CLAIMS

1. A railcar bogie comprising:

a cross beam configured to support a carbody of a railcar;

a pair of front and rear axles sandwiching the cross beam and respectively arranged in front of and behind the cross beam in a railcar longitudinal direction so as to extend in a railcar width direction;

bearings respectively provided at both railcar width direction sides of each of the axles and configured to rotatably support the axles:

axle boxes configured to respectively accommodate the bearings;

coupling mechanisms configured to couple the axle boxes to the cross beam;

plate springs extending in the railcar longitudinal direction so as to respectively support both railcar width direction end portions of the cross beam and each including both railcar longitudinal direction end portions respectively supported by the axle boxes; and

an auxiliary supporting mechanism configured to support at least one of the railcar width direction end portions of the cross beam in a case where said one end portion of the cross beam is displaced downward beyond a predetermined elastic deformation range of the plate spring, wherein:

the auxiliary supporting mechanism includes stoppers each configured to limit a rotation angle of the axle box around the axle within a predetermined angular range;

in a case where the plate spring is within the elastic deformation range, there is a gap between each of the stoppers and a portion provided integrally with the axle box; and

in a case where the railcar width direction end portion of the cross beam is displaced downward beyond the elastic deformation range of the plate spring, and this causes the axle box to rotate around the axle, each of the stoppers contacts the portion provided integrally with the axle box, to prevent the axle box from rotating, thereby supporting the railcar width direction end portion of the cross beam via the coupling mechanism.

2. The railcar bogie according to claim 1, wherein:

the auxiliary supporting mechanism further includes a front receiving frame extending downward from the axle box located at a front side in the railcar longitudinal direction, a rear receiving frame extending downward from the axle box located at a rear side in the railcar longitudinal direction, and a rod extending between the front receiving frame and the rear receiving frame and inserted through internal spaces of the receiving frames;

the stoppers are threadedly engaged with the rod at both front-rear direction sides of each of the receiving frames;

each of the stoppers is too big to pass through the internal space of the receiving frame;

there is the gap between each of the stoppers and the corresponding receiving frame in a front-rear direction;

in a case where the plate spring is within the elastic deformation range, there is the gap between each of the stoppers and the corresponding receiving frame; and

in a case where the railcar width direction end portion of the cross beam is displaced downward beyond the elastic deformation range of the plate spring, and this causes the axle box to rotate around the axle, each of the stoppers contacts the corresponding receiving frame to prevent the axle box from rotating.

3. The railcar bogie according to claim 1, wherein:

the auxiliary supporting mechanism further includes a front receiving frame extending downward from the axle box located at a front side, a rear receiving frame extending downward from the axle box located at a rear side, a pair of front and rear brackets each extending downward integrally from the cross beam, a front rod connected to the front bracket and inserted through an internal space of the front receiving frame, and a rear rod connected to the rear bracket and inserted through an internal space of the rear receiving frame;

the stoppers are threadedly engaged with the rods at both front-rear direction sides of each of the receiving frames;

each of the stoppers are too big to pass through the internal space of the receiving frame;

there is the gap between each of the stoppers and the corresponding receiving frame in a front-rear direction;

in a case where the plate spring is within the elastic deformation range, there is the gap between each of the stoppers and the corresponding receiving frame; and

in a case where the railcar width direction end portion of the cross beam is displaced downward beyond the elastic deformation range of the plate spring, and this causes the axle box to rotate around the axle, each of the stoppers contacts the corresponding receiving frame to prevent the axle box from rotating.

4. The railcar bogie according to claim 1, wherein:

the coupling mechanisms respectively include axle beams extending in a front-rear direction integrally from the axle boxes;

the auxiliary supporting mechanism further includes overhang portions respectively projecting integrally from the axle beams;

in a case where the plate spring is within the elastic deformation range, there is a gap between each of the stoppers and the corresponding overhang portion; and

in a case where the railcar width direction end portion of the cross beam is displaced downward beyond the elastic deformation range of the plate spring, and this causes the axle box to rotate around the axle, each of the stoppers contacts the corresponding overhang portion to prevent the axle box from rotating.

5. The railcar bogie according any one of claims 1 to 4, wherein:

spring seats each configured to support a front-rear direction end portion of the plate spring are respectively provided at upper end portions of the axle boxes;

the railcar longitudinal direction end portions of the plate springs are respectively disposed on the spring seats from above to respectively contact upper surfaces of the spring seats;

fitting portions that are fitted to each other in an upper-lower direction with a play are provided at each of portions at each of which a lower surface of the front-rear

direction end portion of the plate spring and the upper surface of the spring seat contact each other; and

covers each configured to cover the railcar longitudinal direction end portion of the plate spring are respectively provided at the axle boxes so as to each maintain a fit state between the fitting portions and be spaced apart from an upper surface of the plate spring.

6. The railcar bogie according to any one of claims 1 to 5, wherein:

the auxiliary supporting mechanism includes a bar member extending in the railcar longitudinal direction, and

an attaching portion to which a peripheral device is attached is provided at the bar member.

CLAIMS

1. A railcar bogie comprising:

a cross beam configured to support a carbody of a railcar, the cross beam extending in a railcar width direction;

a pair of front and rear axles between which the cross beam is disposed, the front and rear axles being respectively arranged in front of and behind the cross beam in a railcar longitudinal direction so as to extend in the railcar width direction;

bearings respectively provided at both railcar width direction sides of each of the axles and configured to rotatably support the axles;

axle boxes configured to respectively accommodate the bearings;

coupling mechanisms configured to couple the axle boxes to the cross beam;

plate springs extending in the railcar longitudinal direction so as to respectively support both railcar width direction end portions of the cross beam and each including both railcar longitudinal direction end portions respectively supported by the axle boxes; and

an auxiliary supporting mechanism configured to support at least one of the railcar width direction end portions of the cross beam in a case where said one end portion of the cross beam is displaced downward beyond a predetermined elastic deformation range of the plate spring,

wherein:

the auxiliary supporting mechanism includes stoppers each configured to limit a rotation angle of the axle box around the axle within a predetermined angular range;

in a case where the plate spring is within the elastic deformation range, there is a gap between each of the stoppers and a portion provided integrally with the axle box; and

in a case where the railcar width direction end portion of the cross beam is displaced downward beyond the elastic deformation range of the plate spring, and this causes the axle box to rotate around the axle, each of the stoppers contacts the portion provided integrally with the axle box, to prevent the axle box from rotating, thereby supporting the railcar width direction end portion of the cross beam via the coupling mechanism.

2. The railcar bogie according to claim 1, wherein:

the auxiliary supporting mechanism further includes a front receiving frame extending downward from the axle box located at a front side in the railcar longitudinal direction, a rear receiving frame extending downward from the axle box located at a rear side in the railcar longitudinal direction, and a rod extending between the front receiving frame and the rear receiving frame and inserted through internal spaces of the receiving frames;

the stoppers are threadedly engaged with the rod at both front-rear direction sides of each of the receiving frames;

each of the stoppers is too big to pass through the internal space of the receiving frame;

there is the gap between each of the stoppers and the corresponding receiving frame in a front-rear direction;

in a case where the plate spring is within the elastic deformation range, there is the gap between each of the stoppers and the corresponding receiving frame; and

in a case where the railcar width direction end portion of the cross beam is displaced downward beyond the elastic deformation range of the plate spring, and this causes the axle box to rotate around the axle, each of the stoppers contacts the corresponding receiving frame to prevent the axle box from rotating.

3. The railcar bogie according to claim 1, wherein:

the auxiliary supporting mechanism further includes a front receiving frame extending downward from the axle box located at a front side, a rear receiving frame extending downward from the axle box located at a rear side, a pair of front and rear brackets each extending downward integrally from the cross beam, a front rod connected to the front bracket and inserted through an internal space of the front receiving frame, and a rear rod connected to the rear bracket and inserted through an internal space of the rear receiving frame;

the stoppers are threadedly engaged with the rods at both front-rear direction sides of each of the receiving frames;

each of the stoppers are too big to pass through the internal space of the receiving frame;

there is the gap between each of the stoppers and the corresponding receiving frame in a front-rear direction;

in a case where the plate spring is within the elastic deformation range, there is the gap between each of the stoppers and the corresponding receiving frame; and

in a case where the railcar width direction end portion of the cross beam is displaced downward beyond the elastic deformation range of the plate spring, and this causes the axle box to rotate around the axle, each of the stoppers contacts the corresponding receiving frame to prevent the axle box from rotating.

4. The railcar bogie according to claim 1, wherein:

the coupling mechanisms respectively include axle beams extending in a front-rear direction integrally from the axle boxes;

the auxiliary supporting mechanism further includes overhang portions respectively projecting integrally from the axle beams;

in a case where the plate spring is within the elastic deformation range, there is a gap between each of the stoppers and the corresponding overhang portion; and

in a case where the railcar width direction end portion of the cross beam is displaced downward beyond the elastic deformation range of the plate spring, and this causes the axle box to rotate around the axle, each of the stoppers contacts the corresponding overhang portion to prevent the axle box from rotating.

5. The railcar bogie according claim 1, wherein:

spring seats each configured to support a front-rear direction end portion of the plate spring are respectively provided at upper end portions of the axle boxes;

the railcar longitudinal direction end portions of the plate springs are respectively disposed on the spring seats from above to respectively contact upper surfaces of the spring seats;

fitting portions that are fitted to each other in an upper-lower direction with a play are provided at each of portions at each of which a lower surface of the front-rear direction end portion of the plate spring and the upper surface of the spring seat contact each other; and

covers each configured to cover the railcar longitudinal direction end portion of the plate spring are respectively provided at the axle boxes so as to each maintain a fit state between the fitting portions and be spaced apart from an upper surface of the plate spring.

6. The railcar bogie according to claim 1, wherein:

the auxiliary supporting mechanism includes a bar member extending in the railcar longitudinal direction; and

an attaching portion to which a peripheral device is attached is provided at the bar member.