actuator 200. The wheels 604 are attached to the other ends of the axles 603a and 603b.

[0134] The bearings 602 are attached to respective axle boxes, and the axle boxes are attached to the bogie frame 605 via respective axle box support devices. The bearings 602 and the axle boxes are buffer-supported with respect to the bogie frame 605 (frame) by the axle box support devices. The axles 603a and 603b are rotatably supported by respective bearings 602.

[0135] FIG. 26 is a block diagram showing a schematic configuration of an electric power feeding system 690S (electric drive system 690) of the railroad car 600 according to the tenth embodiment of the present invention. The electric power feeding system 690S, together with a plurality of electric actuators 200 (specifically, a plurality of motors 10) mounted on the railroad car 600, constitutes the electric drive system 690.

[0136] The railroad car 600 is a dynamic car that collects electric power using an overhead line electric power collection system and includes, as an electric power collector, a pantograph 691c that contacts an overhead line 691b which is a trolley line (contact wire). The overhead line 691b is supplied with system electric power (e.g., three-phase AC) from an electric power substation 691a.

[0137] Of the electric drive system 690 (electric power feeding system 690S), a mobile drive system 690M (mobile electric power feeding system 690MS) installed in the railroad car 600 consists of one or more mobile drive units 690MU (mobile electric power feeding system 690MSU) unitized for each corresponding bogie 601. The mobile drive unit 690MU (mobile electric power feeding system 690MSU) may be configured not in units of bogies 601, but in units of railroad cars 600, or in units of trains with multiple railroad cars 600 connected.

[0138] According to the electric drive system 690 according to the tenth embodiment of the present invention, the same effect as that of the electric drive system 290 according to the second embodiment of the present invention is obtained. That is, since regenerative electric power is efficiently used to drive the motor 10, it is possible to drive the railroad car 600 (electric actuator 200) with low electric power consumption.

[0139] In the present embodiment, the overhead line electric power collection system using pantograph 692c as an electric power collector is employed, but other types of electric power collectors (e.g., view gels, trolley poles, etc.) or other types of electric power collection systems (e.g., third rail system in which electric power collecting shoes contact the electric power feeding rail [third rail] to collect electric power) may be used.

[0140] The railroad car 600 of the present embodiment is a bogie type railroad car that uses the bogies 601 as a traveling device and the mobile drive unit 690MU is mounted on the bogie 601,

be applied to the tire T.

[0151] In the present embodiment, power output from the inverter motor 2080 is again transmitted to the rotating drum 2010 via the rotating drum 2010, the relay shaft 2013, the torque generator 130, the constant velocity joint 2014, the spindle of the alignment adjustment mechanism 2160, and the tire T. That is, the power transmission path consisting of the rotating drum 2010, the relay shaft 2013, the torque generator 130, the constant velocity joint 2014, the spindle of the alignment adjustment mechanism 2160, and the tire T constitutes a power circulation system. Therefore, the power of the inverter motor 2080 is used efficiently, thereby enabling operation with less power consumption.

[0152] The alignment adjustment mechanism 2160 of the present embodiment is a mechanism that rotatably supports the tire T, which is a test specimen, in a state in which the tire T is mounted on a wheel, presses a tread portion of the tire T against the simulated road surface of the rotating drum 2010, and adjusts orientation of the tire T relative to the simulated road surface and tire load (contact pressure) to set conditions. The alignment adjustment mechanism 2160 includes a tire load adjustment section 2161 that adjusts the tire load by moving a position of a rotation axis of the tire T in a radial direction of the rotating drum 2010, a slip angle adjustment section 2162 that adjusts a slip angle of the tire T relative to the simulated road surface by tilting the rotation axis of the tire T around a perpendicular line of the simulated road surface, a camber angle adjustment section 2163 that adjusts a camber angle by tilting the rotation axis of the tire T relative to a rotation axis of the rotating drum 2010, and a traverse device 2164 that moves the tire T in the direction of the rotation axis. The tire load adjustment section 2161, the slip angle adjustment section 2162, the camber angle adjustment section 2163, and the traverse device 2164 include servomotors M1, M2, M3, and M4, respectively. The servomotors M1, M2, M3 and M4 are, for example, AC servomotors.

[0153] FIG. 30 is a block diagram showing a schematic configuration of an electric power feeding system 2800S (electric drive system 2800) of the eleventh embodiment of the present invention, which provides electric power to the servomotor 10 and the inverter motor 2080.

[0154] The electric power feeding system 2800S of the present embodiment differs from the electric power feeding system 90S of the first embodiment in that the electric power feeding system 2800S has an electric power feeding structure 2860 (a reactor 2870 and a driver 2880) that supplies electric power to the inverter motor 2080 branched from a rear stage of an electromagnetic switch 2830, and electric power feeding structures 2891 (a reactor R1 and a servo amplifier A1), 2892 (a reactor R2 and a servo amplifier A2), 2893 (a reactor R3 and a

wherein the motion converter includes:

a first motion converter that converts the reciprocating rotary motion into reciprocating linear motion; and

a second motion converter that converts the reciprocating linear motion into the unidirectional rotary motion.

[Additional Note 4]

An electric actuator including:

an electric motor;

a first motion converter that converts rotary motion into linear motion;

a second motion converter that converts the linear motion into a rotary motion;

a drive device that supplies driving electric power to the electric motor; and

a controller that controls the drive device,

wherein the drive device includes:

a converter that converts alternating current electric power supplied from a power source into direct current electric power; and

an inverter that generates driving electric power from the direct current electric power,

wherein the controller controls the electric motor to be driven to repeatedly rotate back and forth.

[Additional Note 5]

The electric actuator according to Additional Note 4,

wherein the first motion converter is a ball screw and includes:

a linear motion part that is fixed to a nut of a feed screw and moves linearly together with the nut, the linear motion part including a first pin;

a crankshaft including an eccentric crank pin; and

a connecting rod rotatably connected to the first pin and the crank pin.

[Additional Note 6]

The electric actuator according to any one of Additional Note 1 to Additional Note 5,

wherein the drive device includes:

a direct current bus bar consisting of a pair of conductors that connects the converter to the inverter; and

a capacitor that connects the pair of conductors.

[Additional Note 7]

The electric actuator according to any one of Additional Note 1 to Additional Note 5 including

respect to the first rotation axis and to a portion of the second disk part eccentric with respect to the second rotation axis.

[Additional Note 37]

An electric mobility vehicle including the electric actuator according to any one of Additional Note 31 to Additional Note 36.

[0220]

DESCRIPTION OF REFERENCE NUMERALS

[0221]

1 electric car

10 motor

40 ball screw

50, 250, 350 piston (linear motion part)

60, 135, 260, 360, 560 connecting rod

70, 270, 270a crankshaft

80 generator

95, 295, 695, 795, 895, 995, 2850 servo amplifier

95a, 2851 power regenerative converter

95b, 97b, 2852 inverter

95c, 97c, 2853 capacitor

96, 296, C2 controller (control unit)

100, 200, 201, 300, 400, 500, 5320, 5320a, 5420 electric actuator

100d, 200d, 300d, 400d, 500d drive unit

600 railroad car

CLAIMS

1. An electric actuator comprising:

an electric motor;

a drive device that drives the electric motor to output a first rotary motion using power accumulated in a capacitor; and

a motion converter that is coupled to the electric motor and converts the first rotary motion into a second rotary motion,

wherein:

the first rotary motion is forward and reverse rotary motions that are output by the electric motor as the drive device drives the electric motor to repeat forward rotation and reverse rotation,

the second rotary motion is a unidirectional rotary motion, and

regenerative electric power generated in the electric motor by the electric motor repeating the forward rotation and the reverse rotation is supplied to the capacitor.

2. The electric actuator according to claim 1,

wherein the drive device supplies, to a power source, excess electric power among the regenerative electric power.

3. The electric actuator according to claim 1,

wherein the drive device supplies, to a power source, excess electric power according to electric power to be consumed in acceleration of the electric motor and the regenerative electric power.

4. The electric actuator according to claim 1,

wherein the drive device supplies electric power supplied from a power source to the electric motor via the capacitor, and outputs, among electric power regenerated from the electric motor while repeating the forward rotation and reverse rotation, excess electric power that has not been consumed in acceleration of the electric motor to the power source.

5. The electric actuator according to claim 1,

wherein the drive device includes a power regenerative converter that is connected to a

power source and supplies electric power to the capacitor, and an inverter that converts direct current electric power output by the capacitor into alternating current electric power and supplies the alternating current electric power to the electric motor, and

wherein the power regenerative converter outputs, to the power source, excess electric power that is not accumulated in the capacitor among regenerative electric power regenerated from the electric motor.

6. The electric actuator according to claim 5, wherein:

the power source consists of an alternating current power source, and

the power regenerative converter consists of a bidirectional ACDC converter.

7. The electric actuator according to claim 5, wherein:

the power source consists of a direct current power source, and

the power regenerative converter consists of a bidirectional DCDC converter.

8. The electric actuator according to claim 1,

wherein the drive device drives the electric motor to repeat the forward rotation and reverse rotation at a required frequency of 3Hz or more.

9. The electric actuator according to claim 1,

wherein the motion converter includes:

a first motion converter that converts the forward and reverse rotary motions into a reciprocating linear motion; and

a second motion converter that converts the reciprocating linear motion into a unidirectional rotary motion.

10. The electric actuator according to claim 9,

wherein the motion converter includes:

a ball screw having a nut;

a linear motion part fixed to the nut and that moves linearly together with the nut;

a rotating body that is freely rotatable around a rotation axis; and

a connecting rod rotatably connected to a portion of the rotating body that is

eccentric with respect to the rotation axis and to the linear motion part.

11. The electric actuator according to claim 10, wherein:
the rotating body is a crankshaft, and
the connecting rod is rotatably connected to a crank pin of the crankshaft.

12. The electric actuator according to claim 10 wherein:
the rotating body is a spindle, and
the connecting rod is rotatably connected to a projection formed to the spindle at a position eccentric with respect to the rotation axis.

13. The electric actuator according to claim 11 or claim 12 further comprising a controller that controls the drive device,
wherein the controller controls the drive device to switch rotation of the electric motor between the forward rotation and the reverse rotation while avoiding timings at which the linear motion part reaches dead points where no rotational force is generated to the rotating body by the movement of the linear motion part.

14. The electric actuator according to claim 11 or claim 12 further comprising a controller that controls the drive device,
wherein the controller controls the drive device so that torque of the electric motor is limited at least at timings at which the linear motion part reaches dead points where no rotational force is generated to the rotating body by the movement of the linear motion part.

15. The electric actuator according to any one of claim 1 to claim 8,
wherein the motion converter includes:
a first disk part connected to a shaft of the electric motor and freely rotatable about a first rotation axis;
a second disk part connected to an output shaft of the motion converter and freely rotatable about a second rotation axis; and
a connecting rod rotatably connected to a portion of the first disk part eccentric with respect to the first rotation axis and to a portion of the second disk part eccentric with respect to the second rotation axis.

16. An electric mobility vehicle comprising the electric actuator according to any one of claim 1 to claim 15.

17. The electric mobility vehicle according to claim 16 having:

the electric actuator;

a power transmission of which input shaft is connected to an output shaft of the motion converter;

a drive shaft connected to an output shaft of the power transmission; and

a wheel attached to the drive shaft.

18. The electric mobility vehicle according to claim 16 that obtains unidirectional drive force from a unidirectional rotary motion obtained by causing the electric actuator to rotate back and forth.