

DESCRIPTION

Title of Invention: OBSTACLE DEFLECTOR OF RAILCAR

Technical Field

[0001] The present invention relates to an obstacle deflector of a railcar, the obstacle deflector being capable of detecting derailment of the railcar from a permanent way and an obstacle on the permanent way.

Background Art

[0002] Detection of derailment of a railcar from a permanent way and detection of an obstacle on the permanent way are required in some cases. For example, PTL 1 discloses an obstacle deflector 100 of a railcar, the obstacle deflector 100 being capable of detecting the derailment and the obstacle as shown in Fig. 12.

[0003] The obstacle deflector 100 includes: a collision bar 111 extending so as to cross a permanent way; a pair of operating members 112 (Fig. 12 shows only one of the operating members) coupled to both respective end portions of the collision bar 111; and a pair of supporting members 120 supporting the respective operating members 112. The operating members 112 extend from both respective end portions of the collision bar 111 rearward and obliquely upward. Each of the operating members 112 is coupled to the supporting member 120 by an articulated joint 140 so as to be rotatable, and rotation of the operating member 112 relative to the supporting member 120 is inhibited by a fixing unit 150. The fixing unit 150 is, for example, a shear pin.

[0004] A distance sensor 130 configured to measure a distance to the operating member 112 is attached to the supporting member 120. If the railcar derails, the fixing unit 150 is destroyed by collision between the collision bar 111 and a rail, and the operating member 112 rotates upward. Further, if an obstacle is on the permanent way, the fixing unit 150 is destroyed by collision between the collision bar 111 and the obstacle, and the operating member 112 rotates rearward. Thus, the derailment and the obstacle can be detected in such a manner that the distance sensor 130 detects an increase or decrease in the distance to the operating member 112.

Citation List

Patent Literature

[0005] PTL 1: Singapore Patent Application Publication No. 187359

Summary of Invention

Technical Problem

[0006] According to the obstacle deflector 100 shown in Fig. 12, once the derailment or the obstacle is detected, the fixing unit 150 is destroyed. Therefore, the obstacle deflector 100

cannot be reused.

[0007] An object of the present invention is to provide an obstacle deflector of a railcar, the obstacle deflector being able to be reused at least after detection of an obstacle.

Solution to Problem

[0008] To solve the above problem, an obstacle deflector of a railcar according to the present invention is the obstacle deflector capable of detecting derailment and an obstacle, the obstacle deflector including: a collision bar extending in front of a bogie so as to cross a permanent way; a pair of operating members coupled to both respective end portions of the collision bar; a pair of supporting members supporting the respective operating members through respective rotating shafts extending in a car width direction behind and above the collision bar; elastic bodies configured to maintain the respective operating members at normal positions and allow at least rearward rotation of the operating members around the rotating shafts by elastic deformation of the elastic bodies; and a signal generator configured to generate a first signal when at least one of the operating members rotates upward by a predetermined angle or more and generate a second signal when the operating member rotates rearward by a predetermined angle or more.

[0009] According to the above configuration, if the railcar derails, the operating member rotates upward by the predetermined angle or more by collision between the collision bar and a rail, and the signal generator generates the first signal. If an obstacle on a permanent way is such an obstacle that an impact with the collision bar becomes a predetermined value or more, the operating member rotates rearward by the predetermined angle or more by the collision between the collision bar and the obstacle, and the signal generator generates the second signal. With this, the derailment and the obstacle having a predetermined weight or more can be detected. In addition, the operating member is rotatable at least rearward by the elastic deformation of the elastic body. Therefore, even if rotational force is applied to the operating member, and the obstacle is detected, the elastic body returns to an original state by removing the rotational force from the operating member, and the operating member returns to the normal position. On this account, the obstacle deflector can be reused after the detection of the obstacle.

Advantageous Effects of Invention

[0010] The present invention provides an obstacle deflector of a railcar, the obstacle deflector being able to be reused at least after detection of an obstacle.

Brief Description of Drawings

[0011] Fig. 1 is a perspective view showing an obstacle deflector of a railcar according to

Embodiment 1.

Fig. 2 is an enlarged view showing major components shown in Fig. 1.

Fig. 3 is a sectional view taken along line III-III of Fig. 2.

Fig. 4 is a side view showing one of supporting members shown in Fig. 2 and one of operating members shown in Fig. 2.

Fig. 5 is a side view showing one of the supporting members and one of the operating members in the obstacle deflector of the railcar according to Modified Example.

Fig. 6 is a perspective view showing the obstacle deflector of the railcar according to Embodiment 2.

Fig. 7 is an enlarged view showing major components shown in Fig. 6.

Fig. 8 is a side view showing one of the supporting members shown in Fig. 6 and one of the operating members shown in Fig. 6.

Fig. 9 is a sectional view taken along line IX-IX of Fig. 8.

Fig. 10 is a diagram for explaining operations of the obstacle deflector at the time of collision with an obstacle.

Fig. 11 is a diagram for explaining operations of the obstacle deflector at the time of derailment.

Fig. 12 is a sectional view showing an obstacle deflector of a conventional railcar.

Description of Embodiments

[0012] Embodiment 1

Fig. 1 shows an obstacle deflector 1A of a railcar according to Embodiment 1. The obstacle deflector 1A includes: a collision bar 10 extending in front of a bogie 11 so as to cross a permanent way (a track and a rail pair; not shown); and a pair of operating members 2A and 2B coupled to both respective end portions of the collision bar 10. The obstacle deflector 1A further includes: a pair of supporting members 3A and 3B rotatably supporting the operating members 2A and 2B, respectively; and a pair of frames 4A and 4B hanging forward from a front end portion of the bogie 11. The supporting members 3A and 3B are attached to the frames 4A and 4B, respectively.

[0013] The collision bar 10 has a substantially V shape that includes a middle portion projecting forward so as to scatter obstacles on the permanent way away toward both sides of the permanent way. However, the collision bar 10 may have a straight shape parallel to a car width direction of the railcar. In the present embodiment, a sectional shape of the collision bar 10 is a circular shape. However, the sectional shape of the collision bar 10 may be the other shape such as a rectangular shape.

[0014] The operating member 2B, the supporting member 3B, and the frame 4B at a left side are respectively symmetrical with the operating member 2A, the supporting member 3A, and the frame 4A at a right side and are respectively the same in structure as the operating member 2A, the supporting member 3A, and the frame 4A at the right side. Therefore, hereinafter, the structures of the operating member 2A, the supporting member 3A, and the frame 4A at the right side will be mainly explained in reference to Figs. 2 to 4.

[0015] The operating member 2A extends rearward and obliquely upward from an end portion of the collision bar 10. Specifically, the operating member 2A includes: a tubular base 21 whose axial direction is parallel to the car width direction; and an arm 23 interposed between the base 21 and the end portion of the collision bar 10. The arm 23 includes: a middle wall 24 perpendicular to the car width direction; and a front wall 25 and a rear wall 26 opposed to each other to sandwich the middle wall 24.

[0016] The supporting member 3A supports the base 21 of the operating member 2A through a rotating shaft 5. The rotating shaft 5 extends in the car width direction behind and above the collision bar 10. The supporting member 3A includes: a main plate 31 perpendicular to a car longitudinal direction of the railcar and elongated in a vertical direction; and a pair of receiving plates 33 projecting forward from a substantially middle portion of the main plate 31 so as to sandwich the base 21 of the operating member 2A. Both end portions of the rotating shaft 5 are held by the respective receiving plates 33.

[0017] The receiving plates 33 include respective grooves 34 opening upward. The end portions of the rotating shaft 5 are fitted in the grooves 34 to be fixed to the receiving plates 33 by bolts B1. However, a method of fixing the rotating shaft 5 to the receiving plates 33 is not limited to this, and various methods are adoptable.

[0018] The base 21 of the operating member 2A is provided with a holding hole 22 centering around the rotating shaft 5. A rubber bushing 61 through which the rotating shaft 5 is inserted is inserted into the holding hole 22. In the present embodiment, the rubber bushing 61 is press-fitted to the holding hole 22, and therefore, the rubber bushing 61 is non-rotatable relative to the base 21. Further, the rubber bushing 61 is joined to the rotating shaft 5. Therefore, the rubber bushing 61 serves as an elastic body that maintains the operating member 2A at a normal position shown in Fig. 4 (i.e., at such a position that the collision bar 10 is located close to the permanent way (not shown)).

[0019] The rubber bushing 61 has a relatively large thickness. Therefore, by elastic deformation of the rubber bushing 61, the operating member 2A is rotatable upward around the rotating shaft 5 as shown by an arrow A in Fig. 4 and also rotatable rearward around the rotating

shaft 5 as shown by an arrow B in Fig. 4. To be specific, the rubber bushing 61 allows the upward and rearward rotations of the operating member 2A.

[0020] Further, in the present embodiment, to prevent the rubber bushing 61 from being excessively twisted rearward, the main plate 31 of the supporting member 3A is provided with a stopper 35 that contacts the rear wall 26 of the arm 23 of the operating member 2A when the operating member 2A rotates rearward. The stopper 35 is provided between the receiving plates 33. However, the stopper 35 may be provided on the rear wall 26 of the arm 23.

[0021] The supporting member 3A is fixed to the frame 4A by bolts B2. The supporting member 3A is configured to be height adjustable relative to the frame 4A. Specifically, a first engagement plate 37 including a toothed projection 36 is joined (welded, for example) to a rear surface of the main plate 31 of the supporting member 3A. A seat plate 41 is joined (welded, for example) to a front surface of the frame 4A. A second engagement plate 42 including a toothed recess that meshes with the toothed projection 36 is joined (welded, for example) to the seat plate 41. Each of the main plate 31 and the first engagement plate 37 is provided with a plurality of (four in the illustrated example) elongated holes 32 extending in an upward/downward direction, and the bolts B2 are inserted through these elongated holes 32.

[0022] A signal generator 7 is attached to a lower portion of the main plate 31 of the supporting member 3A through a bracket 30. In the present embodiment, the signal generators 7 are attached to the respective supporting members 3A and 3B. However, the signal generator 7 is only required to be attached to at least one of the supporting members 3A and 3B.

[0023] When the operating member 2A rotates upward by a predetermined angle (2 to 10 degrees, for example) or more, the signal generator 7 generates a first signal (derailment detection signal). When the operating member 2A rotates rearward by a predetermined angle (2 to 10 degrees, for example) or more, the signal generator 7 generates a second signal (obstacle detection signal). Each of the first signal and the second signal may be an on signal (a-contact) or an off signal (b-contact). The first and second signals generated by the signal generator 7 are transmitted through a cable 74 to a controller mounted on a carbody of the railcar. Thus, emergency brake is performed.

[0024] In the present embodiment, a limit switch 70 is used as the signal generator 7. The limit switch 70 is provided at an outer side of the arm 23 of the operating member 2A in the car width direction. However, the limit switch 70 may be provided at an inner side of the arm 23 in the car width direction.

[0025] The limit switch 70 includes: a main body portion 73 fixed to the bracket 30; a head 72 projecting inward in the car width direction from the main body portion 73; and a rod-shaped

detection lever 71 extending obliquely downward from the head 72 and configured to tilt in accordance with the rearward and upward rotations of the operating member 2A. Instead of the rod-shaped detection lever 71, the limit switch 70 may include a detection arm to which a roller is attached.

[0026] The middle wall 24 of the arm 23 of the operating member 2A is provided with a pair of operating pieces 27 projecting outward in the car width direction from the middle wall 24 so as to sandwich the detection lever 71. In the present embodiment, each of the operating pieces 27 is columnar.

[0027] A certain gap is formed between each operating piece 27 and the detection lever 71. Therefore, contact of each operating piece 27 with the detection lever 71 due to vibrations during travelling can be avoided. In the present embodiment, a swing center of the detection lever 71 (a rotational center of the head 72) is located lower than a center of the rotating shaft 5. Therefore, if the gap is not formed between each operating piece 27 and the detection lever 71, the detection lever 71 is bent by the operating piece 27 at the time of the rotation of the operating member 2A in some cases. Since the certain gap is formed between each operating piece 27 and the detection lever 71, bending deformation of the detection lever 71 can be prevented.

[0028] Next, operations of the obstacle deflector 1A will be explained in reference to Fig. 4. If the railcar derails, the collision bar 10 collides with a rail (not shown). With this, the operating member 2A rotates upward by the predetermined angle or more as shown by the arrow A in Fig. 4, and the detection lever 71 of the limit switch 70 is tilted forward by the operating piece 27 located at a rear side. Then, the limit switch 70 generates the first signal. As a result, the derailment can be detected.

[0029] If an obstacle is on the permanent way, the collision bar 10 collides with the obstacle (not shown). With this, the operating member 2A rotates rearward as shown by the arrow B in Fig. 4. If the obstacle is such an obstacle that an impact with the collision bar 10 becomes a predetermined value or more, the operating member 2A rotates rearward by the predetermined angle or more, and the detection lever 71 of the limit switch 70 is tilted rearward by the operating piece 27 located at a front side. Then, the limit switch 70 generates the second signal. As a result, the obstacle having a predetermined weight or more can be detected. If the obstacle is such a lightweight obstacle that the operating member 2A does not rotate by the predetermined angle or more, the obstacle is scattered away by the collision bar 10.

[0030] In the present embodiment, the operating member 2A is rotatable upward and rearward by the elastic deformation of the rubber bushing 61. Therefore, even if rotational force is applied to the operating member 2A, and the derailment or the obstacle is detected, the

rubber bushing 61 returns to an original state by removing the rotational force from the operating member 2A, and the operating member 2A returns to the normal position. On this account, the obstacle deflector 1A can be reused after the detection of the derailment and the obstacle.

[0031] In the present embodiment, the swing center of the detection lever 71 of the limit switch 70 is located under the center of the rotating shaft 5 by about 100 mm. Therefore, a tilt amount of the detection lever 71 can be increased relative to a rotation amount of the operating member 2A. Therefore, a timing when the limit switch 70 generates the first signal or the second signal can be set to a timing when the operating member 2A rotates by a relatively small angle. Thus, the rubber bushing 61 can be protected.

[0032] **Modified Example**

Embodiment 1 described above may be modified as below.

[0033] The obstacle deflector 1A does not necessarily have to include the pair of frames 4A and 4B. The supporting members 3A and 3B may be directly attached to the front end portion of the bogie 11 depending on the shape of the bogie 11.

[0034] The elastic body that maintains each of the operating members 2A and 2B at the normal position does not necessarily have to be the rubber bushing 61. For example, as shown in Fig. 5, the elastic body may be a compression coil spring 62. Or, a plate spring, a torsion spring, or the like may be used as the elastic body. However, by using the rubber bushing 61 as the elastic body as in the above embodiment, structures around the elastic body can be simplified. When a spring made of metal is used as the elastic body, the elastic body may resonate with vibrations of the bogie 11. However, when the rubber bushing 61 is used as the elastic body, the rubber bushing 61 hardly resonates by damping performance of the rubber bushing 61.

[0035] The signal generator 7 does not necessarily have to be the limit switch 70. For example, as shown in Fig. 5, the signal generator 7 may be a distance sensor 75 or a touch sensor. Further, a rotation angle detection sensor or the like may be used as the signal generator 7. However, when the limit switch 70 is used as in the above embodiment, the rotation of the operating member (2A and/or 2B) can be surely detected by physical contact with the detection lever 71.

[0036] When using the limit switch 70, the direction of the detection lever 71 may be, for example, a horizontal direction (the car longitudinal direction of the railcar or the car width direction of the railcar). A projecting direction of the pair of operating pieces 27 can be suitably changed in accordance with the direction of the detection lever 71.

[0037] **Embodiment 2**

Fig. 6 shows an obstacle deflector 1B of a railcar according to Embodiment 2. In

the present embodiment, the same reference signs are used for the same components as in Embodiment 1, and a repetition of the same explanation is avoided.

[0038] As with Embodiment 1, the obstacle deflector 1B includes the collision bar 10; the pair of operating members 2A and 2B; the pair of supporting members 3A and 3B; and the pair of frames 4A and 4B. It should be noted that the obstacle deflector 1B of the present embodiment is configured to have high rigidity, and the collision bar 10 of the present embodiment is much thicker than the collision bar 10 of Embodiment 1.

[0039] In the present embodiment, the operating member 2B, the supporting member 3B, and the frame 4B at the left side are respectively symmetrical with the operating member 2A, the supporting member 3A, and the frame 4A at the right side and are respectively the same in structure as the operating member 2A, the supporting member 3A, and the frame 4A at the right side. Therefore, hereinafter, the operating member 2A, the supporting member 3A, and the frame 4A at the right side will be mainly explained in reference to Figs. 7 to 9.

[0040] In the present embodiment, the main plate 31 of the supporting member 3A is joined (welded, for example) to the frame 4A. However, as with Embodiment 1, the supporting member 3A may be fixed to the frame 4A by the bolts B2. Further, in the present embodiment, each of the end portions of the rotating shaft 5 is fixed to the receiving plate 33 by the bolt B1 and a nut N1.

[0041] In the present embodiment, a structure 12 for height adjustment is provided at the end portion of the collision bar 10, and the operating member 2A is coupled to the end portion of the collision bar 10 through the structure 12. The arm 23 of the operating member 2A extends vertically downward from the base 21.

[0042] Specifically, the arm 23 includes: a front wall 28 provided at a position corresponding to a front end of the base 21 and perpendicular to the car longitudinal direction of the railcar; and a pair of left and right side walls 29 joined (welded, for example) to the front wall 28 and the base 21.

[0043] In the present embodiment, a stopper 16 that contacts the side walls 29 of the arm 23 of the operating member 2A when the operating member 2A rotates rearward is provided at a portion of the frame 4A which portion is located under the supporting member 3A. It should be noted that the main plate 31 of the supporting member 3A may be extended downward, and the stopper 16 may be provided at a lower portion of the main plate 31. Further, the stopper 16 may be used as an impact absorbing member. In this case, the stopper 16 may be configured to be detachable from the frame 4A so as to be replaceable.

[0044] The structure 12 adjusts the height of the collision bar 10 relative to the frame 4A.

Specifically, the structure 12 includes: an engagement plate 14 located behind the end portion of the collision bar 10 and perpendicular to the car longitudinal direction of the railcar; and a pair of left and right ribs 13 joined (welded, for example) to the engagement plate 14 and the collision bar 10. The engagement plate 14 includes a toothed projection 15 on a rear surface thereof. The front wall 28 of the arm 23 includes a toothed recess on a front surface thereof, and the toothed recess meshes with the toothed projection 15.

[0045] The front wall 28 of the arm 23 is provided with an elongated hole extending in the upward/downward direction. By two bolts B3 inserted through the elongated hole, the engagement plate 14 is fixed to the front wall 28.

[0046] In the present embodiment, the rubber bushing 61 serves as an elastic body that maintains the operating member 2A at a normal position shown in Fig. 8 (i.e., at such a position that the collision bar 10 is located close to the permanent way (not shown)). Further, in the present embodiment, a plate spring 63 is also adopted as the elastic body that maintains the operating member 2A at the normal position.

[0047] The plate spring 63 presses the operating member 2A against a locking member 17 from behind to maintain the operating member 2A at the normal position. To be specific, the plate spring 63 allows rearward rotation of the operating member 2A by elastic deformation of the plate spring 63.

[0048] In the present embodiment, the locking member 17 is a U bolt extending rearward from a front side of the operating member 2A through both sides of the arm 23 of the operating member 2A and including both ends fixed to the main plate 31 of the supporting member 3A by nuts N2 and N3. However, the locking member 17 does not necessarily have to be the U bolt and may be, for example, an L-shaped hook. The locking member 17 is configured to be able to be destroyed (broken) by upward rotational force of the operating member 2A at the time of the derailment.

[0049] The plate spring 63 largely curves at its forward/rearward-direction (car-longitudinal-direction) center portion so as to cover the operating member 2A from above. In Fig. 8, since the plate spring 63 is deformed to be in a biasing state, the plate spring 63 has a U shape. However, the plate spring 63 in a natural state has a shape shown in Fig. 11. A lower end of a rear portion of the plate spring 63 is fixed to the main plate 31 of the supporting member 3A by bolts B7.

[0050] A lower end of a front portion of the plate spring 63 is engaged with a receiving member 8 attached to the operating member 2A. The receiving member 8 includes: a block 84 joined (welded, for example) to the arm 23 of the operating member 2A; and an engagement bar

81 located in front of the arm 23 of the operating member 2A. The block 84 penetrates the side wall 29 along a rear surface of the front wall 28 of the arm 23. A pair of left and right holding pieces 82 and 83 extending in the forward/rearward direction are fixed to both respective end surfaces of the block 84 by bolts B5. The engagement bar 81 is held at front ends of the holding pieces 82 and 83.

[0051] The lower end of the front portion of the plate spring 63 is engaged with the engagement bar 81 from behind to bias the engagement bar 81 and the main plate 31 of the supporting member 3A, thereby separating the engagement bar 81 and the main plate 31 from each other. With this, the operating member 2A is pressed against the locking member 17 from behind.

[0052] A level difference is formed on the front surface of the front wall 28 of the arm 23 of the operating member 2A such that a thickness of a portion of the front wall 28 which portion extends upward from a position lower than the locking member 17 becomes small. Then, a contact sheet 18 that contacts the locking member 17 is fixed to a lower portion of the level difference by bolts B4. The contact sheet 18 is made of, for example, resin or rubber.

[0053] Out of the left and right holding pieces 82 and 83 of the receiving member 8, an outer holding piece 82 located at an outer side in the car width direction extends more rearward than an inner holding piece 83. A guide plate 91 is fixed to a rear end of the outside holding piece 82 by bolts B5. The guide plate 91 extends rearward through one side of the supporting member 3A to one side of the frame 4A while curving outward in the car width direction.

[0054] The signal generator 7 is attached through a bracket 40 to a position of the frame 4A which position corresponds to the guide plate 91. In the present embodiment, the signal generators 7 are attached to the respective frames 4A and 4B. However, the signal generator 7 is only required to be attached to at least one of the frames 4A and 4B.

[0055] In the present embodiment, the head 72 of the limit switch 70 projects outward in the car width direction from the main body portion 73 fixed to the bracket 40, and the rod-shaped detection lever 71 extends forward from the head 72. However, instead of the rod-shaped detection lever 71, the limit switch 70 may include a detection arm to which a roller is attached.

[0056] A pair of operating pieces 92 projecting inward in the car width direction from the guide plate 91 so as to sandwich the detection lever 71 are attached to a rear end of the guide plate 91. To be specific, the operating pieces 92 are provided at the operating member 2A through the guide plate 91 and the outside holding piece 82. It should be noted that a rear portion of the guide plate 91 and the limit switch 70 are covered with a cover 77 from an outside in the car width direction, and the cover 77 is fixed to the frame 4A by bolts B8.

[0057] Next, operations of the obstacle deflector 1A will be explained in reference to Figs. 10 and 11. If the railcar derails, the collision bar 10 collides with a rail (not shown). With this, as shown in Fig. 11, the locking member 17 is destroyed (broken) by the upward rotational force of the operating member 2A, and the operating member 2A rotates upward. If the operating member 2A rotates upward by a predetermined angle or more, the detection lever 71 of the limit switch 70 is tilted downward by the operating piece 92 located at an upper side. Then, the limit switch 70 generates the first signal. As a result, the derailment can be detected.

[0058] If an obstacle is on the permanent way, the collision bar 10 collides with the obstacle (not shown). With this, the operating member 2A rotates rearward as shown in Fig. 10. If the obstacle is such an obstacle that an impact with the collision bar 10 becomes a predetermined value or more, the operating member 2A rotates rearward by a predetermined angle or more, and the detection lever 71 of the limit switch 70 is tilted upward by the operating piece 92 located at a lower side. Then, the limit switch 70 generates the second signal. As a result, the obstacle having a predetermined weight or more can be detected. If the obstacle is such a lightweight obstacle that the operating member 2A does not rotate by the predetermined angle or more, the obstacle is scattered away by the collision bar 10.

[0059] In the present embodiment, the operating member 2A is rotatable rearward by the elastic deformation of the rubber bushing 61 and the plate spring 63. Therefore, even if rotational force is applied to the operating member 2A, and the obstacle is detected, the rubber bushing 61 and the plate spring 63 return to original states by removing the rotational force from the operating member 2A, and the operating member 2A returns to the normal position. On this account, the obstacle deflector 1A can be reused after the detection of the obstacle.

[0060] **Modified Example**

Embodiment 2 described above may be modified as below.

[0061] As the elastic body that maintains the operating member 2A (2B) at the normal position, only the plate spring 63 may be used without using the rubber bushing 61. In this case, as with Fig. 5, the rotating shaft 5 may be fitted in a center hole of the base 21 of the operating member 2A (2B). Or, only the rubber bushing 61 may be used without using the plate spring 63.

[0062] Needless to say, some of the matters explained in Modified Example of Embodiment 1 (i.e., omissions of the frames 4A and 4B, adoption of a sensor other than the limit switch 70 as the signal generator 7, etc.) are applicable to Embodiment 2.

Reference Signs List

[0063] 1A, 1B obstacle deflector of railcar

- 10 collision bar
- 11 bogie
- 17 locking member
- 2A, 2B operating member
- 22 holding hole
- 27 operating piece
- 3 supporting member
- 4 frame
- 5 rotating shaft
- 61 rubber bushing (elastic body)
- 62 compression coil spring (elastic body)
- 63 plate spring (elastic body)
- 7 signal generator
- 70 limit switch
- 71 detection lever
- 75 distance sensor
- 8 receiving member
- 81 engagement bar

CLAIMS

1. An obstacle deflector of a railcar,
the obstacle deflector being capable of detecting derailment and an obstacle,
the obstacle deflector comprising:
a collision bar extending in front of a bogie so as to cross a permanent way;
a pair of operating members coupled to both respective end portions of the collision bar;
a pair of supporting members supporting the respective operating members through respective rotating shafts extending in a car width direction behind and above the collision bar;
elastic bodies configured to maintain the respective operating members at normal positions and allow upward and rearward rotation of the operating members around the rotating shafts by elastic deformation of the elastic bodies; and
a signal generator configured to generate a first signal when at least one of the operating members rotates upward by a predetermined angle or more and generate a second signal when the operating member rotates rearward by a predetermined angle or more, wherein:
each of the operating members is provided with a holding hole centering around the rotating shaft; and
each of the elastic bodies is a rubber bushing through which the rotating shaft is inserted and which is inserted into the holding hole.
2. An obstacle deflector of a railcar,
the obstacle deflector being capable of detecting derailment and an obstacle,
the obstacle deflector comprising:
a collision bar extending in front of a bogie so as to cross a permanent way;
a pair of operating members coupled to both respective end portions of the collision bar;
a pair of supporting members supporting the respective operating members through respective rotating shafts extending in a car width direction behind and above the collision bar;
elastic bodies configured to maintain the respective operating members at normal positions and allow at least rearward rotation of the operating members around the rotating shafts by elastic deformation of the elastic bodies; and
a signal generator configured to generate a first signal when at least one of the operating members rotates upward by a predetermined angle or more and generate a second signal when the operating member rotates rearward by a predetermined angle or more, wherein:

each of the elastic bodies presses the corresponding operating member against a locking member from behind to maintain the operating member at the normal position; and

if the railcar derails, the locking member is destroyed by upward rotational force of the operating member, and the operating member rotates upward.

3. The obstacle deflector according to claim 2, further comprising receiving members attached to the respective operating members, the receiving members including respective engagement bars located in front of the operating members, wherein

each of the elastic bodies is a plate spring configured to bias the corresponding engagement bar and the corresponding supporting member to separate the engagement bar and the supporting member from each other.

4. The obstacle deflector according to claim 2 or 3, wherein the locking member is a U bolt extending rearward from a front side of the corresponding operating member through both sides of the operating member and including both ends fixed to the corresponding supporting member.

5. The obstacle deflector according to any one of claims 1 to 4, wherein the signal generator is a limit switch including a detection lever configured to tilt in accordance with rearward and upward rotations of the operating member.

6. The obstacle deflector according to claim 5, wherein at least one of the operating members is provided with a pair of operating pieces sandwiching the detection lever.

7. The obstacle deflector according to any one of claims 1 to 6, further comprising a pair of frames hanging forward from a front end portion of the bogie, wherein the supporting members are attached to the respective frames.