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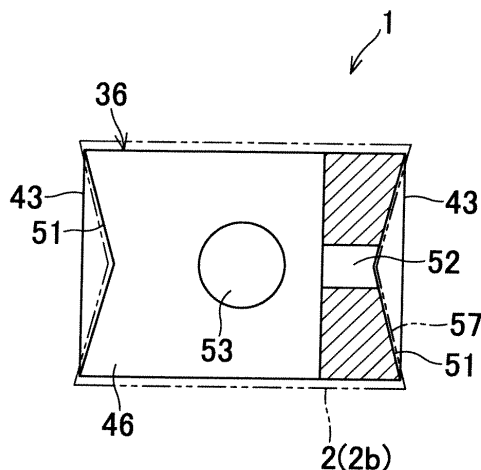
(54) **PUSHER IN PACKING DEVICE**

(57) The present invention aims to provide a pusher used in packaging equipment improved so that undesirable deformation of articles to be packaged can be effectively prevented.

A pusher 1 used in the packaging equipment includes a head unit 36 provided in its frontal end wall 46 with an air supply port 53 and in lateral walls 43 with air suction ports 52. The air supply port 53 is adapted to

maintain fluid-communication between inside and outside of an envelope 2b as long as the frontal end wall 46 of the pusher 1 stays inside the envelope 2b. The air suction ports 52 are adapted to suck an amount of air inside the envelope 2b as the frontal end wall of the pusher 1 moves away from inside of the envelope 2b and thereby allow the open end of the envelope 2b to be formed with the gussets 57.

FIG.4



Description

TECHNICAL FIELD

[0001] The present invention relates to pushers used in packaging equipments to push articles to be packaged into individual envelopes through each of an open end thereof and thereby to obtain packaged articles.

RELATED ART

[0002] In packaging equipments, it is well known to use a pusher by which a plurality of articles to be packaged is into an envelope having a closed end and an open end opposite to the closed end, then to seal the open end and thereby to obtain a finished package. For example, the high-speed packaging machine described in JP 61-160002 Y (PATENT DOCUMENT 1) uses a plurality of transverse sealer and a cutter to obtain, from cylindrical plastic film, an envelope having a heat-sealed end and an open end opposite to the heat-sealed end. Using a pusher, an assembly comprising a given number of articles to be packaged is pushed in a lump into this envelope and then the open end is heat-sealed to obtain a finished package. In such packaging machine, it is also well known to form both side walls of the pusher with air suction ports, respectively. Specifically, air inside the envelope may be sucked through the air suction ports as the pusher moves away from the envelope after the pusher has pushed the articles to be packaged into the envelope. The open end of the envelope is formed with gussets as the pusher moves away from the envelope and finally the open end is heat-sealed.

Patent Document 1: JP 61-160002 Y

DISCLOSURE OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0003] According to the pusher of prior art as has been exemplarily described above, the inside of the envelope is apt to be in a depressurized condition as the pusher moves away from the envelope. Particularly when the articles constituting the assembly to be packaged are of flexible nature and the envelope also is made of flexible material such as plastic film or paper, undesirable deformation of the envelope under the depressurized condition may cause the assembly of the articles to be undesirably deformed. As consequence, expected function of the individual articles may be deteriorated when these articles are actually used and, in addition, the appearance thereof also may be disfigured. Furthermore, the outer shapes of these individual articles may become uneven and make it difficult to stack the articles in an orderly fashion, for example, in the shop.

[0004] In the case of the prior art exemplarily described above, the pusher's forehead is preferably dimensioned to have the area as large as possible so that the forehead

of the pusher may push the assembly of the articles over an area as large as possible. In fact, such measure is advantageous in that uniform suppress strength may be exerted on the assembly of the articles over an area as large as possible and damage of the individual articles due to use the pusher may be restricted. However, the larger the area of the pusher's forehead is, the more tightly the inner surface of the envelope comes in close contact with the pusher and, in consequence, it may become difficult for the envelope to be deformed neatly along the grooves of the pusher. As a result, it may become difficult to form instantly the envelope with neat gussets.

[0005] In view of the various problems as have been described above, it is a principal object of the present invention to improve the pusher used in the packaging equipment so that these problems involved with the assembly of the articles to be packaged as well as with the finished package may be effectively eliminated.

MEASURE TO SOLVE THE PROBLEM

[0006] The present invention to achieve the object set forth above includes a first aspect and a second aspect. The object set forth above is achieved, according to the first aspect of the present invention, by an improvement in the pusher used in packaging equipment, the pusher operating to push articles to be packaged into an envelope having a closed end and an open end opposite to the closed end, then to seal the open end concurrently with formation of gussets on both sides of the open end and thereby to obtain a finished package comprising the envelope and the articles to be packaged.

[0007] The improvement according to the first aspect of the present invention is **characterized in that:** the pusher is adapted for to-and-fro movement in a forward direction in which the articles to be packaged are pushed into the envelope and in a rearward direction opposed to the forward direction and includes a head unit having a frontal end wall adapted to be pressed against the articles to be packaged and to move into the envelope, a rear end wall opposed to the frontal end wall and both lateral walls defined between the frontal end wall and the rear end wall and extending in parallel to each other in the forward direction; the frontal end wall is provided with an air supply port adapted to maintain a fluid-communication between inside and outside of the envelope by an intermediary of the pusher so long as the frontal end wall lies inside the envelope; and the lateral walls are respectively provided with air suction ports allowing the open end of the envelope to be formed with the gussets as the frontal end wall moves away from the inside of the envelope in the opposite direction.

[0008] According to one preferred embodiment of the present invention on the first aspect thereof, the air supply port provided in the frontal end wall of the head unit is kept in fluid-communication with ambient air between the frontal end wall and the rear end wall, on the rear end wall or behind the rear end wall.

[0009] According to another preferred embodiment of the present invention on the first aspect thereof, the air supply port provided in the frontal end wall of the head unit is adapted to supply an inside of the envelope with pressurized air.

[0010] According to still another preferred embodiment of the present invention on the first aspect thereof, the lateral walls are respectively formed with V-shaped grooves extending from the frontal end wall toward the rear end wall and the V-shaped grooves are formed in respective surfaces thereof with the air suction ports.

[0011] The object set forth above is achieved, according to the second aspect of the present invention, by an improvement in the pusher used in packaging equipment, the pusher operating to push a plurality of articles to be packaged into an envelope having a closed end and an open end opposite to the closed end, then to seal the open end concurrently with formation of gussets on both sides of the open end and thereby to obtain a finished package comprising the envelope and the articles to be packaged.

[0012] The improvement according to the second aspect of the present invention is **characterized in that:** said pusher being **characterized in that:** the pusher is adapted for to-and-fro movement in a forward direction in which the articles to be packaged are pushed into the envelope and in a rearward direction opposed to the forward direction and includes a head unit having a frontal end wall adapted to be pressed against the articles to be packaged and to move into the envelope, a width direction extending orthogonally to the direction of the to-and-fro movement and a thickness direction extending orthogonally to both the direction of the to-and-fro movement and the width direction; the head unit is divided in two, i.e., a first plate and a second plate face each other in the thickness direction or divided in three, i.e., a first plate, a second plate and a third plate, the first plate being interposed between the second plate and the third plate wherein both sides of the first plate in the width direction are respectively formed with V-shaped grooves extending in the direction of the to-and-fro movement and utilized to form the gussets and the grooves are formed with ports connected to a vacuum suction source; the head unit operates in a manner such that, in a course of movement in the forward direction of the pusher, the second plate and the third plate cooperate with the first plate to push the articles to be packaged into the envelope and, in a course of movement in the rearward direction of the pusher occurring after the articles to be packaged have been fully pushed into the envelope, the second plate and the third plate move away from the envelope leaving the first plate therein, and thereafter the first plate moves away from the envelope to subject the envelope to vacuum from the vacuum suction source; and a frontal end sub-wall defined by any one of the first, second and third plates has an air supply port adapted to maintain fluid-communication between inside and outside of the envelope as long as the frontal end wall lies inside the envelope.

lopes.

[0013] According to one preferred embodiment of the present invention on the second aspect thereof, the second plate and the third plate are integrated with each other behind the head unit.

[0014] According to another preferred embodiment of the present invention on the second aspect thereof, the air supply ports are adapted to supply an inside of the envelope with pressurized air.

EFFECT OF THE INVENTION

[0015] The pusher according to the first aspect of the present invention has the air supply port provided in the frontal end wall of the head unit and the air suction ports provided in the both lateral walls. With such arrangement, there is practically no possibility that the central region of the envelope containing the articles to be packaged having pushed therein might be trapped in the depressurized condition even when air inside the envelope is sucked through the air suction ports in order to form the open end of the envelope with the gussets as the head unit moves away from the envelope after the articles to be packaged have been pushed into the envelope. In this way, undesirable deformation of the articles to be packaged due to formation of the gussets can be practically prevented.

[0016] The pusher according to the second aspect of the present invention includes the head unit comprising the first plate and the second plate overlapping each other in the height direction or comprising the first plate, the second plate and the third plate wherein the first plate interposed between the second and third plates so that only the second plate or the second plate and the third plate may move away from the envelope after the articles to be packaged have been pushed into the envelope and only the first plate may be used to form the gussets. With such unique arrangement, even if the envelope has been put in close contact with the head unit in the course of pushing the articles to be packaged into the envelope, the envelope is not in close contact with the head unit in the course of forming the gussets. Consequentially, even if the grooves of the first plate utilized to form the gussets are relatively deep, the envelope can quickly and smoothly move into the grooves to be deformed in accordance with the shape of the respective grooves. In this way, the neat gussets can be quickly obtained.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

[Fig. 1] Fig. 1 is a perspective view of an envelope and articles to be packaged.

[Fig. 2] Fig. 2 is a side view of packaging equipment using a pusher.

[Fig. 3] Fig. 3 is a detailed diagram illustrating a process of packaging by following steps 3A through 3E.

[Fig. 4] Fig. 4 is a sectional view taken along the line IV-IV in Fig. 3.

[Fig. 5] Fig. 5 is a diagram exemplarily illustrating a manner in which the pusher is used.

[Fig. 6] Fig. 6 is a perspective view of the envelope and the articles to be packaged.

[Fig. 7] Fig. 7 is a side view of the packaging equipment using the pusher.

[Fig. 8] Fig. 8 is a perspective view of the pusher.

[Fig. 9] Fig. 9 is a sectional view taken along the line IX-IX in Fig. 8.

[Fig. 10] Fig. 10 is a detailed diagram illustrating a process of packaging by following steps (a) through (f).

[Fig. 11] Fig. 11 is a diagram exemplarily illustrating a manner in which the pusher is used.

[Fig. 12] Fig. 12 is a view similar to Fig. 9, showing the head member according to another embodiment.

[Fig. 13] Fig. 13 is a perspective view of the finished package obtained by using the head member shown by Fig. 12.

IDENTIFICATION OF REFERENCE NUMERALS USED IN THE DRAWINGS

[0018]

1	pusher
2, 2a, 2b	envelope
4	closed end
5	open end
10	packaging equipment
14	finished package
15, 15a	assembly of individually packaged articles
36	head unit
41	front end wall
42	rear end wall
43	lateral walls
51	V-shaped grooves
52	air suction ports
53	air supply port
57	gussets
101	pusher
110	packaging equipment
136	head unit
141	frontal end wall
151	first plate (main plate)
152	second plate (upper sub-plate)
153	third plate (lower sub-plate)
156	grooves
157	ports (suction ports)
158	air supply ports
A	to-and-fro movement direction (machine direction)
B	width direction (cross direction)
T	height direction

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] Details of the pusher according to the present invention adapted to be used in the packaging equipment will be more fully understood from the description of preferred embodiments given hereunder with reference to the accompanying drawings.

[0020] Fig. 1 shows an envelope 2 for which a pusher 1 (See Figs. 2 and 3) according to the present invention is used and articles to be packaged in the envelope 2, more specifically, an assembly 15 comprising a plurality of individual menstruation napkin-packages 3. The envelope 2 is made of, for example, a flexible and air-imperious plastic film and has a closed end 4 formed with heat-seal 2d and an open end 5 opposite to the closed end 4. Between the closed end 4 and the open end 5, a pair of lateral walls 7 formed with a pair of gussets 6, respectively. Each of the individual napkin-packages 3 comprises a menstruation napkin (not shown) and a bag 3a made of flexible sheet material such as a plastic film or a nonwoven fabric wherein a given number of such individual napkin-packages which will be packaged in the envelope 2 are orderly arranged in a machine direction A (See Fig. 2 also) and in a cross direction B extending orthogonally to the machine direction A to form the assembly 15.

[0021] Fig. 2 is a lateral diagram schematically illustrating packaging equipment 10 using the pusher 1 according to the present invention. Operation of the packaging equipment comprises a first feeding step 11 in which the envelopes 2 are intermittently fed, a second feeding step 12 in which the assembly 15 of the individual napkin-packages 3 is intermittently fed and a packing step 13 in which the finished packages 14 (See Fig. 3 also) are successively obtained.

[0022] In the first feeding step 11 illustrated in Fig. 2, the envelopes 2 each previously formed with the gussets 6 associated with the closed end 4 are intermittently fed with the open end 5 ahead from the left hand as viewed in Fig. 2. Top and bottom surfaces 8, 9 (See Fig. 1) of the envelope 2 are respectively sucked by upper and lower suction plates 16 for flaring and thereby the open end 5 is flared as shown by Fig. 1. The suction plates 16 horizontally move in a direction of the arrow C to put the flared open end 5 on one bucket 21a of a plurality of buckets 21 and then move away from the open end 5 to respective initial positions as illustrated in Fig. 2. The buckets 21 serve to maintain the open end 5 in the flared state and, in Fig. 2, the envelope 2 put on the one bucket 21a of the buckets 21 is indicated as the envelope 2a contoured by the imaginary line. These buckets 21 are mounted on a disc 22 adapted to be intermittently clockwise or counterclockwise rotated so that the envelope 2a put on the bucket 21a is integrally rotated by 180° and thereby moved from the upper-side to the lower-side as viewed in Fig. 2. In Fig. 2, the envelope 2a having moved downward is indicated as the envelope 2b con-

toured by the imaginary line and the bucket 21a is indicated as the bucket 21b.

[0023] In the second feeding step 12 illustrated in Fig. 2, the assembly 15 is transported on a conveyor 17 in a direction of the arrow D and transferred to a lifter 18 included in the conveyor 17. The lifter 18 is vertically movable to transfer the assembly 15 loaded on the conveyor 17 upward as indicated by the arrow E. In Fig. 2, the assembly 15 having been moved in this manner is indicated as the assembly 15a. In the conveyor 17, an endless belt 17a adapted to be intermittently moved is provided with a plurality of pins 17b at regular intervals so that the assembly 15 slidably loaded on a support means (not shown) on the conveyor 17 is pushed by the pin 17b from the right as viewed in Fig. 2, i.e., in the direction of the arrow D and thereby moved in the direction of the arrow D.

[0024] The packing step 13 in Fig. 2 involves the pusher 1, upper and lower pressure plates 31, upper and lower seal plates 32 and an endless belt 33. The pusher 1 includes a head unit 36 at the left hand as viewed in the machine direction A and a rod unit 37 at the right hand as viewed in the machine direction A, respectively. The rod unit 37 is interlocked with a drive mechanism (not shown) causing to-and-fro movement of the pusher 1 in the machine direction A and, in Fig. 2, the pusher 1 is shown to be in its retracted position. In the packing step 13, the envelope 2b, the bucket 21b on which the envelope 2b is put, the assembly 15a having moved upward and the pusher 1 are aligned in the machine direction A. The pusher 1 is moved leftward so that the head unit 36 thereof may come in contact with and push the assembly 15a into the bucket 21b. The head unit 36 is moved further forward to push the assembly 15a into the envelope 2b and then to push the envelope 2b leftward by the intermediary of the assembly 15a until the envelope 2b containing therein the assembly 15a comes free from the bucket 21b and is loaded on the endless belt 33. Then, the head unit 36 moves away from the envelope 2b rightward in the machine direction A and simultaneously the two pressure plates 31 move in a vertical direction so as to get close to each other and thereby to prevent the envelope 2b from moving rightward. In response to the head unit 36 moving away from the envelope 2b, the two heated seal plates 32 move in a vertical direction so as to get close to each other until these heated seal plates 32 pinch the open end 5 of the envelope 2b and thereby form a heat-seal 2e (See Fig. 3). The seal plates 32 move back to the respective positions as illustrated and a finished package 14 is obtained. The finished package 14 is transported leftward by the endless belt 33.

[0025] Fig. 3 is a diagram illustrates details of the packing step 13 wherein the lifter 18 and the disc 22 are not illustrated for simplicity. In a phase illustrated by Fig. 3A, the bucket 21b having the envelope 2b put thereon, the assembly 15a and the pusher 1 are aligned in the machine direction A. The head unit 36 of the pusher 1 has a front end portion 41 and a rear end portion 42 opposite

to the front end portion 41 between which a pair of lateral walls 43 and top and bottom walls 44, 45 are defined. The front end portion 41 includes a front surface 46 (See Fig. 4) adapted to come in contact with the assembly 15 and the rear end portion 42 includes a rear surface 47 adapted to be connected with the rod unit 37. The lateral walls 43 are formed with V-shaped grooves 51 extending from the front end portion 41 toward the rear end portion 42 and surfaces of the respective V-shaped grooves 51 are formed with air suction ports 52. The air suction ports 52 are fluid-communication with air suction means such as a vacuum pump so that air inside the envelope 2b may be sucked through these air suction ports for a predetermined time period in the packing step 13. The front surface 46 is formed with an air supply port 53 (See Fig. 4). The air supply port 53 is fluid-communication with ambient air via a ductwork (not shown) extending within the head unit 36 or connected to a compressed air supply source (not shown) such as a compressor. The ductwork provided in the case of the air supply port 53 adapted to be in fluid-communication with ambient air will have its open end in a region between the front end portion 41 and the rear end portion 42, in the rear end portion 42 or a region behind the rear end portion 42.

[0026] In a phase illustrated by Fig. 3B, the head unit 36 moves forward to push the assembly 15a into the tunnel-like bucket 21b and further moves forward to push the assembly 15a into the envelope 2b until the envelope 2b comes free together with the assembly 15a from the bucket 21b.

[0027] In a phase illustrated by Fig. 3C, the head unit 36 begins to move away from the envelope 2b and simultaneously a pair of the pressure plates 31 begins to get close to each other. In the head unit 36, in turn, the air suction port 52 starts to be activated and, in response thereto, the lateral walls 7 of the envelope 2b begins to be deformed in accordance with the V-shape of the respective grooves 51 in the vicinity of the open end 5 and the gussets 57 (See Fig. 3E) begin to be formed. When the front end portion 41 lies inside the envelope 2b, the air supply port 53 of the head unit 36 is maintained in fluid-communication with the ambient air or the inside of the envelope 2b can be supplied with compressed air as the head unit 36 moves away from the envelope 2b and, in each case, fluid-communication is maintained between the inside and the outside of the envelope 2b. As a consequence, it is possible to prevent a central region of the envelope 2b from being rearward movement of the head unit 36 or vacuum suction might unacceptably depressurize a central region of the envelope 2b containing therein the assembly 15. If the menstruation napkin contained in the individual package 3 has a sufficient elastic recovery, the assembly 15 is compressed and its volume is decreased as the pusher 1 moves forward to push the assembly 15 and decompressed and its volume is increased again as the pusher 1 moves rearward. The envelope 2b would otherwise be trapped in so-called depressurized condition as the pusher 1 moves rearward.

However, the pusher 1 may be provided with the air supply port 53 to prevent the envelope 2b from being trapped in such depressurized condition.

[0028] In a phase of Fig. 3D, the heated upper and lower seal plates 32 get close to each other about the envelope 2b from which the head unit 36 has moved away and pinch the open end 5 of the envelope 2b to form the heat-seal 2e (See Fig. 3E).

[0029] Fig. 3E illustrates the finished package 14 obtained in the packing step 13. The finished package 14 is formed with, in addition to the previously formed heat-seal 2d, the heat-seal 2e. In the finished package 14, the lateral walls 7 of the envelope 2 are formed with the gussets 56, 57, respectively, in the vicinity of the heat-seals 2d, 2e.

[0030] Fig. 4 is a sectional view taken along the line IV-IV in the head unit 36 illustrated by Fig. 3A. In Fig. 4, a part of the front surface 46 of the head unit 36 constituting the pusher 1 and one of the V-shaped grooves 51 of the lateral walls 43. The front surface 46 is formed with the air supply port 53. V-shaped groove 51 is laterally facing and provided in its surface with the air suction port 52. The envelope 2b indicated by the imaginary line along the V-shaped groove 51 is deformed under vacuum exerted through the air suction port 52 and starts to form the gusset 57. It should be noted here that, in the case of the pusher 1 according to the present invention, the central region of the envelope 2 is assured to be maintained in fluid-communication with ambient air or supplied with compressed air via the air supply port 53 formed in the head unit 36 even the vacuum suction to form the envelope 2 with the gussets 57 begins. Consequentially, the envelope 2 would not be trapped in the depressurized condition. In this way, the individual packages 3 constituting the assembly 15 would not be compressed by depressurized envelope and thereby deformed. In addition, the finished package would not be undesirably deformed and therefore it is facilitated to stack a plurality of the finished packages 14 for bale packaging or displaying. In the pusher 1, timing control for starting and ending of air suction through the air suction port 52 and for starting and ending of air supply through the air supply port 53 can be done by providing the packaging equipment with control mechanisms (not shown) operatively associated with these timing control operations. In the pusher 1, the V-shaped grooves 51 in the illustrated embodiment may be replaced by U-shaped grooves or the other various types of grooves.

[0031] Fig. 5 is a diagram similar to Fig. 3A exemplarily illustrating a manner in which the pusher 1 is used. Referring to Fig. 5, the envelope 2b has been put on the bucket 21b and the closed end 4 has moved into the bucket 21b from the left hand and in the machine direction A. The closed end 4 has its inner surface exposed and faces the assembly 15a. The assembly 15a comes in contact with the inner surface of the closed end 4 of the envelope 2b as the assembly 15a is pushed by the pusher 1 into the bucket 21b. The assembly 15a is moved into

the envelope 2b until the position shown by Fig. 3B is reached as the pusher 1 is moved forward. To bring the envelope 2b into the state of Fig. 5, after the open end 5 has been put on the bucket 21b, pressurize air may be injected from outside of the closed end 4 into the envelope 2b and thereby the closed end 4 may be forced to move into the bucket 21b from the left hand as viewed in Fig. 5.

[0032] According to the embodiment illustrated by Fig. 5, when the pusher 1 is used to push the assembly 15a into the envelope 2b, air would not be confined within the envelope 2b in front of the assembly 15a. Consequentially, the compact finished package 14 can be obtained.

[0033] While the pusher 1 and packaging equipment 10 including this pusher 1 having been described hereinabove with reference to Figs. 1 through 5 are suitable for packaging of the flexible and easily deformable articles such as menstruation napkins and disposable diapers, it is obvious that these pusher 1 and packaging equipment 10 can be effectively used for the other articles which are not easily deformable.

[0034] Fig. 6 shows an envelope 2 for which a pusher 101 (See Figs. 7 and 8) according to one preferred embodiment of the present invention is used and articles to be packaged in the envelope 2, more specifically, an assembly 15 comprising a plurality of individual menstruation napkin-packages 3. The envelope 2 is made of, for example, flexible and air-imperious plastic film and has a closed end 4 formed with heat-seal 2d and an open end 5 opposite to the closed end 4. Between the closed end 4 and the open end 5, a pair of lateral walls 7 formed with a pair of gussets 6, respectively. Each of the individual menstruation napkin-packages 3 comprises a menstruation napkin (not shown) and a bag 3a made of a flexible sheet material such as a plastic film or a non-woven fabric wherein a given number of such individual menstruation napkin-packages which will be packaged in the envelope 2 are orderly arranged in a machine direction A (See Fig. 7 also) and in a cross direction B extending orthogonally to the machine direction A to form the assembly 15.

[0035] Fig. 7 is a lateral diagram schematically illustrating packaging equipment 110 using the pusher 101 according to the present invention. Operation of the packaging equipment 110 comprises a first feeding step 11 in which the envelopes 2 are intermittently fed, a second feeding step 12 in which the assembly 15 of the individually packaged articles 3 is intermittently fed and a packing step 13 in which the finished packages 14 (See Fig. 6 also) are successively obtained.

[0036] In the first feeding step 11 illustrated in Fig. 7, the envelopes 2 each previously formed with the gussets 6 associated with the closed end 4 are intermittently fed with the open end 5 ahead from the left hand as viewed in Fig. 7. Top and bottom surfaces 8, 9 (See Fig. 6) of the envelope 2 are respectively sucked by upper and lower suction plates 16 for flaring and thereby the open end 5 is flared as shown by Fig. 6. The suction plates 16

horizontally move in a direction of the arrow C to put the flared open end 5 on one bucket 21a of a plurality of buckets 21 and then move away from the open end 5 to respective initial positions as illustrated in Fig. 7. The buckets 5 serve to maintain the open end 5 in the flared state and, in Fig. 7, the envelope 2 put on the one bucket 21a of the buckets 21 is indicated as the envelope 2a contoured by the imaginary line. These buckets 21 are mounted on a disc 22 adapted to be intermittently clockwise or counterclockwise rotated so that the envelope 2a put on the bucket 21a is rotated integrally rotated by 180° and thereby moved from the upper-side to lower-side as viewed in Fig. 7. In Fig. 7, the envelope 2a having moved downward is indicated as the envelope 2b contoured by the imaginary line and the bucket 21a is indicated as the bucket 21b.

[0037] In the second feeding step 12 illustrated in Fig. 7, the assembly 15 is transported on a conveyor 17 in a direction of an arrow D and transferred to a lifter 18 inclined in the conveyor 17. The lifter 18 is vertically movable to transfer the assembly 15 loaded on the conveyor 17 upward as indicated by the arrow E. In Fig. 7, the assembly 15 having been moved in this manner is indicated as the assembly 15a. In the conveyor 17, an endless belt 17a adapted to be intermittently moved is provided with a plurality of pins 17b at regular intervals so that the assembly 15 slidably loaded on a support means (not shown) on the conveyor 17 is pushed by the pin 17b from the right hand as viewed in Fig. 7, i.e., in the direction of the arrow D and thereby moved toward the lifter 18.

[0038] The packing step 13 in Fig. 7 involves the pusher 101, upper and lower pressure plates 31, upper and lower seal plates 32 and an endless belt 33. The pusher 101 includes a head unit 136 at the left hand as viewed in the machine direction A and a rod unit 137 at the right hand as viewed in the machine direction A, respectively. The rod unit 137 is interlocked with a drive mechanism (not shown) causing to-and-fro movement the pusher 101 in the machine direction A and, in Fig. 7, the pusher 101 is shown to be in its retracted position. In the packing step 13, the envelope 2b, the bucket 21b on which the envelope 2b is put, the assembly 15a having moved upward and the pusher 101 are aligned in the machine direction A. The pusher 101 is moved leftward as viewed in the machine direction A so that the head unit 136 thereof may come in contact with and push the assembly 15a into the bucket 21b. The head unit 136 moves further forward to push the assembly 15a into the envelope 2b and then to push the envelope 2b leftward by the intermediary of the assembly 15a until the envelope 2b containing therein the assembly 15a comes free from the bucket 21b and is loaded on the endless belt 33. A part of the head unit 136 having completed its function to push the assembly 15a into the envelope 2b remains inside the envelope 2b together with the assembly 15a. Then, the head unit 136 moves away from the envelope 2b rightward in the machine direction A and simultaneously the two pressure plates 31 move in a vertical direction

so as to get close to each other and thereby to prevent the envelope 2b from moving rightward. In response to the head unit 36 fully moving away from the envelope 2b, the two heated seal plates 32 move in a vertical direction so as to get close to each other until these heated seal plates 32 pinch the open end 5 of the envelope 2b and thereby form a heat-seal 2e (See Fig. 8). The seal plates 32 move back to the respective positions as illustrated and a finished package 14 is obtained. The finished package 14 is transported leftward by the endless belt 33.

[0039] Fig. 8 is a perspective view of the pusher 101 and Fig. 9 is a sectional view taken along the line IX-IX in Fig. 8. In Fig. 9, the envelope 2b into which the pusher 101 has moved and the envelope 2b' beginning to be formed with the gusset 61 (See Fig. 10) as an upper sub-plate 152 and a lower sub-plate 153 are moved away from the envelope 2b are indicated by the imaginary lines. Referring to Fig. 8, the head unit 136 of the pusher 101 has a horizontal to-and-fro movement direction corresponding to the machine direction A, a width direction corresponding to the cross direction B orthogonal to the machine direction A and a height direction T orthogonal to both the to-and-fro movement direction and the width direction. As viewed in the height direction T, the head unit 136 comprises three plates, i.e., a main plate 151 as a first plate, and upper and lower sub-plates 152, 153 as second and third plates, respectively, arranged to sandwich the main plate 151 therebetween. The main plate 151, the upper sub-plate 152 and the lower sub-plate 153 are adapted for to-and-fro movement in the machine direction A which is independent one from another. Specifically, a main rod 137 functioning to actuate to-and-fro movement of the main plate 151 is attached to a rear end wall 151b of the main plate 151, a sub-rod 138 functioning to actuate to-and-fro motion of the upper sub-plate 152 is attached to a side plate 152b of the upper sub-plate 152 and a sub-rod 139 functioning to actuate to-and-fro movement of the lower sub-plate 153 is attached to a side plate 153b of the lower sub-plate 153. The main rod 137 and the sub-rods 138, 139 are respectively connected to drive sources (not shown) such as pistons.

[0040] The main plate 151, the sub-plate 152 and the sub-plate 153 respectively have a main frontal end wall 151a, a frontal end sub-wall 152a and a frontal end sub-wall 153a integrated together to define a frontal end wall 141 of the pusher 101. These main front end wall 151a, the front end sub-wall 152a and the frontal end sub-wall 153a are regions cooperating together to be pressed against the assembly 15 as the pusher 101 moves forward. To prevent the contact pressure from being locally exerted on the assembly 15, the frontal end wall 141 of the pusher 101 integrally defined by the frontal surface wall 151a, 152a and 153a may be shaped and sized to be generally coincident with those of a region 19 of the assembly 15 facing the frontal end wall 141 of the pusher 101 or to be slightly smaller than the size of this region 19 of the assembly 15. In other words, the maximum dimension of the frontal end wall 141 as measured in the

cross direction B and the height direction T may be set to be generally the same as or slightly smaller than the maximum dimension of the region 19 of the assembly 15.

[0041] The pusher 101 further includes a pair of lateral walls 142 symmetrically shaped as viewed in the cross direction B. Each of the lateral walls 142 comprises a main lateral wall 151c in the main plate 151, a lateral sub-wall 152c of the sub-plate 152 and a lateral sub-wall 153c of the sub-plate 153 wherein the main lateral wall 151c is formed with a groove 15 extending from the frontal wall 151a in the machine direction A and having a V-shaped cross-section and the groove 151c is formed with a suction port 157. The suction port 157 is connected to an air suction source (not shown) such as a vacuum pump. The lateral sub-walls 152c, 153c are smoothly finished. Referring to Fig. 9, the main frontal end wall 151a of the frontal end wall 141 is formed with an air supply port 158. The air supply port 158 extends to an air inlet 159 formed in a main rear end wall 151b of the main plate 151 and fluid-communicates with ambient air.

[0042] Fig. 10 is a diagram illustrates details of the packing step 13 wherein the lifter 18 and the disc 22 are not illustrated for simplicity. In a phase of Fig. 10A, the bucket 21b having the envelope 2b put thereon, the assembly 15a and the pusher 101 are aligned in the machine direction A wherein the region 19 of the assembly 15a faces the frontal end wall 41 of the pusher 101.

[0043] In a phase of Fig. 10B, the head unit 136 moves forward and is pressed against a generally entire area of the region 19 of the assembly 15a to push the assembly 15a into the tunnel-like bucket 21b and then into the envelope 2b until the envelope 2b comes free from the bucket 21b. A part of the head unit 136 moves into the envelope 2b.

[0044] In a phase of Fig. 10C, with the main plate 151 remaining at rest, the upper sub-plate 152 and the lower sub-plate 153 are moved away from the open end 5 of the envelope by the sub-rod 138 and the sub-rod 139, respectively. A pair of the pressure plates 31 moves closer to the envelope 31 and thereby prevents the envelope 2b from moving as the upper and lower sub-plates 152, 153 begin to move back.

[0045] In a phase of Fig. 10D, the main plate 151 which has remained stationary in the phase of Fig. 10C begins to move away from the envelope 2b and a pair of the pressure plates 31 moves further closer to the envelope 2b. In the main plate 151, air inside the envelope 2b begins to be sucked via the suction port 157 and, in consequence, the lateral walls 7 of the envelope 2b begin to be deformed in the vicinity of the open end 5 in accordance with the shape of the respective grooves 156. In this way, the gussets 61 (See Fig. 10F) begin to be formed. Even when the frontal end wall 151a of the main plate 151 is still lies inside the envelope 2b, the air supply ports 158 (See Fig. 9) are in fluid-communication with ambient air and thereby ventilation is assured between inside and outside of the envelope 2b. Consequentially, backward movement of the main plate 151 and the sub-

plates 152, 153 and/or air suction by the suction port 157 of the main plates 151 would not bring the central region of the bag 2b into depressurized state. Thereby it is possible to prevent the assembly 15 having been pushed into the central region of the envelop 2b from being undesirably deformed due to the air suction effect. In the case of the individual menstruation napkin-packages having elastic recovery property, certainly there is a possibility that the assembly 15 might have its volume decreased as the assembly 15 is pushed by the pusher 101 moving forward and might have its volume increased and might be brought into depressurized state as the pusher 101 moves backward. However, the air supply port 158 of the pusher 101 can reliably prevent the assembly 15 from becoming such depressurized state.

[0046] In a phase of Fig. 10E, a pair of heated seal plate 32 moves closer to each other about the envelope 2b from which the main plate has moved away and forms the open end 5 of the envelope 2b with the heat-seal 2e (See Fig. 10F). While not illustrated, the main plate 151, the upper sub-plate 152 and the lower sub-plate 153 having moved back are position-adjusted so that the frontal end wall 151a, 152a and 153a are positioned as illustrated by Fig. 8.

[0047] Fig. 10F illustrates the finished package 14 having been obtained in the packing step 13. The finished package 14 has, in addition to the previously formed heat-seal 2d as seen in Fig. 6, the heat-seal 2e which has been formed on an end wall 62 of the finished package 14 substantially at a middle level as viewed in a vertical direction of Fig. 10F. In the vicinity of the heat-seals 2d, 2e, respectively, the lateral walls 7 of the envelope 2 in the finished package 14 have been formed with the gussets 6, 61, respectively.

[0048] The process in which the gussets 61 are formed in the vicinity of the open end 5 in the step of Fig. 10D is illustrated also by Fig. 9. Specifically, the main plate 151 constituting the head unit 136 is formed in the V-shaped groove 156 thereof with the suction ports 157 and the envelope 2b indicated by the imaginary line is formed with the gussets 61 under vacuum acting upon the envelope 2b via the suction port 157. However, it should be noted here that, in the step of Fig. 10D, the gussets 61 are formed after the upper and lower sub-plates 152, 153 have moved away from the envelope 2b. Immediately before vacuum acts upon the envelope 2b along the grooves 156 to deform the envelope 2b in accordance with the shape of the respective grooves 156, portions of the envelope 2b having been in a state of tension due to close contact with the upper and lower sub-plates 152, 153 are relaxed as the upper and lower sub-plates 152, 153 move away from the envelope 2b so that the envelope 2b may be easily deformed in accordance with the shape of the respective grooves 156. In this way, it is easily possible for the pusher 101 to form the envelope 2b with the gussets 61 even if the envelope 2b has partially been in close contact with the head unit 136 when the pusher 101 has pushed the assembly 15 into the

envelope 2b.

[0049] The unique arrangement of the head unit 136 as has been described above effectively facilitates the operation of deforming the envelope 2b along the grooves 156 as indicated by the imaginary lines and thereby forming the gussets 61 without damaging the assembly 15a. A beneficial effect can be expected from such head unit 136 when an open angle α of the groove 156 is set to be as small as possible and thereby a depth in the cross section B of the gusset 61 formed by the main plate 151 is set to be as large as possible.

[0050] In the case of the pusher 101 according to the present invention, the central region of the envelope 2 is assured to be maintained in fluid-communication with ambient air or supplied with compressed air via the air supply port 158 formed in the head unit 136 even the vacuum suction to form the envelope 2 with the gussets 61 begins. Consequentially, the envelope 2 would not be trapped in the depressurized condition. In this way, the individual packages 3 constituting the assembly 15 would not be compressed by depressurized envelope and thereby deformed. In addition, the finished package 14 would not be undesirably deformed and therefore it is facilitated to stack a plurality of the finished packages 14 for bale packaging or displaying. The air inlet 159 extending to the air supply port 158 functioning in the manner as has been described above may be provided in the rear end wall 151b of the main plate 151 or between the main frontal end wall 151a and the main rear end wall 151b or behind the main rear end wall 151b. The air inlet 159 may be connected to a pressurized air supply source such as a compressor so that the air inlet 159 may be used to supply the envelope 2b with pressurized air. In the pusher 101, timing control for starting and ending of air suction through the air suction port 157 and for starting and ending of air supply through the air supply port 158 can be done by providing the packaging equipment with control mechanisms (not shown) operatively associated with these timing control operations. In the pusher 101, the V-shaped grooves 156 in the illustrated embodiment may be replaced by U-shaped grooves or the other various types of grooves.

[0051] In the pusher 101 according to the present invention, it is possible to provide the upper sub-plate 152 or the lower sub-plate 153 also with the air supply ports functioning for the envelope 2b in order to prevent the envelope 2b from being trapped in the depressurized condition when these sub-plates 152, 153 move away from the envelope 2b. It is not essential to provide the main plate 151 with such air supply ports as in the illustrated embodiment but it is possible without departing from the scope of the invention to provide any one of the main plate 151, the upper sub-plate 152 and the lower sub-plate 153 depending on respective sizes of the envelope 2b, the assembly 15 and the head unit 136.

[0052] The head unit 136 of the pusher 101 according to the present invention preferably comprises three components, i.e., three plates 151, 152 and 153 in the height

direction T. However, it is possible without departing from the scope of the invention to replace the upper sub-plate 152 and the lower sub-plate 153 provided as the separate components in the illustrated embodiment by these sub-plates 152, 153 integrally connected to each other behind the head unit 136 so that these two sub-plates 152, 153 may move together forward or backward. It is also possible without departing from the scope of the invention to save one of the upper sub-plate 152 and the lower sub-plate 153. In other words, the head unit 136 comprising three components may be replaced by the head unit 136 comprising two components in the height direction.

[0053] Fig. 11 is a diagram similar to Fig. 10A exemplarily illustrating a manner in which the pusher 101 is used. Referring to Fig. 11, the open end 5 of the envelope 2b has been put on the bucket 21b and the closed end 4 has moved into the bucket 21b from the left hand and in the machine direction A. The closed end 4 has its inner surface exposed and faces the assembly 15a. The assembly 15a comes in contact with the inner surface of the closed end 4 of the envelope 2b as the assembly 15a is pushed by the pusher 101 into the bucket 21b. The assembly 15a is moved into the envelope 2b until the position shown by Fig. 10B is reached as the pusher 101 is moved forward. To bring the envelope 2b into the state of Fig. 11, after the open end 5 has been put on the bucket 21b, pressurize air may be injected from outside of the closed end 4 into the envelope 2b and thereby the closed end 4 may be forced to move into the bucket 21b from the left hand as viewed in Fig. 11.

[0054] Referring to Fig. 11, the pusher 101 may be used to push the assembly 15a into the envelope 2b to obtain a compactly finished package 14 without trapping air inside the envelope 2b in front of the assembly 15a.

[0055] Fig. 12 is a partial sectional view similar to Fig. 9, showing one preferred embodiment of the head unit 136 in the pusher 101 according to the present invention and Fig. 13 is a perspective view of the finished package 14 obtained by using the head unit 136 shown by Fig. 12. The head unit 136 shown by Fig. 12 comprises the main plate 151 as the first plate and the upper sub-plate 152 as the second plate. In this head unit 136 also, the grooves 156 of the main plate 151 may be used to form the envelope 2b with the gussets 61 after the upper sub-plate 152 has moved away from the envelope 2b. The envelope 2b indicated by imaginary lines in Fig. 12 is the envelope in a phase that the upper sub-plate 152 is moving into the envelope 2b and the envelope 2b' indicated also by the imaginary line is the envelope in a phase that the gussets 61 are gradually formed as the upper sub-plate 152 moves away from the envelope 2b'. In the finished package 14 obtained by using this head unit 136, the heat-seal 2e formed on the end wall 62 of the envelope 2 is not at the middle as viewed in the vertical direction of Fig. 13 but biased downward. Such end wall 62 may be advantageously utilized when it is desired to provide this end wall 62 with print of large graphic or logo

for which it is undesirable to divide such graphic or logo in two.

[0056] While the pusher 101 and packaging equipment 110 including this pusher 101 having been exemplarily described hereinabove with reference to Figs. 6 through 13 are also suitable for packaging of the flexible and easily deformable articles such as menstruation napkins and disposable diapers, it is obvious that these pusher 101 and packaging equipment 110 can be effectively used for the other articles which are not easily deformable.

Claims

1. A pusher used in packaging equipment, said pusher operating to push articles to be packaged into an envelope having a closed end and an open end opposite to said closed end, then to seal said open end concurrently with formation of gussets on both sides of said open end and thereby to obtain a finished package comprising said envelope and said articles to be packaged, said pusher being **characterized in that:**

said pusher is adapted for to-and-fro movement in a forward direction in which said articles to be packaged are pushed into said envelope and in an rearward direction opposed to said forward direction and includes a head unit having a frontal end wall adapted to be pressed against said articles to be packaged and to move into said envelope, a rear end wall opposed to said frontal end wall and both lateral walls defined between said frontal end wall and said rear end wall and extending in parallel to each other in said forward direction; and

said frontal end wall is provided with an air supply port adapted to maintain a fluid-communication between inside and outside of said envelope by an intermediary of said pusher so long as said frontal end wall lies inside said envelope; and

said lateral walls are respectively provided with air suction ports allowing said open end of said envelope to be formed with said gussets as said frontal end wall moves away from said inside of said envelope in said opposite direction.

2. The pusher defined by Claim 1 wherein said air supply port provided in said frontal end wall of said head unit is kept in fluid-communication with ambient air between said frontal end wall and said rear end wall, on said rear end wall or behind said rear end wall.
3. The pusher defined by Claim 1 wherein said air supply port provided in said frontal end wall of said head unit is adapted to supply an inside of said envelope with pressurized air.

4. The pusher defined by any one of Claims 1 through 3 wherein said lateral walls are respectively formed with V-shaped grooves extending from said frontal end wall toward said rear end wall and said V-shaped grooves are formed in respective surfaces thereof with said air suction ports.

5. A pusher used in packaging equipment, said pusher operating to push a plurality of articles to be packaged into an envelope having a closed end and an open end opposite to said closed end, then to seal said open end concurrently with formation of gussets on both sides of said open end and thereby to obtain a finished package comprising said envelope and said articles to be packaged, said pusher being **characterized in that:**

said pusher is adapted for to-and-fro movement in a forward direction in which said articles to be packaged are pushed into said envelope and in a rearward direction opposed to said forward direction and includes a head unit having a frontal end wall adapted to be pressed against said articles to be packaged and to move into said envelope, a width direction extending orthogonally to said direction of said to-and-fro movement and a thickness direction extending orthogonally to both said direction of said to-and-fro movement and said width direction;

said head unit is divided in two, i.e., a first plate and a second plate face each other in said thickness direction or divided in three, i.e., a first plate, a second plate and a third plate, said first plate being interposed between said second plate and said third plate wherein both sides of said first plate in said width direction are respectively formed with V-shaped grooves extending in said direction of said to-and-fro movement and utilized to form said gussets and said grooves are formed with ports connected to a vacuum suction source;

said head unit operates in a manner such that, in a course of movement in said forward direction of said pusher, said second plate and said third plate cooperate with said first plate to push said articles to be packaged into said envelope and, in a course of movement in said rearward direction of said pusher occurring after said articles to be packaged have been fully pushed into said envelope, said second plate and said third plate move away from said envelope leaving said first plate therein, and thereafter said first plate moves away from said envelope to subject said envelope to vacuum from said vacuum suction source; and

a frontal end sub-wall defined by any one of said first, second and third plates has an air supply port adapted to maintain fluid-communication

between inside and outside of said envelope as long as said frontal end wall lies inside said envelope.

6. The pusher defined by Claim 5 wherein said second plate and said third plate are integrated with each other behind said head unit. 5
7. The pusher defined by Claim 5 or 6 wherein said air supply ports are adapted to supply an inside of said envelope with pressurized air. 10

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FIG.1

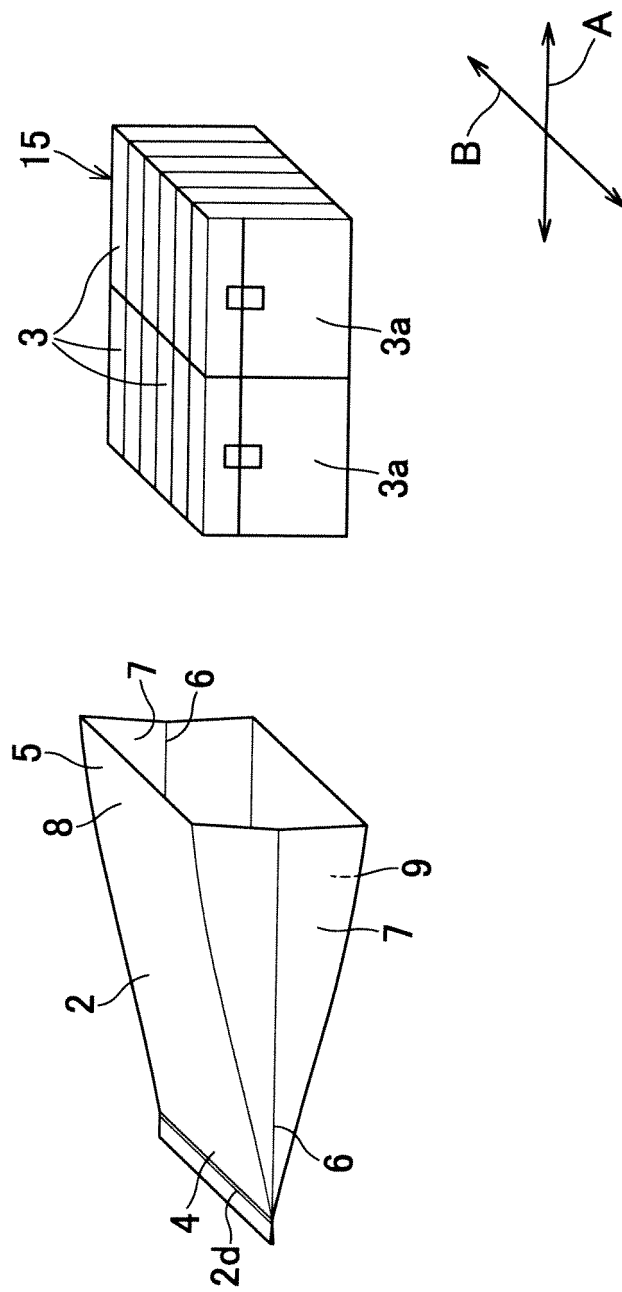


FIG. 2

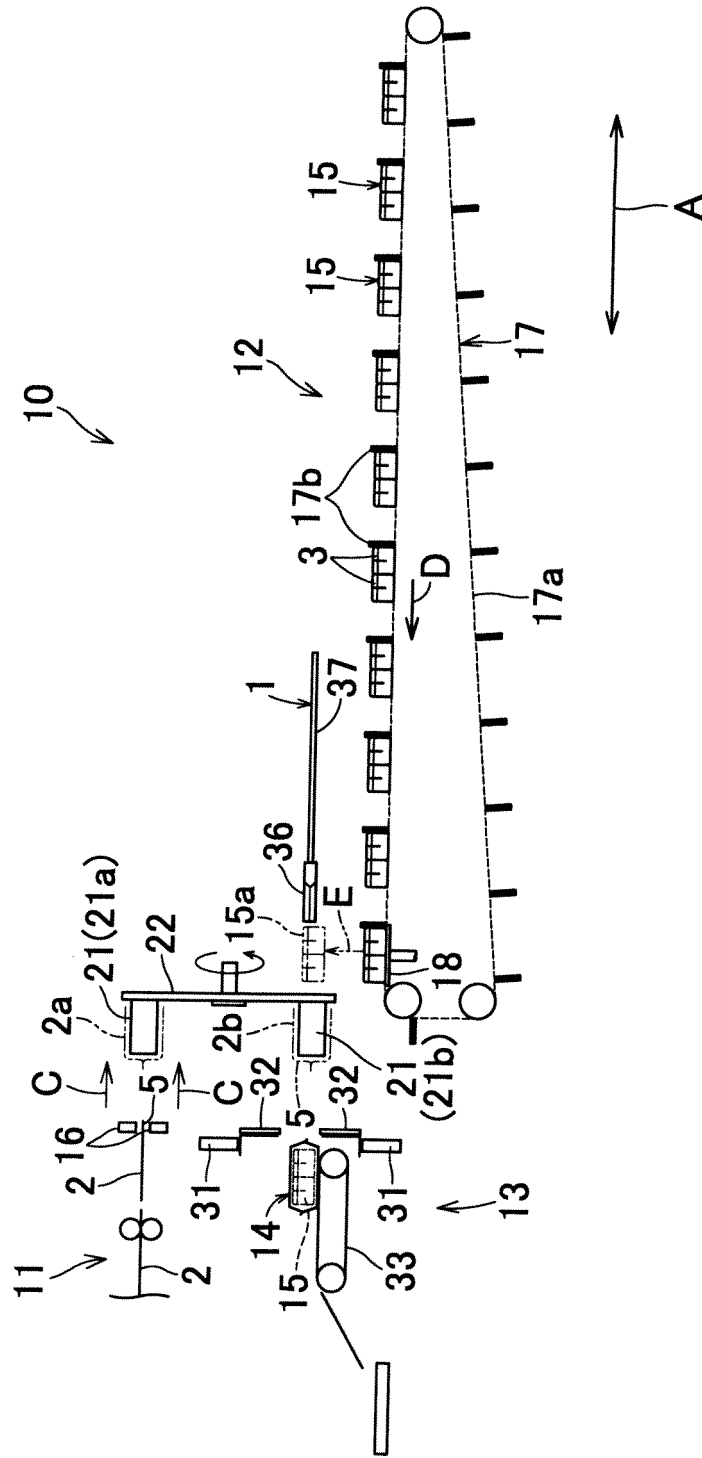


FIG.3A

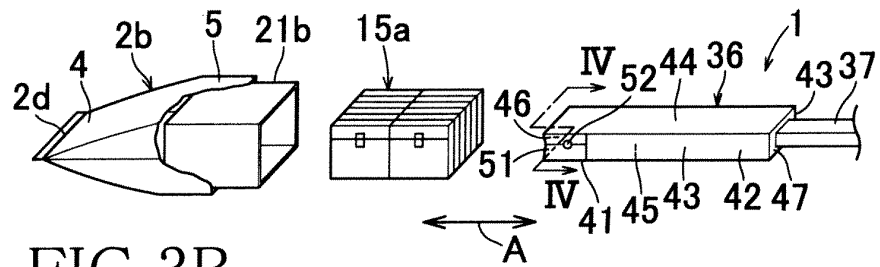


FIG.3B

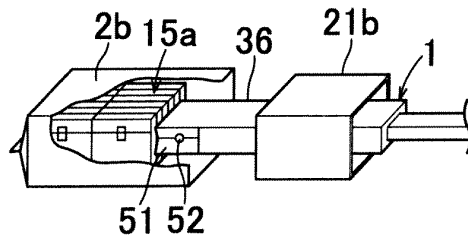


FIG.3C

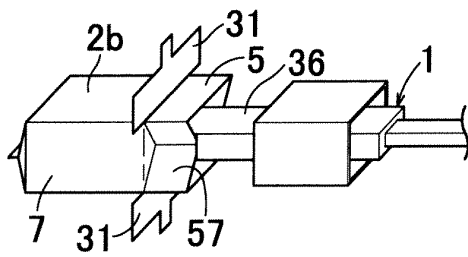


FIG.3D

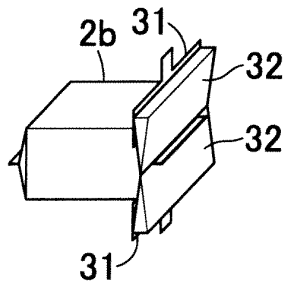


FIG.3E

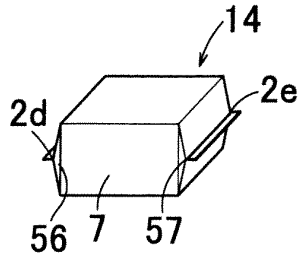


FIG.4

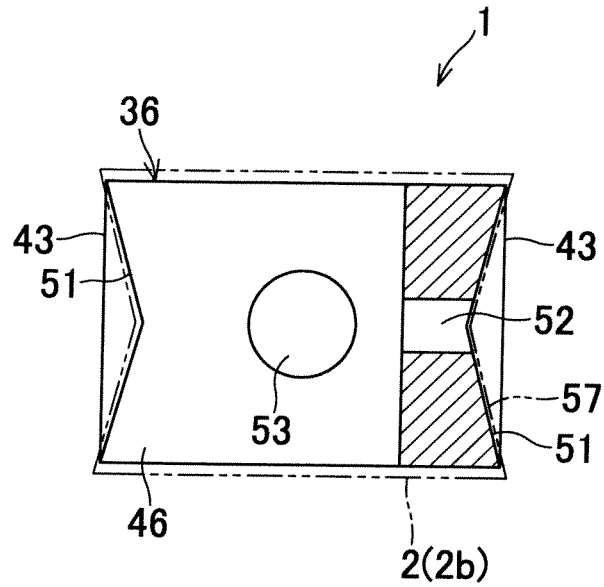


FIG.5

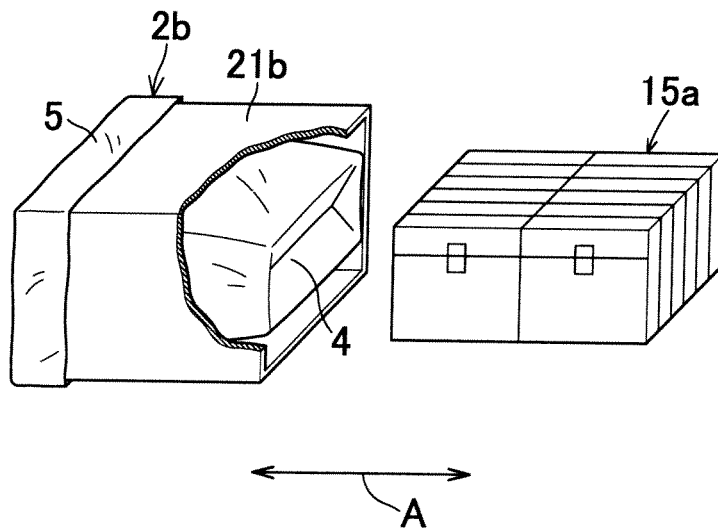


FIG.6

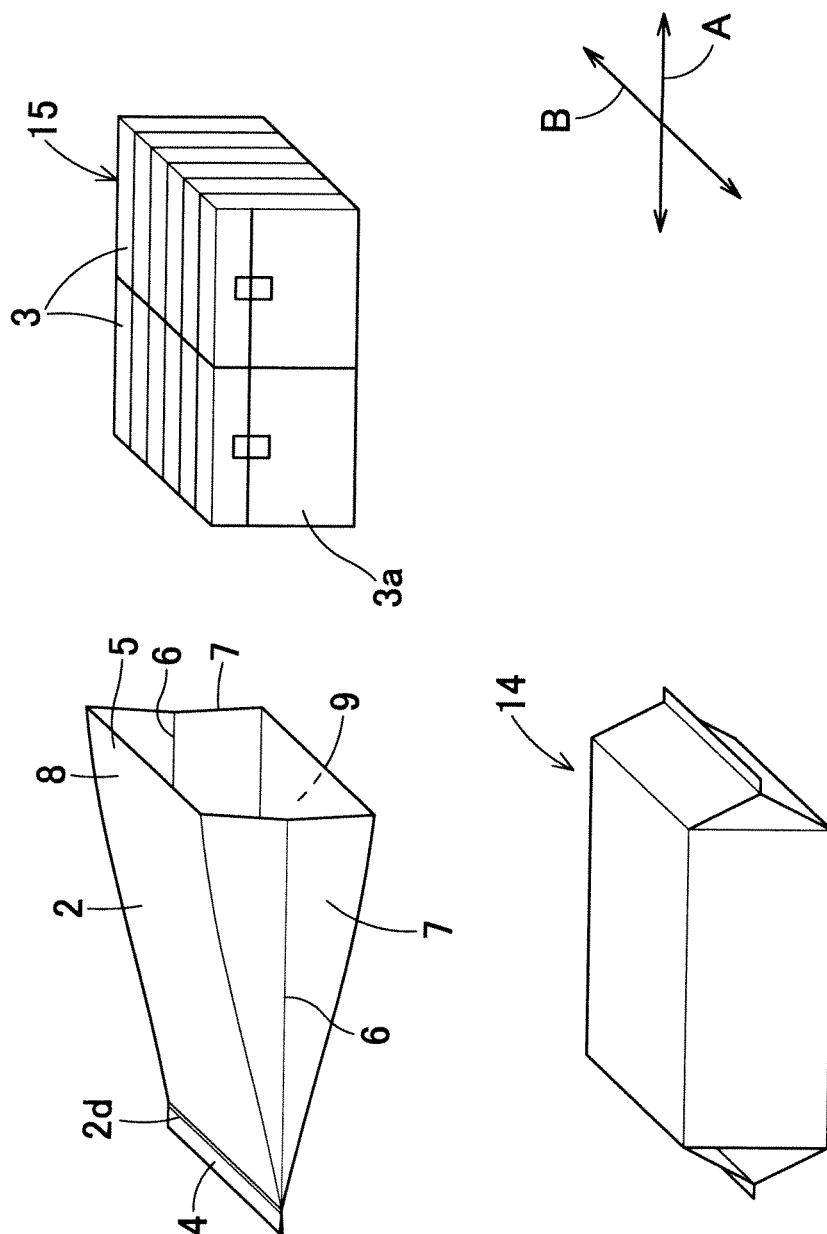


FIG. 7

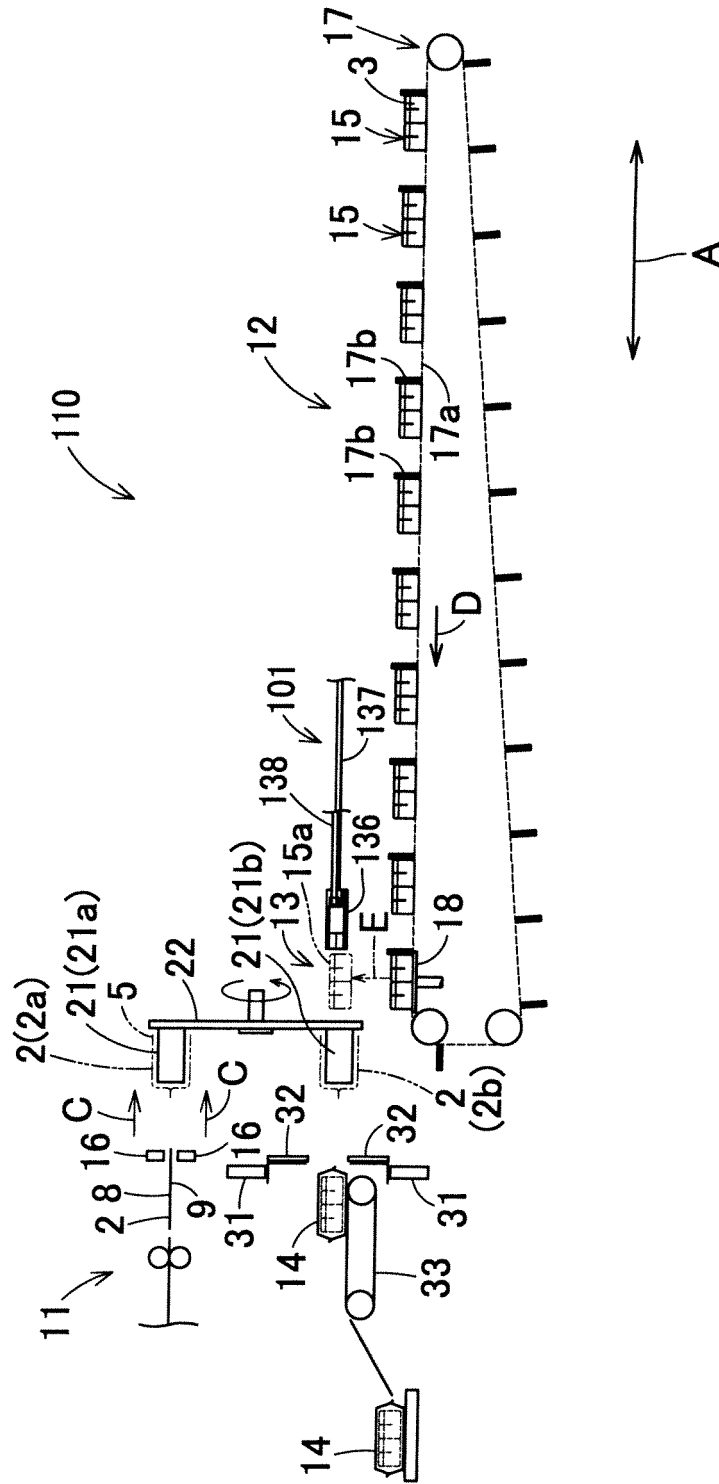


FIG. 8

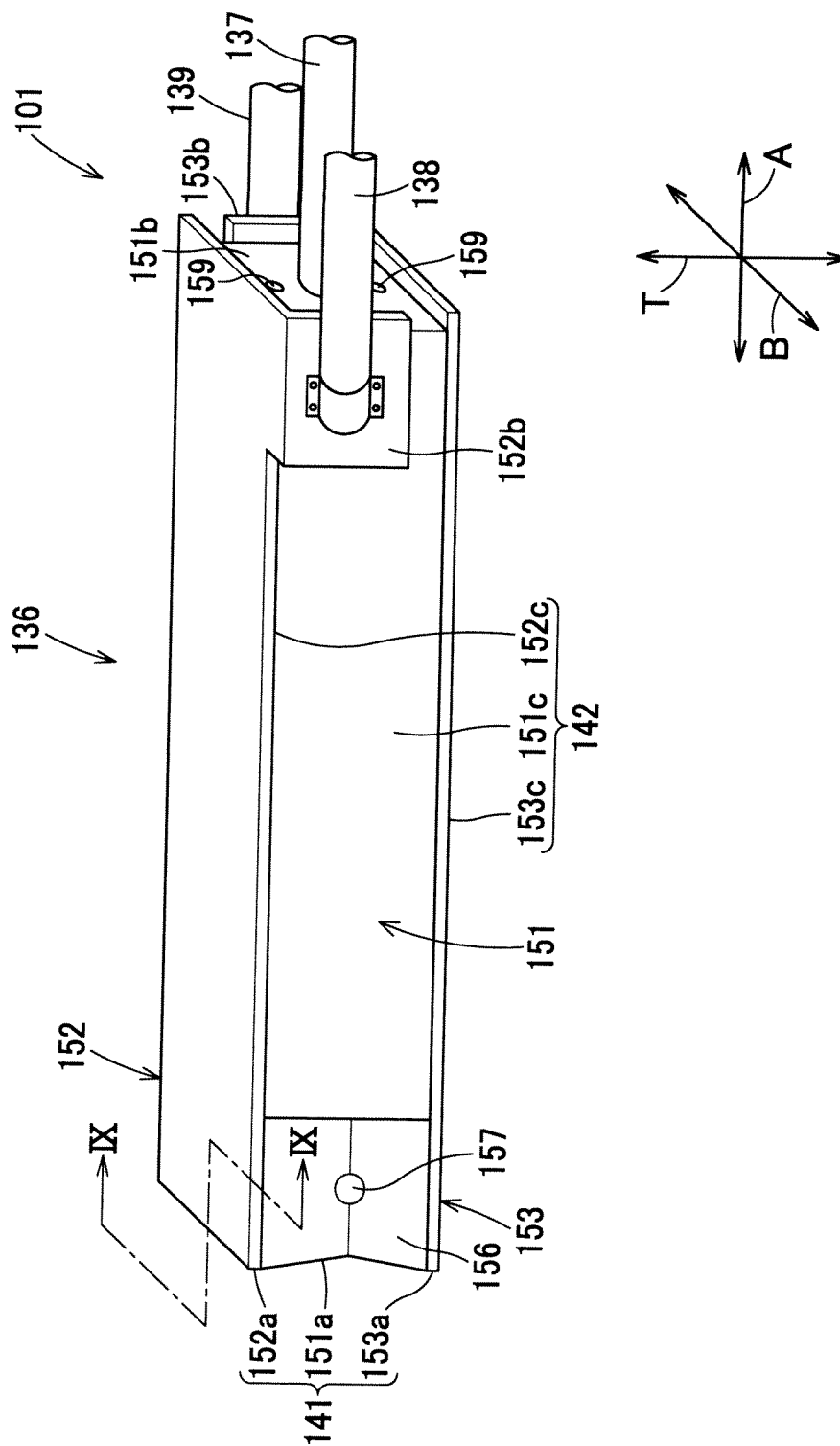


FIG.9

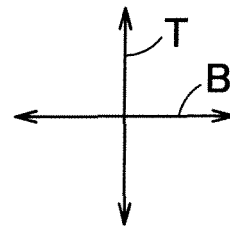
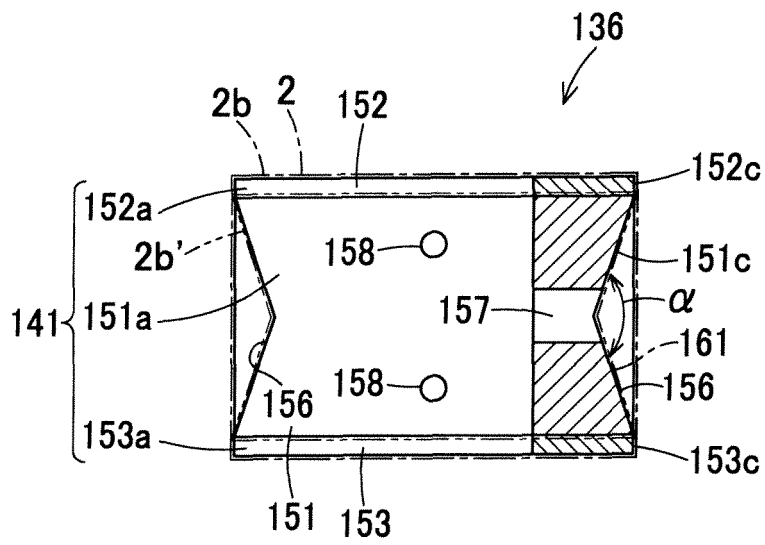


FIG.10A

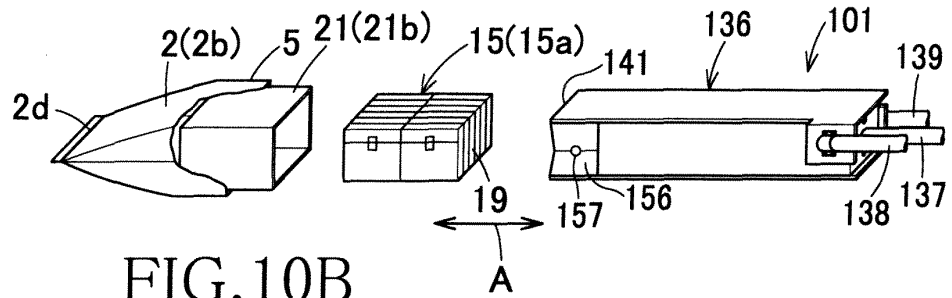


FIG.10B

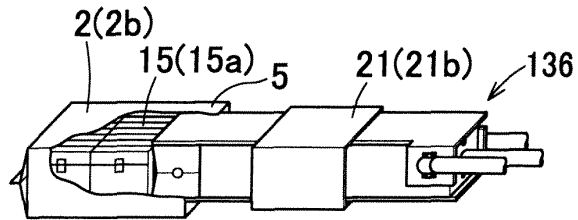


FIG.10C

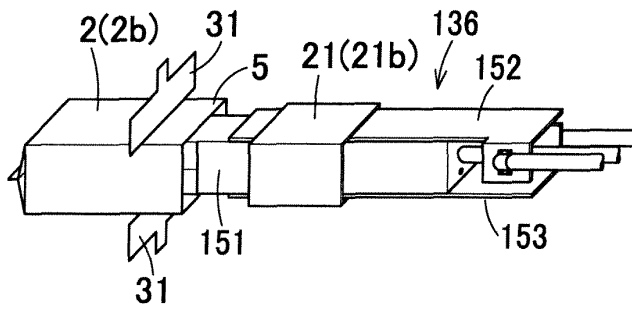


FIG.10D

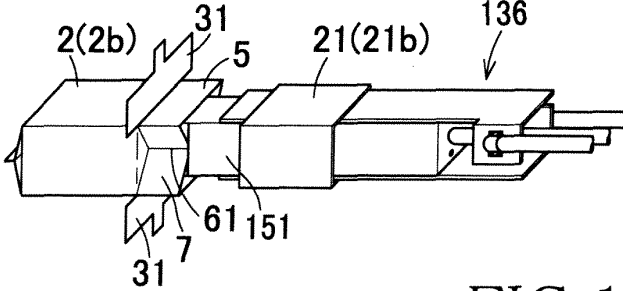


FIG.10E

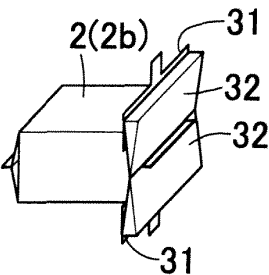


FIG.10F

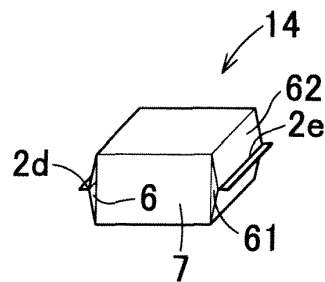


FIG.11

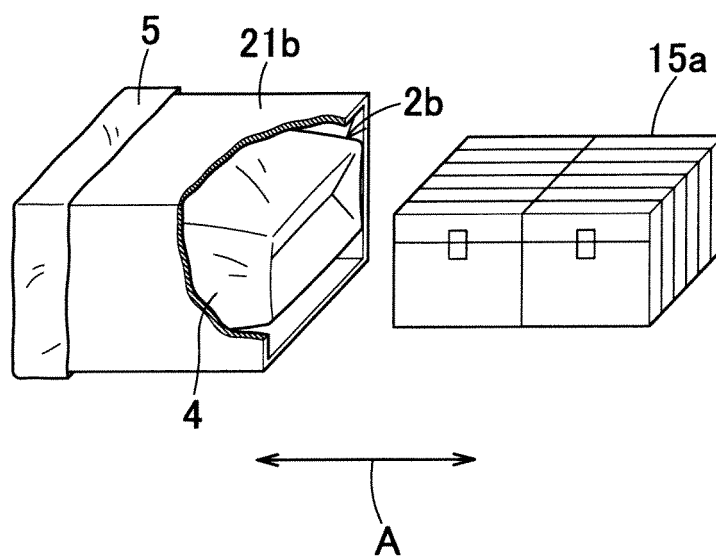


FIG.12

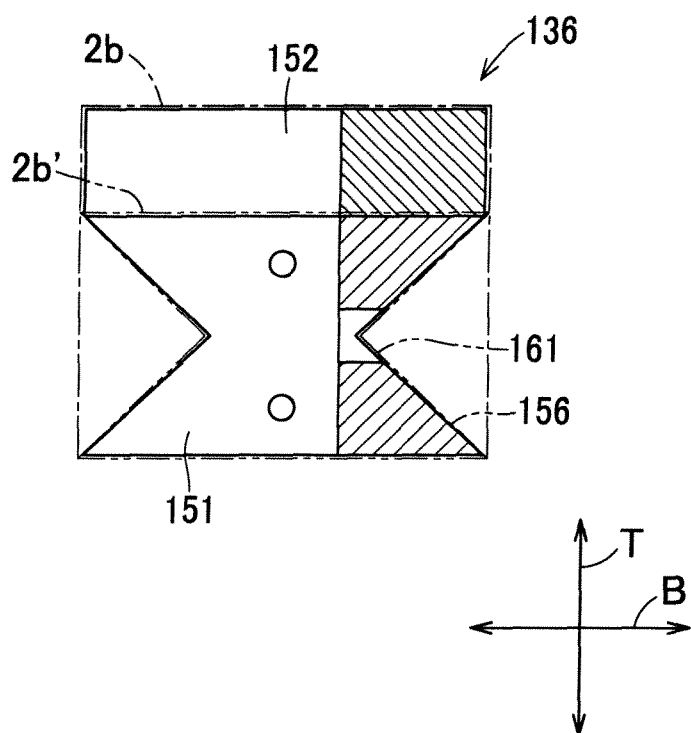
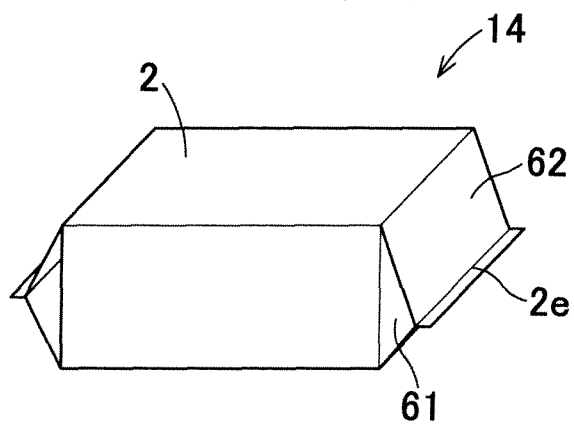


FIG.13



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2008/073037

A. CLASSIFICATION OF SUBJECT MATTER

B65B5/06(2006.01)i, B65B35/20(2006.01)i, B65B51/10(2006.01)i, B65B51/14(2006.01)i, B65G47/82(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B65B5/06, B65B35/20, B65B51/10, B65B51/14, B65G47/82

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2009
Kokai Jitsuyo Shinan Koho 1971-2009 Toroku Jitsuyo Shinan Koho 1994-2009

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 151419/1985 (Laid-open No. 060505/1987) (Orion Kikai Kogyo Kabushiki Kaisha), 15 April, 1987 (15.04.87), Description, page 7, line 13 to page 14, line 14; Figs. 1 to 4 (Family: none)	1-4 5-7
Y A	JP 2003-137202 A (Aititekuno Kabushiki Kaisha), 14 May, 2003 (14.05.03), Par. No. [0043]; Fig. 10 (Family: none)	1-4 5-7

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:

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"E" earlier application or patent but published on or after the international filing date

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
13 January, 2009 (13.01.09)

Date of mailing of the international search report
20 January, 2009 (20.01.09)

Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 61160002 Y [0002]