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(54) **BOGIE AND VEHICLE**

(71) Applicant: **MITSUBISHI HEAVY INDUSTRIES ENGINEERING, LTD.**, Kanagawa (JP)

(72) Inventors: **Koji UCHIDA**, Tokyo (JP); **Hiroyuki KONO**, Tokyo (JP); **Masaya MITAKE**, Tokyo (JP); **So TAMURA**, Kanagawa (JP)

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(57) **ABSTRACT**

This bogie and vehicle is provided with: a bogie body; a pair of travel wheels disposed on both sides of the bogie body in a direction intersecting with the traveling direction and capable of rolling motion on the traveling road surface of a track; a guide device guided along a guide rail and rotatably supported to the bogie body about the axial line along a vertical direction; and a pair of motors disposed between the pair of travel wheels of the bogie body and transferring a drive force to the pair of travel wheels.

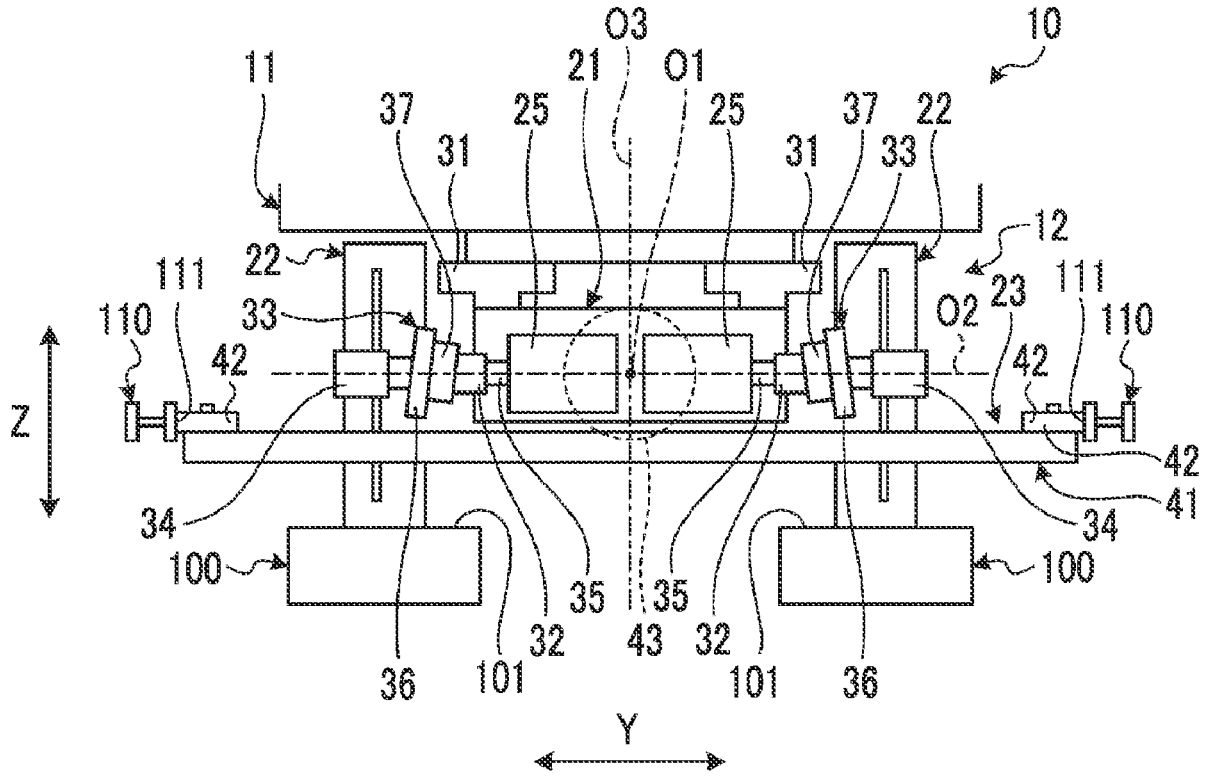

FIG. 1

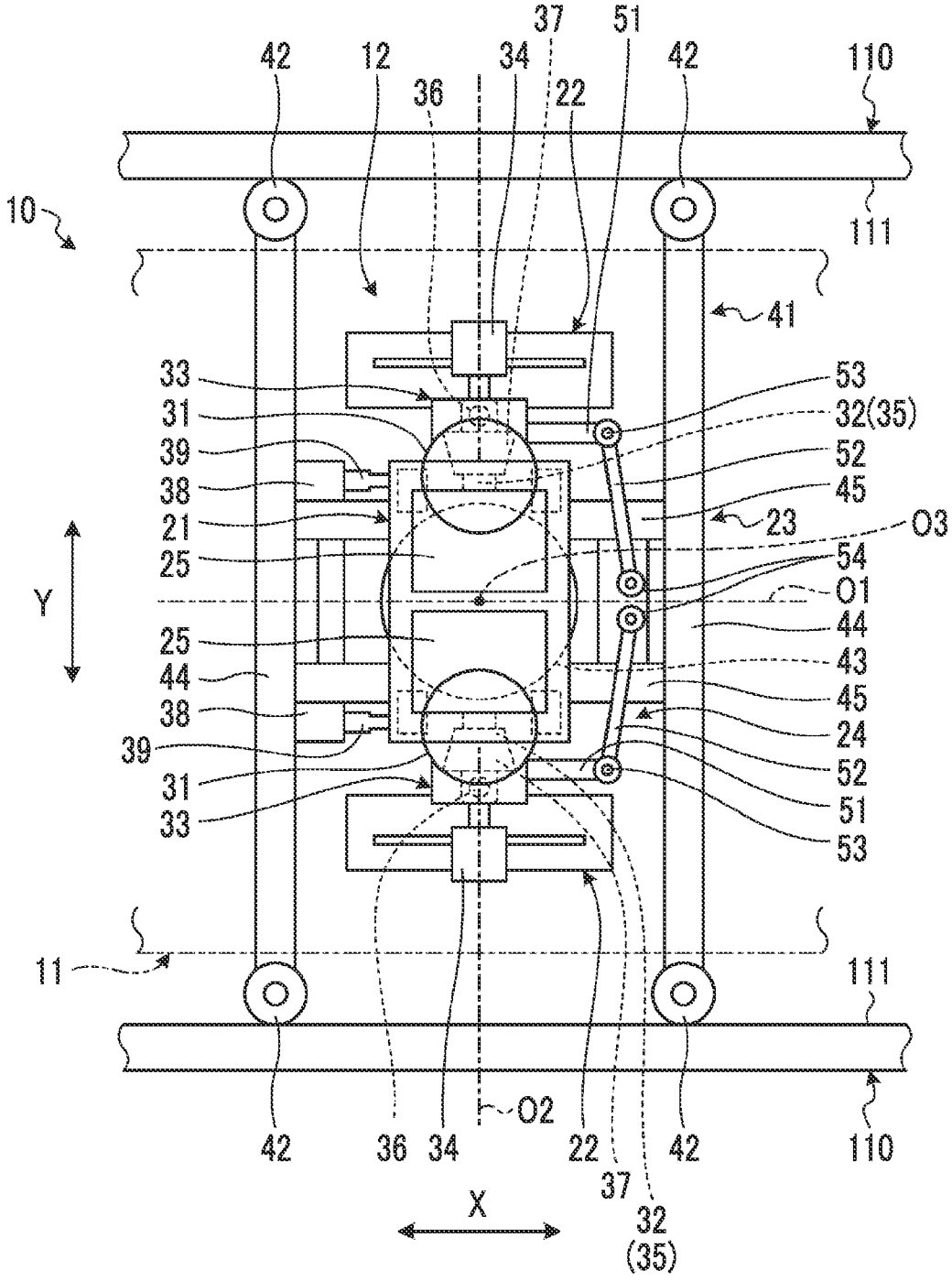
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FIG. 2

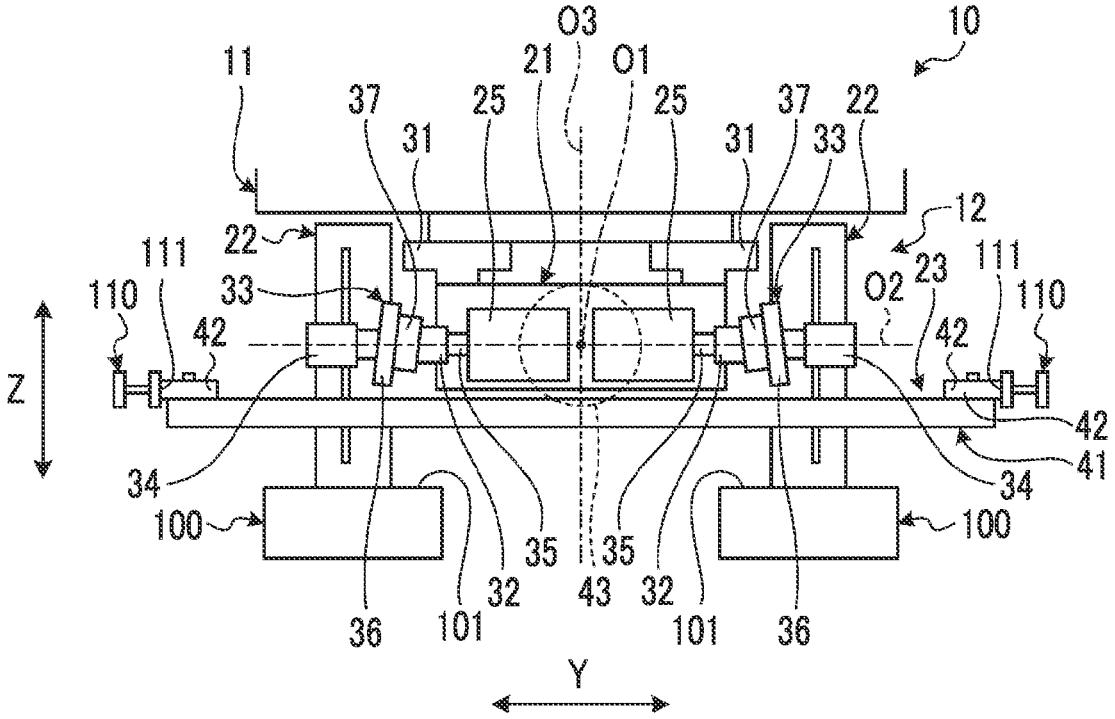
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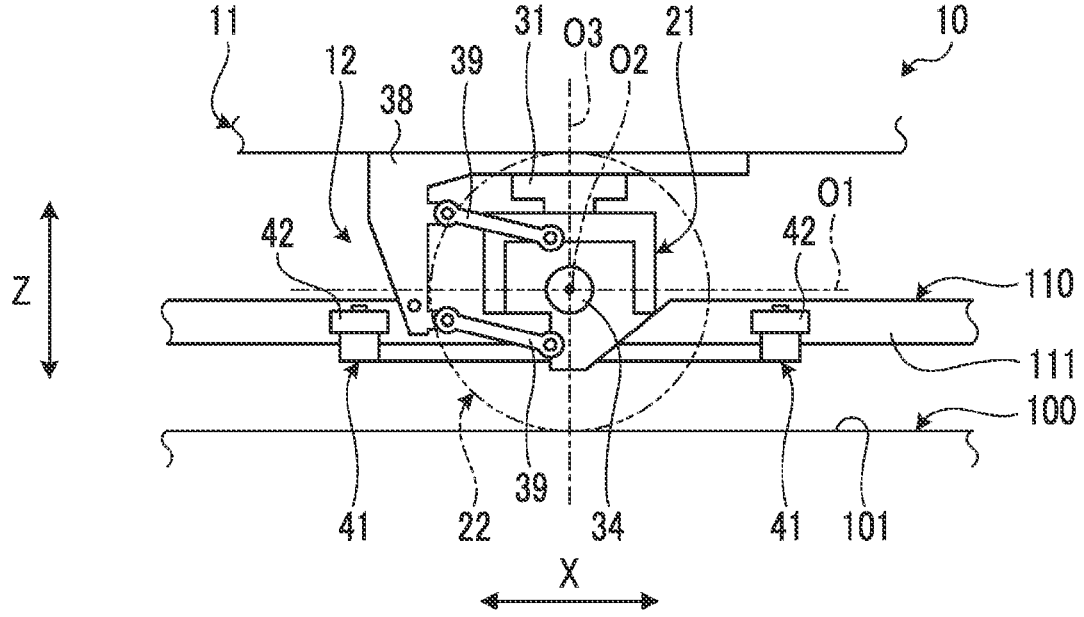
FIG. 3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BOGIE AND VEHICLE

TECHNICAL FIELD

[0001] The present disclosure relates to a bogie and a vehicle including a bogie.

BACKGROUND ART

[0002] As new transportation means, a railway transportation system that runs on a railway by using a running wheel such as a rubber tire is known. A vehicle used for the railway transportation systems is guided by a guide rail in which guide wheels provided on both sides in a width direction are disposed along the railway.

[0003] The vehicle used for the railway transportation system includes a vehicle body and a bogie. The bogie is configured so that a bogie body is equipped with an electric motor, a power transmission mechanism, a differential gear, a constant velocity ball joint for steering, a braking device, and a running wheel. Therefore, when the electric motor is driven, a driving rotational force is decelerated by the power transmission mechanism, is distributed to axles on both sides by the differential gear, and is transmitted to a pair of right and left running wheels via the constant velocity ball joint so that the pair of running wheels is rotationally driven. For example, the bogie configured in this way is disclosed in PTL 1 below.

CITATION LIST

Patent Literature

[0004] [PTL 1] Japanese Patent No. 4461189

SUMMARY OF INVENTION

Technical Problem

[0005] In the railway vehicle in the related art described above, the driving rotational force of the electric motor disposed in a central portion of the bogie body is distributed and transmitted to the pair of running wheels by the differential gear. Therefore, a space in the central portion of the bogie body is occupied by the electric motor, thereby causing a problem in that the bogie body is less likely to be equipped with other devices.

[0006] The present disclosure is to solve the above-described problem, and an object of the present disclosure is to provide a bogie and a vehicle which can achieve a compact device and can effectively use a space.

Solution to Problem

[0007] According to the present disclosure, in order to achieve the above-described object, there is provided a bogie including a bogie body, a pair of running wheels disposed on both sides of the bogie body in a direction intersecting with a running direction of the bogie body and rollable on a running road surface of a railway, a guide device guided along a guide rail and supported to be pivotable around an axial center along a vertical direction by the bogie body, and a pair of motors disposed between the pair of running wheels in the bogie body and transmitting a drive force to the pair of running wheels.

[0008] In addition, according to the present disclosure, there is provided a vehicle including the bogie and a vehicle body supported from below by the bogie.

Advantageous Effects of Invention

[0009] According to the bogie of the present disclosure, a compact device can be achieved, and a space can be effectively used.

BRIEF DESCRIPTION OF DRAWINGS

[0010] FIG. **1** is a schematic plan view illustrating a vehicle including a bogie of the present embodiment.

[0011] FIG. **2** is a front view of the vehicle.

[0012] FIG. **3** is a side view of the vehicle.

DESCRIPTION OF EMBODIMENTS

[0013] Hereinafter, a preferred embodiment of the present disclosure will be described in detail with reference to the drawings. The present disclosure is not limited by the embodiment. In a case where there are a plurality of the embodiments, the present disclosure also includes a configuration adopted by combining the respective embodiments with each other. In addition, configuration elements in the embodiment include those which can be easily assumed by those skilled in the art, those which are substantially the same, and those which have a so-called equivalent scope.

[0014] [Configuration of Vehicle]

[0015] FIG. **1** is a schematic plan view illustrating a vehicle including a bogie of the present embodiment, FIG. **2** is a front view of the vehicle, and FIG. **3** is a side view of the vehicle. In the following description, a running (forward-rearward) direction of the vehicle will be defined as an X-direction, a rightward-leftward (width) direction intersecting with the running direction (X-direction) of the vehicle will be defined as a Y-direction, and a vertical (height) direction intersecting with the running direction (X-direction) and the rightward-leftward direction (Y-direction) of the vehicle will be defined as a Z-direction. In addition, a center along the X-direction of the vehicle will be defined as an axial center O**1**, a center along the Y-direction of the vehicle will be defined as an axial center O**2**, and a center along the Z-direction of the vehicle will be defined as an axial center O**3**. The axial center O**2** is a rotation center of the running wheel, the axial center O**1** is orthogonal to the axial center O**2** in a horizontal direction at an intermediate position in the width direction of the vehicle, and the axial center O**3** is orthogonal to the axial center O**1** and the axial center O**2** in the vertical direction at the intermediate position in the width direction of the vehicle.

[0016] In the present embodiment, as illustrated in FIGS. **1** to **3**, a vehicle **10** is a vehicle of a new transportation system which runs on a running road surface **101** of a railway **100** and is guided by a guide surface **111** of guide rails **110** provided on both sides of the railway **100**. The vehicle **10** is applied to a new side guide rail type (side guide type) transportation system in which the railway **100** is disposed below and the guide rail **110** is disposed outside the railway **100** in the Y-direction.

[0017] The vehicle **10** includes a vehicle body **11** and a bogie **12**. For example, the vehicle body **11** carries an occupant or a passenger. The bogie **12** causes the vehicle body **11** to run along the railway **100** and the guide rail **110**. The bogie **12** is provided in each of a front lower portion and

a rear lower portion of the vehicle body **11**. In addition, FIGS. **1** to **3** illustrate only one bogie **12**.

[0018] The bogie **12** includes a bogie body **21**, a pair of running wheels **22**, a guide device **23**, a steering device **24**, and a pair of motors **25**.

[0019] The bogie body **21** is disposed at an intermediate position in the Y-direction of the vehicle body **11**. The bogie body **21** has a frame shape, and a pair of right and left bolster springs **31** is disposed in an upper portion, and a lower portion of the vehicle body **11** is supported by the bolster spring **31**.

[0020] The pair of running wheels **22** is disposed on both right and left sides of the bogie body **21** in the Y-direction. The running wheel **22** is rollable on the running road surface **101** of the railway **100**. The bogie body **21** is internally equipped with the pair of motors **25**. The pair of motors **25** is disposed between the pair of running wheels **22** in the bogie body **21**. The pair of motors **25** can transmit a drive force to the pair of running wheels **22**. The pair of running wheels **22** is rotatable around an axial center O**2** along the Y-direction.

[0021] In the bogie body **21**, a spline joint **32**, a pair of constant velocity ball joints **33**, and a pair of speed reducers **34** are disposed between the pair of running wheels **22** and the pair of motors **25**. In the motor **25**, an output shaft **35** is connected to the constant velocity ball joint **33** via the spline joint **32**. However, the output shaft **35** of the motor **25** may be directly connected to the constant velocity ball joint **33**. The constant velocity ball joint **33**, a kingpin **36**, and an attachment shaft **37** are provided between the output shaft **35** and the speed reducer **34**. The running wheel **22** is a rubber tire supported on the bogie body **21** side via the attachment shaft **37**, and a metal wheel and a brake disc forming a braking device are mounted inside the running wheel **22**. The running wheel **22** is integrated with the attachment shaft **37**, and is pivotable around the kingpin **36** serving as a fulcrum in the X-direction. In other words, the running wheel **22** is pivotable around a Z-axis direction.

[0022] For example, the speed reducer **34** is a planetary gear mechanism. The speed reducer **34** is a hub reduction disposed inside a wheel forming the running wheel **22**. However, the speed reducer **34** may be disposed between the output shaft **35** of the motor **25** and the constant velocity ball joint **33**. The pair of motors **25** includes an electric motor, and is disposed on an upper side of the guide device **23** in the Z-direction. A rotation axial center of the pair of motors **25** and a rotation axial center of the pair of running wheels **22** are disposed on a straight line (axial center O**2**) along the rightward-leftward direction (Y-direction) intersecting with the running direction (X-direction) of the bogie body **21**. The output shaft **35** of the motor **25**, the spline joint **32**, the constant velocity ball joint **33**, the speed reducer **34**, and the running wheel **22** are disposed on a straight line (axial center O**2**) along the Y-direction. In this case, the motor **25**, the spline joint **32**, the constant velocity ball joint **33**, the speed reducer **34**, and the running wheel **22** are disposed to be line-symmetrical in the Y-direction with respect to the axial center O**1**.

[0023] The pair of running wheels **22** are supported to be rotatable in the bogie body **21**. The bogie body **21** is fixed to a lower portion of the vehicle body **11**, and is connected to a suspension frame **38** extending downward via a pair of upper and lower traction rods **39**.

[0024] The guide device **23** has a guide frame **41**, a plurality of guide wheels **42**, and a turning bearing **43**. The guide frame **41** has two horizontal beams **44** and two vertical beams **45**. The two horizontal beams **44** are disposed along the Y-direction, and are disposed at a predetermined interval in the X-direction. The two vertical beams **45** are disposed along the X-direction, and are disposed at a predetermined interval in the Y-direction. Each end portion is connected to the two horizontal beams **44**. The two horizontal beams **44** are mounted at each end portion in the Y-direction so that the guide wheel **42** is rotatable around the rotation axial center along the Z-direction. Each of the guide wheels **42** can come into contact with the guide surface **111** of the guide rail **110**. In addition, the guide frame **41** is supported to be pivotable around the axial center O**3** along the vertical direction by the turning bearing **43** in the bogie body **21**.

[0025] Therefore, when the bogie **12** runs on a curved portion of the railway **100**, each of the guide wheels **42** comes into contact with the guide rail **110**. In this manner, the guide frame **41** is pivotable along the curved portion by the turning bearing **43**. That is, in the vehicle **10**, each of the guide wheels **42** receives a reaction force from the outer guide rail **110** of the curved portion, the guide frame **41** pivots so that the outer guide wheel **42** is pushed forward compared to the inner guide wheel **42**.

[0026] In addition, when the bogie **12** runs on the curved portion of the railway **100**, rolling distances of the pair of running wheels **22** are different. Therefore, a torque of each of the motors disposed on both sides is controlled to rotate the motor in accordance with a tire rolling distance. In addition, a rotation speed of the pair of motors **25** is adjusted and controlled in accordance with an operation state of the guide device **23**. In this manner, curved running can be smoothly performed. Although not illustrated, the bogie body **21** is provided with a control device that controls the pair of motors **25**. The control device adjusts the rotation speed of the pair of motors **25**, based on a pivoting angle from a reference position of the guide frame **41** and a pressing force (load) applied to the guide rail **110** by the guide wheel **42**.

[0027] The steering device **24** is provided on a front side of the running wheel **22** in the running direction of the vehicle **10**. The steering device **24** has a pair of right and left steering arms **51** and a pair of right and left steering rods **52**. One end portion of the steering arm **51** and the steering rod **52** in a longitudinal direction is connected to be pivotable by a connection pin **53**. Then, the other end portion of the steering arm **51** in the longitudinal direction is fixed to the attachment shaft **37**, and the other end portion of the steering rod **52** in the longitudinal direction is connected to the guide frame **41** to be pivotable by a connection pin **54**.

[0028] Therefore, the steering arm **51** horizontally oscillates around the kingpin **36** serving as a fulcrum together with the running wheel **22**, and the steering rod **52** oscillates in response to oscillation of the steering arm **51**. When the guide frame **41** pivots around the axial center O**3**, a pivoting operation of the guide frame **41** is transmitted to the steering arm **51** via the steering rod **52**, and the attachment shaft **37** pivots around the kingpin **36** serving as the fulcrum so that the running wheel **22** is steered.

[0029] [Operation of Vehicle]

[0030] When the pair of motors **25** is driven, the driving rotational force is transmitted to the speed reducer **34** via the spline joint **32** and the constant velocity ball joint **33**. The

speed reducer **34** decelerates the transmitted driving rotational force, and transmits the driving rotational force to the running wheels **22** so that the running wheels **22** are rotationally driven. In the vehicle **10**, since the running wheel **22** is rotationally driven, the running wheel **22** rolls on the running road surface **101** of the railway **100**. In this case, each of the guide wheels **42** of the guide device **23** is guided to the guide surface **111** of the guide rail **110** so that the vehicle **10** can run along the railway **100**.

[0031] When the vehicle **10** reaches the curved portion of the railway **100**, each of the guide wheels **42** receives the reaction force from the outer guide rail **110** of the curved portion, and the guide frame **41** pivots so that the outer guide wheel **42** is pushed forward in the running direction, compared to the inner guide wheel **42**. In this case, the steering rod **52** and the steering arm **51** oscillate in response to pivoting of the guide frame **41**, and the attachment shaft **37** pivots around the kingpin **36** serving as the fulcrum so that the running wheel **22** is steered. Therefore, the vehicle **10** can run along the railway **100** even when the vehicle **10** reaches the curved portion of the railway **100**.

Operational Effect of Present Embodiment

[0032] The bogie according to a first aspect includes the bogie body **21**, the pair of running wheels **22** disposed on both sides of the bogie body **21** in the rightward-leftward direction intersecting with the running direction of the bogie body **21** and rollable on the running road surface **101** of the railway **100**, the guide device **23** guided along the guide rail **110** and supported to be pivotable around the axial center along the vertical direction by the bogie body **21**, and the pair of motors **25** disposed between the pair of running wheels **22** in the bogie body **21** and transmitting the drive force to the pair of running wheels **22**.

[0033] In the bogie according to the first aspect, the pair of motors **25** that transmit the drive force to the pair of running wheels **22** is disposed between the pair of running wheels **22** in the bogie body **21**. Therefore, the pair of motors **25** can be efficiently disposed in the bogie body **21**. Accordingly, a compact device can be achieved, and a space in the bogie body **21** can be effectively used.

[0034] In the bogie according to a second aspect, the pair of speed reducers **34** is provided between the output shaft **35** of the pair of motors **25** and the rotary shaft of the pair of running wheels **22**. In this manner, the speed reducer **34** can be efficiently disposed so that a compact device can be achieved. The rotational drive force of the motor **25** is decelerated by the speed reducer **34**, and is transmitted to the running wheels **22**. Therefore, a large output torque can be secured.

[0035] In the bogie according to a third aspect, the pair of speed reducers **34** is disposed inside the pair of running wheels **22**. In this manner, a compact device can be achieved.

[0036] In the bogie according to a fourth aspect, the pair of constant velocity ball joints **33** is provided between the output shaft **35** of the pair of motors **25** and the rotary shaft of the pair of running wheels **22**. In this manner, the constant velocity ball joint **33** can be efficiently disposed so that a compact device can be achieved, and steerability of the running wheel **22** can be secured.

[0037] In the bogie according to a fifth aspect, the pair of spline joints **32** is provided between the output shaft **35** of the pair of motors **25** and the rotary shaft of the pair of running wheels **22**. In this manner, the rotational drive force of the motor **25** can be properly transmitted to the running wheel **22** by the spline joint **32**.

[0038] In the bogie according to a sixth aspect, the rotation axial center of the pair of motors **25** and the rotation axial center of the pair of running wheels **22** are disposed on the straight line along the rightward-leftward direction intersecting with the running direction of the bogie body **21**. In this manner, a compact device can be achieved.

[0039] In the bogie according to a seventh aspect, the pair of motors **25** is disposed above the guide device **23** in the vertical direction. In this manner, a compact device can be achieved.

[0040] In the bogie according to an eighth aspect, the control device that controls the rotation speed of the pair of motors **25** in accordance with the operation state of the guide device **23** is provided. In this manner, running stability of the bogie can be improved in the curved portion of the railway **100**.

[0041] The vehicle according to a ninth aspect includes the bogie **12** and the vehicle body **11** supported from below by the bogie **12**. In this manner, the pair of motors **25** can be efficiently disposed in the bogie **12** so that a compact device can be achieved, and a space in the bogie body **21** can be effectively used.

[0042] In the above-described embodiment, the rotation axial center of the pair of motors **25** and the rotation axial center of the pair of running wheels **22** are disposed on the straight line along the Y-direction. However, when necessary, the motor **25** and the running wheel **22** may be disposed to be shifted in the X-direction or the Z-direction.

REFERENCE SIGNS LIST

[0043] **10**: Vehicle
[0044] **11**: Vehicle body
[0045] **12**: Bogie
[0046] **21**: Bogie body
[0047] **22**: Running wheel
[0048] **23**: Guide device
[0049] **24**: Steering device
[0050] **25**: Motor
[0051] **31**: Bolster spring
[0052] **32**: Spline joint
[0053] **33**: Constant velocity ball joint
[0054] **34**: Speed reducer
[0055] **35**: Output shaft
[0056] **36**: Kingpin
[0057] **37**: Attachment shaft
[0058] **38**: Suspension frame
[0059] **39**: Traction rod
[0060] **41**: Guide frame
[0061] **42**: Guide wheel
[0062] **43**: Turning bearing
[0063] **44**: Horizontal beam
[0064] **45**: Vertical beam
[0065] **51**: Steering arm
[0066] **52**: Steering rod
[0067] **53**, **54**: Connection pin

[0068] **100**: Railway
[0069] **101**: Running road surface
[0070] **110**: Guide rail
[0071] **111**: Guide surface
[0072] O**1**, O**2**, O**3**: Axial center

1. A bogie comprising:
a bogie body;
a pair of running wheels disposed on both sides of the bogie body in a direction intersecting with a running direction of the bogie body and rollable on a running road surface of a railway;
a guide device guided along a guide rail and supported to be pivotable around an axial center along a vertical direction by the bogie body; and
a pair of motors disposed between the pair of running wheels in the bogie body and transmitting a drive force to the pair of running wheels.

2. The bogie according to claim **1**,
wherein a pair of speed reducers is provided between an output shaft of the pair of motors and a rotary shaft of the pair of running wheels.

3. The bogie according to claim **2**,
wherein the pair of speed reducers is disposed inside the pair of running wheels.

4. The bogie according to claim **1**,
wherein a pair of constant velocity ball joints is provided between an output shaft of the pair of motors and a rotary shaft of the pair of running wheels.

5. The bogie according to claim **1**,
wherein a pair of spline joints is provided between an output shaft of the pair of motors and a rotary shaft of the pair of running wheels.

6. The bogie according to claim **1**,
wherein a rotation axial center of the pair of motors and a rotation axial center of the pair of running wheels are disposed on a straight line along a direction intersecting with the running direction of the bogie body.

7. The bogie according to claim **1**,
wherein the pair of motors is disposed above the guide device in the vertical direction.

8. The bogie according to claim **1**,
wherein a control device that controls a rotation speed of the pair of motors in accordance with an operation state of the guide device is provided.

9. A vehicle comprising:
the according to claim **1**; and
a vehicle body supported from below by the bogie.

* * * * *