

Storage Box

Technical Field of the Invention

[0001] The present application relates to the technical field of storage boxes, and in particular to a storage box capable of achieving bidirectional ventilation between the interior and the exterior of the storage box and being waterproof and dustproof.

Background of the Invention

[0002] A storage box (e.g. a toolbox) facilitates the storage of items for users. In order to achieve waterproof and moisture-proof effects, most storage boxes adopt a completely sealed structure, while pressure balance is not taken into consideration. Once closed, the cover body of the box is always difficult to open due to an imbalance between the internal and external pressures of the box (for example, during transportation between different altitude areas).

[0003] To solve the above technical problem, a Chinese Utility Model Patent CN217375591U (patent No. CN202220838967.7) disclosed a sealed storage box, which comprises a box body having an inner chamber and a box cover for closing the box body, and further comprising a locking mechanism and a sealing mechanism. The locking mechanism is used for locking the box cover and the box body when the box cover is closed on the box body, and the sealing mechanism comprises a sealing body for sealing a gap between the box cover and the box body when the box cover is closed on the box body, and a pressure differential balancing device for communicating the inner chamber of the box body with the external environment. The box cover has a groove circumferentially arranged on a mating surface where the box cover is closed on the box body. The groove has a hole for mounting the pressure differential balancing device at an outer wall of the groove, and the pressure differential balancing device compresses the sealing body to make same deformed, so as to allow the inner chamber of the box body to be in communication with the external environment. The groove has a deformation relief notch at an inner wall for receiving the sealing body when the sealing body is compressed and deformed under movement. The sealing body is a sealing ring with a square cross section, and the pressure differential balancing device is a button with one end passing through the hole and the other end resisting against a side surface of the sealing body. When the storage box is in a closed state, if the interior pressure is not consistent with the exterior pressure, the button of the pressure differential balancing device is pressed, the sealing ring is compressed due

to receiving a pressure from the other end of the button, and then deforms and protrudes into the notch. At this time, the deformed and protruding portion of the sealing ring is misaligned with the mating surface of the box body, thereby forming a gap, such that the sealed state is released, and the storage box can be opened easily.

[0004] However, the storage box disclosed in the above patent application still has certain disadvantages. The user needs to manually operate the button to balance the air pressures inside and outside the storage box; when a user is unfamiliar with the function of balancing air pressures inside and outside the box body of the storage box or cannot find the button of the pressure differential balancing device, the opening process of the box cover of the box becomes very tedious; and in some emergency situations, a safety hazard may exist because the box cannot be opened in time.

[0005] Therefore, the existing storage box requires further improvement.

Summary of the Invention

[0006] It is an object of the present invention to provide a storage box capable of automatically balancing air pressures inside and outside a box body of the storage box, so as to ensure that the storage box can be opened easily.

[0007] For achieving the above object, the storage box comprises a box body having a containing chamber and a sidewall; and a valve assembly comprising a vent base and a breathable waterproof membrane;

[0008] wherein, the vent base is connected to the sidewall of the box body and has a ventilation chamber opening toward outside of the box body;

[0009] the breathable waterproof membrane is disposed inside the ventilation chamber and divides the ventilation chamber into a first ventilation chamber located away from the sidewall of the box body and a second ventilation chamber located adjacent to the sidewall of the box body;

[0010] the vent base has one or more first through holes to communicate the first ventilation chamber with the outside of the box body, and the box body has one or more second through holes at the sidewall of the box body to communicate the second ventilation chamber with the containing chamber.

[0011] In order to mount the components such as the breathable waterproof membrane in the ventilation chamber of the vent base, preferably, the vent base comprises a front wall and an annular wall extending toward the sidewall of the box body from an annular edge of the front wall, the annular wall and the front wall define the ventilation chamber, the one or more first through holes are located on the front wall of the vent base.

[0012] In order to connect the vent base with the box body, preferably, the vent base is connected to the sidewall of the box body by a connecting shaft extending rearward, the box body has a mounting hole at the sidewall for the connecting shaft to pass through, the connecting shaft passes through the mounting hole and connected to the vent base, and the connecting shaft is connected to the sidewall of the box body by a screw.

[0013] In order to ensure that the breathable waterproof membrane is maintained in a planar state at all times, thereby avoiding deformation or damage caused by air pressure variations and prolonging the service life thereof, preferably, a first gasket and a second gasket are further disposed inside the ventilation chamber, the breathable waterproof membrane is located between the first gasket and the second gasket, the breathable waterproof membrane, the first gasket, and the second gasket form a breathable membrane assembly that is sleeved outside the connecting shaft; the vent base has a first step portion protruding inwardly from an inner surface of the annular wall, and the connecting shaft has a second step portion protruding outwardly from an outer surface of the connecting shaft, an outer annular edge of the breathable membrane assembly is clamped between the first step portions and the sidewall of the box body, and an inner annular edge of the breathable membrane assembly is clamped between the second step portions and the sidewall of the box body.

[0014] In order to ensure the sealing performance between a peripheral edge of an opening of the vent base and the box body, preferably, the second gasket is disposed adjacent to the second ventilation chamber, and the second gasket has an annular flange extending radially outward from an outer annular wall of the second gasket, the annular flange is sandwiched between an annular end of the annular wall of the vent base and the sidewall of the box body.

[0015] Preferably, the second gasket is made of rubber.

[0016] In order to conceal the valve assembly so as to prevent it from being damaged due to excessive exposure relative to the sidewall of the box body and contact with foreign objects, preferably, the box body has a pair of bumps arranged separately and protruding outwardly from the sidewall of the box body, a mounting region is defined between the two bumps on the sidewall of the box body for receiving the valve assembly.

[0017] In order to ensure the firm connection between the vent base and the box body, preferably, the vent base has one or more retaining portions protruding outwardly from an outer annular edge of the vent base, and the box body further comprises one or more retaining ribs at a top portion of the mounting region on the sidewall of the box body, each retaining rib is capable of engaging with the corresponding retaining portion so as to

limit rotation of the vent base.

[0018] In view of the limited mounting space on a cover of the storage box, preferably, the box body comprises a box main body having a top opening and the cover covering the top opening of the box main body, the valve assembly is disposed on the sidewall of the box main body.

[0019] Preferably, the valve assembly is disposed on the sidewall of the box main body adjacent to the top opening of the box main body. If the valve assembly is disposed away from the top opening of the box main body, the valve assembly may be blocked by items placed in the box body, which adversely affects the ventilation performance of the valve assembly; but such a problem can be well avoided by arranging the valve assembly adjacent to the top opening of the box main body.

[0020] Compared with the prior art, the storage box of the present application has the following advantages: when there is an air pressure difference between the interior and the exterior of the box body, under the design of the present application, air can automatically and promptly equalize the pressure difference through the breathable waterproof membrane in the vent base. In this way, the user can open the box body relatively easily at any time, thereby improving the user experience. On the other hand, the breathable waterproof membrane also has waterproof and dustproof functions while ensuring that air can pass therethrough, thereby preventing items in the box body from becoming damp or contaminated by dust.

Brief Description of the Drawings

[0021] Fig. 1 is a perspective view of a storage box according to an embodiment of the present invention;

[0022] Fig. 2 is an exploded view of a valve assembly of the storage box according to the embodiment of the present invention;

[0023] Fig. 3 is a front view of the storage box according to the embodiment of the present invention;

[0024] Fig. 4 is a sectional view of the storage box along A-A line in Fig. 3;

[0025] Fig. 5 is an enlarged view of Part-A in Fig. 4.

Detailed Description of the Invention

[0026] The present invention will be further described in detail with reference to the accompanying drawings by embodiments.

[0027] It should be noted that in the description and claims of the present invention, the

terms used to indicate direction, such as "front, back", "up, down", "left, right", "side, top, bottom", etc. are used to describe structures and elements of the present invention for better explanation. And these terms used here are based on an orientation in the accompanying drawings. Since the embodiments disclosed by the present invention can be set in different directions, these terms indicating directions are only used as explanations and should not be used as restrictions. For example, the verbs "up", "down" should not be limited to the direction opposite or consistent with the gravity.

[0028] Figs. 1-5 show a preferred embodiment of a storage box of the present invention. The storage box comprises a box main body 11 having four sidewalls, a cover 12 and a valve assembly D which is disposed on a front sidewall of the box main body 11. The box main body 11 and the cover 12 are together defined as a box body 10 of the storage box.

[0029] The box main body 11 has a containing chamber 100 for containing tools or items and a top opening. The cover 12 covers on the top opening of the box main body 11 and can be opened and closed, so that the containing chamber 100 can be closed by the cover 12. The movable opening/closing connection manner between the cover 12 and the box main body 11 can use various existing technologies. In this embodiment, the cover 12 is rotatably connected to a rear sidewall (which is opposite to the front sidewall where the valve assembly D is located at) of the box main body 11 through a rotating shaft. As the detail connection manner is an existing technology, details will not be repeated herein.

[0030] Specifically, the box main body 11 has a pair of bumps 111 protruding outwardly from the front sidewall of the box main body 11 and extending vertically downward. The two bumps 111 are both strip-shaped and are arranged separately in a left-right direction. A mounting region 112 is defined between the two bumps 111 on the front sidewall of the box main body 11 for receiving the valve assembly D, so that the valve assembly D are hidden between the two bumps 111, thereby preventing the valve assembly D from being damaged due to excessive outward exposure relative to a sidewall of the box body 10 and contacting with foreign objects. Further, in consideration of the fact that if the valve assembly D is disposed away from the top opening of the box main body 11, the valve assembly D may be blocked by items placed in the box body 10, which adversely affects the ventilation effect of the valve assembly D. Therefore, in this embodiment, the valve assembly D is disposed on the front sidewall of the box main body 11 adjacent to the top opening of the box main body 11.

[0031] Referring to Figs. 2 and 5, the valve assembly D comprises a vent base 20, a breathable waterproof membrane 30, a first gasket 41 and a second gasket 42.

[0032] The vent base 20 is connected to the front sidewall of the box main body 11 by a

screw 31. Specifically, the vent base 20 is cover-like and comprises a front wall 21 and an annular wall 22 extending toward the outside of the box body 10 from an annular edge of the front wall 21. The annular wall 22 and the front wall 21 define the ventilation chamber 23 with a ventilation chamber opening facing the outside of the box body 10. The vent base 20 is connected to the front sidewall of the box body 10 by a connecting shaft 211 extending rearward. The box main body 11 has a mounting hole 114 at the front sidewall for the connecting shaft 211 to pass through. The connecting shaft 211 passes through the mounting hole 114 and connected to the vent base 20, and the connecting shaft 211 is connected to the front sidewall of the box main body 11 by a screw 31 disposed in the box body 10.

[0033] The breathable waterproof membrane 30 is located between the first gasket 41 and the second gasket 42, so that the breathable waterproof membrane 30, the first gasket 41, and the second gasket 42 form a breathable membrane assembly. The first gasket 41 and the second gasket 42 each has a hollow structure, which do not affect the breathable performance of the breathable waterproof membrane 30. The breathable waterproof membrane 30 has a central opening for receiving the connecting shaft 211.

[0034] In order to fix the breathable membrane assembly, the vent base 20 has a first step portion 221 protruding inwardly from an inner surface of the annular wall 22, and the connecting shaft 211 has a second step portion 2110 protruding outwardly from an outer surface of the connecting shaft 211. The first step portion 221 and the second step portion 2110 are located on the same plane. When the breathable membrane assembly is sleeved on the connecting shaft 211 of the vent base 20, an outer annular edge of the breathable membrane assembly is clamped between the first step portions 221 and the sidewall of the box body 10, and an inner annular edge of the breathable membrane assembly is clamped between the second step portions 2110 and the sidewall of the box body 10. The breathable membrane assembly supports and protects the breathable waterproof membrane 30 by means of the first gasket 41 and the second gasket 42 respectively located at front and rear sides of the breathable waterproof membrane 30, thereby ensuring that the breathable waterproof membrane 30 remains in a planar state at all times, thereby avoiding deformation or damage caused by air pressure variations and prolonging the service life thereof.

[0035] The vent base 20 in this embodiment has a plurality of first through holes 210 at the front wall 21 and each first through hole 210 communicates with the ventilation chamber 23. The breathable waterproof membrane 30 disposed inside the ventilation chamber 23 divides the ventilation chamber 23 into a first ventilation chamber 231 located

away from the sidewall of the box body 10 and a second ventilation chamber 232 located adjacent to the sidewall of the box body 10. The first gasket 41 is disposed adjacent to the first ventilation chamber 231, and the second gasket 42 is disposed adjacent to the second ventilation chamber 232. The vent base 20 has the plurality of first through holes 210 to communicate the first ventilation chamber 231 with the outside of the box body 10, and the box body 10 has a plurality of second through holes 110 at the sidewall of the box body 10 to communicate the second ventilation chamber 232 with the containing chamber 100.

[0036] In order to ensure the sealing performance between a peripheral edge of an opening of the vent base 20 and the box body 10, the second gasket 42 is made of rubber. The second gasket 42 is disposed adjacent to the second ventilation chamber 232, and the second gasket 42 has an annular flange 421 extending radially outward from an outer annular wall of the second gasket 42. The annular flange 421 is sandwiched between an annular end of the annular wall 22 of the vent base 20 and the sidewall of the box body 10.

[0037] The vent base 20 has two retaining portions 222 arranged separately and protruding outwardly from an outer annular edge of the vent base 20. The box body 10 comprises two retaining ribs 113 at a top portion of the mounting region 112 on the front sidewall of the box main body 110. Each of the two retaining ribs 113 is capable of engaging with the corresponding retaining portion 222 of the vent base 20 in a counterclockwise direction and a clockwise direction respectively so as to limit rotation of the vent base 20 in any direction, thereby ensuring the firm connection between the vent base 20 and the box body 10.

[0038] The breathable waterproof membrane 30 is capable of bidirectional ventilation between the interior and the exterior of the storage box. When a pressure difference exists between the interior and the exterior of the box body, air can automatically and promptly equalize the pressure difference through the breathable waterproof membrane in the vent base. In this way, the user can open the box body relatively easily at any time, therefore the user experience can be improved. On the other hand, the breathable waterproof membrane 30 also has waterproof and dustproof functions, it can be ensured that air can pass therethrough and prevent items or tools in the box body from becoming damp or contaminated by dust.

Claims

1. A storage box, comprising:
 - a box body (10) having a containing chamber (100) and a sidewall;
 - a valve assembly (D) comprising a vent base (20) and a breathable waterproof membrane (30);
 - wherein,
 - the vent base (20) is connected to the sidewall of the box body (10) and has a ventilation chamber (23) opening toward outside of the box body (10);
 - the breathable waterproof membrane (30) is disposed inside the ventilation chamber (23) and divides the ventilation chamber (23) into a first ventilation chamber (231) located away from the sidewall of the box body (10) and a second ventilation chamber (232) located adjacent to the sidewall of the box body (10);
 - the vent base (20) has one or more first through holes (210) to communicate the first ventilation chamber (231) with the outside of the box body (10), and the box body (10) has one or more second through holes (110) at the sidewall of the box body (10) to communicate the second ventilation chamber (232) with the containing chamber (100).
2. The storage box of claim 1, wherein the vent base (20) comprises a front wall (21) and an annular wall (22) extending toward the sidewall of the box body (10) from an annular edge of the front wall (21), the annular wall (22) and the front wall (21) define the ventilation chamber (23), the one or more first through holes (210) are located on the front wall (21) of the vent base (20).
3. The storage box of claim 2, wherein the vent base (20) is connected to the sidewall of the box body (10) by a connecting shaft (211) extending rearward, the box body (10) has a mounting hole (114) at the sidewall for the connecting shaft (211) to pass through, the connecting shaft (211) passes through the mounting hole (114) and connected to the vent base (20), and the connecting shaft (211) is connected to the sidewall of the box body (10) by a screw (31).
4. The storage box of claim 3, wherein a first gasket (41) and a second gasket (42) are further disposed inside the ventilation chamber (23), the breathable waterproof membrane (30) is located between the first gasket (41) and the second gasket (42), the breathable waterproof membrane (30), the first gasket (41), and the second gasket (42) form a breathable membrane assembly that is sleeved outside the connecting shaft (211);
 - the vent base (20) has a first step portion (221) protruding inwardly from an inner surface of the annular wall (22), and the connecting shaft (211) has a second step portion (2110) protruding outwardly from an outer surface of the connecting shaft (211), an outer

annular edge of the breathable membrane assembly is clamped between the first step portion (221) and the sidewall of the box body (10), and an inner annular edge of the breathable membrane assembly is clamped between the second step portions (2110) and the sidewall of the box body (10).

5. The storage box of claim 4, wherein the second gasket (42) is disposed adjacent to the second ventilation chamber (232), and the second gasket (42) has an annular flange (421) extending radially outward from an outer annular wall of the second gasket (42), the annular flange (421) is sandwiched between an annular end of the annular wall (22) of the vent base (20) and the sidewall of the box body (10).

6. The storage box of claim 5, wherein the second gasket (42) is made of rubber.

7. The storage box of any one of claims 1-6, wherein the box body (10) has a pair of bumps (111) arranged separately and protruding outwardly from the sidewall of the box body (10), a mounting region (112) is defined between the two bumps (111) on the sidewall of the box body (10) for receiving the valve assembly (D).

8. The storage box of claim 7, wherein the vent base (20) has one or more retaining portions (222) protruding outwardly from an outer annular edge of the vent base (20), and the box body (10) further comprises one or more retaining ribs (113) at a top portion of the mounting region (112) on the sidewall of the box body (10), each retaining rib (113) is capable of engaging with the corresponding retaining portion (222) so as to limit rotation of the vent base (20).

9. The storage box of any one of claims 1-6, wherein the box body (10) comprises a box main body (11) having a top opening and a cover (12) covering the top opening of the box main body (11), the valve assembly (D) is disposed on the sidewall of the box main body (11).

10. The storage box of claim 9, wherein the valve assembly (D) is disposed on the sidewall of the box main body (11) adjacent to the top opening of the box main body (11).