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(54) **Air spring for rail transit**

(57) An air spring for rail transit according to the present application includes an upper cover plate; an hourglass-shaped spring adapted to support the upper cover plate and having an interior provided with a separating plate adapted to divide the hourglass-shaped spring to have a multilayer structure; and an air bag hermetically connected to both of the upper cover plate and the hourglass-shaped spring, and a sealed space is formed among the upper cover plate, the hourglass-shaped spring and the air bag. Compared to the air spring in the prior art, the air spring for rail transit in the present application may have a better deformability and a low vertical and lateral characteristics in an inflated state, and the hourglass-shaped spring may still provide a low vertical rigidity in a deflated state, thereby enhancing the operation safety of the railway vehicle operating in the deflated state.

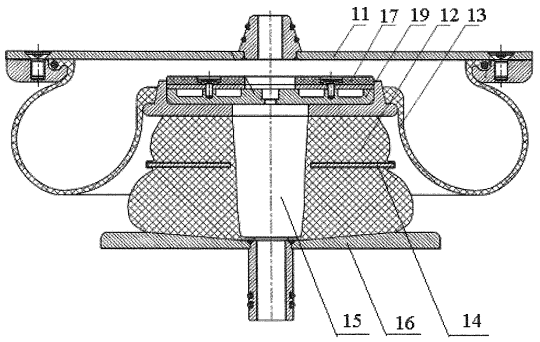

Fig. 3

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Description

TECHNICAL FIELD

[0001] The present application relates to the technical field of accessories of rail transit vehicles, and in particular to an air spring for rail transit.

BACKGROUND

[0002] An air spring has functions of supporting, buffering, height adjusting, angle adjusting and etc., and is widely used in commercial vehicles, buses, rail vehicles and other devices. The air spring for rail transit includes an air bag and an auxiliary spring, and the auxiliary spring may support the air bag, avoid interference, and meet the operation requirement of the vehicle when the air bag is deflated, so as to ensure the safe operation of the vehicle when the air bag is deflated.

[0003] Two types of air springs for rail transit used in railway vehicles in the prior art are described in detail hereinafter in conjunction with accompanying drawings.

[0004] Reference is made to Figure 1, which is a schematic view showing the structure of an air spring for rail transit in the prior art.

[0005] The air spring includes a small convolution bellows air bag 011, a laminated spring 012 and an upper cover plate 013. The small convolution bellows air bag 011 is hermetically connected to both of the upper cover plate 013 and the laminated spring 012, and a sealed space is formed among the small convolution bellows air bag 011, the upper cover plate 013 and the laminated spring 012. When the small convolution bellows air bag 011 is filled with gas, i.e., the sealed space formed by the small convolution bellows air bag 011, the laminated spring 012 and the upper cover plate 013 is filled with gas, the upper cover plate is supported by the gas in the small convolution bellows air bag 011; and the upper cover plate is supported by the laminated spring 012 when the small convolution bellows air bag 011 is deflated.

[0006] However, the laminated spring 012 of the air spring has a large rigidity. When the vehicle runs in a curve in a case that the small air bag 011 of the air spring is deflated, there is a risk that the vehicle may be derailed due to the large vertical rigidity of the laminated spring 012.

[0007] Reference is made to Figure 2, which is a schematic view showing the structure of another air spring for rail transit in the prior art.

[0008] The air spring includes a big convolution bellows air bag 03 and a tapered spring 04. The tapered spring 04 includes a spindle 05, a rubber layer 06 and an outer sleeve 07, and the outer sleeve 07 is connected to a press plate 08.

[0009] The structure formed by the big convolution bellows air bag 03 and the tapered spring 04 has a strong deflection capacity, a low vertical rigidity and a low lateral rigidity, thus may ensure a high operation security for the vehicle. However, this structure is relatively complicated, has a greater weight and requires a larger installation space.

[0010] Therefore, a technical problem to be solved presently by those skilled in the art is to solve problems of the conventional air springs for rail transit, such as the laminated spring has a large vertical rigidity, the tapered spring has a complicated structure and a large installation space is required.

SUMMARY

[0011] The present application provides an air spring for rail transit, which has a strong deformability in an inflated state, and may provide a low vertical rigidity in a deflated state via a hourglass-shaped spring, thereby enhancing the operation safety for a railway vehicle operating in the deflated state. Moreover, the air spring for rail transit according to the present application has a simple structure and requires a small installation space.

[0012] The air spring for rail transit according to the present application includes:

an upper cover plate;
an hourglass-shaped spring adapted to support the upper cover plate and having an interior provided with a separating plate adapted to divide the hourglass-shaped spring to have a multilayer structure; and
an air bag hermetically connected to both of the upper cover plate and the hourglass-shaped spring, and a sealed space being formed among the upper cover plate, the hourglass-shaped spring and the air bag.

[0013] Preferably, the hourglass-shaped spring is provided with a hollow structure, and the hollow structure has a centerline coinciding with a centerline of the hourglass-shaped spring, and has a diameter decreasing gradually in a direction from a top surface to a bottom surface of the hourglass-shaped spring.

[0014] Preferably, a bottom of the hourglass-shaped spring is provided with a bottom plate, an upper surface of the bottom plate is provided with a concave area having a depth increasing gradually from an edge to a center of the concave

area, and a bottom surface of the hourglass-shaped spring matches with the concave area.

[0015] Preferably, a top surface of the hourglass-shaped spring is provided with a wear plate adapted to support the upper cover plate.

[0016] Preferably, the top surface of the hourglass-shaped spring is provided with a top plate having a groove, the wear plate is arranged in the groove, and an upper surface of the wear plate is protruded out of the groove.

[0017] Preferably, a supporting plate is fixedly arranged in the groove and is connected to the wear plate.

[0018] The air spring for rail transit according to the present application includes an upper cover plate; an hourglass-shaped spring adapted to support the upper cover plate; and an air bag hermetically connected to both of the upper cover plate and the hourglass-shaped spring, and a sealed space is formed among the upper cover plate, the hourglass-shaped spring and the air bag. It is to be noted that, the upper cover plate of the air spring for rail transit according to the present application is connected to a vehicle body, and a lower air-guide tube of the hourglass-shaped spring is connected to a bogie. The hourglass-shaped spring is used in the air spring in the present application, and the separating plate is inserted in the hourglass-shaped spring to enable the hourglass-shaped spring to have a multilayer structure. For example, one separating plate may be inserted in the hourglass-shaped spring to enable the hourglass-shaped spring to have a two-layer structure; apparently, more separating plates may be provided to enable the hourglass-shaped spring to have a structure of more layers. With such arrangement, a better balance between the lateral rigidity and the vertical rigidity of the hourglass-shaped spring may be realized by arranging the separating plate, thus the air spring may have a better deformability and a low vertical and lateral characteristics when the air bag is in an inflated state, and the hourglass-shaped spring may still provide a low vertical rigidity in a deflated state, thereby enhancing the operation safety of the railway vehicle operating in the deflated state. In addition, compared to the tapered spring in the prior art, the hourglass-shaped spring in the air spring according to the present application has a simple structure and a low manufacturing difficulty.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] For more clearly illustrating embodiments of the present application or the technical solution in the prior art, drawings referred to describe the embodiments or the prior art will be briefly described hereinafter. Apparently, the drawings in the following description are only several embodiments of the present application, and for the person skilled in the art other drawings may be obtained based on these drawings without any creative efforts.

Figure 1 is a schematic view showing the structure of an air spring for rail transit in the prior art;

Figure 2 is a schematic view showing the structure of another air spring for rail transit in the prior art;

Figure 3 is a schematic view showing the structure of an air spring for rail transit according to an embodiment of the present application; and

Figure 4 is a schematic view showing the structure of an hourglass-shaped spring according to an embodiment of the present application.

[0020] Reference Numeral in Figs. 1 and 2:

011	small convolution bellows air bag,	012	laminated spring,
013	upper cover plate,	03	big convolution bellows air bag,
04	tapered spring,	05	spindle,
06	rubber layer,	07	outer sleeve,
08	press plate, and	09	upper cover plate;

[0021] Reference Numeral in Figs. 3 and 4:

11	upper cover plate,	12	hourglass-shaped spring,
13	air bag,	14	separating plate,
15	hollow structure,	16	bottom plate,
17	wear plate,	18	groove, and
19	supporting plate.		

DETAILED DESCRIPTION

[0022] The present embodiment provides an air spring for rail transit, so as to solve the technical problems of the air spring for rail transit in the prior art, such as having a large vertical rigidity and a complicated structure, and being difficult to manufacture.

[0023] The technical solutions in the embodiments of the present application will be described clearly and completely hereinafter in conjunction with the drawings in the embodiments of the present application. Apparently, the described embodiments are only a part of the embodiments of the present application, rather than all embodiments. Based on the embodiments in the present application, all of other embodiments, made by the person skilled in the art without any creative efforts, fall into the protection scope of the present application.

[0024] Referring to Figs. 3 and 4, an air spring for rail transit according to the present application includes an upper cover plate 11, an hourglass-shaped spring 12 adapted to support the upper cover plate 11, and an air bag 13 hermetically connected to both of the upper cover plate 11 and the hourglass-shaped spring 12, and a sealed space is formed among the upper cover plate 11, the hourglass-shaped spring 12 and the air bag 13.

[0025] It is to be noted that, the upper cover plate 11 and a lower end of the hourglass-shaped spring 12 of the air spring for rail transit according to this embodiment are both connected to components of the vehicle. It is to be noted that, in this embodiment, a separating plate 14 is inserted in the hourglass-shaped spring 12 to enable the hourglass-shaped spring 12 to have a multilayer structure. For example, one separating plate 14 may be inserted in the hourglass-shaped spring 12 to enable the hourglass-shaped spring 12 to have a two-layer structure; and two separating plates 14 may be inserted in the hourglass-shaped spring 12 to enable the hourglass-shaped spring 12 to have a three-layer structure; apparently, more separating plates 14 may be provided to enable the hourglass-shaped spring 12 to have a structure of more layers. The separating plate 14 may be arranged to be parallel to a top surface of the hourglass-shaped spring 12, or arranged with a certain inclination angle.

[0026] A better balance between the lateral rigidity and the vertical rigidity of the hourglass-shaped spring 12 may be realized by arranging the separating plate 14 in the above manners. In this embodiment, the hourglass-shaped spring 12 having the separating plate is used in the air spring, thus the air spring may have a better deformability and a low vertical and lateral characteristics when the air bag is in an inflated state, and the hourglass-shaped spring 12 may still provide a low vertical rigidity in a deflated state, thereby enhancing the operation safety of the railway vehicle operating in the deflated state.

[0027] In addition, compared to the tapered spring in the prior art, the hourglass-shaped spring 12 in the air spring according to this embodiment does not require a multilayer conical separating plate structure and an inclined cooperating surface, thus has a simple structure and a low manufacturing difficulty.

[0028] In this embodiment, the hourglass-shaped spring 12 may be provided with a hollow structure 15, and the hollow structure 15 has a centerline coinciding with a centerline of the hourglass-shaped spring 12, and has a diameter decreasing gradually in a direction from a top surface to a bottom surface of the hourglass-shaped spring 12.

[0029] With the above arrangement, an interior of the hourglass-shaped spring 12 has a hollow structure, and the hollow structure is just located at a center of the hourglass-shaped spring 12, and the centerline of the hollow structure 15 coincides with the centerline of the hourglass-shaped spring 12. Thus, the vertical rigidity and the lateral rigidity of the hourglass-shaped spring 12 may be adjusted by adjusting a dimension and a structure of the hollow structure. In addition, by arranging the interior of the hourglass-shaped spring 12 as a hollow structure, the vertical rigidity and the lateral rigidity of the hourglass-shaped spring 12 may be further reduced, which further ensures a smooth running of the vehicle.

[0030] Moreover, the bottom of the hourglass-shaped spring 12 is provided with a bottom plate 16, an upper surface of the bottom plate 16 is provided with a concave area having a depth increasing gradually from an edge to a center thereof, and the bottom surface of the hourglass-shaped spring 12 matches with the concave area.

[0031] With the above arrangement, the concave area on the bottom plate 16 may limit a lateral displacement of the hourglass-shaped spring 12, which may facilitate improving the performance of the hourglass-shaped spring 12, thus the hourglass-shaped spring 12 may have a better stability.

[0032] In this embodiment, the top surface of the hourglass-shaped spring 12 may be provided with a wear plate 17 adapted to support the upper cover plate 11. The material of the wear plate 17 may be nylon, or polyethylene and etc.. When the vehicle is operated in a case that the air bag 13 is deflated, the upper cover plate 11 is in direct contact with the wear plate 17, which may avoid the abrasion of the upper cover plate caused by a direct contact between the upper cover plate 11 and the hourglass-shaped spring 12.

[0033] In addition, in order to achieve a better connection between the wear plate 17 and the hourglass-shaped spring 12, the top surface of the hourglass-shaped spring 12 is provided with a top plate having a groove 18, the wear plate 17 is arranged in the groove 18, and an upper surface of the wear plate 17 is protruded out of the groove 18. With the above arrangement, the groove 18 is arranged on the top plate at the top surface of the hourglass-shaped spring 12, and the wear plate 17 may be confined in the groove 18, thereby preventing the wear plate 17 from being disengaged

from the hourglass-shaped spring 12.

[0034] In another preferable solution of this embodiment, a supporting plate 19 is fixedly arranged in the groove 18, and the wear plate 17 is connected to the supporting plate 19 via screws to be fixed in the groove 18.

[0035] Based on the above description of the disclosed embodiments, the person skilled in the art is capable of carrying out or using the present application. It is obvious for the person skilled in the art to make many modifications to these embodiments. The general principle defined herein may be applied to other embodiments without departing from the spirit or scope of the present application. Therefore, the present application is not limited to the embodiments illustrated herein, but should be defined by the broadest scope consistent with the principle and novel features disclosed herein.

Claims

1. An air spring for rail transit, comprising:

   an upper cover plate;
   an hourglass-shaped spring adapted to support the upper cover plate and having an interior provided with a separating plate adapted to divide the hourglass-shaped spring to have a multilayer structure; and
   an air bag hermetically connected to both of the upper cover plate and the hourglass-shaped spring, and a sealed space being formed among the upper cover plate, the hourglass-shaped spring and the air bag.

2. The air spring for rail transit according to claim 1, wherein the hourglass-shaped spring is provided with a hollow structure, and the hollow structure has a centerline coinciding with a centerline of the hourglass-shaped spring, and has a diameter decreasing gradually in a direction from a top surface to a bottom surface of the hourglass-shaped spring.

3. The air spring for rail transit according to claim 1, wherein a bottom of the hourglass-shaped spring is provided with a bottom plate, an upper surface of the bottom plate is provided with a concave area having a depth increasing gradually from an edge to a center of the concave area, and a bottom surface of the hourglass-shaped spring matches with the concave area.

4. The air spring for rail transit according to claim 1, wherein a top surface of the hourglass-shaped spring is provided with a wear plate adapted to support the upper cover plate.

5. The air spring for rail transit according to claim 4, wherein the top surface of the hourglass-shaped spring is provided with a top plate having a groove, the wear plate is arranged in the groove, and an upper surface of the wear plate is protruded out of the groove.

6. The air spring for rail transit according to claim 5, wherein a supporting plate is fixedly arranged in the groove and is connected to the wear plate.

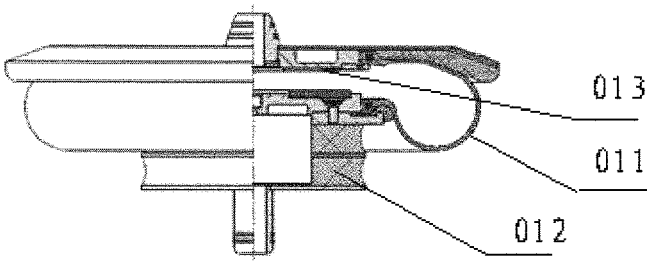

Fig. 1

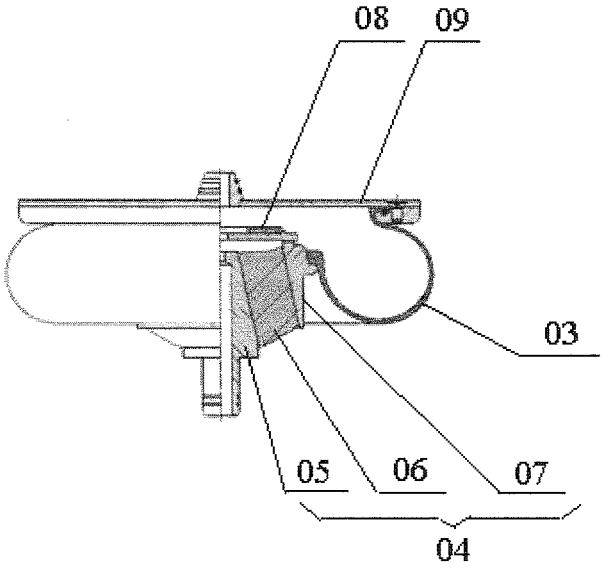

Fig. 2

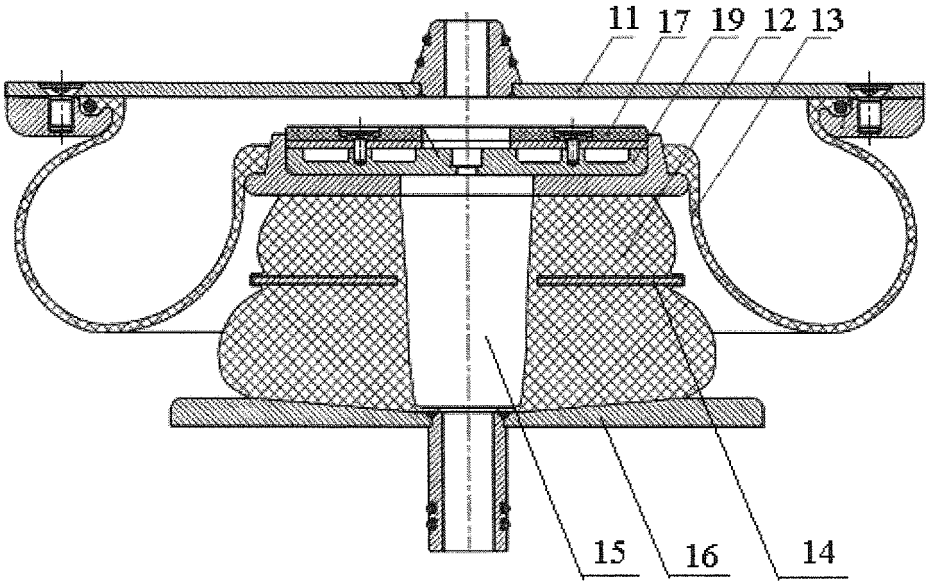

Fig. 3

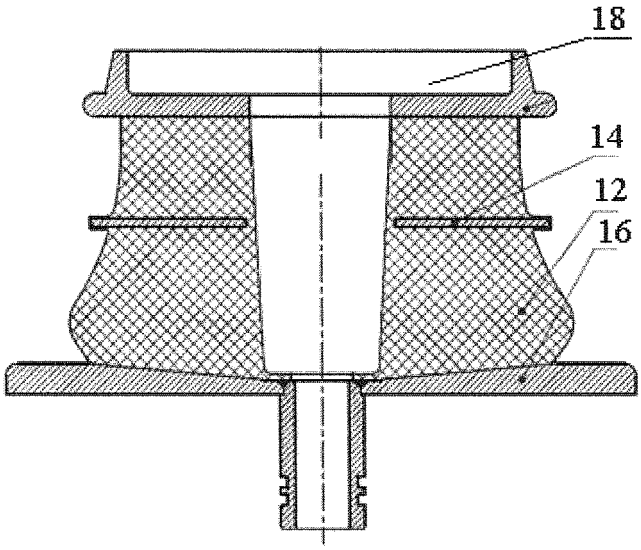

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 13 19 9485

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	19 December 2014	Lendfers, Paul

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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