevent the pouches from overlapping each other on the conveyance surface during conveyance.

[0025] In accordance with the sixth aspect of the present invention, the pouch loading machine having the above first feature is characterized in that the pouch aligning means is constructed such that the passage is inclined with its one side (the first side) lower than the other side (the second side), and projections that change the orientations of pouches by abutting each pouch advancing on the passage so as to position the pouch approximately parallel to the passage surface and bringing it into contact with the first side wall face, are provided on the second side wall face which is on the higher side of the passage.

[0026] In accordance with the seventh aspect of the present invention, the pouch loading machine having the above sixth feature further includes: an anti-overlap means having a constraint member disposed over the passage surface approximately one to two times the thickness of the pouch above the passage surface so as to prevent the pouches from overlapping each other on the passage surface during conveyance.

[0027] In accordance with the eighth aspect of the present invention, the pouch loading machine having the above first feature is characterized in that the pouch separation/conveyance means includes: a first belt conveyor unit which conveys pouches by driving a first belt while carrying on the first belt the pouches that are delivered in alignment from the passage exit of the pouch aligning means; and a second belt conveyor unit which conveys pouches, one by one, to the loading chute means by driving a second belt while carrying on the second belt the pouches that are conveyed by the first belt conveyor unit.

[0028] In accordance with the ninth aspect of the present invention, the pouch loading machine having the above eighth feature is characterized in that the pouch separation/conveyance means includes: stop sensors for stopping the drives of the first and second belts respectively when a pouch is detected at the pouch exit positions of the first conveyor unit and the second conveyor unit; and confirmation sensors disposed downstream of respective stop sensors for detecting whether there is a pouch that has moved on the first and second belts after cessation of belt drive.

[0029] According to the pouch loading machine of the present invention, the pouch feed means supplies pouches into the conveyance passage in a manner free from influence
of its own weight, by pushing the pouches located at the top of the storage portion sideways by the pusher, the pouch aligning means moves the pouches placed on the passage toward the exit side and aligns them by its reciprocating movement, and the conveyor belt means carries the pouches on the belt and conveys them, one by one, to the loading chute means. Therefore, there is no longer any operation such as feeding individual pouches of connectedly packed pouches, by nipping them with rollers, hence it is possible to reliably prevent the problems such as that the pouch content is broken by the pressing force of rollers and that pinholes are formed in the package by irregular projections of the content.

Further, the pouch aligning means includes a passage formed on the top thereof and enclosed by walls that are formed along both sides of the passage, opposing each other with a distance smaller than the length of the pouch and greater than the width of the pouch part, and aligns the pouches into position with their length oriented along the direction of the passage as the pouches pass through the passage, and the aligner reciprocating means moves the pouches delivered onto the passage from the above-mentioned conveyance passage, toward the passage exit by aligning them by reciprocating movement of the pouch aligning means along the direction of the passage. Therefore, it is possible to reliably align the pouches.

Moreover, since the belt type pouch separation/conveyance means individually separates the pouches that are delivered in alignment from the passage exit of the pouch aligning means, in the direction of conveyance and conveys the pouches, one by one, to the loading chute means, the pouches in alignment can be individually separated, conveyed at intervals and delivered correctly to the loading chute means, so that the pouches can be loaded into packages.

In addition to the above operation and effect, according to the second aspect of the present invention, the pouch feed means rotates the belt having multiple plate-like pushers, arranged on the belt peripheral surface at intervals along the feed direction, by driving the motor driver of the pulleys that supports the belt. When absence of pouches on the conveyance passage is detected by the conveyance path pouch detector, the drive controller drives the support pulleys by the aforementioned motor driver. Therefore, it is possible to feed the pouches by pushing them instead of nipping them, with a simple configuration where the pushers are arranged on the belt peripheral surface at intervals along the feed direction. Thus, this simple configuration enables reliable feed of pouches and further improved prevention against breakage of pouches.

According to the third aspect of the present invention, since the belt and support pulleys are supported by a pivot that is provided on the top of the storing portion and on the side opposite to the conveyance passage, so as to open and close the top of the storing portion, this configuration enables the top of the storing portion to be opened so as to supply pouches quickly and easily when the storing portion is out of pouches and needs to be supplied, and to be closed quickly and easily after the supply so as to restart pouch feeding.

According to the fourth aspect of the present invention, since the pouch loading machine further includes: a top pouches detecting means for detecting the presence of pouches at the top inside the storage portion; and a lift plate-lifting means for raising a lift plate in the storing portion so that pouches will be positioned at the top of the storing portion when the top pouches detecting means detects the absence of pouches located at the top of the storing portion, pouches can be automatically set at the top of the storing portion at any time, whereby it is possible for the pouch feed means to feed the pouches to the conveyance passage reliably when required.

According to the fifth aspect of the present invention, since the conveying means carries the pouches supplied by the pouch feed means on the conveyance surface and conveys the pouches toward the pouch aligning means by movement of the conveyance surface while the anti-overlap means having a constraint member disposed over the conveyance surface approximately one to two times the thickness of the pouch above the conveyance surface, prevents the pouches from overlapping each other on the conveyance surface during conveyance. Therefore, it is possible to supply the pouches to the pouch aligning means in such a manner that pouches do not overlap each other, by positively clearing up overlaps between the pouches.

According to the sixth aspect of the present invention, the pouch aligning means is constructed such that the passage is inclined with its one side (the first side) lower than the other side (the second side), and projections that change the orientations of pouches by abutting each pouch advancing on the passage so as to position the pouch approximately parallel to the passage surface and bringing it into contact with the first side wall face, are provided on the second side wall face which is on the higher side of the passage. In this way, a simple configuration, i.e., merely inclination of the passage with provision of projections, makes it possible to align the pouches that advance in the passage, into position with their length oriented along the direction of passage and deliver them out of the passage.

According to the seventh aspect of the present invention, since the pouch loading machine further includes: an anti-overlap means having a constraint member disposed over the passage surface approximately one to two times the thickness of the pouch above the passage surface so as to prevent the pouches from overlapping each other on the passage surface during conveyance, it is possible to reliably prevent the pouches being conveyed on the passage from overlapping each other.

According to the eighth aspect of the present invention, the pouch separation/conveyance means is constructed such that the first belt conveyer unit conveys pouches by driving a first belt while carrying on the first belt the pouches that are delivered in alignment from the passage exit of the pouch aligning means, and the second belt conveyer unit conveys pouches, one by one, to the loading chute means by driving a second belt while carrying on the second belt the pouches that are conveyed by the first belt conveyer unit. In this way, it is possible to separate the aligned pouches one from another and set them to the chute means, by use of a relatively simple means consisting of two belt conveyers. Further, since each pouch sent out from the pouch aligning means is received first by the first belt conveyer unit, then delivered sequentially, one by one to the second belt conveyer unit, detection errors and conveyance
errors due to bouncing of pouches are unlikely to occur, hence it is possible to handle the pouches, one by one, in a delicate manner, compared to a configuration where a single conveyor conveys the pouches delivered from the pouch aligning means directly to the loading chute means. As a result, it is possible to minimize the occurrence of troubles such as two pouches being fed together, frequent shutdown of the loading device and the like.

[0039] According to the ninth aspect of the present invention, the pouch separation/conveyance means includes: stop sensors for stopping the drives of the first and second belts respectively when a pouch is detected at the pouch exit positions of the first conveyor unit and the second conveyor unit; and confirmation sensors disposed downstream of respective stop sensors for detecting whether there is a pouch that has moved on the first and second belts after cessation of belt drive. Accordingly, even when a pouch slides over the conveyor and cannot be detected by the stop sensor due to intermittent driving cessation of the belt conveyor, the confirmation sensor is able to surely detect the presence of the pouch on the belt conveyor. This pouch detection scheme makes the control of the whole operations of all the units reliable.

BRIEF DESCRIPTION OF THE DRAWINGS

[0040] FIG. 1 is an illustration showing conventional connected pouches;
[0041] FIG. 2A is an illustration showing a conventional parts feeder, FIG. 2B is an illustration showing a state of works being conveyed;
[0042] FIG. 3 is an illustration showing a conveyor with a clefted belt;
[0043] FIGS. 4A and 4B are illustrations showing a pouch of pillow type packet, FIG. 4A an external perspective view, FIG. 4B a sectional view cut on a line A-A of FIG. 4A;
[0044] FIG. 5 is an illustration showing a state of pouches being conveyed in the prior art;
[0045] FIG. 6 is a front view showing a pouch loading machine according to the embodiment of the present invention;
[0046] FIG. 7 is a top view (plan view) showing the same pouch loading machine;
[0047] FIG. 8 is a detailed illustrative view from the front showing a storing portion and a pouch feed means located in the upper part of the pouch loading machine;
[0048] FIGS. 9A, 9B and 9C are illustrative views from the top, front and side, respectively, showing a conveying means and anti-overlap means of the same pouch loading machine;
[0049] FIG. 10 is an illustrative view of a pouch aligning means of the same pouch loading machine, viewed from its entrance side;
[0050] FIG. 11 is a side view showing the pouch aligning means and aligner reciprocating means of FIG. 10;
[0051] FIG. 12 is a plan view showing the pouch aligning means and aligner reciprocating means of FIG. 10;
[0052] FIG. 13 is a detailed illustrative side view showing a pouch separation/conveyance means;
[0053] FIG. 14 is a detailed illustrative plan view showing a pouch separation/conveyance means;
[0054] FIG. 15 is an illustrative view of a chute means, viewed from its pouch loading side;
[0055] FIG. 16 is an illustrative side view showing the same chute means;
[0056] FIG. 17 is an illustrative block diagram showing a control system of a pouch loading machine;
[0057] FIGS. 18A and 18B are illustrative views for explaining a state of a pouch to be aligned by a pouch aligning means;
[0058] FIGS. 19A and 19B are illustrative views for explaining another state of a pouch to be aligned by a pouch aligning means;
[0059] FIGS. 20A and 20B are operational illustrative views of an anti-overlap means;
[0060] FIG. 21 is a flowchart for explaining the operation of a pouch loading machine;
[0061] FIG. 22 is a flowchart following FIG. 21;
[0062] FIG. 23 is a flowchart for explaining the operation of preventing two pouches being fed together; and
[0063] FIGS. 24A to 24C are views for explaining the operation of preventing two pouches being fed together.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0064] The embodiment of the present invention will hereinafter be described with reference to the accompanying drawings.

[0065] FIGS. 6 to 24C show one example of the embodiment of the present invention, and the same reference numerals in the drawings represent the same components.

[0066] FIG. 6 is a front view showing a pouch loading machine according to a practical mode (to be referred to as “the embodiment” hereinbelow); FIG. 7 is a top view (plan view) of the same pouch loading machine; FIG. 8 is a detailed illustrative view from the front showing a storing portion and a pouch feed means located in the upper part of the pouch loading machine; FIGS. 9A to 9C are illustrative views showing a conveying means and anti-overlap means of the same pouch loading machine; FIG. 10 is an illustrative view of a pouch aligning means of the same pouch loading machine, viewed from its entrance side; FIGS. 11 and 12 are side and plan views showing the pouch aligning means and aligner reciprocating means of FIG. 10; FIGS. 13 and 14 are detailed illustrative side and plan views showing a pouch separation/conveyance means; FIG. 15 is an illustrative view of a loading chute means, viewed from its pouch loading side; FIG. 16 is an illustrative side view showing the same chute means; FIG. 17 is an illustrative block diagram showing a control system of a pouch loading machine; FIGS. 18A and 18B and FIGS. 19A and 19B are illustrative views for explaining states of a pouch to be aligned by a pouch aligning means; FIGS. 20A and 20B are operational illustrative views of an anti-overlap means, FIG.
21 is a flowchart for explaining the operation of a pouch loading machine; FIG. 22 is a flowchart following FIG. 21; FIG. 23 is a flowchart for explaining the operation of preventing two pouches being fed together; and FIGS. 24A to 24C are views for explaining the operation of preventing two pouches being fed together.

[1] The Overall Configuration of the Pouch Loading Machine will be Described.

[0067] As shown in FIGS. 6 to 16, the pouch loading machine conveys single packed pouches 12 from storing portion 10 and aligns them in an individually separated state and loads a predetermined number of pouches 12 into a package 14 such as a container, bag, etc. The pouch loading machine comprises: a pouch feed means 20 which pushes a pouch 12 located at the top of storage portion 10 sideways by a pusher 16 to supply the pouch 12 into a conveyance passage 18; a pouch aligning means 26, having a passage 24 formed on a top face 26U thereof and enclosed by walls 22 that are formed along both sides of the passage, opposing each other with a distance 22W smaller than length 12L of pouch 12 and greater than width 12W of pouch 12 apart, for aligning the pouches 12 into position with their length oriented along the direction of the passage as the pouches pass through passage 24; an aligner reciprocating means 28 which moves pouches 12 delivered onto passage 24 from the conveyance passage 18 toward the passage exit, designated at 240, by aligning them by reciprocating movement of pouch aligner 26 in the direction of the passage; a pouch separation/conveyance means 32 which individually separates the pouches 12 that are delivered in alignment from passage exit 240 of pouch aligning means 26, in the direction of conveyance and conveys the pouches 12, one by one, to a loading chute means 30; and a loading chute means 30 for loading the pouches 12 conveyed from pouch separation/conveyance means 32, one by one, into the packages 14.

[0068] Detailely, the pouch loading machine has a roughly, pillar-like overall configuration formed with a base table 34 extended at an approximately mid height from the lower structure, designated at 36, toward the pouch separation/conveyance means 32 side, when viewed from the top.

[0069] Arranged on base table 34 are the main components for handling pouches 12 such as pouch feed means 20, pouch aligning means 26, aligner reciprocating means 28, pouch separation/conveyance means 32 and loading chute means 30, and the like.

[0070] The vertical position of this base table 34 approximately corresponds to the level of line conveyance of a conveyor line 38 of packages 14, and is set so that the exit end of loading chute means 30 is directed to an appropriate position for loading pouch 12 into package 14 on conveyor line 38, constituted by a belt conveyor or the like.

[0071] The aforementioned principal components on base table 34 are surrounded by a wall structure 40 made up of transparent resin and the like, so as to protect them from airborne pollutants such as dust and dirt. This wall structure 40 is configured so as to be opened and closed or ready to be detached for maintenance improvement.

[0072] Arranged under base table 34 is lower structure 36 which is formed of frame members at the four corners for supporting base table 34. This lower structure 36 is enclosed on its peripheral sides by a cover 36a. This lower structure 36 incorporates inside the cover 36a a control board 42a (see FIG. 17) including a CPU, ROM, RAM, etc., for various control operations of the pouch loading machine and a power supply unit 42b having breakers. Further, an unillustrated air inlet including a water drain etc., for conducting compressed air for air pressure power is provided outside cover 36a.

[0073] At the underside of lower structure 36, legs 44a for mounting the pouch loading machine onto the base floor and fixing it so as to permit vertical adjustment in a limited range and caster wheels 44b for easy movement are provided.

[0074] Next, the configuration of each component of the pouch loading machine will be described in detail.

[0075] In the embodiment, pouch 12 is the same one shown in FIG. 4, i.e., a small bag of a pillow type packet, and its parts are specified by the reference numerals in FIG. 4. Pouch 12 is small, having a length 12L of 30 mm and a width 12W of 20 mm (30 mm×20 mm) and the seals 12a at the longitudinal ends are designed to be extremely short, about 0.5 to 2 mm due to the requirement for miniaturization. Further, a length-wise seal 12b is not positioned on the side of the pouch 12, but is located on one of the planes that define the thickness of the pouch.

[0076] As a premise, it is assumed that storing portion 10 is a top-open box-like structure having a rectangular shape when viewed from the top and its external wall is formed of transparent resin for ease of visibility from outside. The open top of storing portion 10 is covered by a belt 48 etc. of pouch feed means 20.

[0077] This pouch feed means 20 supplies pouches 12 into conveyance passage 18 by pushing the pouches 12 located at the top of storage portion 10 sideways by pusher 16.

[0078] As shown in FIG. 8, the pouch feed means 20 in the embodiment includes: a belt 48 having multiple plate-like pushers 16, 16, . . . , formed on the belt 48 peripheral surface at intervals along the feed direction; support pulleys 50 and 50 for supporting the belt 48 circumferentially; a motor driver 52 for rotationally driving the support pulleys 50 and 50; a conveyance path pouch detector 54 (see FIGS. 9A to 9C) for detecting the presence of pouches 12 on conveyance passage 18; and a drive controller which, when absence of pouch 12 is detected on conveyance passage 18 by conveyance path pouch detector 54, supplies pouches 12 on conveyance passage 18 by means of pushers 16 by causing the motor driver 52 to drive support pulleys 50.

[0079] Specifically, in pouch feed means 20, support pulleys 50 and 50 and belt 48 are disposed in a space enclosed by a frame 56 having a rectangular U-shape, when viewed from the top, and all these are covered from the top by a cover 58.

[0080] A pair of pulleys 50 and 50 (axes 50a and 50a) are rotatably supported between the front side and interior side (not shown) of frame 56, when FIG. 8 is viewed from the front. Circulating belt 48 wound between the pulleys 50 and 50 is formed of rubber or elastomer. A guide member 50b having a skid-like shape (with its underside beveled at the front and rear ends) arranged between support pulleys 50 and 50 below a line joining these axes 50a and 50a, guiding the belt 48 from its interior by sliding contact therewith, so
as to prevent belt 48 from being warped upward as belt 48 receives reaction from pushers 16, 16, . . . when the pushers make the pushing action (scraping action).

[0081] Pushers 16, 16, . . . are elastic plates consisting of rubber, elastomer or urethane resin, and fastened to belt 48 with a fixed pitch with bolts and metal parts, etc. Pushers 16, 16, . . . should have resiliency and flexibility so as not to damage the packing material of pouches 12 when pouches 12 are pushed and scraped out from storing portion 12.

[0082] The aforementioned motor driver 52 is positioned adjacent to one of support pulleys 50 and 50 (and on the side opposite to conveyance passage 18) and disposed outside and opposite to the support pulley 50 of frame 56. A timing belt (or chain) 60 is wound between motor driver 52 and the support pulley 50 so that driving force from motor driver 52 is transferred to the pulley.

[0083] Frame 56 is bolt-fixed at its lower part below the site where motor driver 52 is attached, to the upper part of storing portion 10 on the side opposite to conveyance passage 18, by means of a hinge 62. Provision of this hinge 62 enables support pulleys 50 and 50, belt 48, frame 56 and cover 58 to integrally rotate upwards so as to open and close the top opening of storing portion 10.

[0084] Further, in storing portion 10, a top pouches detector 64 for detecting the presence of pouches 12 is provided at the top while a lift plate-lifting means 68 is provided for raising a lift plate 66 in storing portion 10 so that pouches 12 will be positioned at the top portion 10 when the top pouches detecting means 64 detects the absence of pouches 12 located at the top of storing portion 10.

[0085] Specifically, top pouches detecting means 64 is an illumination type sensor, i.e., a transmission type photoelectric sensor comprised of a light source for emitting a light beam and a paired photodetector for detecting reception of the light beam. Other than this, a reflection type photoelectric sensor may be used.

[0086] Lift plate-lifting means 68 is a device that raises and lowers rectangular lift plate 66 in storing portion 10, and includes: a rod gear 68a with a rack gear arranged at the underside of lift plate 66; and a motor 68c disposed on the underside of a bottom 10a of storing portion 10 for actuating a linear head 68b for linear feed by pinion gear feed so as to raise and lower the rod 68a. Further, in order to raise and lower lift plate 66 so as to be horizontal, a rod member 70b extended downward from the bottom of lift plate 66 is adapted to slide inside a guide member 70a made up of a slide bush and disposed in the bottom 10a of storing portion 10. This rod member 70b is accompanied by a sensor 70c which detects the presence of lift plate 66 at either the topmost end or lowermost end or both.

[0087] Further, a chute member 10b made up of, for example, a wide gutter-like plate inclined downward, to feed the pouch 12, pushed by pusher 16, down to conveyance passage 18 is provided adjacent to conveyance passage 18 at the top of storing portion 10.

[0088] Feed means 20 disposed over storing portion 10 adopts an on-top scraping method, i.e., scraping pouches 12 from the top of storing portion 10, pouch 12 will not be affected by the influence of its own weight. Hence, pouch 12 can be scraped out without any effective stress and without any damage.

[3] Conveyance Passage 18 will be Described.

[0089] FIGS. 9A to 9C are illustrative views showing conveyance passage 18, FIG. 9A a plan view of conveyance passage 18, FIG. 9B a side view of conveyance passage 18, viewed from the side to which pouch 12 flows down from storing portion 10, FIG. 9C a front view of conveyance passage 18 viewed from the exit side.

[0090] As shown in FIGS. 9A to 9C, conveyance passage 18 includes: a conveying means 72 for carrying pouches 12 supplied by pouch feed means 20 on a conveyance surface 72a and conveys the pouches 12 toward pouch aligning means 26 by movement of conveyance surface 72a; and an anti-overlap means 76 having constraint members 74 disposed over conveyance surface 72a approximately one to two times the thickness of pouch 12 above conveyance surface 72a so as to prevent pouches 12, 12, . . ., from overlapping each other on conveyance surface 72a during conveyance.

[0091] Specifically, in conveyance passage 18, conveying means 72 is a conveyer of a flexible belt member being circumferentially driven between pulleys (the pulleys are driven by an unillustrated motor). The top of the belt corresponds to conveyance surface 72a. Conveyance surface 72a is formed of a material which presents an appropriate frictional force for conveying the works, i.e., pouches 12 without slip.

[0092] Conveying means 72 is arranged adjacent to storage portion 10 and disposed in the position to which pouches 12 are flowed down from chute member 10b, at a level as high as the bottom 10a of storing portion 10. In conveying means 72, the belt is circulated so that the belt on the upper side of conveying means 72 travels from the start end to the terminating end of conveyance passage 18, folds back at that terminating end and moves on the lower side of conveying means 72 back to the start end. Further, in conveyance passage 18, a pair of wall-like guide members 72b, 72b formed of rigid metal or the like are arranged on both sides of conveying means 72 so as to temporarily keep the delivered pouches 12 from falling from conveyance passage 18.

[0093] The part from the starting end of conveyance passage 18 to its midpart faces the exit port of pouches 12 from the chute member 10b, and a conveyance passage pouch detector 54 for detecting the presence of pouches 12 in that area is arranged in conveyance passage 18. This conveyance passage pouch detector 54 is composed of two sets of illumination type sensors (designated at 541 and 542). Each sensor is a transmission type photoelectric sensor comprised of a light source for emitting a light beam and a paired photodetector for detecting reception of the light beam. These sensors detect a target present in the course of the light beam and are arranged so that two light beams cross each other while all of the light sources and photodetectors are arranged outside conveyance passage 18. Also, guide members 72b, 72b are formed with apertures permitting the light beams to pass through. Thus, conveyance passage pouch detector 54 detects the presence of pouch 12 by the cross-wise arrangement of the beams crossing each other (like a letter X) by means of two sets of sensors (541, 542), so that it is possible to secure a large detection area and detect the work, i.e., pouch 12 even when it is off centered on the belt.

[0094] The terminating end of conveyance passage 18 corresponds to the exit side of pouches 12, where a pair of
illumination type sensor devices (designated at 543) for
detecting the presence of pouch 12 is arranged.

[0095] As for the conveyance passage pouch detector 54
(541, 542) and exit side sensor (543), a reflection type
photoelectric sensor composed of a light source integrated
with a photodetector may be used other than the above.

[0096] Next, with regard to anti-overlap means 76, mul-
tiple constraint members 74 are each formed of a flexible
sheet of rubber, etc., and deployed radially on a rotary shaft
74a which is laid perpendicularly to the direction of con-
veyance, when viewed from the top (see FIG. 10).

[0097] This anti-overlap means 76 is arranged so that the
distal end of each constraint member 74, whose proximal
end is fixed to rotary shaft 74a, passes by the position
approximately one to two times the thickness of pouch 12
over conveyance surface 72a.

[0098] As these constraint members 74 are driven by a
motor 74b to rotate about rotary shaft 74a, only the thickness
of a single pouch 12 is permitted to pass on conveyance
surface 72a. Accordingly, if some pouches 12, 12 . . .
overlapping each other are fed, only the bottom most pouch
12 is allowed to pass while the pouches 12 over it cannot
pass. It is thus possible to reliably remove and prevent
overlapping of pouches 12. In addition, the number of
pouches to be conveyed each time is limited to about 5 to 10
by regulating the timing of belt feed of conveying means 72
and the rotation of constraint members 74.

Means 28 will be Described.

[0099] FIGS. 10 to 12 are illustrative views showing
pouch aligning means 26. FIG. 10 is a view of pouch
aligning means 26 from the entrance side and corresponds
to the side view of conveyance passage 18 shown in FIG. 9B.
FIG. 11 is a side view showing pouch aligning means 26 and
aligner reciprocating means 28 and corresponds to FIG. 9C
in which the exit side of conveyance passage 18 is depicted.
FIG. 12 is a plan view showing pouch aligning means 26.
In addition, FIGS. 18A and 18B and FIGS. 19A and 19B
described later are also used to describe the pouch aligning
operation by projections 78.

[0100] As shown in FIGS. 9A to 9C to FIG. 12, pouch
aligning means 26 has a passage 24 formed on the top face
26U thereof and enclosed by walls 22 that are formed along
both sides of the passage, opposing each other with a
distance 22W smaller than length 12L of pouch 12 and
greater than width 12W of pouch 12 apart and aligns the
pouches 12 into position with their length oriented along
the direction of passage 24 as the pouches pass through this
passage 24.

[0101] On the other hand, aligner reciprocating means 28
moves pouches 12 delivered onto passage 24 from the
conveyance passage 18, toward passage exit 24b by aligning
them by reciprocating movement of pouch aligner 26 in the
direction of the passage.

[0102] In the embodiment, in pouch aligning means 26
passage 24 is inclined with its one side (the first side) lower
than the other side (the second side) (inclined by an angle a
as in FIG. 10), and projections 78 that change the orienta-
tions of pouches 12 by abutting each pouch 12 advancing on
passage 24 so as to position the pouch 12 approximately
parallel to passage 24 surface and bringing it into contact
with the first side wall face 22a provided on the second
side wall face 22b which is on the higher side of passage 24.

[0103] As a specific structure, pouch aligning means 26 is
formed of a rectangular metal sheet for flat top face 26U and
a pair of metal rods having a rectangular section, fixed
parallel to each other on the top face 26U of the sheet, by
bolts or any other fasteners. These paired rectangular rods
are attached to the metal sheet with their one side contacted
to the top face 26U and other opposing sides set parallel to
each other. These opposing sides of the rods constitute the
first and second wall faces 22a and 22b, and the structure
formed between these wall faces 22a and 22b forms the
passage 24 for conveying pouches 12 as they are aligned.
This pouch aligning means 26 is also called a “groove”
because the passage 24 with wall faces 22a and 22b con-
stitutes a trough-like gutter.

[0104] The advancing direction of pouch 12 on the pas-
 sage 24 is perpendicular to the moving direction of the
pouches conveyed by conveyance passage 18, when viewed
from the top, and lies along one side of storing portion 10.
In other words, the advancing direction of pouches 12 in
passage 24 is opposite to the moving direction (scraping
direction) of pouches 12 pushed by pusher 16. Additionally,
the first side of passage 24, which is set lower than the
second side, is located close to the storing portion 10 side,
and wall face 22a on the first side is located under the exit
of the conveyance passage 18. Arranged over the first wall
face 22a is a chute member 80 for chuting pouches 12 from
the exit of conveyance passage 18 toward passage 24. This
chute member 80 is formed of an inclined board that extends
from the first wall face 22a to the undermeanth of the exit
of conveyance passage 18. This chute member 80 is formed
extending halfway up passage 24 while it is sufficient for the
receiving side to be formed at least corresponding to the
width of the exit of conveyance passage 18. Further, a
wall-like guide panel 82 extended along passage 24 is
cracked from the second wall face 22b, correspondingly to
the chute member 80, whereby pouches 12 falling down
through chute member 80 are prevented from running out
from passage 24, by bouncing or any other reason.

[0105] As pouch aligning means 26 is arranged so that
passage 24 is inclined with respect to the width or with the
first side lower than the second side (inclined by an angle a
as in FIG. 10), this inclination urges pouches 12 passing
through passage 24 to be conveyed along the first wall face
22a that is relatively low. This contributes to ease of aligning
the orientation of pouches 12, hence it is possible to reliably
and easily align the orientation of pouches 12 in combina-
tion with the orientation aligning function of the aforemen-
tioned projections 78.

[0106] Here, there are multiple projections 78 provided for
passage 24 and they have different functions. One of them
is a projection 78a which projects from, at least, the bottom
of the second wall face 22b toward the first wall face 22a,
to an extent that leaves approximately the same spacing to
the first wall face 22a as the width dimension of pouch 12.
This projection 78a should be formed at least in the bottom
part of passage 24, but it may be extended upward from the
bottom. Additionally, projection 78a is formed with a bevel
78a1 on the upstream side of passage 24.

[0107] The other is a projection 78b which projects from the
top of the second wall face 22b toward the top of first
wall face 22a, to an extent that leaves less spacing to the first wall face 22a than the width dimension of pouch 12.

[0108] The functions of aligning pouches 12 by these projections 78a and 78b will be described with reference to FIGS. 18A, 18B, and FIGS. 19A, 19B.

[0109] When pouch 12 moves forward with its length oriented along the direction of passage 24 (this state is called “aligned state”), the pouch flows downward with its one side edge sliding along the first wall face 22a while not interfering with any of projections 78a and 78b.

[0110] When, however, pouch 12 advances with its width oriented along the direction of passage 24, the pouch moves forwards with its one longitudinal end (the first end 12(1) or the second end 12(2)) sticking out beyond the first wall face 22a or the second wall face 22b of passage 24 and sliding over the wall top (this state is called “non-aligned state”) because passage 24 is narrower than the length of pouch 12.

FIGS. 18A, 18B, and FIGS. 19A, 19B show different non-aligned states. The direction of movement is shown by the arrow. FIGS. 18A and 19A are plan views and FIGS. 18B and 19B are sectional views in the direction opposing the direction of movement.

[0111] FIGS. 18A and 18B show a non-aligned state where pouch 12 moves with its longitudinal second end 12(2) in sliding contact with the second wall face 22b and its longitudinal first end 12(1) riding over and in sliding contact with the top of the first wall face 22a. In this case, as projection 78a abuts the longitudinal second end 12(2) of pouch 12, pouch 12 turns about a point of abutment against projection 78a as a fulcrum so that the first end 12(1) is directed forwards with respect to the direction of movement. Thus, the orientation of the length of pouch 12 is changed, resultantly pouch 12 moves forwards with its length aligned with the length of passage 24.

[0112] FIGS. 19A and 19B show another non-aligned state where pouch 12 advances with its longitudinal first end 12(1) in sliding contact with the first wall face 22a and its longitudinal second end 12(2) riding over and in sliding contact with the top of the second wall face 22b. In this case, as projection 78b abuts the longitudinal second end 12(2) of pouch 12, pouch 12 turns about a point of abutment against projection 78b as a fulcrum so that the first end 12(1) is directed forwards with respect to the direction of movement. Thus, the orientation of the length of pouch 12 is changed, resultantly pouch 12 moves forwards with its length aligned with the length of passage 24.

[0113] FIGS. 20A and 20B are illustrative views for explaining the function of an anti-overlap means for clearing up over laps.

[0114] Provided for passage 24 is an anti-overlap means 86 having a constraint member 84 disposed over the passage 24 surface approximately one to two times the thickness of pouch 12 above the passage 24 surface so as to prevent pouches 12, 12, . . . from overlapping each other on the passage 24 surface during conveyance.

[0115] In anti-overlap means 86, constraint member 84 is formed of an elastic and flexible sheet of rubber, etc., and deployed and fixed to a support shaft 84a (see FIG. 11).

[0116] This constraint member 84 is arranged over the passage 24 surface so that the distal end 84b of constraint member 84, whose proximal end is fixed to support shaft 84a is positioned approximately one to two times the thickness of pouch 12 apart from the passage 24 surface.

[0117] As shown in FIGS. 20A and 20B, this distal end 84b of constraint member 84 permits only the thickness of a single pouch 12 to pass on the passage 24 surface. Accordingly, if some pouches 12, 12, . . . overlapping each other are conveyed, only the bottom most pouch 12 is allowed to pass while the pouches 12 over it is held up by constraint member 84. It is thus possible to reliably remove and prevent overlapping of pouches 12.

[0118] Pouch aligning means 26 includes passage-entrance side pouch detecting means 88 for detecting the presence of pouches 12 around the site where pouches are input to passage 24 from the aforementioned chute member 80. Specifically, the passage-entrance side pouch detecting means 88 includes, in order to improve reliability of detection, a multiple number of reflection type sensors, which detect the presence of a work, i.e., pouch 12 by emitting a source light and sensing its reflection. Hence, in the position where pouch aligning means 26 adjoins chute member 80, multiple holes 88a, 88b are formed in passage 24, so that the aforementioned passage-entrance side pouch detecting means 88 may detect the presence of pouch 12 on passage 24 by emitting detection light and receiving its reflection through these holes 88a, 88b.

[0119] On the exit side of the pouch aligning means 26, passage-exit side pouch detecting means 114 for detecting the presence of pouches 12 on passage 24 is provided. This passage-exit side pouch detecting means 114 is supported by the entrance side end of a support member 116 of the aforementioned passage separation/conveyance means 32, and is composed of a reflection type sensor for detecting the presence of the works or pouches 12, by emitting source light and sensing its reflection.


[0121] This vibration cylinder unit is configured so that a front end of a cylinder rod 28a is fixed to a slide rail 28b, which in turn is fixed to the underside of pouch aligning means 26. Also, slide rail 28b is slidable supported by a slide bearing 28d. A cylinder 28c of the vibration cylinder unit and slide bearing 28d are fixed to base table 34.

[0122] Pouch aligning means 26 is slidable supported via slide rail 28b located below on slide bearing 28d which is fixed to the base table 34 side.

[0123] In this arrangement, compressed air (also referred to merely as air) is supplied to cylinder 28c of this vibration cylinder unit by way of an uninstructed electromagnetic valve. When the electromagnetic valve is turned on, the interior piston automatically switches the valves, and the vibration cylinder unit causes the piston and cylinder rod 28a connected thereto to automatically move back and fourth by the function of the supplied air (air pressure), whereby pouch aligning means 26 moves in a reciprocating manner. Aligner reciprocating means 28 moves pouch aligning means 26 along the extension of the passage, back and forth at different speeds, respectively.
The specific operation of the vibration cylinder unit is actuated by supplying air so that forward travel is made slowly while return travel is made quickly. More detailedy, pouch 12 is moved forward by the friction of passage 24 in forward travel, then passage 24 only is moved backward in return travel during which pouch 12 momentarily stops moving due to inertial of the mass. As a result, pouch 12 can move forward intermittently. In this way, pouches 12 delivered from the conveyance passage 18 and placed on passage 24 can be moved toward the passage exit 240 side while they are aligned.

It should be understood that the actuator of aligner reciprocating means 28 is not limited to the vibration cylinder unit disclosed in the above publication as long as it is able to offer a vibrating feed.

The Pouch Separation/Conveyance Means 32 will be described.

FIGS. 13 and 14 are a detailed side illustrative view and a top illustrative view of pouch separation/conveyance means 32. FIG. 15 is an illustrative view of loading chute means 30, viewed from the pouch 12 loading side.

As shown in FIGS. 13 to 15, pouch separation/conveyance means 32 individually separates pouches 12 that are delivered in alignment from passage exit 240 of pouch aligning means 26 in the direction of conveyance and conveys the pouches 12, one by one, to loading chute means 30.

In the present embodiment, pouch separation/conveyance means 32 includes: a first belt conveyor unit 92 which conveys pouches 12 by driving a first belt 90 while carrying on the first belt 90 the pouches 12 that are delivered in alignment from passage exit 240 of pouch aligning means 26; and a second belt conveyor unit 96 which conveys pouches 12, one by one, to loading chute means 30 by driving a second belt 94 while carrying on the second belt 94 the pouches 12 that are conveyed by the first belt conveyor unit 92.

Pouch separation/conveyance means 32 includes stop sensors 100 and 102 for stopping the drives of first belt 90 and second belt 94 respectively when a pouch 12 is detected at the pouch exit position of first conveyor unit 92 and the second conveyor unit 96; and confirmation sensors 104 and 106 disposed downstream of respective stop sensors 100 and 102 for detecting whether there is a pouch 12 that has moved on the first and second belts 90 and 94 due to inertial force or the like after cessation of belt drive.

Specifically, first belt conveyor unit 92 and second belt conveyor 96 include respectively, drive pulleys 92a and 96a provided at the bottom and driven pulleys 92b and 96b disposed at the front and rear ends of respective conveyance path and on part way to the bottom and circulate first and second belts 90 and 94 along these pulleys, respectively.

Drive pulleys 92a and 96a are fixed respectively to the drive shafts of motors 92c and 96c such as servo motors or the like, which can start and stop driving without time lag.

The conveyance path of pouches 12 in first belt conveyor unit 92 is the top surface of first belt 90 extending between driven pulleys 92b and 92b at the front and rear ends, and the conveyance path of pouches 12 in second belt conveyor unit 96 is the top surface of second belt 94 extending between driven pulleys 96b and 96b at the front and rear ends. First and second belts 90 and 94 are formed of a material which presents an appropriate frictional force for conveying the works, i.e., pouches 12 without slip on the conveyance path.

Further, in order to prevent the conveyance paths on the top side of the belts, which carry pouches 12, from moving up and down due to slack of first and second belts 90 and 94, guide members 92d and 96d having a skid-like shape (with their underside beveled at the front and rear ends) arranged respectively along the undersides of the conveyance paths for supporting the first and second belts 90 and 94 to prevent their slack movement, are disposed in the conveyance paths of first and second belt conveyor units 92 and 96. In addition, wall-like guide members for preventing pouches 12 from falling sidewards are erected on both sides of the conveyance paths.

The conveyance path of first belt conveyor unit 92 is positioned at a level lower than passage 24 of the pouch aligning means 26, so that pouches 12 transfer by falling down to the conveyance path of first belt conveyor unit 92. The conveyance path of second belt conveyor unit 96 is positioned at a relatively lower level than conveyance path of first belt conveyor unit 92. Accordingly, pouch 12 is delivered from first belt conveyor unit 92 to second belt conveyor unit 96 with its front slightly inclined downward.

In the conveyance paths of first and second belt conveyor units 92 and 96, in addition to the aforementioned stop sensors 100 and 102 and confirmation sensors 104 and 106 arranged over the exit positions, are conveyer entrance pouch detecting means 110 and 112, for detecting the presence of pouches 12, disposed over respective entrance positions.

Further, a passage exit-side pouch detecting means 114 for detecting the presence of pouches 12 on the passage on the exit side of the pouch aligning means 26 is disposed upstream of conveyer entrance pouch detecting means 110 of the first belt conveyor unit 92.

Again, in the conveyance paths of first and second belt conveyor units 92 and 96, the aforementioned stop sensors 100 and 102 and confirmation sensors 104 and 106 are arranged over the exit positions. When stop sensor 100 or 102 detects “the presence of a work” belt 90 or 94 stops, correspondingly. At this moment, pouch 12 may move sliding over belt 90 or 94 due to influence of inertial force. If pouch 12 has moved, the detection changes to the “no work” state after the cessation of the belt, and the belt would start moving again if only a single sensor is provided. This is why two sensors, namely a stop sensor and a confirmation sensor, are arranged in series in order to prevent such an event. Thus, the signal output of “presence of a work” is adapted to continue even if the work slides from its inertia after cessation of the belt.

It is understood that provision of a single sensor at the exit position will work if the moving speed of the belt is too low to cause sliding due to inertial force.

Alternatively, though increased in cost, the belts 90 and 94 of the first and second belt conveyor units 92 and 96 may be formed with holes and vacuum chambers may be provided under the belts, so that pouches 12 can be con-
veyed while being attracted to the belts. In this case it is possible to prevent pouches 12 from sliding after a cessation.

The aforementioned stop sensors 100 and 102, conveyor entrance pouch detecting means 110 and 112, and passage exit-side pouch detecting means 114 are all fixed by fastening to support member 116 that is fixed to base table 34 so that these detectors are spaced from and approximately parallel to the conveyance path, and, they can be unfastened so as to be adjusted to appropriate positions along the conveyance path.

Loading Chute Means 30 will be Described.

Loading chute means 30 loads the pouches 12 conveyed by pouch separation/conveyance means 32, one by one, into individual packages 14.

In the embodiment, loading chute means 30 is formed of a sheet material bent so as to have a rectangular U-shaped section, forming a conveyance path 30a of pouches 12 and erected walls 30b on both sides. This loading chute means 30 is arranged so that its proximal end is set at a level slightly lower than the level of the second belt conveyor unit 96 and the front end is set at a level further lower, or is, in one word, inclined overlooking conveyor line 38 of packages 14.

Arranged inside loading chute means 30 is a shutter means 118 for stop and delivery, or for blocking and releasing pouches 12, one by one, to slide them into conveyance path 30a.

Shutter means 118 includes: a plate member 120 of an elastic material such as rubber, etc., for blocking pouch 12 at a predetermined position; and a driver 122 of a rotary actuator which pivotally supports this plate member 120 by a swivel axis and causes the plate member to move into contact with and away from, conveyance path 30a. Also a loading chute pouch detecting means 124 for detecting the presence of pouch 12 at the predetermined position is provided for conveyance path 30a.

Loading chute pouch detecting means 124 detects the presence of pouches 12 on conveyance path 30 by emitting detection light and receiving its reflection through a hole 30c of conveyance path 30a of loading chute means 30.

Also, as shown in FIG. 16, a line package detecting means 126 for detecting the presence of package 14 on conveyance line 38 is provided for conveyance line 38 adjacent to the exit side of loading chute means 30.

Line package detecting means 126 is a transmission type photoelectric sensor comprised of a light source for emitting a light beam and a paired photodetector for detecting reception of the light beam, and detects the presence of a package by judging whether the light is blocked by the work, i.e., package 14.

Referring next to the control block diagram shown in FIG. 17, the electric control system of the pouch loading machine of the present embodiment will be described.

In the pouch loading machine, top pouches detecting means 64 and sensor 70c of lift plate-lifting means 68 are provided for storing portion 10; conveyance passage pouch detecting means 54 (541, 542) and conveyance passage exit side sensor 543 are provided for conveyance passage 18; passage-entrance side pouch detecting means 88 and passage-exit side pouch detecting means 114 are provided for pouch aligning means 26; conveyor entrance pouch detecting means 110 and 112, stop sensors 100 and 102, and confirmation sensors 104 and 106 are provided for belt conveyor units 92 and 96 of pouch separation/conveyance means 32; loading chute pouch detecting means 124 is provided for loading chute means 30; and line package detecting means 126 is provided for conveyance line 38. These signals of detection are input to a central processing unit (CPU) 130 through an input side interface 128 in control board 42a.

Based on these input signals, CPU 130 performs various control operations necessary for the pouch loading machine through various drivers and driving means, based on the programs stored in various storage media such as a rewritable RAM (Random Access Memory), hard disk drive (HDD) 132, unrewritable ROM (Read-Only Memory) 134 and the like.

CPU 130 outputs drive signals through an interface 136 on the output side, to motor driver 52 of pouch feed means 20, motor 68c for driving lift plate-lifting means 68, the motor for driving conveying means 72, motor 74b for rotating constraint members 74 of anti-overlap means, the electromagnetic valve for air of aligner reciprocating means 28, motor 92c for driving first belt 90 of first belt conveyor unit 92 and motor 96c for driving second belt 94 of second belt conveyor unit 96 in pouch separation/conveyance means 32, shutter means 118 and driver 122 of the rotary actuator for pivoting plate member 120 in loading chute means 30. Electric power for driving these is supplied from power supply unit 42b which transforms commercial power supply into predetermined a.c. and d.c. voltages. Drive air for the necessary units is supplied from the air inlet by way of appropriate ducts.

Signals from an automatic operation start signal input switch 138 and a manual operation signal input switch 140 are also input to control board 42a. These switches are located on the front side of the pouch loading machine and disposed on base table 34.

Next, the operation of the pouch loading machine of the above embodiment will be described.

FIGS. 21 and 22 show flowcharts (each step . . . is abbreviated as “5 . . . ”) for explaining the operation control of the pouch loading machine. FIG. 23 is a chart for explaining the operation timing of driving and cessation of the pouch aligner reciprocating means.

As shown in FIGS. 21 to 23, upon the start of a loading operation of the pouch loading machine, it is judged first whether the standby conditions required for start of a loading operation at that time are established (S1).

The standby conditions here are as follows:

The standby conditions are achieved when all the detection signals indicate “work present” or when pouch 12 is detected, such as loading chute pouch detecting means 124 presents “work present”, stop sensor 102 or confirma-
tion sensor 106 of second belt conveyor unit 96 of pouch separation/conveyance means 32 presents “work present”, stop sensor 100 or confirmation sensor 104 of first belt conveyor unit 92 presents “work present”, conveyor entrance pouch detecting means 110 of first belt conveyor unit 92 presents “work present”, and passage-exit side pouch detecting means 114 of pouch aligning means 26, presents “work present”.

[0159] In preparation of the pouch loading machine, if the above standby conditions are established (S1: Yes (abbreviated as “Y”)), a “ready-to-operate” state is reached, and the operation waits for input of a start signal for the loading operation such as a start signal input switch 138 being turned on (S2).

[0160] In the “ready-to-operate” state, when the start signal of the loading operation is input as start signal input switch 138 is turned on (S2:Y), the operation goes to S3.

[0161] In control during the loading operation, basically, the upstream side will operate if a work request command is made on the downstream side (see FIG. 22).

[0162] To begin with, it is judged whether a sufficient amount of pouches 12 are stored in storage portion 10 so that pouches 12 can be fed by pouch feed means 20 (S3). If few pouches 12 remain in storage portion 10, the operator should open storing portion 10 by lifting pouch feed means 20 as indicated by a reference numeral 20H in FIG. 6 and supply pouches 12 from the top.

[0163] At S3, when top pouches detecting means 64 detects “no work” (S3: No (to be abbreviated as “N”, hereinbelow)), lift plate 66 is raised by lift plate-lifting means 68 until “work present” is detected (S4). When the “work present” is detected, it is determined that the pouches are ready to be fed (S3:Y).

[0164] Then, pouches are fed to conveyance passage 18 in accordance with a pouch request signal (S5 and S6). That is, it is judged whether the detection result from conveyance passage pouch detector 54 is the “work present” state (a pouch 12 is present) on conveyance surface 72a of conveyance means 72 in conveyance passage 18 (S5). If the judgement at S5 is not the “work present” state but is the “no work” state (S5:N), the pouch feed means 20 is actuated so that pouches 12 are fed towards the site to be loaded on conveyance surface 72a of conveying means 72 (S6).

[0165] When, as a result of the supply of pouches 12, conveyance passage pouch detector 54 (541, 542) detects the “work present” state (S5:Y), the feed operation of pouches feed means 20 stops.

[0166] In this operation, pouches 12 present in the pouch loaded area of conveying means 72 are conveyed by belt conveyance, but since the rubber plates (scrapers) or constraint members 74 of the aforementioned anti-overlap means 76 are rotated in the direction opposite to the direction of conveyance, a limited number of pouches 12 (5 to 10 pouches each time) are conveyed downstream.

[0167] Next, control of pouch conveyance (belt drive and stop) of conveying means 72 is made based on the detection result of sensor 543 on the exit side of conveyance passage 18 and that of passage-exit side pouch detecting means sensors 88, 88 arranged on the entrance side of pouch aligning means 26. Specifically, it is checked whether either of passage-exit side pouch detecting means sensors 88, 88 presents the “work present” state (S7). If the detection result is negative or the “no work” state (S7:N), conveying means 72 is started (S8).

[0168] Then, if any of the pouch detecting means sensors 88, 88 indicates the “work present” state (S7:Y), it is checked whether the sensor 543 on the exit side of conveyance passage 18 detects the “work present” state (S9). When the “work present” state is detected, belt feed of conveying means 72 is stopped (S9:Y). In sum, belt feed of conveying means 72 starts when both of passage-exit side pouch detecting means sensors 88, 88 present the “no work” state; and when any of detecting sensors 88, 88 detects the “work present” state and when sensor 543 on the exit side of conveyance passage 18 detects the “work present” state, belt feed of conveying means 72 stops.

[0169] This is because if belt feed of conveying 72 stops as soon as one of passage-exit side pouch detecting means sensors 88, 88 detects the “work present” state, there occurs a case where the pouch 12 to be fed next has not yet arrived at the exit of conveyance passage 18, which will cause delay in supply and conveyance. This is why the belt of conveying means 72 is moved until sensor 543 on the exit side of conveyance passage 18 detects the “work present” state to prevent delay of supply and conveyance.

[0170] Next, pouches 12 from the above-described conveying means 72 are delivered onto pouch aligning means 26 with their orientations at random. In order to align the pouches by pouch aligning means 26 aligner reciprocating means 28 including a vibration cylinder is actuated. Drive and stop control of the reciprocating movement of aligner reciprocating means 28 is made based on the detection results from passage-exit side pouch detecting means 114 located on the exit side of passage 24 and pouch detecting means 110 on the entrance side of pouch separation/conveyance means 32, i.e., on the entrance side of first belt conveyor unit 92.

[0171] Specifically, it is judged whether first belt conveyor unit 92 is working to convey works (S10), and if first belt conveyor unit 92 is working (S10:Y), it is judged whether the detection from entrance side pouch detecting means 110 is the “work present” state (S11). If it is not the “work present” state but the “no work” state (S11: N), aligner reciprocating means 28 is started to move (S12). Aligner reciprocating means 28 starts to reciprocate pouch aligning means 26 and feed pouches 12 into first belt conveyor unit 92.

[0172] If the pouch detecting means 110 detects the “work present” state (S11:Y), then it is judged whether passage exit-side pouch detecting means 114 has detected the “work present” state (S13). Aligner reciprocating means 28 is stopped only when the detector 114 has detected the “work present” state (S13:Y). In other words, when the detection result from pouch detecting means 110 is the “no work” state, aligner reciprocating means 28 stops alignment and conveyance of pouches. When pouch detecting means 110 detects the “work present” state and when passage exit-side pouch detecting means 114 has detected the “work present” state, drive of pouch aligning means 26 by aligner reciprocating means 28 stops.

[0173] The reason why pouch aligning means 26 is driven by aligner reciprocating means 28 until passage exit-side
pouch detecting means 114 detects a pouch 12, is to prevent delay of supply and conveyance by eliminating the possibility that the pouch 12 to be fed next has not arrived at the exit of passage 24, similarly to the case of conveying pouch 12 from the conveyance passage 18 to pouch aligning means 26.

[0174] On the other hand, when first belt conveyor unit 92 is not driven (S13: N), aligner reciprocating means 28 is started to operate so that pouches 12 advance on pouch aligning means 26 (S14). As a result of this movement, when either the aforementioned passage exit-side pouch detecting means 114 or pouch detecting means 110 detects the “work present” state (S15: Y), aligner reciprocating means 28 stops driving.

[0175] The state of pouches 12 at the exit of pouch aligning means 26, is one where their orientations are uniformly aligned but they flow densely with less pitches (pushing each other). If they remain as is, it is impossible to load pouches 12 into packages 14, or containers or bags holding medicines or foods, which are conveyed at intervals of a fixed distance on conveyance line 38. To deal with this, first belt conveyor unit 92 and second belt conveyor unit 96 separate pouches 12, one by one, and shutter means 118 of loading chute means 30 makes pouch 12 ready. When a loading request signal is sent, shutter means 118 opens so as to load pouch 12 into place.

[0176] The above control, or the control of first and second belt conveyor units 92 and 96 to loading chute means 98 will be described in detail.

[0177] As package 14 is conveyed to the predetermined position on conveyance line 38, it is judged whether a pouch loading signal is input (S16). If a pouch loading signal is input (S16: Y), shutter means 118 opens so that pouch 12 is loaded into package 14 located at the predetermined position (S17).

[0178] Loading chute pouch detecting means 124 judges whether there is a “work present” (S18). If there is “no work” (S18: N), shutter means 118 closes and second belt 94 of second belt conveyor unit 96 is driven so that the pouch 12 located at the front end of the belt is fed into loading chute means 98 (S19).

[0179] It is judged whether both stop sensor 102 and confirmation sensor 106 of second belt conveyor unit 96 detect the “no work” state (S20). When both the sensors present the “no work” state (S20: Y), and if loading chute pouch detecting means 124 has detected the “work present” state (S21), second belt 94 of second belt conveyor unit 96 continues to drive until either stop sensor 102 or confirmation sensor 106 of second belt conveyor unit 96 detects the “work present” state or a pouch 12 (S22).

[0180] For the operation of second belt conveyor unit 96, it is necessary to supply a pouch 12 on its exit side. Entrance pouch detecting means 112 of second belt conveyor unit 96 judges whether there occurs a “no work” state (S23). If the “no work” state is detected (S23: Y), the belt of first belt conveyor unit 92 is driven until the “work present” state is obtained (S24).

[0181] In first belt conveyor unit 92, first belt 90 continues driving (S24) until either stop sensor 100 or confirmation sensor 104 on the exit side detects the “work present” state (S25: Y) as a result of a work having been fed.

[0182] In first belt conveyor unit 92, when either stop sensor 100 or confirmation sensor 104 on the exit side presents the “work present” state (S25: N), the conveyor unit 92 stops driving and the operation returns to S1.

[0183] As has been described, in pouch separation/conveyance means 32, the operation of first belt conveyor unit 92 and second belt conveyor unit 96 for separation of pouches 12, conveyance of the pouches and loading of the pouches into loading chute means 30, based on the detection results from different detecting means, namely, passage exit-side pouch detecting means 114, entrance pouch detecting means 110 and 112, stop sensors 100 and 102 and confirmation sensors 104 and 106, is separated into three sections (1) to (3) as follows:

[0184] (1) When two pouches 12 are delivered together from pouch aligning means 26 to first belt conveyor unit 92, passage exit-side pouch detecting means 114 and entrance pouch detecting means 110 detect the “work present” state, at the same time. In this case, first belt conveyor unit 92 keeps on moving, while aligner reciprocating means 28 is stopped and starts moving again only when entrance pouch detecting means 110 presents the “no work” state.

[0185] (2) In a case where two pouches 12 are about to be delivered in a row from first belt conveyor unit 92 to second belt conveyor unit 96, when first belt conveyor unit 92 and second belt conveyor unit 96 both move, stop sensor 100 or confirmation sensor 104 at the exit of first belt conveyor unit 92 and the entrance side sensor (entrance pouch detecting means 112) on second belt conveyor unit 96 detect the “work present” state at the same time.

[0186] Also in this, similarly to the above (1), the downstream, second belt conveyor unit 96 keeps on moving, while the upstream, first belt conveyor unit 92 is stopped so as to halt and limit delivery of pouch 12 into the downstream, second belt conveyor unit 96.

[0187] (3) Delivery of two pouches 12 from second belt conveyor unit 96 into loading chute means 30 at a time is prevented.

[0188] By the above separation functions (1) and (2), there is no risk of two pouches 12 flowing together on second belt conveyor unit 96, but there is a possibility that two pouches 12 are conveyed with a small interval. Stop sensor 102 and confirmation sensor 106 on the exit side play a role guarding against such situation.

[0189] FIG. 23 shows the flowchart for this function and FIGS. 24A to 24C show its operational states.

[0190] When stop sensor 102 and confirmation sensor 106 both detect the “work present” state (S11: Y) as shown in FIG. 24A, and then the output from confirmation sensor 106 changes from the “no work” (OFF) state to the “work present (ON)” state (S10: Y) as shown in FIGS. 24B to 24C, second belt conveyor unit 96 is stopped (S10: Y) so that the second pouch 12 is positively prevented from falling into loading chute means 30.

[0191] It should be noted that the pouch loading machine of the present invention should not be limited to the embodi-
What is claimed is:

1. A pouch loading machine which conveys single packed pouches from a storing portion and aligns them in an individually separated manner and loads a predetermined number of the pouches into a package such as a container, bag or the like, comprising:

   a pouch feed means which pushes a pouch located at the top of the storage portion sidewards by a pusher to supply the pouch into a conveyance passage;

   a pouch aligning means, having a passage formed on the top thereof and enclosed by walls that are formed along both sides of the passage, opposing each other with a distance smaller than the length of the pouch and greater than the width of the pouch apart, for aligning the pouches into position with their length oriented along the direction of the passage as the pouches pass through the passage;

   an aligner reciprocating means which moves the pouches delivered onto the passage from the conveyance passage, toward the passage exit by aligning them by reciprocating movement of the pouch aligner in the direction of the passage;

   a pouch separation/conveyance means which individually separates the pouches that are delivered in alignment from the passage exit of the pouch aligning means, in the direction of conveyance and conveys the pouches, one by one, to a loading chute means; and,

   a loading chute means for loading the pouches conveyed by pouch separation/conveyance means, one by one, into the package.

2. The pouch loading machine according to claim 1, wherein the pouch feed means includes: a belt having multiple plate-like pushers, arranged on the belt peripheral surface at intervals along the feed direction; support pulleys for supporting the belt circumferentially; a motor driver for rotationally driving the support pulleys; a conveyance path pouch detector for detecting the presence of pouches on the conveyance passage; and a drive controller which, when no pouch has been detected on the conveyance passage by the conveyance path pouch detector, supplies pouches by means of the pushers by causing the motor driver to drive support pulleys.

3. The pouch loading machine according to claim 2, wherein the belt and support pulleys are supported by a pivot that is provided on the top of the storing portion and on the side opposite to the conveyance passage, so as to open and close the top of the storing portion.

4. The pouch loading machine according to claim 1, further comprising: a top pouches detecting means for detecting the presence of pouches at the top inside the storage portion; and a lift plate-lifting means for raising a lift plate in the storing portion so that pouches will be positioned at the top of the storing portion when the top pouches detecting means detects the absence of pouches located at the top of the storing portion.

5. The pouch loading machine according to claim 1, wherein the conveyance passage includes: a conveying means for carrying the pouches supplied by the pouch feed means on a conveyance surface and conveys the pouches toward the pouch aligning means by movement of the conveyance surface; and an anti-overlap means having a constraint member disposed over the conveyance surface approximately one to two times the thickness of the pouch above the conveyance surface so as to prevent the pouches from overlapping each other on the conveyance surface during conveyance.

6. The pouch loading machine according to claim 1, wherein the pouch aligning means is constructed such that the passage is inclined with its one side (the first side) lower than the other side (the second side), and projections that change the orientations of pouches by abutting each pouch advancing on the passage so as to position the pouch approximately parallel to the passage surface and bringing it into contact with the first side wall face, are provided on the second side wall face which is on the higher side of the passage.

7. The pouch loading machine according to claim 1, further comprising: an anti-overlap means having a constraint member disposed over the conveyance surface approximately one to two times the thickness of the pouch above the passage surface so as to prevent the pouches from overlapping each other on the passage surface during conveyance.

8. The pouch loading machine according to claim 1, wherein the pouch separation/conveyance means includes: a first belt conveyor unit which conveys pouches by driving a first belt while carrying on the first belt the pouches that are delivered in alignment from the passage exit of the pouch aligning means; and a second belt conveyor unit which conveys pouches, one by one, to the loading chute means by driving a second belt while carrying on the second belt the pouches that are conveyed by the first belt conveyor unit.

9. The pouch loading machine according to claim 1, wherein the pouch separation/conveyance means includes: stop sensors for stopping the drives of the first and second belts respectively when a pouch is detected at the pouch exit positions of the first conveyor unit and the second conveyor unit; and confirmation sensors disposed downstream of respective stop sensors for detecting whether there is a pouch that has moved on the first and second belts after cessation of belt drive.

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