

FILTER DEVICE AND FILTERING INFUSION CONTAINER COMPRISING SAME

The present invention claims the priority of Chinese patent applications No. 201710595779.X and No. 201720896157.6, filed on July 20, 2017, the contents of which are incorporated herein by its entirety.

Field of invention

The present invention relates to a filter device and a filtering infusion container comprising same.

Prior arts

During the clinical infusion, before using the filter device with the filter membrane, in order to achieve a best filtration effect, a filter membrane should maintain an integrity, which means that the filter membrane should not only be in an unbroken condition, but also demand a first contact with the infusion liquid when used by the patient. However, in the prior art, since the filter membrane has been readily in contact with the vapor and other substances due to a pre-treated different specific sterilization processes (sterilization methods such as steam sterilization and so on in the pharmaceutical industry) in the factory, the expected filtration effect of the filter membrane will be changed and the effectiveness of the filter membrane will also be reduced.

Content of the present invention

The technical problem to be solved by the present invention is to overcome the defects in the prior art that the vapor and other substances has been in contact with the filter membrane before the filter membrane is used by the patient, and thus the expected filtration effect of the filter membrane has been changed and the effectiveness of the filter membrane has been reduced, and the present application thereby provides a filter device and a filtering infusion container comprising same.

The present invention solves the technical problem mentioned above by the following technical solutions:

A filter device, characterized in that the filter device comprises:

A first component comprising an outer casing, wherein a first side wall and a substrate of the outer casing are surrounded to form a first accommodating cavity;

A second component connected to first component, wherein the second component comprises a flow channel;

An actuator used to close or open the flow channel, wherein the actuator comprises a head portion and a rod portion which are connected with each other, wherein the head portion of the actuator is rotatably connected to the second component and the rod portion of the actuator is inserted in

the flow channel, and wherein the outer surface of the rod portion of the actuator is covered by a seal cover; and

A filter membrane sandwiched between the first component and the second component;

Wherein the filter device further comprises a flow path which sequentially passes through the flow channel, the filter membrane and the first accommodating cavity.

In this technical solution, the sealing method of using the seal cover enables the filter device to continually maintain a good impermeability after being implemented by a specific sterilization processes (sterilization methods such as steam sterilization and so on in the pharmaceutical industry), which means that the filter membrane and the infusion fluid are always located in different closed spaces before usage by the patient, so that the best integrity of the filter membrane can be maintained, moreover no fluid leakage will happen in the filter device, and the actuator will not get loose during transportation.

Preferable, central axis of the actuator is perpendicular to central axis of the flow channel, wherein the actuator motions rotationally around the central axis of the actuator while motions linearly in a direction perpendicular to the central axis of the flow channel.

Preferable, the second component further comprises a mount which is provided with an inner cavity, wherein the rod portion of the actuator is inserted in the inner cavity, and central axis of the inner cavity is perpendicular to the central axis of the flow channel.

Preferable, one side of the head portion facing to the flow channel is provided with a limiting slot, and one end of a side wall of the mount facing to the limiting slot is inserted in the limiting slot, wherein the limiting slot and the side wall of the mount are engaged with each other to limit the movement of the actuator.

Preferable, outer surface of the side wall of the mount is provided with a rotating protrusion, and inner surface of the limiting slot is provided with a rotating groove which is corresponding to the rotating protrusion, wherein the rotating protrusion and the rotating groove are engaged with each other to limit the rotating motion trajectory of the actuator.

In this technical solution, the engagement of the rotating protrusion and the rotating groove enables the actuator to move more smoothly and controlling the movement speed and the distance of the actuator more steadily that closes or opens the flow channel; meanwhile, the rotating protrusion and the rotating groove engaged with each other can limit the motions of the actuator under a pressure directly in a direction away from the mount, such that the flow channel can be prevented from being opened.

Preferable, inner wall of the inner cavity is provided with a limiting step which extends in a

radial direction towards the central axis of the inner cavity, and outer wall of the rod portion is provided with a limiting protrusion which extends in a radial direction towards the mount, wherein the limiting protrusion abuts against to the limiting step, and wherein the limiting protrusion and the limiting step are engaged with each other to limit the movement of the actuator in the direction away from the mount.

In this technical solution, the limiting protrusion and the limiting step engaged with each other limit the moving position of the actuator and prevents the actuator from falling out of the mount which can ensure the safety.

Preferable, the first component further comprises an inner casing, wherein one end of the inner casing passes through and within the first accommodating cavity, and wherein another end of the inner casing passes through the substrate of the outer casing and be located outside of the outer casing, and wherein the substrate is hermetically connected to outer surface of the second side wall of the inner casing, and wherein the second side wall and top plate are surrounded to form a second accommodating cavity, and wherein the second side wall which the inner casing passes through and within the first accommodating cavity is provided with a plurality of gaps, and wherein the plurality of gaps are all communicated with the first accommodating cavity and the second accommodating cavity.

Wherein the flow path sequentially passes through the flow channel, the filter membrane, the first accommodating cavity, the gap and the second accommodating cavity.

In this technical solution, by providing the structure of the inner casing, it enables that after the infusion fluid arrives into the first accommodating cavity along the flow path and then the liquid level reaches a specified height, the infusion fluid enters the second accommodating cavity through the gaps, after that, the infusion fluid is discharged downwards, which can prevent the infusion fluid from dripping into the pinhole of the injection bottle pin directly in the form of water droplets after being filtered by the filter membrane and forming continuous air embolism thereby, and thus the infusion process can be better controlled. Meanwhile, by providing the structure of the inner casing, due to the block of the top plate of the inner casing, it can prevent the injection bottle pin from pricking the filter membrane directly when the injection bottle pin is inserted into the second accommodating cavity, and thus the safety in the operating process can be improved. Furthermore, the gap in this technical solution can also prevent the bubbles from entering the second accommodating cavity, and thus the security of the infusion fluid can be ensured.

Preferable, the first component is integrally molded.

Preferable, the second side wall of the inner casing comprises a first section and a second section which are connected with each other, wherein thickness of the first section is less than the one

of the second section; wherein the first section is located within the first accommodating cavity and is provided with the plurality of gaps; wherein the second section is located out of the outer casing, and the substrate of the outer casing is hermetically connected to the outer surface of the second section adjacent to one end of the first section.

Preferable, the filter device further comprises a sealing component, wherein the sealing component is snapped to other end of the inner casing and is used to seal the second accommodating cavity.

Preferable, the seal cover is screwed with the rod portion.

Preferable, material of the seal cover is rubber.

Preferable, one end of the first section is snapped to the corresponding end of the second section, and the first section and the second section are hermetically connected to each other.

The present invention further provides a filtering infusion container, wherein it comprises the filter device as mentioned above, and wherein the filtering infusion container further comprises an infusion container connected to the filter device, and wherein one end of the flow path is leaded to the infusion container, and the other end is leaded to the filter membrane.

The positive effects of the present invention are:

1. The structure of the present invention is compact, and possesses a high utilization rate of space;
2. By providing the seal cover on the outer surface of the actuator, the present invention enables the filter device to continually maintain a good impermeability after being implemented by a specific sterilization processes (sterilization methods such as steam sterilization and so on in the pharmaceutical industry), which means that the filter membrane and the infusion fluid are always located in different closed spaces before usage by the patient, so that the best integrity of the filter membrane can be maintained, moreover no fluid leakage will happen in the filter device, and the actuator will not get loose during transportation;
3. By providing the rotating protrusion and the rotating groove engaged with each other, the present invention enables the actuator to move more smoothly and controlling the movement speed and the distance of the actuator more steadily that closes or opens the flow channel; meanwhile, the rotating protrusion and the rotating groove engaged with each other can limit the motions of the actuator under a pressure directly in a direction away from the mount, such that the flow channel can be prevented from being opened;
4. By providing the rotating protrusion and the rotating groove engaged with each other, the present invention limits the moving position of the actuator and prevents the actuator from falling out of the mount which ensures the safety;

5. By providing the structure of the inner casing, the present invention not only prevents the infusion fluid from dripping into the pinhole of the injection bottle pin directly in the form of water droplets after being filtered by the filter membrane and forming continuous air embolism thereby, and thus the infusion process can be controlled optimally, but also due to the block of the top plate of the inner casing , it can prevent the injection bottle pin from pricking the filter membrane directly, and thus the safety in the operating process can be improved. Furthermore, the gap of the inner casing can also effect to prevent the bubbles from entering the second accommodating cavity, and thus the security of the infusion fluid can be ensured.

Brief description of the drawings

Fig. 1 is an exploded structure view of the filtering infusion container in an optimal embodiment according to the present invention.

Fig. 2 is a perspective view of the filtering infusion container in an optimal embodiment according to the present invention.

Fig. 3 is a cross-section view of the actuator of the filter device when opening the flow channel in an optimal embodiment according to the present invention.

Explanation of the reference numbers

Filter device	1
Sealing component	10
First component	20
Outer casing	21
First side wall	211
Substrate	212
First accommodating cavity	213
Inner casing	22
Second side wall	221
First section	2211
Second section	2212
Top plate	222

Second accommodating cavity	223
Gap	224
Filter membrane	30
Second component	40
Flow channel	41
Mount	43
Inner cavity	431
Limiting step	4311
Side wall of the mount	432
Rotating protrusion	4321
Actuator	50
Head portion	51
Limiting slot	512
Rotating groove	513
Rod portion	52
Limiting protrusion	521
Seal cover	53
Flow path	60
Fastener	70
Infusion container	2

Detailed description of the preferred embodiment

Hereinafter, the present invention will be described in detail with respect to the embodiment, but is not intended to be limited in the scope disclosed therein.

Referring to Figs. 1-3, it can be understood that the embodiment of the present invention provides a filter device 1 comprising a sealing component 10, a first component 20, a filter membrane 30, a second component 40 and an actuator 50. One end of the first component 20 is snapped to

the corresponding end of the second component 40, and the first component 20 and the second component 40 are hermetically connected with each other. The filter membrane 30 is sandwiched between the first component 20 and the second component 40. The first component 20 is integrally molded.

The first component 20 comprises an outer casing 21 and an inner casing 22. A first side wall 211 and a substrate 212 of the outer casing 21 surround to form a first accommodating cavity 213. One end of the inner casing 22 passes through and within the first accommodating cavity 213, and another end of the inner casing 22 passes through the substrate 212 of the outer casing 21 and is located outside of the outer casing 21, and the substrate 212 is hermetically connected to outer surface of the second side wall 221 of the inner casing 22, and the second side wall 221 and top plate 222 surround to form a second accommodating cavity 223, and the second side wall 221 of the inner casing 22 which passes through and within the first accommodating cavity 213 is provided with four gaps 224, and the four gaps 224 are all communicated with the first accommodating cavity 213 and the second accommodating cavity 223. The four gaps 224 are distributed circumferentially with an isometric interval along the second accommodating cavity 223. In other alternative embodiment, the number of the gaps 224 can also be two, three or other quantities.

The second side wall 221 of the inner casing 22 comprises a first section 2211 and a second section 2212 which are connected with each other, wherein the thickness of the first section 2211 is less than that of the second section 2212; wherein the first section 2211 is located within the first accommodating cavity 213 and is provided with the gaps 224 mentioned above; wherein the second section 2212 is located outside of the outer casing 21, and the substrate 212 of the outer casing 21 is hermetically connected to the outer surface of the second section 2212 adjacent to one end of the first section 2211.

The sealing component 10 is snapped to other end of the inner casing 22 and is used to seal the second accommodating cavity 223. The material of the sealing component 10 is rubber. In the present embodiment, the sealing component 10 is covered by a fastener 70, wherein one end of the fastener 70 is circumferentially snapped to the outside of one end of inner casing 22 adjacent to the sealing component 10. The fastener 70 is used to better fix the sealing component 10 to one end of the inner casing 22.

The second component 40 comprises a flow channel 41. The actuator 50 is used to close or open the flow channel 41. The central axis of the actuator 50 is perpendicular to the central axis of the flow channel 41, wherein the actuator 50 motions rotationally around the central axis of the actuator 50 while motions linearly in a direction perpendicular to the central axis of the flow channel 41. The actuator 50 comprises a head portion 51 and a rod portion 52 which are connected with each other, wherein the diameter of the head portion 51 is greater than the one of

the rod portion 52. The head portion 51 of the actuator 50 is rotatably connected to the second component 40. The rod portion 52 of the actuator 50 is inserted in the flow channel 41, and the outer surface of the rod portion 52 of the actuator 50 is covered by a seal cover 53. In this way, the sealing method of using the seal cover 53 enables the filter device 1 to continually maintain a good impermeability after being implemented by a specific sterilization processes (sterilization methods such as steam sterilization and so on in the pharmaceutical industry), which means that the filter membrane 30 and the infusion fluid are always located in different closed spaces before usage by the patient, so that the best integrity of the filter membrane can be maintained, in the meantime no liquid leakage will happen in the filter device, and the actuator will not get loosen during transportation. In the present embodiment, the seal cover 53 is screwed with the rod portion 52. The material of the seal cover 53 is rubber.

The second component 40 further comprises a mount 43. The mount 43 is provided with an inner cavity 431, wherein the rod portion 52 of the actuator 50 is inserted in the inner cavity 431, and central axis of the inner cavity 431 is perpendicular to the central axis of the flow channel 41.

One side of the head portion 51 facing to the flow channel 41 is provided with a limiting slot 512, and one end of a side wall 432 of the mount facing to the limiting slot 512 is inserted in the limiting slot 512, wherein the limiting slot 512 and the side wall 432 of the mount are engaged with each other to limit the movement of the actuator 50.

In the present embodiment, the outer surface of the side wall 432 of the mount is provided with a rotating protrusion 4321, and the inner surface of the limiting slot 512 is provided with a rotating groove 513 which is corresponding to the rotating protrusion 4321, wherein the rotating protrusion 4321 and the rotating groove 513 are engaged with each other to limit the rotating motion trajectory of the actuator 50. In this way, the provision and engagement of the rotating protrusion 4321 and the rotating groove 513 enables the actuator 50 to move more smoothly and controlling the movement speed and the distance of the actuator 50 more steadily that closes or opens the flow channel; meanwhile, the rotating protrusion 4321 and the rotating groove 513 engaged with each other can limit the motions of the actuator 50 under a pressure directly in a direction away from the mount 43, such that the flow channel 41 can be prevented from being opened.

Specifically, as for the seal cover 53 of the actuator 50, when the actuator 50 closes the flow channel 41, meanwhile the seal cover 53 keeps in a steam sterilization state, the expanding pressure of the above medicine liquid due to the rising temperature will appportion on the whole seal cover 53. At this time, since the seal cover 53 effects to seal the flow channel 41, a dead space (which means the air will be unable to be discharged normally) with certain volume will form at the terminal end of the flow channel 41. Similarly, during in a steam sterilization state,

since the rising temperature (the steam sterilization temperature reaches 121°C) will lead to the air in the dead space being expanded, the actuator 50 will be pushed to motion in a direction away from the mount 43, which is motioning in a direction of opening the flow channel 41, thus, it will come into a potential risk that the flow channel 41 will be opened during the sterilization and the medicine liquid will permeate the filter membrane resulting in an invalidation thereof. While, the screw engagement between the rotating groove 513 of the actuator and the rotating protrusion 4321 of the mount can neutralize the expanding force from the air, and thus the filter membrane will be prevented from being wet during the sterilization.

The inner wall of the inner cavity 431 of the mount is provided with a limiting step 4311 which extends in a radial direction towards the central axis of the inner cavity 431, and outer wall of the rod portion 52 is provided with a limiting protrusion 521 which extends in a radial direction towards the mount 43, wherein the limiting protrusion 521 abuts against to the limiting step 4311, and wherein the limiting protrusion 521 and the limiting step 4311 are engaged with each other to limit the movement of the actuator 50 in the direction away from the mount 43. In this way, the provision and engagement of the limiting protrusion 521 and the limiting step 4311 limits the moving position of the actuator 50 and prevents the actuator 50 from falling out of the mount 43, which ensures the safety.

The filter device 1 further comprises a flow path 60 which sequentially passes through the flow channel 41, the filter membrane 30, the first accommodating cavity 213, the gap 224 and the second accommodating cavity 223.

The operating principle of the present invention is that: when the infusion fluid arrives in the first accommodating cavity along the flow path, the liquid level of the infusion fluid rises gradually, after the liquid level reaches the specified height, the infusion fluid enters the second accommodating cavity through the gap, and after that, the infusion fluid is discharged downwards, which can prevent the infusion fluid from dripping into the pinhole of the injection bottle pin directly in the form of water droplets after being filtered by the filter membrane and forming continuous air embolism thereby, and thus the infusion process can be better controlled. Meanwhile, by providing the structure of the inner casing, due to the block of the top plate of the inner casing, it can prevent the injection bottle pin from pricking the filter membrane directly when the injection bottle pin is inserted into the second accommodating cavity, and thus the safety in the operating process can be improved. Furthermore, the gap in this technical solution can also prevent the bubbles from entering the second accommodating cavity, and thus the security of the infusion fluid can be ensured.

The present embodiment further provides a filtering infusion container, wherein it comprises the filter device 1 as mentioned above, and wherein the filtering infusion container further comprises an infusion container 2 connected to the filter device 1, and wherein one end of the flow path 60

is leaded to the infusion container 2, and other end is leaded to the filter membrane 30.

While the foregoing specific embodiment has been described in the present invention, it will be understood by those skilled in the art that those are only for the illustration purposes and the scope sought to be protected by the present invention is limited by the accompanying claims. Those skilled in the art can implement various changes and modifications to these embodiments without departing from the principle and essence of the present invention, however these changes and modifications will all fall into the scope sought to be protected the present invention.

What is claimed is:

1. A filter device, characterized in that the filter device comprises:

a first component comprising an outer casing, wherein a first side wall and a substrate of the outer casing surround to form a first accommodating cavity;

a second component connected to the first component, wherein the second component comprises a flow channel;

an actuator used to close or open the flow channel, wherein the actuator comprises a head portion and a rod portion which are connected with each other, wherein the head portion of the actuator is rotatably connected to the second component and the rod portion of the actuator is inserted in the flow channel, and wherein the outer surface of the rod portion of the actuator is covered by a seal cover; and

a filter membrane sandwiched between the first component and the second component;

wherein the first component further comprises an inner casing, wherein one end of the inner casing passes through and within the first accommodating cavity, and wherein the other end of the inner casing passes through the substrate of the outer casing and be located outside of the outer casing, and wherein the substrate is hermetically connected to outer surface of a second side wall of the inner casing, and wherein the second side wall and top plate surround to form a second accommodating cavity, and wherein the second side wall of the inner casing which passes through and within the first accommodating cavity is provided with a plurality of gaps, and wherein the plurality of gaps are communicated with the first accommodating cavity and the second accommodating cavity,

wherein the flow path sequentially passes through the flow channel, the filter membrane, the first accommodating cavity, the gap and the second accommodating cavity.

2. The filter device according to claim 1, wherein a central axis of the actuator is perpendicular to a central axis of the flow channel, wherein the actuator motions rotationally around the central axis of the actuator while motions linearly in a direction perpendicular to the central axis of the flow channel.

3. The filter device according to claim 2, wherein the second component further comprises a mount which is provided with an inner cavity, wherein the rod portion of the actuator is inserted in the inner cavity, and a central axis of the inner cavity is perpendicular to the central axis of the flow channel.

4. The filter device according to claim 3, wherein one side of the head portion facing to the

flow channel is provided with a limiting slot, and one end of a side wall of the mount facing to the limiting slot is inserted in the limiting slot, wherein the limiting slot and the side wall of the mount are engaged with each other to limit the movement of the actuator.

5. The filter device according to claim 4, wherein outer surface of the side wall of the mount is provided with a rotating protrusion, and inner surface of the limiting slot is provided with a rotating groove which is corresponding to the rotating protrusion, wherein the rotating protrusion and the rotating groove are engaged with each other to limit the rotating motion trajectory of the actuator.

6. The filter device according to any one of claims 3-5, wherein an inner wall of the inner cavity is provided with a limiting step which extends in a radial direction towards the central axis of the inner cavity, and an outer wall of the rod portion is provided with a limiting protrusion which extends in a radial direction towards the mount, wherein the limiting protrusion abuts against to the limiting step, and wherein the limiting protrusion and the limiting step are engaged with each other to limit the movement of the actuator in the direction away from the mount.

7. The filter device according to claim 1, wherein the first component is integrally molded.

8. The filter device according to claim 1 or 7, wherein the second side wall of the inner casing comprises a first section and a second section which are connected with each other, wherein thickness of the first section is less than that of the second section; wherein the first section is located within the first accommodating cavity and is provided with the plurality of gaps; wherein the second section is located outside of the outer casing, and the substrate of the outer casing is hermetically connected to the outer surface of the second section adjacent to one end of the first section.

9. The filter device according to any one of claims 1, 7 and 8, wherein the filter device further comprises a sealing component, wherein the sealing component is snapped to the other end of the inner casing and is used to seal the second accommodating cavity.

10. The filter device according to any one of claims 1-9, wherein the seal cover is screwed with the rod portion.

11. The filter device according to any one of claims 1-10, wherein material of the seal cover is rubber.

12. The filter device according to any one of claims 1-11, wherein one end of the first section is snapped to the corresponding end of the second section, and the first section and the second section are hermetically connected to each other.

13. A filtering infusion container, characterized in that the filtering infusion container comprises the filter device according to any one claims 1-12, wherein the filtering infusion container further comprises an infusion container connected to the filter device, and wherein one end of the flow path leads to the infusion container, and the other end leads to the filter membrane.