

Description

Medical pendant box body

5 The present application claims the priorities of Application No. 201410181214.3 of Chinese patent application filed on April 30, 2014, the entire contents of which are incorporated herein by reference.

Technical field

10 The present invention relates to the technical field of medical equipment, and more particularly to a medical pendant box body.

Background art

15 Medical pendant system is an indispensable medical equipment used in modern hospital operating room, intensive care unit and the like. The main structure of a medical pendant is a box body. The existing medical pendant box body is generally composed of panels and posts. The installation mode for the panels and posts of existing medical pendant box body lies in that holes are formed in the two sides of the front of the panels, the panels are fixed to the posts using large number
20 of installation screws in a fixed interval, and silica gel or rubber sealing strips are needed to mask the screws after fixing with the screws.

 Therefore, the existing medical pendant box body has the following drawbacks:

25 (1) A large number of installation screws are needed to use, the installation is laborious and time-consuming, and the screws are exposed on the surface of the panels;

30 (2) silica gel or rubber sealing strips are needed to mask the screws after fixing with the screws if it is not desired for the screws to be exposed on the surface of the panels, but the use of silica gel or rubber sealing strips is not good for the cleaning and disinfection in hospitals.

Summary of invention

One of the purposes of the present invention is to overcome the above-mentioned disadvantages of the existing medical pendant box body, there is provided a medical pendant box body, which can be installed using a small amount of screws or even not using a screw to achieve the reliable connection of the panels and posts as well as the entire box body, without exposed screws on the surface of the panels, without using the silica gel or rubber sealing strips to mask the screws, which facilitates the cleaning and disinfection, being capable of realizing the rapid disassembly and assembly of the medical pendant box body with very short time consumption.

The above purposes of the present invention are achieved by a medical pendant box body, the medical pendant box body comprises at least two panels, at least two posts extending along the longitudinal direction of the medical pendant box body, an upper base plate and a lower base plate, the at least two panels are fixed to the at least two posts, respectively, the upper base plate and the lower base plate are fixed to the upper edge and the lower edge of each panel of the at least two panels, respectively, a snap-fit portion is provided on each panel of the at least two panels at or in the vicinity of its at least one side edge, and a slot for receiving the corresponding snap-fit portion of the corresponding panel is provided on at least one side of each post of the at least two posts.

According to the above-mentioned technical solution, the medical pendant box body of the present invention can have the following beneficial technical effects: it can be installed using a small amount of screws or even not using a screw to achieve the reliable connection of the panels and posts as well as the entire box body, without exposed screws on the surface of the panels, without using the silica gel or rubber sealing strips to mask the screws, which facilitates the cleaning and disinfection, being capable of realizing the rapid disassembly and assembly of the medical pendant box body with very short time consumption.

Preferably, the upper base plate and the lower base plate each comprises a through-hole at or the in the vicinity of its periphery for a base plate-fixing screw to pass through, and a base plate-fixing threaded hole for receiving the corresponding

base plate-fixing screw is provided at or in the vicinity of the upper edge and lower edge of each panel of the at least two panels.

According to the above-mentioned technical solution, the medical pendant box body of the present invention can have the following beneficial technical effects:
5 the number of the screws used in the medical pendant box body of the present invention is greatly reduced as compared with the number of the screws used in the medical pendant box body of the prior art, furthermore, there is no exposed screws on the surface of the panels, without using the silica gel or rubber sealing strips to mask the screws, which facilitates the cleaning and disinfection, being capable of
10 realizing the rapid disassembly and assembly of the medical pendant box body with very short time consumption.

Preferably, the at least two panels are three panels, the at least two posts are three posts, the three panels comprises two side panels with generally L-shaped cross section and one rear panel with generally I-shaped cross section.

According to the above-mentioned technical solution, the medical pendant box body of the present invention can have the following beneficial technical effects: a relatively simple medical pendant box body having relatively small space of the box body is provided, which can be installed using a small amount of screws or even not
15 using a screw to achieve the reliable connection of the panels and posts as well as the entire box body, without exposed screws on the surface of the panels, being
20 capable of realizing the rapid disassembly and assembly of the medical pendant box body.

Preferably, the cross section of the medical pendant box body is generally square or trapezoidal.

According to the above-mentioned technical solution, the medical pendant box body of the present invention can have the following beneficial technical effects: a medical pendant box body having preferable cross section shape is provided, which
25 can realize the simple and rapid disassembly and assembly of the medical pendant box body using less screws, meanwhile can more appropriately accommodate the
30 internal components of the box body.

Preferably, the at least two panels are eight panels, the at least two posts are

four posts, the medical pendant box body further comprises four auxiliary columns extending along the longitudinal direction of the medical pendant box body, the eight panels comprises two side panels having generally L shaped cross section and six panels having generally I-shaped cross section, in which the medical pendant box body comprises two sub-box bodies, each sub-box body comprises one side panel having generally L shaped cross section, three panels having generally I-shaped cross section, two posts and two auxiliary columns.

According to the above-mentioned technical solution, the medical pendant box body of the present invention can have the following beneficial technical effects: a medical pendant box body having relatively large space of the box body and rational space distribution is provided, which can be installed using a small amount of screws or even not using a screw to achieve the reliable connection of the panels and posts as well as the entire box body, without exposed screws on the surface of the panels, being capable of realizing the rapid disassembly and assembly of the medical pendant box body.

Preferably, the total cross section of the medical pendant box body is generally rectangular or trapezoidal, and the cross section of each sub-box body is generally square or trapezoidal.

According to the above-mentioned technical solution, the medical pendant box body of the present invention can have the following beneficial technical effects: a medical pendant box body and its sub-box body having preferable cross section shape are provided, which can realize the simple and rapid disassembly and assembly of the medical pendant box body using less screws, meanwhile can more appropriately accommodate the internal components of the box body.

Preferably, there is an interval between the two sub-box bodies, which forms a hollow area from top to bottom.

According to the technical solutions described above, the medical pendant box body of the present invention can have the following beneficial technical effects: the hollow area can be used as the cable management area of the medical pendant.

Preferably, the at least two panels are eight panels, the at least two posts are four posts, the medical pendant box body further comprises four auxiliary columns

extending along the longitudinal direction of the medical pendant box body, the eight panels comprises eight panels having generally I-shaped cross section.

According to the above-mentioned technical solution, the medical pendant box body of the present invention can have the following beneficial technical effects: a medical pendant box body having relatively large space of the box body and rational space distribution is provided, which can be installed using a small amount of screws or even not using a screw to achieve the reliable connection of the panels and posts as well as the entire box body, without exposed screws on the surface of the panels, being capable of realizing the rapid disassembly and assembly of the medical pendant box body.

Preferably, the cross section of the medical pendant box body is generally rectangular or trapezoidal.

According to the above-mentioned technical solution, the medical pendant box body of the present invention can have the following beneficial technical effects: a medical pendant box body having preferable cross section shape is provided, which can realize the simple and rapid disassembly and assembly of the medical pendant box body using less screws, meanwhile can more appropriately accommodate the internal components of the box body.

Preferably, the auxiliary columns are provided with panel-fixing thread grooves for receiving the panel-fixing screws so as to fix at least one panel to the auxiliary columns.

According to the technical solutions described above, the medical pendant box body of the present invention can have the following beneficial technical effect: the firmness of the medical pendant box body is further reinforced through the additional fixation of the auxiliary columns and the panel-fixing screws.

Preferably, the medical pendant box body also comprises a side cover plate for masking the panel-fixing screws.

According to the above-mentioned technical solution, the medical pendant box body of the present invention can have the following beneficial technical effects: in the case of setting the auxiliary columns and panel-fixing screws, the panel-fixing screws are effectively masked, so that the screws are not exposed on the surface of

the panels, without using the silica gel or rubber sealing strips to mask the screws, which facilitates the cleaning and disinfection.

Preferably, at least two spare thread grooves are provided on the internal surface of each panel of the at least two panels.

5 According to the above-mentioned technical solution, the medical pendant box body of the present invention can have the following beneficial technical effects: the installation of the air port of the panel can be implemented without exposing screws, which changes the phenomenon that a large number of screws are exposed after installing the air port in the panels of the box body of the prior art, which
10 facilitates the cleaning and disinfection in hospitals.

Preferably, the distances among the at least two spare thread grooves on each panel are equal.

According to the above-mentioned technical solution, the medical pendant box body of the present invention can have the following beneficial technical effects:
15 when electrical isolation is needed among the panels, electrical separators can be made into a general part owing to the uniform interval among the spare thread grooves, so that the electrical separators of different panels can totally be installed interchangeably, which strengthens the versatility of the electrical separators.

Preferably, the medical pendant box body also comprises a separator, the edge
20 part of the separator pressing against the top surface of the periphery of the groove of the spare thread grooves via the head of the separator-fixing screw.

According to the technical solutions described above, the medical pendant box body of the present invention can have the following beneficial technical effect: the separator can be rapidly and simply installed on the panel without exposing the
25 separator-fixing screw.

Preferably, the cross section of the separator is generally in a shape which looks like the Chinese character "几 (ji)".

According to the above-mentioned technical solution, the medical pendant box body of the present invention can have the following beneficial technical effects:
30 the electrical isolation can be achieved, meanwhile can more appropriately

accommodate the internal components of the box body.

Preferably, the medical pendant box body also comprises auxiliary columns extending along the longitudinal direction of the medical pendant box body, the auxiliary columns are provided with panel-fixing thread grooves for receiving the panel-fixing screws so as to fix at least one panel to the auxiliary columns.

According to the technical solutions described above, the medical pendant box body of the present invention can have the following beneficial technical effect: the firmness of the medical pendant box body is further reinforced through the additional fixation of the auxiliary columns and the panel-fixing screws.

Brief description of drawings

Figure 1 is the three-dimensional view for the medical pendant box body of the first embodiment of the present invention.

Figure 2 is the three-dimensional view for the medical pendant box body of the first embodiment of the present invention, in which the upper base plate is removed for clarity.

Figure 3 is the top view of the medical pendant box body shown in figure 2.

Figure 4 is the partial enlarged view of a portion of the top left corner of figure 3, in which the portion of the top left corner of figure 3 is rotated by 180 degrees for clarity.

Figure 5 is the three-dimensional view for the medical pendant box body of the second embodiment of the present invention.

Figure 6 is the three-dimensional view for the medical pendant box body of the second embodiment of the present invention, in which the upper base plate is removed for clarity.

Figure 7 is the top view of the medical pendant box body shown in figure 6, in which the anterior-posterior direction is turned by 180 degrees for clarity.

Figure 8 is the partial enlarged view of a portion of the top left corner of figure 7.

Figure 9 is the partial enlarged view showing the details of the spare thread grooves and separator in the medical pendant box body.

Sign list for drawings

1. panel;
2. post;
3. upper base plate;
4. lower base plate;
5. side cover plate;
6. auxiliary columns;
10. medical pendant box body;
11. snap-fit portion;
12. base plate-fixing threaded holes;
13. spare thread grooves;
14. separator;
15. top surface of periphery of the groove;
21. slot;
22. panel-fixing thread grooves;
31. mechanical connecting piece;
101. sub-box body;
102. sub-box body.

Detailed description

The present invention is further described in connection with drawings and particular embodiments as follows and elaborated in more detail in the following description in order to fully understand the present invention, but it is evident that the present invention can be implemented in many other ways which are different from those described herein; generalization and deduction can be made by a skilled in the art without departing from the connotation of the invention according to practical application, and therefore the protective scope of the present invention should not be limited by the specific content of embodiments of the present invention herein.

(The first embodiment)

Figure 1 and figure 2 respectively show the three-dimensional views for the medical pendant box body 10 of the first embodiment of the present invention, in which the upper base plate is removed from the medical pendant box body 10 in figure 2 for clarity. Figure 3 shows the top view of the medical pendant box body 10 shown in figure 2. Figure 4 shows the partial enlarged view of a portion of the top left corner of figure 3, in which the portion of the top left corner of figure 3 is rotated by 180 degrees for clarity.

The medical pendant box body 10 of the present invention comprises at least two panels 1, at least two posts 2 extending along the longitudinal direction of the medical pendant box body, an upper base plate 3 and a lower base plate 4, at least two panels 1 are fixed to the at least two posts 2, respectively, the upper base plate 3 and the lower base plate 4 are fixed to the upper edge and the lower edge of each panel 1 of at least two panels 1, respectively, a snap-fit portion 11 is provided on or near to at least one side edge of each panel 1 of at least two panels 1, and a slot 21 is provided on at least one side of each post 2 of at least two posts 2 for receiving the corresponding snap-fit portion 11 of the corresponding panel 1.

In this way, the medical pendant box body of the present invention can be installed using a small amount of screws or even not using a screw to achieve the reliable connection of the panels and posts as well as the entire box body, without exposed screws on the surface of the panels, without using the silica gel or rubber sealing strips to mask the screws, which facilitates the cleaning and disinfection, being capable of realizing the rapid disassembly and assembly of the medical pendant box body with very short time consumption.

Note that, "upper", "lower", "front", "rear", "left", "right" and the like used herein are only exemplary directions defined to facilitate the description of the invention, as shown in figure 3, the direction toward the reader is "upper", the direction away from the reader is "lower", the direction of the bottom side in the paper is "front", the direction of the top side in the paper is "rear", the direction of the left side in the paper is "left", and the direction of the right side in the paper is "right". Of course, those skilled in the art on the basis of the present invention can understand that "upper", "lower", "front", "rear", "left", "right" and other directions

can also be defined in other ways, which also fall into the protective scope of the present invention.

Preferably, the upper base plate 3 and the lower base plate 4 each comprises a through-hole (not shown) at or the in the vicinity of its periphery for a base plate-fixing screw (not shown) to pass through, and a base plate-fixing threaded hole 12 is provided at or in the vicinity of the upper edge and lower edge of each panel 1 of at least two panels 1 for receiving the corresponding base plate-fixing screw.

Although the embodiments given above only describe the case of the additional fixation of the base plates and the panels through the base plate-fixing screws, a person skilled in the art on the basis of the present invention will understand that other fixing modes (for example, riveting, welding, etc.) can also be employed as long as the base plates can be fixed to the panels. Such variation also falls into the protection scope of the present invention.

In this way, even though the base plates and the panels are additionally fixed via the base plate-fixing screws, the number of the screws (for example, in the embodiment shown in figure 3, only need totally upper and lower eight screws) used in the medical pendant box body of the present invention has been also greatly reduced as compared with the number of the screws (generally need several dozens) used in the medical pendant box body of the prior art, furthermore, there is no exposed screws on the surface of the panels (for example, in the embodiment shown in figure 3, the screws are located at the upper base plate and the lower base plate), without using the silica gel or rubber sealing strips to mask the screws, which facilitates the cleaning and disinfection, being capable of realizing the rapid disassembly and assembly of the medical pendant box body with very short time consumption.

According to the first embodiment of the present invention, preferably, as shown in figures 1-4, the medical pendant box body 10 comprises three panels 1 and three posts 2, the three panels 1 comprises two side panels with generally L-shaped cross section and one rear panel with generally I-shaped cross section.

According to the first embodiment of the present invention, preferably, as

shown in figures 1-4, the cross section of the medical pendant box body 10 is generally square or trapezoidal.

As shown in figures 3 and 4, the medical pendant box body of the first embodiment of the present invention can be adapted for the mechanical connecting piece 31 with width W1 or W2. That is, a single post can be adapted for a mechanical connecting piece with a width of W1, and the interval between two posts can be adapted for a mechanical connecting piece with a width of W2. Preferably, $W2 > W1$. The mechanical connecting piece can be used for installing various medical accessories, for example, a control handle, an infusion pole, a display arm, a medical guide rail, etc.

(The second embodiment)

Figure 5 and figure 6 respectively show the three-dimensional views for the medical pendant box body 10 of the second embodiment of the present invention, in which the upper base plate is removed from the medical pendant box body 10 in figure 6 for clarity. Figure 7 shows the top view of the medical pendant box body 10 shown in figure 6, in which the anterior-posterior direction is turned by 180 degrees for clarity. Figure 8 shows the partial enlarged view of a portion of the top left corner of figure 7.

According to the second embodiment of the present invention, preferably, as shown in figures 5-8, the medical pendant box body 10 comprises eight panels 1, four posts 2 and four auxiliary columns 6 extending along the longitudinal direction of the medical pendant box body, the eight panels 1 comprises two side panels having generally L shaped cross section and six panels having generally I-shaped cross section, in which the medical pendant box body 10 comprises two sub-box bodies 101 and 102, each sub-box body comprises one side panel having generally L shaped cross section, three panels having generally I-shaped cross section, two posts 2 and two auxiliary columns 6 (in figures 6 and 7, only the panels, posts, and auxiliary columns of the box body 101 are marked for clarity, but it should be understood that the constitution of the sub-box body 102 can be similar to the constitution of the sub-box body 101).

According to the second embodiment of the present invention, preferably, as

shown in figures 5-8, the total cross section of the medical pendant box body 10 is generally rectangular or trapezoidal, and the cross section of each sub-box body is generally square or trapezoidal.

According to the second embodiment of the present invention, preferably, as shown in figures 5-8, there is an interval between the two sub-box bodies, which forms a hollow area from top to bottom. In this way, the hollow area can be used as the cable management area of the medical pendant.

As compared with the medical pendant box body of first embodiment of the present invention, the medical pendant box body of the second embodiment of the present invention can provide a larger space of box body and can be adapted for a mechanical connecting piece with wider width. For example, as shown in figure 7, the medical pendant box body of the second embodiment of the present invention can be adapted for the mechanical connecting pieces with widths W3 and W4. That is, the interval between the front two posts can be adapted for a mechanical connecting piece with a width of W3, and the interval between the rear two posts can be adapted for a mechanical connecting piece with a width of W4. Preferably, $W4 > W3$.

Preferably, the W3 can be made equal to W2 in order to make a mechanical connecting piece of the same width can be used for both the medical pendant box body of the first embodiment of the present invention and used for the second embodiment of the present invention.

As compared with the medical pendant box body of first embodiment of the present invention, the medical pendant box body of the second embodiment of the present invention has larger space of box body and more number of panels and posts, therefore, in order to conduct additional fixation, preferably, as shown in figures 5-8, auxiliary columns 6 are provided with panel-fixing thread grooves 22 (in particular, see figure 8) for receiving panel-fixing screws (not shown) so as to fix at least one panel to the auxiliary columns. The medical pendant box body 10 also comprises a side cover plate 5 for masking the panel-fixing screws.

(The third embodiment)

The medical pendant box body of the third embodiment of the present

invention is substantially the same as the medical pendant box body of the second embodiment of the present invention (therefore, it is not illustrated), the difference therebetween only lies in that: see figure 7, the two side panels with generally L-shaped cross section in the medical pendant box body of the second embodiment of the present invention are removed, and two panels respectively located at the front side and the rear side and having generally I-shaped cross section are added.

That is to say, according to the third embodiment of the present invention, preferably, the medical pendant box body 10 comprises eight panels 1, four posts 2 and four auxiliary columns 6, the eight panels 1 include eight panels having generally I-shaped cross section.

According to the third embodiment of the present invention, preferably, the cross section of the medical pendant box body 10 is generally rectangular or trapezoidal.

Although the three embodiments given above only describe the cases of a particular number of panels and posts, and medical pendant box bodies having a particular cross section shape, a person skilled in the art on the basis of the present invention should understand that the protective scope of the present invention is not limited to the particular number of panels and posts, and the medical pendant box bodies having a particular cross section shape listed above, and other number of panels and posts and the medical pendant box bodies having other cross section shapes can also be employed.

For example, the medical pendant box body can comprise two panels and two posts, both the panels are generally in a shape which looks like the Chinese character "几 (ji)", so that the cross section shape of the medical pendant box body is generally square; or both the panels are generally in semicircular shape, so that the cross section shape of the medical pendant box body is generally circular.

Again, for example, the medical pendant box body can comprise four panels and four posts, all of the four panels are generally I-shaped, so that the cross section shape of the medical pendant box body is generally square; or all of the four panels are generally in quarter of circular shape, so that the cross section shape of the

medical pendant box body is generally circular.

Again, for example, the medical pendant box body can comprise five panels and five posts, all of the five panels are generally I-shaped, so that the cross section shape of the medical pendant box body is generally pentagonal.

5 Owing to the numerous variations, other number of panels and posts, and the medical pendant box bodies having other cross section shapes are not listed one by one, all of them fall into the protective scope of the present invention.

Furthermore, a person skilled in the art on the basis of the present invention should understand that auxiliary columns can be set according to needs or no
10 auxiliary column is set, and if auxiliary columns are set, the setting modes of auxiliary columns are not limited to the embodiments give above, and other setting modes can be employed, all of them falling into the protective scope of the present invention. That is to say, in addition to the panels, the posts, the upper base plate and the lower base plate, the medical pendant box body 10 can also comprises
15 auxiliary columns 6 extending along the longitudinal direction of the medical pendant box body, the auxiliary columns 6 are provided with panel-fixing thread grooves 22 for receiving the panel-fixing screws so as to fix at least one panel 1 to auxiliary columns 6.

20 As shown in figures 3 and 9, preferably, at least two spare thread grooves 13 are provided on the internal surface of panels 1. Preferably, these spare thread grooves 13 can extend along the longitudinal direction of the medical pendant box body and passing through the entire length of the medical pendant box body.

Preferably, the distances among the at least two spare thread grooves 13 on
25 each panel 1 are equal. For example, as shown in figure 3, the distance between the two spare thread grooves 13 on the left panel is equal to the distance between the two spare thread grooves 13 on the right panel.

Preferably, the medical pendant box body 10 also comprises a separator 14, the edge part of the separator 14 pressing against the top surface 15 of the periphery of
30 the groove of the spare thread grooves 13 via the head (not shown) of the separator-fixing screw.

Preferably, separator 14 is an electrical separator so as to achieve the electrical isolation among the various internal components in the medical pendant box body 10.

Preferably, the cross section of the separator 14 is generally in a shape which looks like the Chinese character "几 (ji)".

Preferably, as shown in figures 2 and 6, posts 2 extend along the longitudinal direction of the medical pendant box body 10 and passing through the entire length of the medical pendant box body 10. In this way, by means of a mechanical connecting piece, the location of the medical accessories can be steplessly adjusted along the longitudinal direction of the medical pendant box body.

The present invention has been exemplarily described above in connection with the figures, although the specific implementations of the present invention are not limited to the above embodiments. Various modifications or variations can be made by a person skilled in the art on the premise of without departing from the technical concept of the present invention, and such modifications or variations of course fall within the protection scope of the present invention.

Claims

1. A medical pendant box body, characterized in that the medical pendant box body comprises at least two panels, at least two posts extending along the longitudinal direction of the medical pendant box body, an upper base plate and a lower base plate, the at least two panels are fixed to the at least two posts, respectively, the upper base plate and the lower base plate are fixed to the upper edge and the lower edge of each panel of the at least two panels, respectively, a snap-fit portion is provided on at least one side edge of each panel of the at least two panels and a slot for receiving the corresponding snap-fit portion of the corresponding panel is provided on at least one side of each post of the at least two posts;

wherein the at least two panels are eight panels, the at least two posts are four posts, the medical pendant box body further comprises four auxiliary columns extending along the longitudinal direction of the medical pendant box body, the eight panels comprises two side panels having generally L shaped cross section and six panels having generally I-shaped cross section, in which the medical pendant box body comprises two sub-box bodies, each sub-box body comprises one side panel having generally L shaped cross section, three panels having generally I-shaped cross section, two posts and two auxiliary columns.

2. The medical pendant box body of claim 1, wherein the upper base plate and the lower base plate each comprises a through-hole at its periphery for a base plate-fixing screw to pass through, and a base plate-fixing threaded hole for receiving the corresponding base plate-fixing screw is provided in each panel of the at least two panels at or in the vicinity of its upper edge and lower edge.

3. The medical pendant box body of claim 1, wherein the total cross section of the medical pendant box body is generally rectangular or trapezoidal, and the cross section of each sub-box body is generally square or trapezoidal.

4. The medical pendant box body of claim 1, wherein there is an interval

between the two sub-box bodies, which forms a hollow area from top to bottom.

5 5. The medical pendant box body of claim 1, wherein the auxiliary columns are provided with panel-fixing thread grooves for receiving panel-fixing screws so as to fix at least one panel to the auxiliary columns.

6. The medical pendant box body of claim 5, wherein the medical pendant box body also comprises a side cover plate for masking the panel-fixing screws.

10 7. The medical pendant box body of claim 1, wherein at least two spare thread grooves are provided on the internal surface of each panel of the at least two panels.

15 8. The medical pendant box body of claim 7, wherein the distances among the at least two spare thread grooves on each panel are equal.

20 9. The medical pendant box body of claim 7, wherein the medical pendant box body also comprises a separator, the edge part of the separator pressing against the top surface of the periphery of the groove of the spare thread grooves via the head of a separator-fixing screw.

10. The medical pendant box body of claim 9, wherein the cross section of the separator is generally in a shape of the Chinese character "几 (ji)".