

ROAD SIMULATION TEST RIG

TECHNICAL FIELD

5 The disclosure relates to the technical field of road simulation tests, and in particular, to a road simulation test rig.

BACKGROUND

10 In recent years, China's construction machinery develops by leaps and bounds, products are updated more frequently, and market competition is more and more fierce. Therefore, construction machinery manufacturing companies are required to shorten the development cycle. Especially, in the later verification stage of the product research and development process, it is necessary to develop a method to accelerate the product verification, namely, the road simulation test technology. A road simulation test method has become the main means of product verification for the main whole vehicle and parts enterprises at home and abroad to shorten the development cycle of the products and reduce the development costs. However, due to the large chassis size of the construction machinery vehicle, such as a mine truck and an agricultural harvester, and the large mass of the whole vehicle, the parameters such as the whole vehicle mass and the track width are quite different from those of an ordinary passenger car. Therefore, when the construction machinery vehicle is tested on a road simulation test rig, the adjustable size of the road simulation test rig should be large enough, and the maximum bearing capacity is large enough.

20 Although the existing road simulation test rig has a certain size adjustment capability, the adjustment range is limited, the maximum adjustment size of the track width is generally small, and the bearing capacity is generally low, which cannot meet the test requirements of large track width and weight of the construction machinery vehicle.

SUMMARY

The objective of the disclosure is to propose a road simulation test rig with the stable structure and the flexible size to meet road simulation test requirements of different chassis.

30 To achieve the above objective, the disclosure provides the following solution:

The disclosure discloses a road simulation test rig, comprising:

a post supporting structure;

35 a horizontal adjustment structure, wherein the horizontal adjustment structure comprises an adjusting support, a linear guide structure, and a bearing plate; the linear guide structure is fixed to the adjusting support; the linear guide structure is used for supporting the bearing plate and

guiding the bearing plate to conduct linear motion; the first end of the adjusting support is connected with the post supporting structure;

a connecting plate, which is articulated with the lower side of the linear guide structure.

5 Preferably, the post supporting structure comprises a connecting frame, a vertical plate, and two posts. The upper ends of the two posts are fixedly connected through the connecting frame; the vertical plate is fixed to the end part of the connecting frame. The first end of the adjusting support is connected to the vertical plate. The bearing plate is located on a plane, on which the axes of the two posts are located.

10 Preferably, the adjusting support is connected with the vertical plate through a vertical adjustment structure. The vertical adjustment structure comprises vertical guide rails and sliding blocks. The vertical guide rails are fixed to the vertical plate in the vertical direction. The sliding blocks are arranged on the vertical guide rails in a sliding manner. The first end of the adjusting support is fixedly connected with the sliding blocks.

15 Preferably, the adjusting support has a Z-shaped structure and comprises the first horizontal part, a vertical part, and the second horizontal part. The first end of the second horizontal part is fixedly connected with the sliding blocks. The second end of the second horizontal part is fixedly connected with the lower end of the vertical part. The upper end of the vertical part is fixedly connected with the first end of the first horizontal part. The connecting plate is articulated with the lower side of the first horizontal part.

20 Preferably, there are two vertical plates, and two horizontal adjustment structures. The vertical plates are symmetrically distributed on the two sides of the post supporting structure, so the horizontal adjustment structures are. The horizontal adjustment structures comprise the first horizontal adjustment structure and the second horizontal adjustment structure.

25 Preferably, the linear guide structure of the first horizontal adjustment structure is a lead screw and nut assembly. The lead screw and nut assembly comprise a lead screw and a nut. The two ends of the lead screw are connected with the adjusting support of the first horizontal adjustment structure through bearing seats. The bearing plate of the first horizontal adjustment structure is fixedly connected with the nut.

30 Preferably, the linear guide structure of the second horizontal adjustment structure is a linear bearing assembly. The linear bearing assembly comprises an unthreaded shaft and a linear bearing. The two ends of the unthreaded shaft are connected with the adjusting support of the second horizontal adjustment structure through unthreaded shaft seats. The bearing plate of the second horizontal adjustment structure is fixedly connected with the linear bearing.

35 Preferably, a limiting baffle is arranged at one end, away from the post supporting structure, of the adjusting support. The limiting baffle is used for limiting the displacement of the bearing

plate.

Preferably, the bearing plate and the adjusting support are in sliding contact with each other.

Preferably, the lower end of the post has a flange end face. The flange end face can be fixed to the ground through bolts.

5 The disclosure achieves the following technical effects compared with the prior art:

In the disclosure, the position of the bearing plate is adjusted by the linear guide structure; so, the maximum track width of a vehicle to be tested by the test rig is largely increased. The double-post structure is arranged to respectively bear the loads generated by two-side wheels in the simulation test, and the loads are counteracted with each other to improve the total bearing
10 capacity of the road simulation test rig, and effectively avoid that an excitation head of the test rig bears a too large bending moment to be damaged; so, requirements of construction machinery related vehicles, especially large-track width and large-weight vehicles, on the road simulation test can be fully met. The adjusting support is designed to have the Z-shaped structure to provide an enough large space for the chassis stroke of the construction machinery
15 vehicle in the simulation test. Additionally, the maximum track width of the vehicle to be tested are remarkably improved, and the test requirements of the large-track width construction machinery can be met. The road simulation test rig of the disclosure can conduct one-way track width adjustment, one-way wheelbase adjustment, and bidirectional track width adjustment on different vehicles. Furthermore, the disclosure adopts a pure mechanical structure, has a simple
20 structure, low costs, and high working reliability, and is easy to assemble. Besides, all parts of the disclosure are standard parts with excellent interchangeability and repair convenience.

BRIEF DESCRIPTION OF THE DRAWINGS

To describe the technical solutions in the embodiments of the disclosure or in the prior art
25 more clearly, the following briefly introduces the accompanying drawings required for describing the embodiments. Apparently, the accompanying drawings in the following description show merely some embodiments of the disclosure, and a person of ordinary skill in the art may still derive other drawings from these accompanying drawings without creative efforts.

30 FIG. 1 is a schematic diagram showing a whole structure of a road simulation test rig of the disclosure.

FIG. 2 is a schematic diagram showing a local structure of one side of a road simulation test rig of the disclosure.

35 FIG. 3 is a schematic diagram showing a local structure of the other side of a road simulation test rig of the disclosure.

FIG. 4 is a schematic diagram showing a whole structure of a road simulation test rig only equipped with a horizontal adjustment structure.

FIG. 5 is a schematic diagram showing forces and a moment for adjusting a support.

Description of reference signs: 1-unthreaded shaft, 2-linear bearing, 3-unthreaded shaft seat, 4-adjustment support, 5-bearing plate, 6-connecting plate, 7-sliding block, 8-vertical guide rail, 9-fixing seat, 10-post supporting structure, 10-1-connecting frame, 10-2-post, 11-hinge, 12-bearing housing, 13-lead screw, and 14-nut.

DESCRIPTION OF THE EMBODIMENTS

The following clearly and completely describes the technical solutions in the embodiments of the disclosure with reference to the accompanying drawings in the embodiments of the disclosure. Apparently, the described embodiments are merely a part rather than all of the embodiments of the disclosure. All other embodiments obtained by a person of ordinary skills in the art based on the embodiments of the disclosure without creative efforts shall fall within the protection scope of the disclosure.

The objective of the disclosure is to propose a road simulation test rig with the stable structure and the flexible size to meet road simulation test requirements of different chassis.

To make the foregoing objective, features, and advantages of the disclosure more apparent and more comprehensible, the disclosure is further described in detail below with reference to the accompanying drawings and specific embodiments.

As shown in Fig. 1 to Fig. 5, the embodiment provides a road simulation test rig, comprising a post supporting structure 10, a horizontal adjustment structure, and a connecting plate 6. The post supporting structure 10 is used for supporting the horizontal adjustment structure. The horizontal adjustment structure can change the transverse size to meet simulation test requirements of different chassis. The connecting plate 6 is contact with an excitation structure to transfer excitation to the horizontal adjustment structure to simulate vibration situations of a chassis under different road surface conditions.

The horizontal adjustment structure comprises an adjusting support 4, a linear guide structure, and a bearing plate 5. The linear guide structure is fixed to the adjusting support 4. The linear guide structure is used for supporting the bearing plate 5 and guiding the bearing plate 5 to conduct linear motion. The first end of the adjusting support 4 is connected with the post supporting structure 10. There are multiple types of the linear guide structures, which can be selected by those skilled in the art according to practical requirements. The connecting plate 6 is articulated with the lower side of the linear guide structure and can transfer vibration in different directions.

In use, the post supporting structure 10 is fixed to the ground or the chassis. The chassis of a test vehicle is fixed to the bearing plate 5. Then, the excitation structure starts. So, the excitation structure transfers the excitation to the connecting plate 6. The position of the bearing plate 5 can be adjusted according to the actual size of the chassis. So, the maximum track width of a vehicle to be tested by the test rig is largely increased, and the test requirement of a large chassis is met. There are multiple fixing manners of the post 10-2. The post 10-2 in the embodiment has a flange end face at the lower end. The flange end face can be fixed to the ground through bolts.

To improve the stability of the whole test rig, the post supporting structure 10 in the embodiment comprises a connecting frame 10-1, a vertical plate, and two posts 10-2. The upper ends of the two posts 10-2 are fixedly connected through the connecting frame 10-1. The vertical plate is fixed to the end part of the connecting frame 10-1. The first end of the adjusting support 4 is connected to the vertical plate. The bearing plate 5 is located on a plane, on which the axes of the two posts 10-2 are located. The double-post structure is used for bearing forces and moments from the extended force arm. When the bearing capacity of the test rig is increased, such structure can effectively avoid that an excitation head of the test rig bears a too large bending moment to be damaged; so, requirements of construction machinery related vehicles, especially large-track width and large-weight vehicles, on the road simulation test can be fully met.

To conveniently adjust the height of the chassis, the adjusting support 4 in the embodiment is connected with the vertical plate through a vertical adjustment structure. The vertical adjustment structure comprises vertical guide rails 8 and sliding blocks 7. The vertical guide rails 8 are fixed to the vertical plate through fixing seats 9 in the vertical direction. The sliding blocks 7 are arranged on the vertical guide rails 8 in a sliding manner. The first end of the adjusting support 4 is fixedly connected with the sliding blocks 7. The height of the chassis can be adjusted by changing the positions of the sliding blocks 7 on the vertical guide rails 8.

To prevent the chassis from colliding the post supporting structure 10, the adjusting support 4 in the embodiment has a Z-shaped structure and comprises the first horizontal part, a vertical part and the second horizontal part. The first end of the second horizontal part is fixedly connected with the sliding blocks 7. The second end of the second horizontal part is fixedly connected with the lower end of the vertical part. The upper end of the vertical part is fixedly connected with the first end of the first horizontal part. The connecting plate 6 is articulated with the lower side of the first horizontal part. The adjusting support 4 has a truss structure and is formed by welding a plurality of square steels. The connecting plate 6 is articulated with the first horizontal part through hinges 11, wherein the connecting plate 6 and a free end of each

hinge 11 are fixedly connected through bolts, and the other free end of each hinge 11 is fixedly connected with the first horizontal part through bolts. The two free ends of each hinge 11 can relatively rotate. When the sliding blocks 7 slide on the vertical guide rails 8 upwards, the bearing plate 5 can be higher than the connecting frame 10-1, thereby preventing the chassis and the connecting frame 10-1 from colliding with each other.

When there are two horizontal adjustment structures, bidirectional size adjustment can be achieved. When there is one horizontal adjustment structure, one-way size adjustment can be achieved. In the embodiment, there are two vertical plates, and two horizontal adjustment structures. The vertical plates are symmetrically distributed on the two sides of the post supporting structure 10, so the horizontal adjustment structures are. The horizontal adjustment structures comprise the first horizontal adjustment structure and the second horizontal adjustment structure. The first horizontal adjustment structure and the second horizontal adjustment structure are symmetrically arranged to balance the moments of the two sides so as to improve the whole stability.

In the embodiment, the linear guide structure of the first horizontal adjustment structure is a lead screw and nut assembly, and the linear guide structure of the second horizontal adjustment structure is a linear bearing assembly. The lead screw and nut assembly comprise a lead screw 13 and a nut 14. The two ends of the lead screw 13 are connected with the adjusting support 4 of the first horizontal adjustment structure through bearing seats 12. The bearing plate 5 of the first horizontal adjustment structure is fixedly connected with the nut 14. A drive motor drives the lead screw 13 to rotate. So, the axial position of the nut 14 on the lead screw 13 can be adjusted. The linear bearing assembly comprises an unthreaded shaft 1 and a linear bearing 2. The two ends of the unthreaded shaft 1 are connected with the adjusting support 4 of the second horizontal adjustment structure through unthreaded shaft seats 3. The bearing plate 5 of the second horizontal adjustment structure is fixedly connected with the linear bearing 2.

The radial bearing capacity of the lead screw 13 and the unthreaded shaft 1 is limited; so, to meet the test requirements of the large-weight chassis, the bearing plate 5 and the adjusting support 4 in the embodiment are in sliding contact with each other, the lead screw 13 only bears the axial force, and the unthreaded shaft 1 is only used for guiding.

When the position of the bearing plate 5 is adjusted, a limiting baffle is arranged at one end, away from the post supporting structure 10, of the adjusting support 4 in the embodiment to prevent the bearing plate 5 from departing from the adjusting support 4. The limiting baffle is used for limiting the displacement of the bearing plate 5.

According to the force balance and moment balance principles, the force and moment equations of the adjusting support 4 can be obtained, and then the forces and the moments of the

adjusting support 4 can be obtained through calculation, as shown in Fig. 5. It can be seen that the reasonable selection of a connection position of the connecting plate 6 and the road simulation test rig can avoid the additional bending moment caused by the extended force arm. So, the service life of the test rig is guaranteed.

5 Several examples are used for illustration of the principles and implementation methods of the specification. The description of the embodiments is used to help illustrate the method and its core principles of the disclosure. In addition, those skilled in the art can make various modifications in terms of specific embodiments and scope of application in accordance with the teachings of the disclosure. In conclusion, the content of this specification shall not be construed
10 as a limitation to the disclosure.

Claims

WHAT IS CLAIMED IS:

1. A road simulation test rig, comprising:

a post supporting structure;

5 a horizontal adjustment structure, wherein the horizontal adjustment structure comprises an adjusting support, a linear guide structure, and a bearing plate; the linear guide structure is fixed to the adjusting support; the linear guide structure is used for supporting the bearing plate and guiding the bearing plate to conduct linear motion; the first end of the adjusting support is connected with the post supporting structure;

10 a connecting plate, which is articulated with the lower side of the linear guide structure.

2. The road simulation test rig according to claim 1, wherein the post supporting structure comprises a connecting frame, a vertical plate, and two posts; the upper ends of the two posts are fixedly connected through the connecting frame; the vertical plate is fixed to the end part of the connecting frame; the first end of the adjusting support is connected to the vertical plate; the bearing plate is located on a plane, on which the axes of the two posts are located.

15 3. The road simulation test rig according to claim 2, wherein the adjusting support is connected with the vertical plate through a vertical adjustment structure; the vertical adjustment structure comprises vertical guide rails and sliding blocks; the vertical guide rails are fixed to the vertical plate in the vertical direction; the sliding blocks are arranged on the vertical guide rails in a sliding manner; the first end of the adjusting support is fixedly connected with the sliding blocks.

20 4. The road simulation test rig according to claim 3, wherein the adjusting support has a Z-shaped structure and comprises the first horizontal part, a vertical part and the second horizontal part; the first end of the second horizontal part is fixedly connected with the sliding blocks; the second end of the second horizontal part is fixedly connected with the lower end of the vertical part; the upper end of the vertical part is fixedly connected with the first end of the first horizontal part; the connecting plate is articulated with the lower side of the first horizontal part.

25 5. The road simulation test rig according to claim 2, wherein there are two vertical plates, and two horizontal adjustment structures; the vertical plates are symmetrically distributed on the two sides of the post supporting structure, so the horizontal adjustment structures are; the horizontal adjustment structures comprise the first horizontal adjustment structure and the second

horizontal adjustment structure.

- 5 6. The road simulation test rig according to claim 5, wherein the linear guide structure of the first horizontal adjustment structure is a lead screw and nut assembly; the lead screw and nut assembly comprise a lead screw and a nut; the two ends of the lead screw are connected with the adjusting support of the first horizontal adjustment structure through bearing seats; the bearing plate of the first horizontal adjustment structure is fixedly connected with the nut.
- 10 7. The road simulation test rig according to claim 6, wherein the linear guide structure of the second horizontal adjustment structure is a linear bearing assembly; the linear bearing assembly comprises an unthreaded shaft and a linear bearing; the two ends of the unthreaded shaft are connected with the adjusting support of the second horizontal adjustment structure through unthreaded shaft seats; the bearing plate of the second horizontal adjustment structure is fixedly connected with the linear bearing.
- 15 8. The road simulation test rig according to claim 1, wherein a limiting baffle is arranged at one end, away from the post supporting structure, of the adjusting support; the limiting baffle is used for limiting the displacement of the bearing plate.
9. The road simulation test rig according to claim 1, wherein the bearing plate and the adjusting support are in sliding contact with each other.
- 20 10. The road simulation test rig according to claim 1, wherein the lower end of the post has a flange end face; the flange end face can be fixed to the ground through bolts.