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(71) Applicant: **SATAKE ENGINEERING CO., LTD.**
7-2, Sotokanda 4-chome
Chiyoda-ku Tokyo 101(JP)

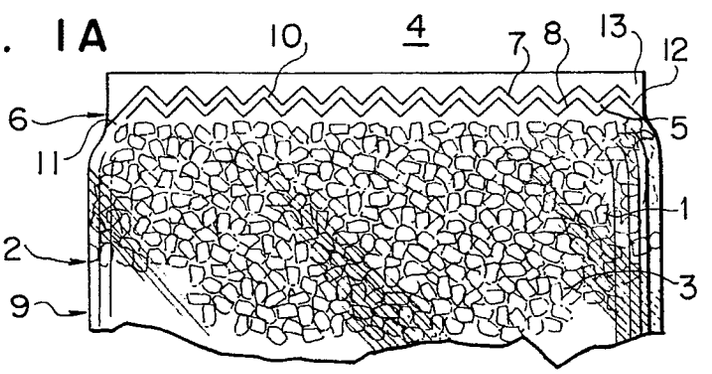
(72) Inventor: **Satake, Toshihiko**
2-38, Saijo Nishihonmachi
Higashihiroshima-shi(JP)
Inventor: **Kanemoto, Shigeharu**
947-3, Miyauracho
Mihara-shi(JP)
Inventor: **Ohno, Chiaki**
25-9, Nigata Nishikicho
Kure-shi(JP)
Inventor: **Kataoka, Minoru**
642, Oda, Kochicho
Kamo-gun, Hiroshima-ken(JP)

(74) Representative: **Patentanwälte Grünecker, Kinkeldey, Stockmair & Partner**
Maximilianstrasse 58
W-8000 München 22(DE)

(54) Vacuum packing method and apparatus for practicing the same.

(57) According to a vacuum packing method for packing contents in a reduced pressure, comprising steps of: after filling the contents into a packing bag, sealing a mouth portion of the packing bag in such a manner as to leave an elongated non-linear communication passage between an inner region of the bag in which the contents are filled and an outside of the bag so as to form an intermediate packed article; subjecting the intermediate packed article to pressure reduction for degassing the inner region in the intermediate packed article; and after the pressure reduction and degassing step, restoring an atmosphere around the packed article to the atmospheric pressure so as to close the communication passage, the vacuum packed state of the article can be maintained in the atmospheric air without sealing the bag member as by welding after the pressure-reduction or evacuation is effected.

FIG. 1A



EP 0 441 189 A1

VACUUM PACKING METHOD AND APPARATUS FOR PRACTICING THE SAME

FIELD OF THE INVENTION

The present invention relates to a vacuum packing method and an apparatus for practicing the same. It is noted in this specification that the term of "vacuum packing" means to pack contents in a bag by reducing the pressure in the bag sufficiently lower than the atmospheric pressure. The pressure in the bag may be relatively high, for example in the order of a few or several hundreds torr, depending upon the kind of contents.

DESCRIPTION OF THE PRIOR ART

There has been disclosed in Japanese Patent Unexamined Publication No. 51-40291 a vacuum packing method and an apparatus therefor in which after a mouth or opening of a bag is temporarily or roughly sealed in such a manner as to prevent the leakage of contents such as cereal grains or the like, the bag thus sealed temporarily is placed in a closed chamber covered with a cover ember serving as a vacuum chamber-forming means, and the interior of the closed chamber is evacuated and, at the same time, the bag is shaped by a pressure plate, and thereafter, the mouth of the bag is sealed completely in the closed chamber.

However, according to the above vacuum packing method, it is necessary for the mouth of the bag to be subjected to the sealing step at twice. Furthermore, in this vacuum packing apparatus, it is necessary to equip a sealing machine for bag welding use which is capable of being positioned in the closed chamber of a vacuum chamber-forming device.

On the other hand, there has been disclosed in Japanese Patent Unexamined Publication No. 58-193227 a vacuum packing method and an apparatus therefor in which after filling contents into a packing bag one end of which is opened, a nozzle is inserted into the opening of the packing bag so as to permit parts of the opening around the inserted nozzle to be sealed, then the interior of the bag is evacuated under an environment of the atmospheric pressure, and the then remaining parts of the opening which are brought into close contact with each other are sealed by welding.

However, even according to this vacuum packing method, it is necessary that the mouth or opening of the bag is subjected to the sealing step at twice. In addition, in the case of this vacuum packing method, it is necessary to shift the nozzle away from the sealing position at the time of the second sealing work. Furthermore, in the case of this vacuum packing method, there is a possibility that a part of the contents is sucked into the nozzle when elements constituting the contents are relatively small in size. Moreover, in this case, there is another possibility that a trace of the shape of the nozzle is left on the bag. Further, in this vacuum packing apparatus, it is required to provide the sealing machine with the vacuum suction nozzle.

Further, in Japanese Patent Unexamined Publication No. 63-317430, a vacuum shaping apparatus is disclosed in which a vacuum-packed article, formed by vacuum-packing granular contents such as rice grains, wheat grains, coffee beans or the like in advance making use of a similar method to the vacuum packing method disclosed in Japanese Patent Unexamined Publication No. 58-193227, is placed in a closed chamber covered with a cover member serving as a vacuum chamber-forming means, the pressure in the closed chamber is reduced down to the internal pressure of the packed article, and then the packed article is given with pressure and oscillation due to a pressure holding plate so as to be shaped.

However, in the case of the similar method to the vacuum packing method disclosed in Japanese Patent Unexamined Publication No. 58-193227, suction or evacuation by the nozzle is performed in the atmospheric environment so that it is hard to avoid variation or unevenness in the degree of vacuum in the packing bags. Accordingly, the pressure in the closed chamber does not always become equal to the internal pressure of the packed article in some cases. Concerning the packed articles the internal pressure of which is relatively low, for example, the internal pressure is lower than the pressure in the vacuum chamber, resulting in that it is difficult to shape the article satisfactorily.

SUMMARY OF THE INVENTION

The present invention has been made in view of the above-described points and an object thereof is to provide a vacuum packing method which is capable of enabling the vacuum-packed state to be maintained in the atmospheric air even without sealing a bag member as by welding after the evacuation suction is effected, and an apparatus for practicing this method.

To this end, there is provided according to the present invention a vacuum packing method for packing contents in a reduced pressure, comprising the steps of: after filling a predetermined quantity of the contents into a packing bag, sealing a mouth or opening portion of the packing bag in such a manner as to leave an elongated non-linear communication passage between an inner region of the bag in which the contents are filled and an outside of the bag so as to form an intermediate packed article; subjecting the intermediate packed article to pressure reduction for degassing the inner region in the intermediate packed article; and after the pressure reduction and degassing step, restoring an atmosphere around the packed article to the atmospheric pressure so as to close the communication passage.

In accordance with the vacuum packing method of the present invention, since the intermediate packed article is formed by sealing the mouth portion of the packing bag in such a manner as to leave the elongated non-linear communication passage between the inner region of in the bag in which the contents are filled and the outside of the bag, it is possible to let air out of (degas) the intermediate packed article through the elongated non-linear communication passage by subjecting the intermediate packed article to pressure reduction. Further, according to the vacuum packing method of the invention, the inner region of the bag in which the contents are filled is communicated with the outside of the bag only through the elongated non-linear communication passage defined by a wall portion having the flexibility attributable to the bag itself, so that the communication passage defined by the flexible wall is squashed to be closed simply by restoring the atmosphere around the packed article to the atmospheric pressure after the degassing. The communication passage thus squashed serves as a check valve in practice so that the sealing is completed automatically. It is preferred that the restoring to the atmospheric pressure is effected rapidly. The term of "rapidly" means, herein, that the restoring is effected sufficiently more quickly than the internal pressure of the packed article becomes higher through the communication passage. In this case, it is possible to close the communication passage without breaking or affecting the vacuum or reduced-pressure state in the packed article in practice. In the case of this method, if the communication passages of the respective packing bags are formed to have the same configuration and size, it is possible to positively obtain the packed articles of a substantially uniform degree of vacuum or reduced pressure by keeping the degassing condition constant.

In a vacuum packing method according to a preferred embodiment of the present invention, the communication passage is formed into a zigzag shape in the intermediate packed article forming step. Further, in a vacuum packing method according to another preferred embodiment of the invention, the communication passage is formed into a mazy shape in the intermediate packed article forming step. The open ends of the communication passage may be formed at side ends of the bag or at a central or intermediate position(s) between the side ends.

In a vacuum packing method according to a preferred embodiment of the invention, the degree of expansion of the packing bag of the intermediate packed article is controlled to be not greater than a predetermined level by a wall of a vacuum chamber, for example, in the pressure reduction and degassing step. In this case, there is no possibility that the bag is expanded in excess to be burst or ruptured even if a large differential pressure is applied between the inside and outside of the bag.

In a vacuum packing method according to a preferred embodiment of the invention, the intermediate packed article is pressed from outside during at least a part of a period of the pressure reduction and degassing step. In this case, pressing of the intermediate packed article makes it possible not only to reduce the time required for the pressure reduction and degassing but also to perform the shaping of the packed article.

In a vacuum packing method according to a preferred embodiment of the invention, the intermediate packed article is vibrated or oscillated during at least a part of a period of the pressure reduction and degassing step. In this case, giving vibration or oscillation to the intermediate packed article makes it possible not only to perform the shaping of the packed article but also to reduce the time required for the pressure reduction and degassing.

In a vacuum packing method according to a preferred embodiment of the invention, the intermediate packed article is pressed from an outside thereof while being vibrated or oscillated during at least a part of a period of the pressure reduction and degassing step. In this case, giving vibration or oscillation to and pressing of the intermediate packed article make it possible not only to reduce the time required for the pressure reduction and degassing but also to perform the shaping of the packed article.

A vacuum packing method according to a preferred embodiment of the invention further comprises the step of closing the communication passage by an additional sealing after the step of exposing to the air, i.e. restoring the atmosphere to the atmospheric pressure. The term "additional sealing" referred to in this case means the simple one such as the bonding with a bonding agent or the adhering of a sheet such as paper, for example. However, if desired, the communication passage may be additionally sealed as by heat

welding means at least at a portion of the aperture or opening thereof. In the case of this embodiment, the vacuum packed state can be prevented from being broken even if it is handled very roughly during the transportation or the like.

Further, there is provided according to the present invention a vacuum packing apparatus for packing, in a reduced pressure, contents of an intermediate packed article formed by sealing a mouth or opening portion of a packing bag in which the contents are filled in such a manner as to leave an elongated non-linear communication passage between an inner region of the bag in which the contents are filled and an outside of the bag, which apparatus comprises a cradle plate on which the intermediate packed article is to be placed, vibration means for vibrating or oscillating the cradle plate on which the intermediate packed article is placed so as to give vibration or oscillation to the intermediate packed article, a chamber-forming means having a concave portion of a capacity greater than a volume of the intermediate packed article, a periphery of an opening end of the concave portion being brought into air-tight contact with the cradle plate so as to form an openable closed chamber in cooperation with the cradle plate, pressure reduction means for reducing a pressure in the closed chamber, and air supply means for supplying air rapidly into the closed chamber, and wherein the intermediate packed article placed on the cradle plate is given with vibration or oscillation by the vibration or oscillation means within the closed chamber and, at the same time, the pressure in the closed chamber is reduced by the pressure reduction means so as to reduce a pressure in the inner region of the intermediate packed article through the communication passage thereof, and thereafter, the pressure in the closed chamber is restored to the atmospheric pressure rapidly by the air supply means. In this case, there is no necessity to equip a sealing machine in the vacuum chamber-forming means because the additional sealing is not necessarily required.

In addition, there is provided according to the present invention a vacuum packing apparatus for packing, in a reduced pressure, contents of an intermediate packed article formed by sealing a mouth portion of a packing bag in which the contents are filled in such a manner as to leave an elongated non-linear communication passage between an inner region of the bag in which the contents are filled and the outside of the bag, which apparatus comprises a cradle plate on which the intermediate packed article is to be placed, vibration means for vibrating or oscillating the cradle plate on which the intermediate packed article is placed so as to give vibration or oscillation to the intermediate packed article, a chamber-forming means having a concave portion of a capacity greater than a volume of the intermediate packed article, a periphery of an opening end of the concave portion being brought into air-tight contact with the cradle plate so as to form an openable closed chamber in cooperation with the cradle plate, pressure means connected to the chamber-forming means for serving to press a top surface of the intermediate packed article placed on the cradle plate, pressure reduction means for reducing a pressure in the closed chamber and air supply means for supplying air rapidly into the closed chamber, and wherein the intermediate packed article placed on the cradle plate is given with vibration or oscillation by the vibration or oscillation means within the closed chamber while being pressed by the pressure means and, at the same time, the pressure in the closed chamber is reduced by the pressure reduction means so as to reduce a pressure in the inner region of the intermediate packed article through the communication passage thereof, and thereafter, the pressure in the closed chamber is restored to the atmospheric pressure rapidly by the air supply means.

The foregoing and other objects, features as well as advantages of the invention will be made clearer from description of preferred embodiments of the invention referring to attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figures 1A to 1C are explanatory views of intermediate packed articles, a mouth or opening of a bag of each article being sealed by a welding sealing machine known per se in accordance with a vacuum packing method of a preferred embodiment of the present invention in such a manner that an elongated non-linear communication passage is left;

Figure 2 is a front sectional view of a vacuum packing apparatus for practicing a vacuum packing method according to a preferred embodiment of the invention;

Figure 3 is a front sectional view of the apparatus of Figure 2 but showing an operating state different from that of Figure 2;

Figure 4 is a front sectional view of a vacuum packing apparatus for practicing a vacuum packing method according to another preferred embodiment of the invention;

Figure 5 is a front sectional view of a vacuum packing apparatus for practicing a vacuum packing method according to still another preferred embodiment of the invention;

Figure 6 is a front sectional view of the apparatus of Figure 5 but showing an operating state different from that of Figure 5; and

Figures 7 and 8 are views for explanation of vacuum packing methods according to further preferred

embodiments of the invention in which a packed article is subjected to an additional sealing work.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

Description will now be given of preferred embodiments of the present invention with reference to the drawings.

Contents 1 are first filled or stuffed into a packing bag 2 and, then, a mouth or opening portion 6 of the packing bag 2 is subjected to the sealing work along lines 7, 8 in such a manner as to permit an elongated non-linear communication passage 5 to be left between a region 3 in the bag 2 in which the contents 1 are filled and an outside 4 of the bag 2, thereby forming an intermediate packed article 9 shown in Figure 1A, for example.

The contents 1 consist of cereal grains such as rice grains, wheat grains, coffee beans or the like, for example. The contents 1 may be other granular substance than the cereal grain or a substance of similar shape such as tea. However, the contents are not limited to these substances but may be any goods so far as it is suitable for the vacuum packing and can be received in the bag 2.

The packing bag 2 is typically made of a thermoplastic film or sheet, and however, it may be made of other material so far as it is a flexible sheet material and fits for the sealing work. More specifically and typically, the film may be made from laminated layers, one of which comprises a gas barrier resin layer of material such as polyamide resin, saponificated ethylene-vinyl acetate copolymer, thermoplastic polyester or polyvinylidene chloride, and the other of which is a transparent polyolefin resin layer of material such as low-density polyethylene, ethylene-vinyl acetate copolymer or polypropylene, as described in Japanese Patent Examined Publication No. 57-40781.

The size of the bag 2, the thickness of the film constituting the bag 2 and the like are so selected as to be conformed to the volume, weight and the like of the contents 1 to be received.

The communication passage 5 is formed to extend long (length) and slenderly or narrow (width) so that when the pressure at the outside 4 of the bag 2 becomes higher than the pressure at the inside 3 thereof, communication between the inside and outside 3 and 4 of the bag 2 is interrupted in a short time due to deformation of a portion of the film constituting a peripheral wall 10 of the communication passage 5. The width and length of the communication passage 5 are respectively sufficiently wide and short enough to make it possible to deflate a gas from the inside 3 of the bag 2 through the communication passage 5 within a short time (within about ten seconds, for example) so as to substantially equalize the pressures at the inside and outside 3 and 4 of the bag 2 to each other when the pressure at the inside 3 of the bag 2 is higher than the pressure at the outside 4 of the bag 2 beyond a certain degree (beyond several hundred torr, for example) as described later in detail. The width and length of the communication passage 5 are selected in accordance with the bag size, kind of material of the film forming the bag 2, thickness of the film and the like. In the case of the example shown in Figure 1A, the communication passage 5 is defined between sealing lines 7 and 8 to extend from a small opening 11 to small openings 12, 13 in a zigzag way. The width of the communication passage 5 may vary depending upon the longitudinal position thereof. In such case, it is preferred to make it easy to close the passage at a narrow portion serving as a bottle neck. The apertures 11, 13 may be formed at intermediate regions, instead of side ends, as shown in Fig. 1C.

Since a sealing operation effected on a bag of a thermoplastic film using the heat or thermal welding as indicated by the sealing lines 7, 8 and a sealing device for carrying out such sealing operation per se is well known, detailed explanation thereof will be omitted. The small openings or apertures 11, 13 can be formed, for example, by placing a thermally passive or non-operative material such as glass fibers in the form of a tape at each of the positions for the apertures 11, 13 before thermal welding operation to form the sealing lines 7, 8. Such provision of glass fibers allows to form the apertures 11, 13 when the sealing lines 7, 8 has been formed. It is noted that any other device or method is available as well so far as it is capable of providing the similar sealing lines and apertures.

This type of bags, having seal lines with small apertures left, per se are known for example in Japanese Patent Examined Publication No. 57-40781 for packing the contents such as mushroom which generate a gas such as carbon dioxide, where there is a possibility that the gas is accumulated in the packing bag to cause the swelling and rupture of the bag provided that the sealing is so effected as to make airtight completely the interior of the bag. In this known sealing technique, therefore, such possibility can be avoided by discharging the gas generate in the bag through an elongated communication passage. In this respect, the present invention differs from this known technique in terms of the manner of using the communication passage.

In place of the zigzag one shown in Figure 1A, the communication passage may be a mazy one 14 or 15 as shown in Figure 1B or 1C, for example. In the case of an intermediate packed article 24 shown in Figure 1B, sealing lines 16 and 17 themselves are straight lines so that the communication passage 14

leads from a gap or a small opening or aperture 11 defined between one end of the sealing line 17 and the peripheral wall of the mouth or opening portion 6 of the bag 2 to another gap or a small opening or aperture 13 defined between one end of the sealing line 16 and the peripheral wall of the mouth or opening portion 6 of the bag 2 through a rectilinear intermediate passage 18. In the case of an intermediate packed article 25 shown in Figure 1C as well, sealing lines 19 and 20 per se are straight lines. However, the sealing line 19 is divided into a plurality of segments 19a, 19b and 19c by intermediate gaps or apertures 21a and 21b, while the sealing line 20 is divided into a plurality of segments 20a and 20b by an intermediate gap or aperture 22. In consequence, the communication passage 15 consists of a first communication passage portion 15a leading from the gap 22 to the gap 21a through an intermediate passage portion 23a and a second communication passage portion 15b leading from the gap 22 to the gap 21b through an intermediate passage portion 23b. One of the apertures 21a, 21b may be omitted, i.e. sealed. Such being the case, the aperture 22 will be offset from the center to allow the associated passage 23a or 23b sufficiently long.

Next, description will be given of the process of letting air out of the inside of the intermediate packed article 9 shown in Figure 1A, for example, with reference to Figures 2 and 3.

Reference numeral 31 denotes a plate pedestal or base fixed to a frame (not shown). A cover member 33 serving as chamber-forming means which cooperates with the pedestal 31 to form a closed chamber 32 is connected to the pedestal 31 through a hinge element 34 so as to be able to rotate in the directions A and B with respect to the pedestal 31. The hinge element 32, however, can be dispensed with. When the cover member 33 is rotated in the direction B and put on the pedestal 31 as shown in the drawing, a peripheral wall end face 35 of an opening portion of a concave portion 33a of the cover member 33 is brought into airtight contact with an upper surface 36 of the pedestal 31. If desired, either of the airtight contact surfaces 35 and 36 may be provided with a proper sealing means such as a seal ring. Although the height C of the cover member 33 is so selected as to be suitable for the degassing operation to be described later, the cover member 33 may be constructed to have a changeable or variable height C.

An oscillating or vibrating plate 38 serving as cradle plate is placed horizontally on the pedestal 31 through an air bag 37. The cradle plate 38 may be formed in the upper surface thereof with a concave portion of a prescribed form suited to the form into which the lower part of the packed article 9 is to be shaped, in place of a flat surface. The air bag 37 is fixed to the pedestal 31 at the lower end hereof and to the oscillating plate 38 at the upper end thereof in such a manner that it is made to expand in the direction D when the pressure in the closed chamber 32 is lowered and to contract in the direction E when the pressure in the closed chamber 32 is increased or when the intermediate packed article 9 or the like is put on the oscillating plate 38. The quantity of air in the air bag 37 may be kept constant or adjustable. An oscillation or vibration generator or generating device 39 serving to oscillate upon receiving energy from the power supply (not shown), for example, is fixed to the oscillating plate 38 so that, when the oscillation generator 39 is made to oscillate, the oscillating plate 38 fixed thereto is caused to oscillate in the horizontal and/or vertical plane, for example.

A pressure plate 41 is fixed to the inner wall of the cover member 33 through elastic members 40 in such a manner as to be opposed to the oscillating plate 38 with space 42 left therebetween when the cover member 33 is brought into a closed chamber-forming position thereof as shown in the drawing. The distance F between a lower surface 43 of the pressure plate 41 and an upper surface 44 of the oscillating plate 38 is greater than the thickness G of the intermediate packed article 9 under the atmospheric pressure.

Reference numeral 45 denotes a evacuating or exhaust device such as a vacuum pump. The evacuating device 45 serves to reduce the pressure in the closed chamber 32 through a pipe 46.

In case of performing the degassing by a degassing apparatus 47 constructed as described above, the cover member 33 is first opened in the direction A through the medium of a handle (not shown), for example, so as to permit the intermediate packed article 9 to be put on the oscillating plate 38, and then, the energy is supplied to the oscillation generator 39 to cause the oscillation plate 38 to oscillate. At this time, since the intermediate packed article 9 on the oscillation plate 38 is also made to oscillate together with the oscillation plate 38, even if the height of the intermediate packed article 9 is not uniform exceedingly at first as indicated by an imaginary line in Figure 2, the contents are moved due to oscillation so that the nonuniformity of height can be reduced as indicated by a solid line in Figure 2, for example, thereby enabling the intermediate packed article 9 to be shaped to a satisfactory degree or, in some cases, almost completely.

Then, if desired, the cover member 33 is rotated in the direction B after once interrupting the oscillation due to the oscillation generator 39, so as to form the closed chamber 32 as shown in Figure 2. At this time, the space 48 is left between the top portion of the shaped intermediate packed article 9 and the lower surface 43 of the pressure plate 41. When the height C of the cover member 33 is sufficiently high or when

the intermediate packed article 9 is freed from over little suffered from the nonuniformity of height, the oscillation or vibration plate 38 may be started to be oscillated or vibrated after the cover member 33 is closed.

Then, as the evacuation device 45 is made to operate, the pressure in the closed chamber 32 is reduced rapidly so that the bag 2 of the intermediate packed article 9 is made to expand due to the pressure difference between the inside and outside of the bag 2 as shown in Figure 3. On the other hand, since the inside and outside of the bag 2 are communicated with each other through the elongated communication passage 5, the air in the bag 2 is discharged into the closed chamber 32 through the communication passage 5, thereby performing the degassing of the stuffed or filled area 3 of the intermediate packed article 9. Further, at this time, the air bag 37 is also caused to expand gradually to push up the oscillating plate 38 in the direction D so that the packed article 9 is pressed against the pressure plate 41. This pressing promotes the degassing of the packed article 9. During the evacuation and degassing, since the oscillation generator 39 continues to operate, the shaping function is continued due to the oscillation of the oscillating plate 38.

After a predetermined time has elapsed in accordance with various characteristics of the intermediate packed article 9, as the oscillation generator 39 is stopped to operate and a valve (not shown) for a branch pipe (not shown) of a pipe 46, for example, is opened to make the air flow into the closed chamber 32, the pressure in the chamber 32 constituting an atmosphere around the packed article 9 is increased very rapidly to become higher than the internal pressure of the packed article 9, resulting in that the elongated communication passage 5 of the packed article 9 is squashed to be closed abruptly so as to serve as a check valve in practice. In a vacuum packed article 49 thus completed, since the pressure at the inside of the packing bag 2 can be maintained lower than the pressure at the outside thereof (usually the atmospheric pressure), the vacuum packed article 49 can hold its vacuum shaped state or form permanently. With the increase of the pressure in the chamber 32, the air bag 37 is brought back again to its contracted state shown in figure 2. After the pressure in the chamber 32 is restored to the atmospheric pressure, the cover member 33 is opened in the direction A through the handle (not shown) so that the vacuum packed article 49 is taken out.

Not only the size and form of the cover member 33 and the size of the air bag 37 but also the amplitude and frequency of oscillation of the oscillation generator 39, the rate of exhaust by the pump 45 and the like are selected to be their respective predetermined values depending on the size and kind of the packed article 9, 49. It is of course possible as well that the oscillation generator 39, pump 45 and the like are so constructed as to be able to adjust these parameters.

By the way, before the degassing, the inside and outside of the intermediate packed article 9 are kept at the atmospheric pressure, so that the contents 1 in the packing bag 2 can flow freely in practice. Therefore, it is also possible to shape the intermediate packed article 9 manually after putting the same on the plate 38. In this case, the oscillation generator 39 may be dispensed with, and the oscillating plate 38 serves simply as the support and pressure plate. However, in order to sufficiently reduce the pressure in the vacuum packed article 49 in a short time, it is preferred as described later to oscillate or vibrate the bag 9 through the oscillating plate 38 even if the shaping is not needed.

Next, description will be given of a modified vacuum packing and shaping apparatus (referred to as "vacuum shaping apparatus" hereinafter) 51 used for practicing the vacuum shaping method according to a preferred embodiment of the present invention with reference to Figure 4. In the vacuum shaping apparatus 51, the same or similar components as those of the apparatus 47 shown in Figures 2 and 3 are designated by the same reference numerals.

In the vacuum shaping apparatus 51, reference numeral 52 denotes a cylinder device actuated by hydraulic or pneumatic pressure. The cylinder device 52 is fixed at cylinder main body portions 53 thereof to the cover member 33. Piston rod portions 54 of the cylinder device 52 penetrate through holes 55 formed in the cover member 33 in such a manner as to be slidable in the directions D and E with respect to the cover member 33. A pressure plate 56 is fixed to projected ends of the piston rod portions 54 so that, when the piston rod portions 54 of the cylinder device 52 are made to stretch in the direction E by means of a driving device (not shown), the pressure plate 56 acts to press the intermediate packed article 9 put on the oscillation plate 38, thereby effecting he degassing of the intermediate packed article 9. In case that the pressure in the chamber 32 is reduced, it is preferred to apply by the cylinder device 52 a force which has a magnitude at which the expansive force of the bag 2 of the packed article 9 in the direction D and the pressing force of the cylinder device 52 acting in the direction E are balanced. This is because, if the pressing force of the cylinder device 52 is too large, the bag 2 of the packed article 9 is prevented from expanding in excess to thereby hinder the contents 1 in the bag 2 from being given with oscillation. In consequence, the cylinder device 52 fulfills the same function as that the the air bag 37 of the apparatus 47.

However, since the cylinder device 52 can be actuated independently whether the pressure in the chamber 32 is reduced or not, it becomes possible, as the degassing of the bag 2 proceeds to make the bag 2 contract, to shape the intermediate packed article 9 without manually not only at the atmospheric pressure but also at reduced pressure. Further, it is also possible to change the operating conditions such as the length of extension stroke, pressing force and the like of the cylinder device 52 in accordance with the size, kind and the like of the intermediate packed article 9. It is common to the apparatuses 51 and 47 that the intermediate packed article 9 is pressed by the pressure plate and the oscillating plate, and however, in the case of the apparatus 51, it is not the oscillating plate but the pressure plate 56 to be moved in the directions E and D. Reference numeral 57 denotes an oscillation generator having the same function as that of the oscillation generator 39. In the apparatus 51, however, there is provided no air bag 37 so that the oscillation generator 57 can be attached to the lower surface of the oscillating plate 38 over a wide range. Reference numeral 58 denotes an elastic or resilient member serving to support he oscillating plate 38 while permitting the plate 38 to oscillate with respect to the pedestal 31.

It is evident that the apparatus 51 can be used for the vacuum packing and shaping of the intermediate packed article 9 in the same manner as the apparatus 47 shown in Figures 2 and 3 and, therefore, description of the operation thereof is omitted.

Next, description will be given of another modified vacuum packing and shaping apparatus (referred to as "vacuum shaping apparatus" hereinafter) 61 used for practicing the vacuum shaping method according to a preferred embodiment of the present invention with reference to Figures 5 and 6. In the vacuum shaping apparatus 61, the same or similar components as those of the apparatus 51 shown in Figure 4 are designated by the same reference numerals.

In the vacuum shaping apparatus 61, the cylinder device 52 of the apparatus 51 is dispensed with and the shaping of the packed article 9 is performed by the oscillation of the oscillating plate 38. If desired, the packed article 9 may be shaped manually beforehand as mentioned before. Further, in this apparatus 61, the height of the elastic support portion 58 and the height C of the cover member 33 are selected to be their respective predetermined values for the purpose of preventing the packing bag 2 by a top wall portion 33b of the cover member 33 from being expanded in excess to be burst or ruptured owing to the pressure reduction in the closed chamber 32.

It is evident that the apparatus 61 can be used for the vacuum packing and shaping of the intermediate packed article 9 in the same manner as the apparatus 47 shown in Figures 2 and 3 and the apparatus 51 shown in Figure 4 and, therefore, description of the operation thereof is omitted.

Description will now be given below of examples of the vacuum packing and shaping performed by making use of the vacuum packing and shaping apparatus 47 shown in Figure 4.

EXAMPLES

The cover member 33 had a concave portion 33a of the size which enabled the closed chamber 32 to have the volume of 30 liters, and the vacuum or exhaust pump 45 had the capacity of enabling the pressure in the closed chamber 32 to be reduced from 760 torr to 160 torr in five seconds. The air cylinders 52 serving as the pressure devices had the pressing force of 210 kgf at the maximum in all. 3 kg of polished rice grains were received as the contents in the packing bag 2 made from laminated film of polyamide resin layer (20 μm) and low density polyethylene layer (80 μm). The intermediate packed article 9 similar to that shown Figure 1C but the aperture 21b being sealed (closed) was made by the sealing machine known per se. The communication passage 23a was about 6 mm in width at the narrowest portion thereof and about 8 cm in length from the aperture 22 (offset from the center as described before) to the aperture 21a.

Results of the vacuum packing and shaping effected by the apparatus 51 shown in Figure 4 are shown in Table 1 below.As understood from Example 1, in case of exhausting at the aforementioned exhaust rate while operating the pressure devices 52 and the oscillation plate 38 concurrently, the pressure in the packed article 49 after the completion of the shaping was 230 torr and the shaped state of the packed article 49 was good as well. Accordingly, there is no possibility, differently from the case of bad shaping, that the bag 2

Table 1

Example No.	Pressure of vacuum in closed chamber	Pressure device 52	Oscillation device 38	Pressure of vacuum after shaping	Shaped state
1	160 torr	Maximum power use	Full time use	230 torr	Good
2	160 torr	Maximum power use	Unuse	650 torr	Bad
3	160 torr	Maximum power use	Initial two seconds	270 torr	Bad
4	160 torr	Unuse	Full time use	-	Bag burst
5	160 torr	100 kgf	Full time use	700 torr	Bad

is broken during the circulation or distribution of the packed article 49 as commercial goods through a trade market.

In case of effecting the vacuum shaping without oscillating the oscillation plate 38 as seen in Example 2, the pressure in the packed article 49 after the shaping was 650 torr which is not so low and the shaped state thereof was also bad. It is proved from this fact that the oscillation is effective for the shaping. Further, it is proved as well that the pressure in the packed article 49 after the shaping greatly depends on the presence of oscillation when the contents 1 consist of granular one such as polished rice grains. On the other hand, in case of operating the oscillation plate 38 only for initial two seconds of the 5-second evacuation time as seen in Example 3, although the pressure in the packed article 49 was sufficiently lowered to assure the vacuum packing completely, the shaped state was bad.

To the contrary, in case of keeping the pressure device 52 inoperative as seen in Example 4, the expansion of the bag 2 could not be controlled within the predetermined range so that the bag 2 was expanded in excess to be burst or ruptured. It goes without saying that different result can be obtained provided that the expansion of the bag 2 is controlled in the manner described in connection with the apparatus 61 shown in Figure 6, for example. On the other hand, in case of setting the pressing force of the pressure devices 52 as small as 100 kgf or so, the pressure in the packed article 49 was 700 torr which was not substantially lowered and the shaped state was also bad, and however, the bag 2 was prevented from being burst.

The examples described above were limited to cases where the capacity and working time of the vacuum pump 45 are fixed. Therefore, by adopting at least one of the measures including to lengthen the evacuation time while maintaining or decreasing the exhaust rate or speed of the vacuum pump 45 and to increase the degree of vacuum in the closed chamber 32 by improving the capacity of the vacuum pump 45, it will be possible to perform the vacuum packing even if the pressure device 52 and the oscillation device 39, 57 are not used. Furthermore, if the manual shaping is performed beforehand, the oscillation generator 39, 57 may not be used.

In addition, it is preferred that the volume of the closed chamber 32, oscillation energy of the oscillating plate 38, evacuating speed and the like can be adjusted in accordance with the size, kind and the like of the packing bag 2.

The vibrating, evacuating and/or pressing operations described above may be automatically controlled by a control mechanism (not shown).

A product finished through the above vacuum packing and shaping can maintain the vacuum packed

and shaped state thereof as it is under the normal handling condition. In order to make it possible to maintain the vacuum packed and shaped state even if given with an excessive shock during the transportation or the like, an additional sealing may be further performed for completely closing the fine gap, such as the apertures 13, 21a, 21b, of the vacuum packed and shaped article described above. It is sufficient for the additional sealing to close the fine gap (corresponding to the portion designated by reference numeral 13 in Figure 1A, for example) of the communication passage 5 only at portions designated by reference numeral 70 as illustrated in Figures 7 and 8, for example. The additional sealing means can include not only the heat or thermal welding by the sealing machine but also any simple means such as the application of a quick dry bonding agent or the like and the adhering of a sheet piece so far as being able to close the fine gap at the opening portion of the communication passage 5.

Claims

1. A vacuum packing method for packing contents in a reduced pressure comprising steps of:
   after filling said contents into a packing bag, sealing a mouth portion of said packing bag in such a manner as to leave an elongated non-linear communication passage between an inner region of the bag in which said contents are filled and an outside of the bag so as to form an intermediate packed article;
   subjecting the intermediate packed article to pressure reduction for degassing the inner region in the intermediate packed article; and
   after said pressure reduction and degassing step, restoring an atmosphere around the packed article to the atmospheric pressure so as to close said communication passage.

2. A method according to Claim 1, wherein said intermediate packed article forming step comprises forming said communication passage in the form of a zigzag shape.

3. A method according to Claim 1, wherein said intermediate packed article forming step comprises forming said communication passage in the form of a mazy shape.

4. A method according to Claim 1, wherein said pressure reduction and degassing step includes controlling the degree of expansion of the packing bag of the intermediate packed article to be not greater than a predetermined level.

5. A method according to Claim 1, wherein said pressure reduction and degassing step includes pressing the intermediate packed article from outside of the article during at least a part of a period of said pressure reduction and degassing step.

6. A method according to Claim 1, wherein said pressure reduction and degassing step includes vibrating the intermediate packed article during at least a part of a period of said pressure reduction and degassing step.

7. A method according to Claim 1, wherein said pressure reduction and degassing step includes pressing the intermediate packed article from outside of the article while vibrating the article during at least a part of a period of said pressure reduction and degassing step.

8. A method according to Claim 1, further comprising a step of closing said communication passage by an additional sealing means after said step of restoring the atmosphere.

9. A vacuum packing apparatus for packing, in a reduced pressure, contents of an intermediate packed article formed by sealing a mouth portion of a packing bag in which the contents are filled in such a manner as to leave an elongated non-linear communication passage between an inner region of the bag in which said contents are filled and an outside of the bag, said apparatus comprising:
   a cradle plate on which the intermediate packed article is to be placed;
   vibration means for vibrating the cradle plate on which the intermediate packed article is placed so as to give vibration to the intermediate packed article;
   a chamber-forming means having a concave portion of a capacity greater than a volume of the intermediate packed article, a periphery of an opening end of the concave portion being brought into air-tight contact with the cradle plate so as to form an openable closed chamber in cooperation with the cradle plate;

pressure reduction means for reducing a pressure in the closed chamber; and

air supply means for supplying air rapidly into the closed chamber,

wherein the intermediate packed article placed on the cradle plate is vibrated by the vibration means within the closed chamber and, at the same time, the pressure in the closed chamber is reduced by the pressure reduction means so as to reduce a pressure in the inner region of the intermediate packed article through the communication passage thereof, and thereafter, the pressure in the closed chamber is restored to the atmospheric pressure rapidly by the air supply means.

10. A vacuum packing apparatus for packing, in a reduced pressure, contents of an intermediate packed article formed by sealing a mouth portion of a packing bag in which the contents are filled in such a manner as to leave an elongated non-linear communication passage between an inner region of the bag in which said contents are filled and an outside of the bag, said apparatus comprising:

a cradle plate on which the intermediate packed article is to be placed;

vibration means for vibrating the cradle plate on which the intermediate packed article is placed so as to give vibration to the intermediate packed article;

a chamber-forming means having a concave portion of a capacity greater than a volume of the intermediate packed article, a periphery of an opening end of the concave portion being brought into air-tight contact with the cradle plate so as to form an openable closed chamber in cooperation with the cradle plate;

pressure means connected to the chamber-forming means for serving to press a top surface of the intermediate packed article placed on the cradle plate;

pressure reduction means for reducing a pressure in the closed chamber; and

air supply means for supplying air rapidly into the closed chamber,

wherein the intermediate packed article placed on the cradle plate is vibrated by the vibration means within the closed chamber while being pressed by the pressure means and, at the same time, the pressure in the closed chamber is reduced by the pressure reduction means so as to reduce a pressure in the inner region of the intermediate packed article through the communication passage thereof, and thereafter, the pressure in the closed chamber is restored to the atmospheric pressure rapidly by the air supply means.

FIG. 1A

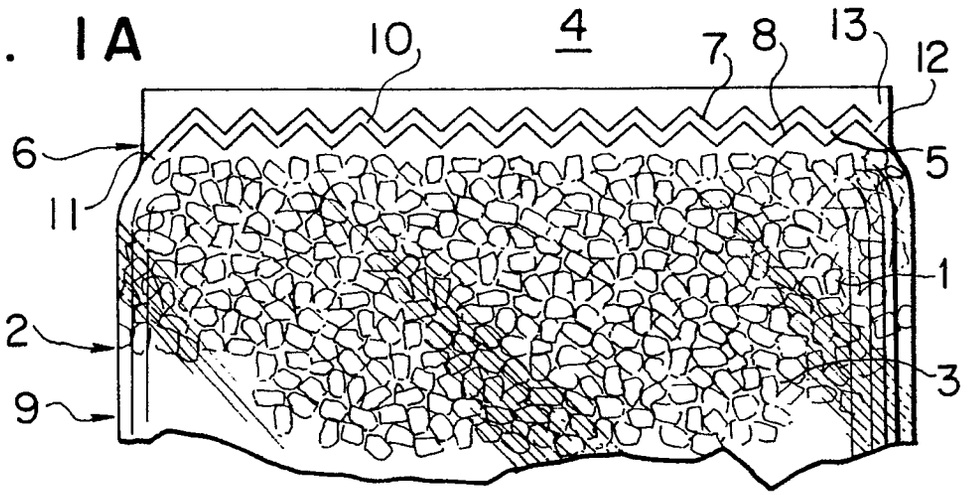


FIG. 1B

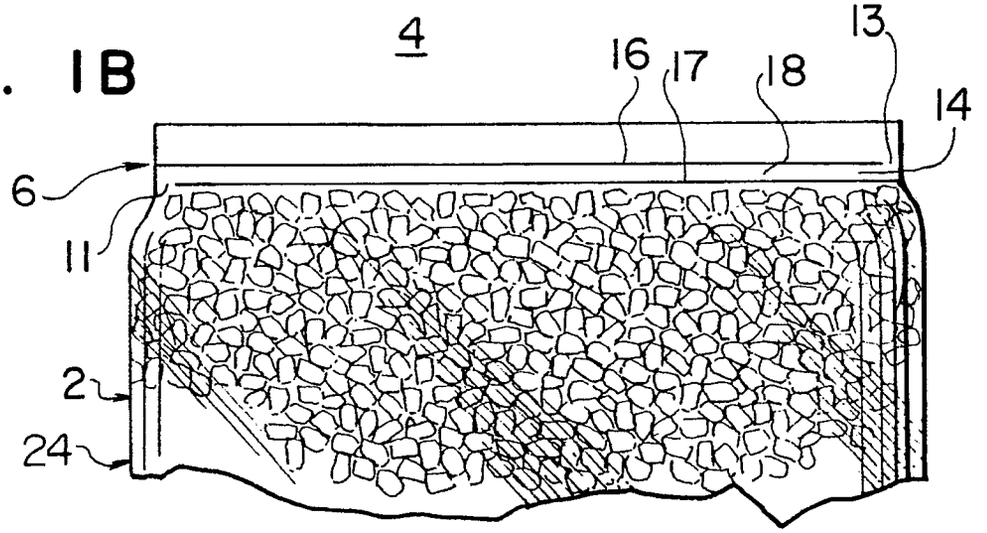


FIG. 1C

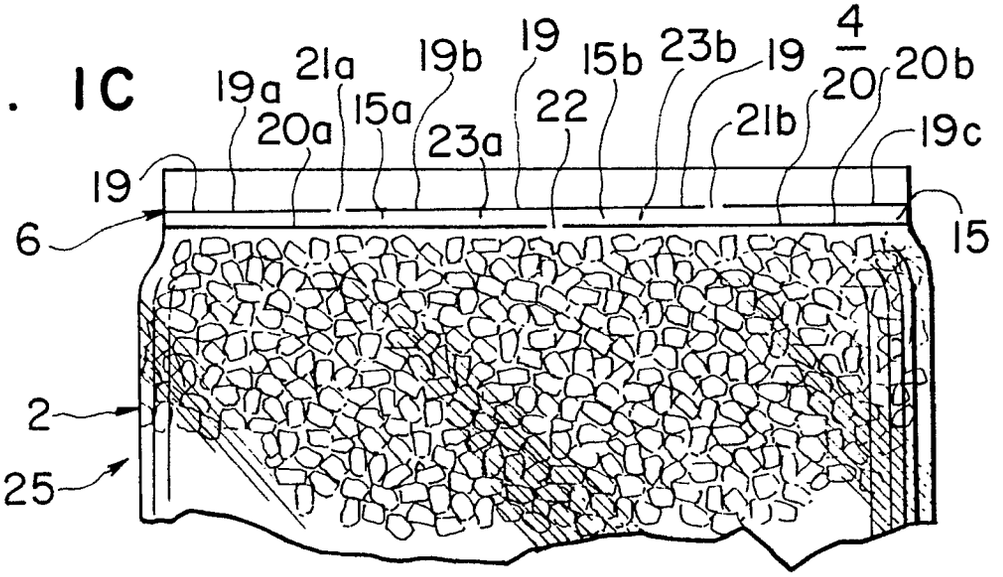


FIG. 2

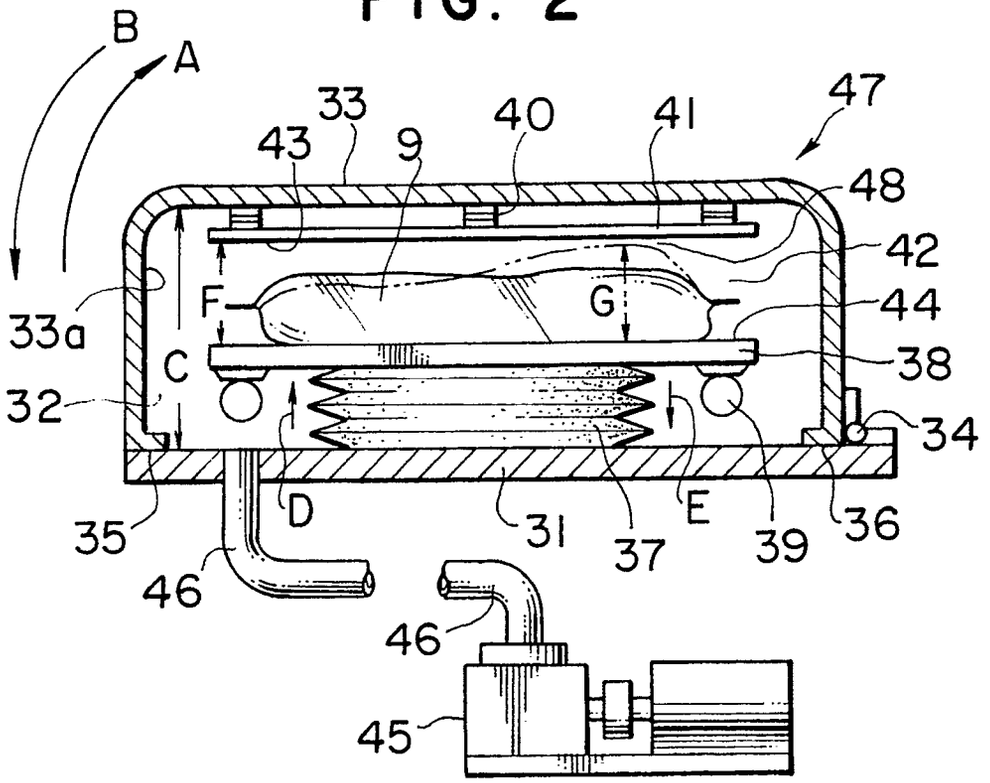

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FIG. 3

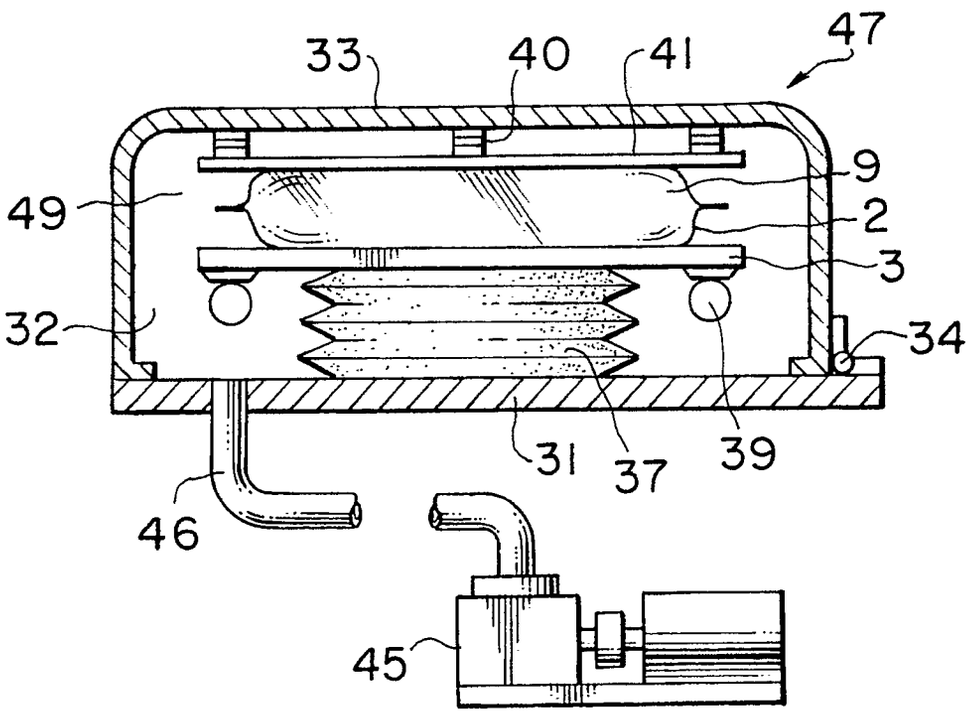
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FIG. 4

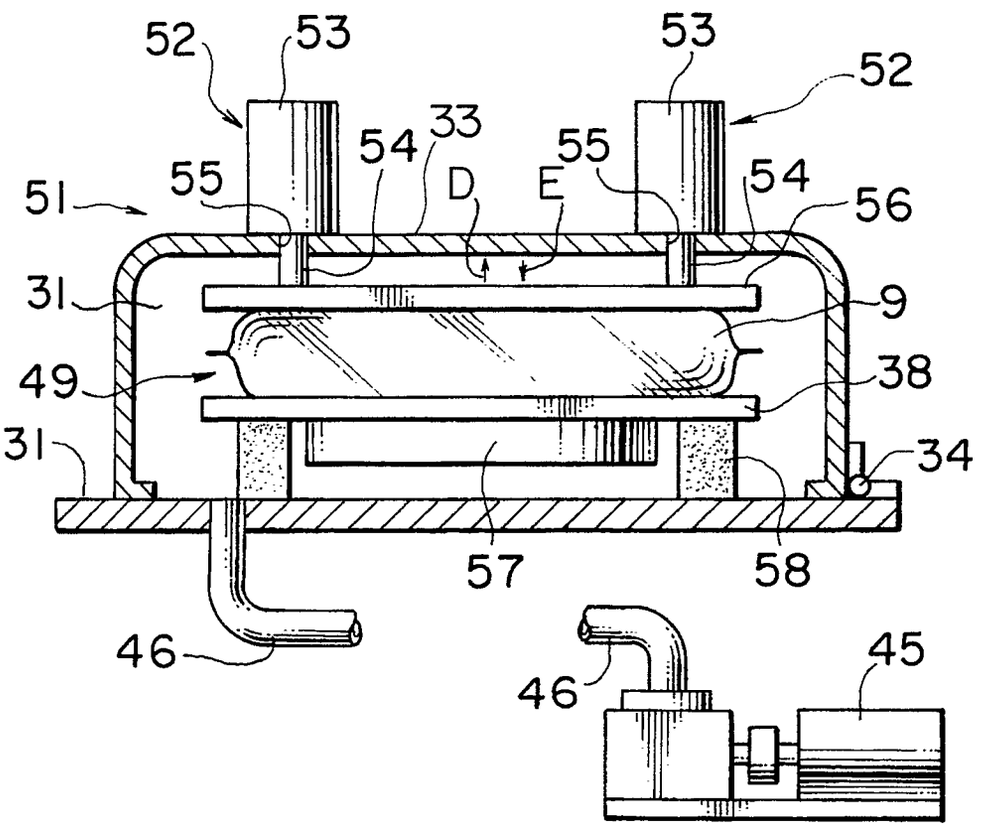

FIG. 5

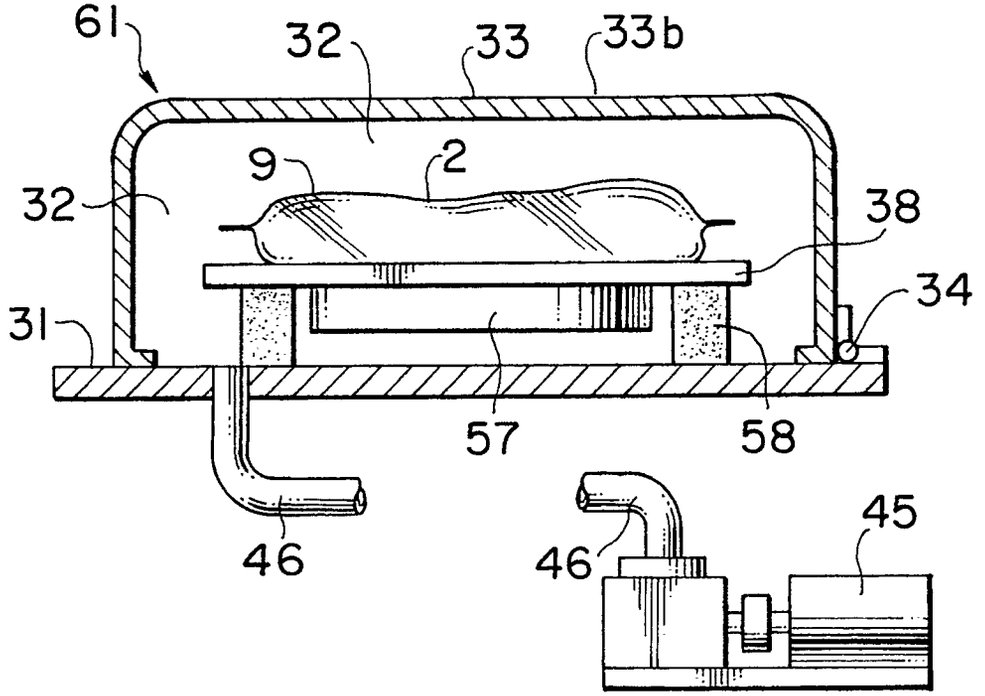
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FIG. 6

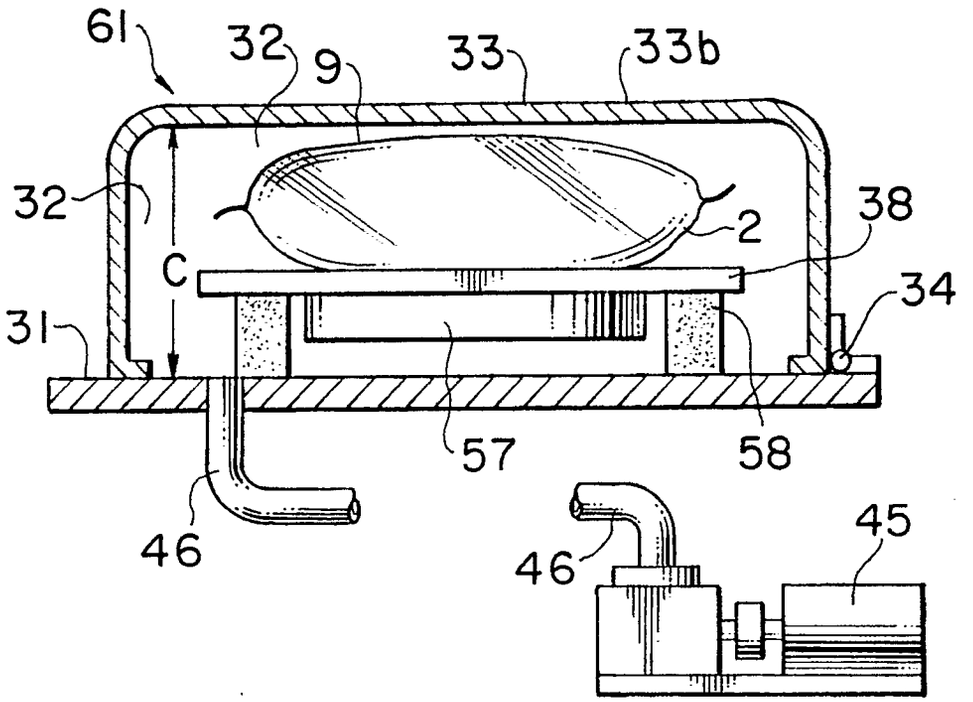
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FIG. 7

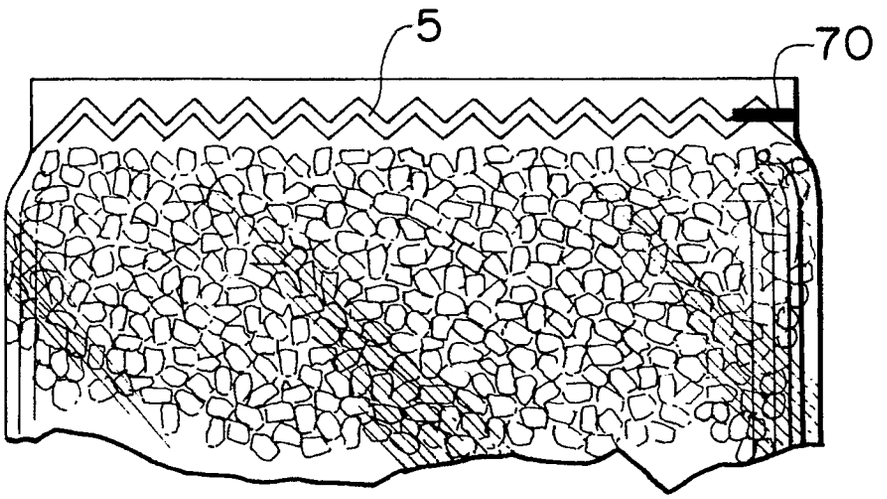
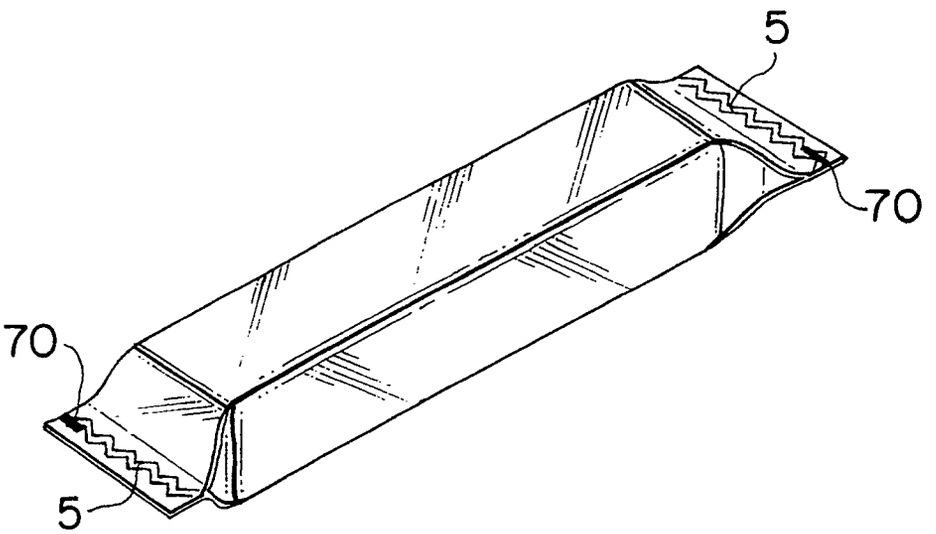


FIG. 8



European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 10 0915

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US-A-4 534 152 (AKKALA) * Whole document *	1,3-5,8	B 65 B 31/02
Y		2,6,9,10	
Y	US-A-4 069 349 (SHAW) * Abstract; figure 3 *	2	
Y	FR-A-2 190 672 (SKF)	6,9,10	
A	US-A-3 200 560 (RANDALL) * Column 7, lines 3-15; figure 7 *	5,10	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B 65 B

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	24 April 91	CLAEYS H.C.M.

CATEGORY OF CITED DOCUMENTS

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