A multiple-chamber medical container comprising a container body 3 having two chambers 10 and 11 for storing medications and a partition seal 20 separating the chamber 10 from the chamber 11, and an outlet 32 attached to the container body 3 for allowing the medications to be discharged from the chamber 11, the partition seal 20 being openable so that the chambers 10 and 11 may communicate with each other at the time of use, wherein the container body 3 comprises a discharge-control seal 21 separating the chamber 11 from the outlet 32 and being openable at the time of use, and the force required to open the partition seal 20 is lower than that required to open the discharge-control seal 21.
Fig. 4
Fig. 5
Fig. 12
Fig. 13
MULTIPLE COMPARTMENT MEDICAL CONTAINER

TECHNICAL FIELD

[0001] The present invention relates to a medical container having multiple chambers for individually storing various unstable medicaments (liquid, powder or solid agents) which will deteriorate with time when mixed together, wherein the medicaments stored in the chambers can be mixed together aseptically without generating any foreign matter by peeling off a partition seal separating the chambers.

BACKGROUND OF THE INVENTION

[0002] Some of the medicaments that are administered to a patient by intravenous injection are unstable and unavoidably deteriorate with time when they are mixed beforehand. For example, if an amino acid transfusion solution and a glucose transfusion solution are mixed and stored, the mixed solution will become brown by the so-called Maillard reaction. When a fat emulsion is mixed with an electrolytic solution and stored, the fat component will cause coagulation. If a phosphoric acid-containing solution and a calcium-containing solution are mixed, the precipitation of calcium phosphate will result, causing undesirable changes.

[0003] For the storage of such medicaments, a medical container having multiple chambers, in which components can be individually contained prior to being mixed, is often used. FIG. 12 is a plan view showing an example of such a conventional multiple-chamber medical container. FIG. 13 is a cross-sectional view from the line X-X of FIG. 12.

[0004] The multiple-chamber medical container has chambers 10 and 11 for storing each of two medicaments that should not be mixed or dissolved beforehand. A weak partition seal 20 is disposed to separate the chambers 10 and 11, ensuring that the medicaments in the chambers 10 and 11 can each be isolated and stored safely and securely until administration. A suspension hole 30 is located on the upper end of the container, and an outlet 32 on the lower end of the container to discharge the medicaments from the chamber 11. A rubber plug (not illustrated) is disposed inside of the outlet 32, thereby stopping the discharge of medicament from the chamber 11 during storage.

[0005] The weak partition seal 20 is formed so as to be openable when the internal pressures of the chambers 10 and 11 are increased. At the time of use, force is applied to either of the chambers 10 or 11 to open the weak partition seal 20, causing the chambers 10 and 11 to communicate with each other and the medicaments a and b to quickly mix or dissolve. To administer the mixed medicament to a patient, the container is hung from a support post or the like by the suspension hole 30, and an infusion tube is then inserted into the rubber plug provided at the end of the container. Therefore, the mixed medicament in the container can be administered to a patient through the infusion tube.

[0006] In such a multiple-chamber medical container, however, a medicament in liquid state is often contained in the chamber 11 to which the outlet 32 is attached. Accordingly, if an infusion tube is inserted into the rubber plug before opening the weak partition seal 20, there is a possibility that the medicament will be discharged from the outlet 32 prior to being mixed.

DISCLOSURE OF THE INVENTION

[0007] The present invention has been accomplished to solve the problems described above, and an object of the present invention is to provide a multiple-chamber medical container that assuredly prevents the discharge of medicaments from the outlet prior to being mixed.

[0008] The first embodiment of the present invention has been accomplished to solve the above-described problems. The first embodiment provides a medical container comprising a container body having multiple chambers for storing medicaments and a partition seal separating said chambers from each other, and an outlet attached to the container body for allowing the medicaments to be discharged from the chamber, wherein the partition seal is openable so that the chambers can communicate with each other at the time of use. The container body comprises a discharge-control seal that separates at least one chamber from the outlet and is openable at the time of use, and the force required to open the partition seal is less than that required to open the discharge-control seal.

[0009] According to this constitution, even in case a infusion tube is accidentally connected to the outlet before opening the partition seal, the discharge of medicaments from the chamber to the outlet can be prevented due to the discharge-control seal disposed therebetween. In addition, since the force required to open the weak discharge-control seal is higher than that required to open the weak partition seal, the discharge-control seal can be opened after the partition seal is opened, thereby discharging only a mixed medicament from the outlet.

[0010] For example, the above difference between the force required to open the two seals may be established as follows. When the partition seal and the discharge-control seal are opened by pressing a disc having a diameter of 100 mm against the container body, the amount of force that must be applied to the disc to open the discharge-control seal may be adjusted to be 5-10 kg higher than that required to open the partition seal. The establishment of such a degree of difference can prevent the discharge-control seal from opening before the partition seal opens.

[0011] In addition, the force required to open the partition seal can be set to be lower than that required to open the discharge-control seal by providing at least a part of the partition seal with a narrower width than that of the discharge-control seal.

[0012] In the above multiple-chamber medical container, at least the innermost layer of the container body comprises a film made from a mixture of two or more kinds of thermoplastics having low miscibility with one another and different melting points, and the container body is given the shape of a bag by heat-sealing its peripheral edge portion. The partition seal and the discharge-control seal are prepared by heat-sealing the facing surfaces of the film of the container body. The sealing strength of the discharge-control seal may be set to be lower than that of the peripheral edge portion of the container body and higher than that of the partition seal. Specifically, it is preferable that at least the innermost layer of the container body comprise a film made from a mixture of polyethylene and polypropylene or of polyethylene and cyclic olefin resin. When the container
body comprises polyethylene and the like in this way, the
seals can be formed by heat-sealing, therefore facilitating the
production of the container.

[0013] The discharge-control seal may be formed arcwise
around the outlet. The seal has a smaller area in this case,
with the result that production time and cost can be reduced.
Moreover, creases are not likely to be produced in a seal
with a small area, providing the advantage that the percent
defective can be reduced.

[0014] The partition seal may be provided with at least one
projecting part toward the chamber. Introduction of such a
projecting part leads to an easier opening seal, as the
projecting part starts to be unsealed when only a little force
is applied to the chamber.

[0015] Both of the seals may be shaped in various forms.
For example, the discharge-control seal may be formed
arcwise around the outlet in the proximity thereof, and the
partition seal may be formed arcwise around the discharge-
control seal at an interval required for chamber formation.

[0016] The second embodiment provides a multiple-
chamber medical container comprising a container body
having multiple chambers for storing medicaments and a
partition seal separating said chambers from each other, and
an outlet attached to the container body for allowing the
medicaments to be discharged from the chamber, wherein
the partition seal is openable so that the chambers
communicate with each other at the time of use. The container body
comprises a discharge-control seal that separates at least one
chamber from the outlet and is openable at the time of use,
and the force required to open the partition seal is equal to
that required to open the discharge-control seal. The dis-
charge-control seal is not opened before an opening of the
partition seal also in this case, and similar effect can be
obtained as in the above-mentioned first embodiment of the
present invention.

[0017] The third embodiment of the present invention has
been accomplished to solve the above-described problems
and comprises at least one inner container for storing a
medicament that is openable by increasing the internal
pressure thereof, an outer container comprising the inner
container and a medicament chamber for storing a medica-
ment on the outside of the inner container, an outlet con-
nected to the outer container, a discharge-control seal sepa-
rating the medicament chamber of the outer container from
the outlet, wherein a liquid medicament is contained in at
least the outer or inner container and the force required to
open the weak discharge-control seal is higher than that
required to open the inner container. According to this
constitution, similarly to the first embodiment, a medicament
is not discharged from the outlet as long as the
discharge-control seal is not opened, even if a infusion tube
or the like is accidentally inserted into the outlet. Accord-
ingly, it is ensured that the discharge of medicament before
mixture is prevented.

[0018] For example, the opening strength described above
may be established as follows: the amount of force that must
be applied to open the inner container by pressing with a disc
having a diameter of 100 mm should be 5-10 kg lower than
that applied to open the discharge-control seal by pressing
the disc against the outer container.

[0019] The inner container may comprise a belt-shaped
seal that is openable by increasing the internal pressure,
wherein at least a part of the seal is formed to have the
narrower width than that of the discharge-control seal,
ensuring that the force required to open the discharge-
control seal is higher than that required to open the inner
container. The discharge-control seal may be formed arcwise
around the outlet in order to save time and cost for the
production.

[0020] The fourth embodiment of the present invention
comprises multiple inner containers that are openable by
increasing the internal pressure, an outer container compris-
ing the multiple inner containers, and an outlet connected to
the outer container, wherein a liquid medicament is con-
tained in at least one of the inner containers. According to
this constitution, similarly to the first embodiment, a medic-
ament is not discharged from the outlet as long as the inner
container is not opened, even if a infusion tube or the like is
accidentally inserted into the outlet. Accordingly, it is
ensured that the discharge of medicament before mixture is
prevented.

BRIEF DESCRIPTION OF DRAWINGS

[0021] FIG. 1 is a perspective view showing the first
embodiment of the multiple-chamber medical container
according to the present invention.

[0022] FIG. 2 is a plan view of the multiple-chamber
medical container shown in FIG. 1.

[0023] FIG. 3 is a plan view showing other example of the
multiple-chamber medical container according to the first
embodiment.

[0024] FIG. 4 is a plan view showing a different example of
the multiple-chamber medical container according to the
first embodiment.

[0025] FIG. 5 is a plan view showing another example of
the multiple-chamber medical container according to the
first embodiment.

[0026] FIG. 6 is a plan view showing further different
example of the multiple-chamber medical container accord-
ing to the first embodiment.

[0027] FIG. 7 is a plan view showing the second embodi-
ment of the multiple-chamber medical container according
to the present invention.

[0028] FIG. 8 illustrates an action of the projecting part in
the weak partition seal of the second embodiment. FIG. 8(a)
is an enlarged view of the projecting part and FIG. 8(b) is
a cross-sectional view from the line B-B of FIG. 8(a).

[0029] FIG. 9 is a plan view showing other example of the
multiple-chamber medical container of the second embodi-
ment.

[0030] FIG. 10 is a plan view showing the third embodi-
ment of the multiple-chamber medical container according
to the present invention.

[0031] FIG. 11 is a plan view showing the fourth embodi-
ment of the multiple-chamber medical container according
to the present invention.

[0032] FIG. 12 is a plan view showing an example of the
conventional multiple-chamber medical container.
FIG. 13 is a cross-sectional view from the X-X line of FIG. 12.

BEST MODE FOR CARRYING OUT THE INVENTION

Embodiments of the multiple-chamber medical container according to the present invention will be illustrated below with reference to the figures. In the following description, the same number is given to the identical or similar part through the embodiments.

The first embodiment of the multiple-chamber medical container according to the present invention will be illustrated in detail. FIG. 1 is a perspective view showing the multiple-chamber medical container according to the first embodiment and FIG. 2 is a plan view of the multiple-chamber medical container shown in FIG. 1.

As shown in FIG. 1, a multiple-chamber medical container 1 comprises a container body 3 formed in the shape of a rectangle and an outlet 32 of medicament which is connected to the container body 3 and has a rubber plug 31 inside thereof. The container body 3 has a first chamber 10 and a second chamber 11 which are disposed in order in the longer direction, and the two chambers 10 and 11 are separated from each other by an openable weak partition seal (partition seal) 20. The outlet 32 is connected to the second chamber 11, and the outlet 32 and the second chamber 11 are separated from each other by an openable weak discharge-control seal (discharge-control seal) 21. Each of the chambers 10 and 11 contains a medicament a or b respectively, which are undesirable to be mixed or dissolved together in advance. For example, the chambers 10 and 11 may contain an amino acid transfusion solution and a glucose transfusion solution, respectively.

The container body 3 is formed in the shape of a bag by carrying out heat-sealing or adhesion of the peripheral edge portion of two single-layered or multi-layered films. Material of the films may be selected from various resins used as raw materials of medical container, such as polyethylene, polypropylene, polystyrene, and like thermoplastic resins.

The weak partition seal 20 and the weak discharge-control seal 21 are formed by heat-sealing of the facing films of container body 3. The weak discharge-control seal 21 may be disposed parallel to the weak partition seal 20 as shown in FIG. 1, or may be formed arcwise around the outlet 32 as shown in FIG. 3. This arcwise formation of discharge-control seal 21 leads to a smaller area of the seal, resulting that time and cost for the production thereof can be reduced. Moreover, a crease is hardly produced in the weak seal 21 having a small area, and consequently the advantage is given that the percent defective can be reduced.

Opening strength required for opening the weak discharge-control seal 21 should be higher than that for opening the weak partition seal 20. The “opening strength” is the strength required for opening a part of the weak seal 20 or 21 so that the chambers partitioned by the weak seals 20 or 21 can communicate with each other. The opening strengths can be measured by various methods. For example, in pressing a disc with a diameter of 100 mm against portions of the container body having the same capacity, the amounts of force applied at the time of opening each of the weak seals can be employed. In this case, it is preferable that the pressure required for opening the weak partition seal 20 is 5-10 kg lower than that for the weak discharge-control seal 21.

Illustrated below is the use of the multiple-chamber medical container having above-mentioned constitution. In order to administer a medicament from the container to a patient, pressure is applied on the first chamber by pressing with a hand or the like to increase the internal pressure of the chamber 10. Thereby, the weak partition seal 20 is opened so that the first chamber 10 and the second chamber 11 communicate with each other, and the medicaments a and b in each chamber 10 and 11 are mixed together. After a needle from infusion tube (not illustrated) is inserted into the rubber plug within the outlet 32, the first and second chambers 10 and 11 are whole pressed to increase the internal pressure of the communicating chambers 10 and 11, and then the weak discharge-control seal 21 is opened. In this case, the needle may be inserted into the plug after opening the weak discharge-control seal 21. In this manner, the mixed medicament in the container 1 is administered from the outlet 32 through the infusion tube to a patient.

Thus, according to the present embodiment, the weak discharge-control seal 21 is provided so that the second chamber 11 and the outlet 32 are not directly communicated with each other. Therefore, even if a needle from infusion tube is accidentally inserted into the outlet 32 before the weak partition seal 20 is opened, the medicament b in the second chamber 11 can be prevented from flowing out of the outlet 32 before mixture. In this case, users can recognize that the weak discharge-control seal 21 and the weak partition seal 20 are not opened, because the medicament b does not discharge from the outlet 32 even if a needle is inserted. Accordingly, the weak discharge-control seal 21 can induce proper use, i.e. the weak discharge-control seal 21 should be opened in the right order after the opening of weak partition seal 20.

In addition, since the strength required for opening the weak discharge-control seal 21 is adjusted to be higher than that required for the weak partition seal 20, the following advantages can be provided. While the weak discharge-control seal 21 is opened after the weak partition seal 20 is opened by pressing the first chamber 10 in the above description, in some cases the second chamber 11 may be pressed first. In this case, the pressure increasing in the second chamber 11 acts upon both the weak partition seal 20 and the weak discharge-control seal 21. However, since the force required to open the weak discharge-control seal 21 is higher than that required to open the weak partition seal 20 as mentioned above, the weak partition seal 20 opens first. Therefore, it is before an opening of the weak discharge-control seal 21 that both chambers 10 and 11 will communicate with each other to mix the medicaments. Specifically, opening of the weak discharge-control seal 21 alone prior to the partition seal 20 can be prevented, and only the mixed medicament is allowed to be discharged from the outlet 32.

In order to control the forces required to open the weak discharge-control seal 21 and the weak partition seal 20, various ways as shown below can be used. For example, if the container body 3 is made from polyethylene, the opening strength can be controlled by adjusting the sealing
strength. In order to establish the difference of sealing strength, for example, heat-sealing time for the weak discharge-control seal 21 is adjusted to be shorter than that for a peripheral edge portion 2 of the container body 3 and longer than that for the weak partition seal 20. Otherwise it is possible to condition the sealing strength by sealing the weak discharge-control seal 21 with a pressure lower than that for the peripheral edge portion 2 of container body 3 and also higher than that for the weak partition seal 20. In this case, the peripheral edge portion 2 of container body 3 has the sealing strength higher than that of the weak partition seal 20, and therefore the peripheral edge portion 2 of container body 3 is not allowed to open even after opening of the weak partition seal 20, preventing that the medicaments leak out from the chambers 10 and 11.

[0045] The above-mentioned sealing strength can be expressed with peel strength shown in JIS-Z0238. The peel strength indicates the strength required for peeling off a weak seal having a width of 15 mm, i.e. the strength required for separating heat-sealed surfaces of two films. Preferably, the peel strength of weak partition seal 20 is adjusted to be 1N/15 mm to 7N/15 mm, and the peel strength of weak discharge-control seal 21 is to be 0.1N/15 mm to 1N/15 mm higher than that of weak partition seal 20.

[0046] When at least the innermost layer of the container body comprises two or more thermostop plastics having low miscibility with one another and different melting point, the difference of sealing strength can be established more easily. Examples of such plastics include mixtures of polyethylene and a resin selected from styrene-based resin, methacrylate ester-based resin, poly-4-methylpentene, polyester, polyamide and polypropylene. Among them polyethylene and polypropylene are especially preferable because the safety is confirmed for medical application and the handling direction in manufacturing is established. The mixing ratio of polyethylene and polypropylene is not especially limited but generally selected from the range of 1:9 to 9:1.

[0047] In addition, the force required to open the weak discharge-control seal 21 can be set to be higher than that required to open the weak partition seal 20 also by adjusting the widths of seals 20 and 21. The force required to open the weak partition seal 20 can be weaken by making at least a part of the width of weak partition seal 20 narrower than the width of weak discharge-control seal 21. This makes it possible to establish a difference of opening strength between the weak seals 20 and 21 while using the sealing time or sealing pressure still same between the seals 20 and 21. Therefore, time and cost for producing the container 1 can be reduced. The location where the weak partition seal 20 is narrowed may be either one or more. In addition, the width of whole weak partition seal may be narrowed.

[0048] The force required to open the weak discharge-control seal 21 is to be higher than that required to open the weak partition seal 20 in the above description, however, these forces can be equivalent in some cases. When the second chamber 11 is pressed in this case, the weak partition seal 20 and the weak discharge-control seal 21 will open almost simultaneously instead of opening alone prior to the seal 20. Accordingly, it is ensured that the medicaments in each of the chambers are mixed together before being administrated to a patient.

[0049] Moreover, if the pressures required for opening the weak partition seal 20 and for the weak discharge-control seal 21 are adjusted to be almost equivalent in this way, the weak partition seal 20 and the weak discharge-control seal 21 can be formed by sealing under the same conditions, thereby facilitating the production of the multiple-chamber container 1. Especially in the case of a multiple-chamber container in which powders are contained in the second chamber 11 on the side of the outlet 32 and a liquid medicament in the first chamber 10, the first chamber 10 on the distant side of the medicament outlet 32 will be pressed. Consequently, the weak partition seal 20 will be opened and the liquid medicament and the powders are mixed without fail, preventing the weak discharge-control seal 21 from opening alone before an opening of the weak partition seal 20.

[0050] In addition to the linear shape as mentioned above, the weak partition seal 20 can also be shaped into a curve, for example. In the example as shown in FIG. 4, the weak discharge-control seal 21 is formed arcwise to surround the outlet 32 and in the outer side thereof the weak partition seal 20 is formed arcwise almost concentrically with the weak discharge-control seal 21, locating the first chamber 10 in the upper part and the second chamber 21 in the lower part of the container body 3. Such constitutions of the seals 20 and 21 can also produce effects similar to the above-described ones.

[0051] In the present embodiment, two chambers 10 and 11 are arranged side by side in the longer direction of the container body 3. However, they may be disposed along side in the crossing direction of the longer direction, for example as shown in FIG. 5. The figure shows the multiple-chamber medical container 1 where the weak discharge-control seal 21 in the shape of inverted V is disposed to surround the outlet 32. The weak partition seal 20, which is narrower than the weak discharge-control seal 21, is extending from the apex of the weak discharge-control seal 21 to the opposite peripheral edge portion 2 in the longer direction of the container body 3, and forming the first chamber 10 on the left side and the second chamber 11 on the right side of the container body 3. As shown in said figure, it is preferable to provide a guide seal 22 that slopes from the peripheral edge portion 2 on the side of the container body 3 towards the apex of the weak discharge-control seal 21 and is broader than the weak discharge-control seal 21. If such guide seal 22 is provided, all the medicaments contained in the first chamber 10 can be flowed into the second chamber 11 when the weak partition seal 20 opens.

[0052] In this multiple-chamber medical container 1, the force required to open the weak discharge-control seal 21 is intensified by forming the width of the weak discharge-control seal 21 broader than that of the weak partition seal 20, so that the weak partition seal 20 will open before the weak discharge-control seal 21. Since the forces required to open the weak seals 20 and 21 can be differentiated without making a difference of sealing time or sealing pressure between the weak seals 20 and 21, time and cost for producing the container 1 can be reduced. In order to establish such difference of opening strength between the weak seals, not only adjusting their widths but also various methods such as adjusting the sealing time and the like can be employed.

[0053] As described above, in order for the guide seal 22 not to peel easily, the width of guide seal 22 is formed
broader than that of the weak discharge-control seal 21. However, for example as shown in FIG. 6, the guide seal 22 may be combined with the peripheral edge portion 2 by sealing the part surrounded by the guide seal 22 and by the peripheral edge portion 2 so that the guide seal 22 can be prevented from opening without fault.

[0054] (The Second Embodiment)

[0055] The second embodiment of the multiple-chamber medical container according to the present invention will be illustrated with reference to FIGS. 7 and 8. FIG. 7 is a plan view showing the multiple-chamber medical container according to the second embodiment and FIG. 8(a) is a plan view illustrating action of a projecting part. FIG. 8(b) is a cross-sectional view from the line B-B of FIG. 8(a).

[0056] The second embodiment is mainly different from the above-described first embodiment in that the projecting part is provided for relatively lowering the pressure required for opening the weak partition seal.

[0057] As shown in FIG. 7, in this multiple-chamber medical container 1, the weak partition seal 20 and the weak discharge-control seal 21 have the same width and are sealed under the same sealing time and the same sealing pressure. The weak partition seal 20 incorporates a V-shaped projecting part 20a in its middle, the projecting part 20a enabling the weak partition seal 20 to open before the weak discharge-control seal 21 as described below.

[0058] As shown in FIG. 8(a), if the internal pressure of the second chamber 11 increases, the weak partition seal 20 receives pressure in the directions as indicated by arrows. As the pressure acts perpendicularly and equally on the seal 20, total pressure acting on the area near an apex C of the projecting part 20a is higher than those on the other areas of the seal 20. In this way, as shown in FIG. 8(b), this pressure acts in the direction of separating the films that constitute the container body 3. When internal pressures of chambers 10 and 11 are increased, the weak partition seal 20 starts to open from the apex C of the projecting part 20a. Then the opening quickly progresses under the action of pressure, and the first chamber 10 and the second chamber 11 communicate with each other and the medicaments a and b are mixed. Subsequently, if the container body 3 is pressed further, the weak discharge-control seal 21 is opened so that the mixed medicament can flow out from the outlet 32.

[0059] Thus, according to the present embodiment, due to the V-shaped projecting part 20a provided in the weak partition seal 20, even if the weak partition seal 20 and the weak discharge-control seal 21 have the same width and are sealed under the same temperature and pressure, the projecting part 20a starts to open first when pressure is applied to the chambers 10 and 11, so that it is possible to open the weak partition seal 20 before the weak discharge-control seal 21 opens. Consequently, the weak discharge-control seal 21 is not opened until mixing of the medicaments a and b in the chambers 10 and 11 is basically finished, therefore the medicament after mixture is allowed to flow out from the outlet 32.

[0060] Moreover, in the present embodiment, the strength required for opening of the weak seals 20 and 21 can be adjusted only by changing the shape of weak partition seal 20. Therefore, sealing of the weak seals 20 and 21 can be carried out under the same conditions without changing the sealing time or the like. Consequently, it is possible to reduce the time and cost for producing the container 1. Specifically, since the weak partition seal 10 and the weak discharge-control seal 11 have the same width, uneven sealing can be prevented and the whole weak seals 10 and 11 can be sealed uniformly.

[0061] In the present embodiment, the projecting part 20a is provided in the multiple-chamber medical container 1 wherein chambers 10 and 11 are disposed side by side in the longer direction of the container body 3. This projecting part 20a is of course also applicable in case chambers 10 and 11 are arranged in the direction crossing the longer direction of the container body 3, as shown in FIG. 9. Moreover, the number of projecting part 20a is not limited to one, and as shown in FIG. 9 two or more may be provided or the direction of each apex of V-shape may be varied.

[0062] The shape of the projecting part is not limited to V-shape as long as having a convex to which a pressure easily focuses.

[0063] (The Third Embodiment)

[0064] The third embodiment of the multiple-chamber medical container according to the present invention will be illustrated with reference to FIG. 10. FIG. 10 is a plan view showing the multiple-chamber medical container according to the third embodiment.

[0065] The multiple-chamber medical container according to the present embodiment is different from the first embodiment in that a partition weak seal is not provided and a bag-shaped inner container storing at least one of the medicaments to be mixed is equipped inside the container body.

[0066] As shown in FIG. 10, the multiple-chamber medical container 1 comprises the arc-shaped weak discharge-control seal (discharge-control seal) 21 around the outlet 32, by which the medicament chamber 12 surrounded by the peripheral edge portion 2 of the container body 4 as an outer container is separated from the outlet 32. In the medicament chamber 12, the medicament a among two kinds of medicaments to be mixed is directly stored and the inner container 13 formed in the shape of a bag is contained. The inner container 13 has a weak seal (seal) 23 formed by adhering the peripheral edge portions of two layered films together, inside of which another liquid medicament b is contained. The weak seal 23 is prepared with lower sealing strength than that of the weak discharge-control seal 21 in such a manner that it can be opened by small power. There are various means to provide the inner container 13 openable by such small power. For example, at least a part of the width of weak seal 23 of the inner container 13 may be narrowed. Among the two kinds of medicaments a and b, at least one should be a liquid.

[0067] If the container body 4 is pressed for mixing the medicaments, the inner container 13 inside thereof is also pressured and the internal pressure of the inner container 13 will increase. Thereby the weak seal 23 opens before the weak discharge-control seal 21, and the liquid medicament b stored in the inner container 13 diffuses to be mixed with the medicament a in the medicament chamber 12 of the container body 4. Further pressure on the container body 4 will open the weak discharge-control seal 21 and then the mixed medicament is allowed to be discharged by inserting a needle into the outlet 32.
Thus, according to the present embodiment, due to the weak discharge-control seal 21 separating the medication chamber 12 from the outlet 32, an unmixed medicament can be prevented from flowing out even in case the outlet 32 is accidentally opened before mixing the medicaments. Moreover, since opening strength required for the weak discharge-control seal 21 is adjusted to be higher than that for the weak seal 23, the weak seal 23 can be opened before the weak discharge-control seal 21 opens when the container body 4 is pressured. Consequently, the seal 23 is already open and the medicaments are in a state of mixture at the time the weak discharge-control seal 21 is opened, therefore only the mixed medicament can be allowed to flow out from the outlet 32. Furthermore, as it is unnecessary to provide a partition weak seal similarly to the first and second embodiments, the production step can be simplified.

The weak seal 23 is provided in the peripheral edge portion of the inner container 13 in the present embodiment but not limited thereto. For example, the weak seal 23 may be provided to cover an opening prepared only in a part of the inner container 13. In addition, without providing the weak seal 23 as above the inner container 13 may be prepared from a film of low strength. In this case, either part of the inner container 13 can be ruptured by pressure from the outside, allowing an internal liquid medicament to flow out into the chamber 12.

The difference of opening strength between the weak discharge-control seal 21 and the inner container 13 may be established, for example as described in the first embodiment: when the weak discharge-control seal 22 is opened by pressing with a disc having a diameter of 100 mm, the required amount of force may be adjusted to be 5-10 kg higher than that required to open the inner container 13. In case the inner container 13 is provided with the weak seal 23, a difference of opening strength can be established using peel strength described in JIS-Z0236. This difference of peel strength can be established as described above in the first embodiment.

One of the methods to establish such difference of opening strength is to provide the weak seal of the inner container 13 in the shape of a belt having narrower width than that of the weak discharge-control seal 21.

(The Fourth Embodiment)

The fourth embodiment of the multiple-chamber medical container according to the present invention will be illustrated with reference to FIG. 11. FIG. 11 is a plan view showing the multiple-chamber medical container according to the fourth embodiment.

The multiple-chamber medical container according to the present embodiment is different from the first embodiment in that a weak discharge-control seal and a partition weak seal are not provided and inner containers each storing a medicament to be mixed are equipped inside the container body.

As shown in FIG. 11, the multiple-chamber medical container 1 comprises the chamber 14 surrounded by the peripheral edge portion 2 of the container body 4 as an outer container, the chamber 4 comprising two bag-shaped inner containers 15 and 16, each of which stores the medicament a or b to be mixed. Each of the inner containers 15 and 16 has a weak seal 23 formed by adhering the peripheral edge portions of two layered films together, in which the medicament a or b is stored. At least one of the medicaments a and b should be a liquid. Each of the inner containers 15 and 16 is provided in the form of rectangle and the weak seal 23 thereof is sealed with an almost equal sealing strength.

If the container body 4 is pressed at the time of mixing medicaments, the pressure also acts on the inner containers 15 and 16 incorporated therein, then the internal pressures of inner containers 15 and 16 increases. Thus, weak seals 23 of inner containers 15 and 16 are opened by pressing the container body 4, then the medicaments a and b each contained inside of the seals will diffuse in the chamber 14 to be mixed. Subsequently, the mixed medicament can be discharged by inserting a needle into the outlet 32.

Thus, according to the present embodiment, the medicaments a and b to be mixed are each stored in the inner containers 15 and 16 respectively, which are incorporated in the container body 4. Therefore, even in case the outlet 32 is accidentally opened before pressing the container body 4, the medicaments can be prevented from flowing out. Moreover, since the container 1 is produced by providing the inner containers 15 and 16 in which the medicaments are already contained and incorporating them into the container body 4, it is not necessary to supply the weak partition seal 20 and the weak discharge-control seal 21 as in the first or third embodiment. Therefore the production process can be simplified.

In the same way as the third embodiment, the weak seals 23 of inner containers 15 and 16 may be provided to cover an opening prepared only in a part of the inner containers 15 and 16 or may be provided from a film of low strength.

Each of the above embodiments of the present invention provides a sealing position as a weak seal prepared by the heat-sealing of films. However, a sealing portion may be provided, for example, by preparing a convex portion and a concave portion respectively on the internal surfaces of facing films, which are subjected to an elastic deformation to carry out concavo-convex interdigitiation. In this case also, if the internal pressure of the container increases, the concavo-convex interdigitiation will be disjointed so that the chambers communicate with each other. Each seal may also have another constitution, as long as it can be opened by increasing the internal pressure.

In each embodiment described above, the multiple-chamber medical container is provided so that two kinds of medicaments can be mixed. However, it does not constitute a limitation and the multiple-chamber medical container may comprise two or more chambers or two or more inner containers.

1. A multiple-chamber medical container comprising:
   a container body having multiple chambers for storing medicaments and a partition seal separating the chambers from each other; and
   an outlet attached to the container body for allowing the medicaments to be discharged from one of the chambers;
   the partition seal being openable so that the chambers may communicate with each other at the time of use; and
the container body comprising a discharge-control seal that separates at least one chamber from the outlet and is openable at the time of use,

wherein the force required to open the partition seal is lower than that required to open the discharge-control seal.

2. The multiple-chamber medical container according to claim 1, wherein

at least an innermost layer of the container body comprises a film prepared from a mixture of two or more kinds of thermoplastics having low miscibility with one another and different melting points, the peripheral edge portion thereof being heat-sealed to form the container body in the shape of a bag;

the partition seal and the discharge-control seal being provided by heat-sealing the surfaces of the film of the container body that are facing each other; and

the discharge-control seal having a sealing strength which is lower than that of the peripheral edge portion of the container body and higher than that of the partition seal.

3. The multiple-chamber medical container according to claim 2, wherein at least the innermost layer of the container body comprises a film prepared from a mixture of polyethylene and polypropylene or of polyethylene and cyclic olefin resin.

4. The multiple-chamber medical container according to claim 1, wherein the partition seal is provided with at least one projecting part that is projecting toward the chamber.

5. The multiple-chamber medical container according to claim 1, wherein the discharge-control seal is formed arcwise around the outlet.

6. The multiple-chamber medical container according to claim 1, wherein the force required to open the discharge-control seal by pressing a disc having a diameter of 100 mm against the container body is 5-10 kg higher than that required to open the partition seal by pressing the disc.

7. The multiple-chamber medical container according to claim 1, wherein at least a part of the partition seal has a narrower width than that of the discharge-control seal.

8. A multiple-chamber medical container comprising:

a container body having multiple chambers for storing medicaments and a partition seal separating the chambers from each other; and

an outlet attached to the container body for allowing the medicaments to be discharged from one of the chambers;

the partition seal being openable so that the chambers may communicate with each other at the time of use; and

the container body comprising a discharge-control seal that separates at least one of the chambers from the outlet and is openable at the time of use;

wherein the force required to open the partition seal is equal to that required to open the discharge-control seal.

9. The multiple-chamber medical container according to claim 8, wherein the discharge-control seal is formed arcwise around the outlet.

10. The multiple-chamber medical container according to claim 1, wherein the discharge-control seal is formed arcwise around the outlet in the proximity thereof and the partition seal is formed arcwise around the discharge-control seal at an interval required to form the chambers.

11. The multiple-chamber medical container according to claim 8, wherein the discharge-control seal is formed arcwise around the outlet in the proximity thereof and the partition seal is formed arcwise around the discharge-control seal at an interval required to provide the chambers.

12. A multiple-chamber medical container comprising:

at least one inner container for storing a medicament that is openable by increasing the internal pressure thereof;

an outer container containing the inner container and comprising a medicament chamber for storing a medicament on the outside of the inner container;

an outlet connected to the outer container; and

a discharge-control seal separating the medicament chamber of the outer container from the outlet;

wherein a liquid medicament is contained in at least the outer or inner container and the force required to open the discharge-control seal is higher than that required to open the inner container.

13. The multiple-chamber medical container according to claim 12, wherein the force required to open the inner container by pressing a disc having a diameter of 100 mm is 5-10 kg lower than that required to open the discharge-control seal by pressing the disc against the outer container.

14. The multiple-chamber medical container according to claim 12, wherein the inner container comprises a bell-shaped seal that is openable by increasing the internal pressure thereof and at least a part of the seal has a narrower width than that of the discharge-control seal.

15. The multiple-chamber medical container according to claim 12, wherein the discharge-control seal is formed arcwise around the outlet.

16. A multiple-chamber medical container comprising:

multiple inner containers that are openable by increasing the internal pressure thereof;

an outer container containing the multiple inner containers; and

an outlet connected to the outer container,

wherein a liquid medicament is contained in at least one of the inner containers.