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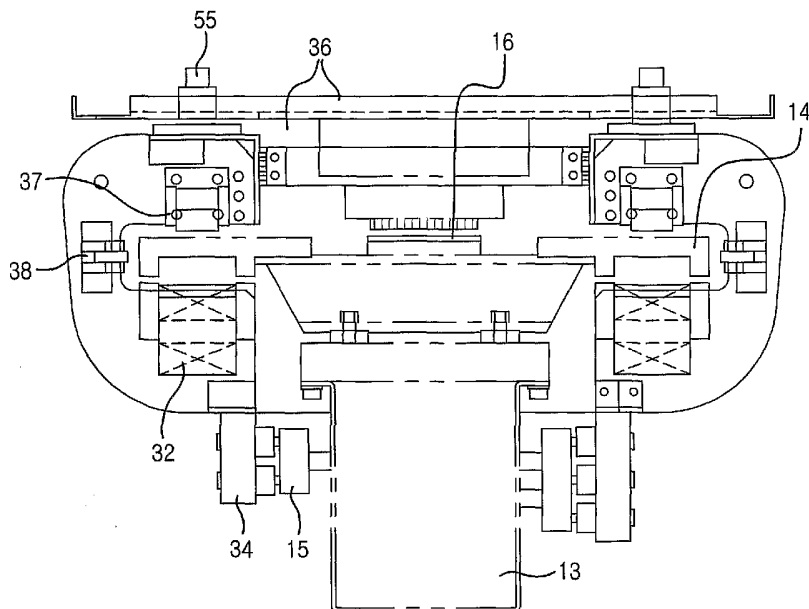
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[Continued on next page]

(54) Title: TESTING SYSTEM FOR MAGNETIC LEVITATION TRAIN



(57) Abstract: The present invention provides a testing system for a magnetic levitation train, by which an optimal configuration for testing a real state of a magnetic levitation train service is implemented to facilitate an acquisition of various data resulting from a service test as most ideal result values. The present invention includes a track provided with a rail to be used as a service track and a plurality of columns coupled with a bottom of the rail to set up a service height and a carriage provided with a truck coupled with the rail to levitate to travel over the rail along the service track of the rail and a carriage body coupled with an upper part of the truck to form an exterior of the magnetic levitation train.



SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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Testing System for Magnetic Levitation Train

TECHNICAL FIELD

The present invention relates to a testing system for a magnetic levitation train, by which an optimal configuration for testing a real state of a magnetic levitation train service is implemented to facilitate an acquisition of various data resulting from a service test as most ideal result values.

BACKGROUND ART

Generally, a magnetic levitation train is levitated to a prescribed height to travel along rails by a magnetic force. The magnetic levitation train failing to be directly contacted with the rails minimizes noise and vibration thereof and excludes friction occurrence with various members to enable a high speed traveling.

The magnetic levitation train abruptly rises as a next generation transportation means due to its various advantages such as minimal noise and vibration, high speed traveling, and the like. And, many efforts are made to more stable traveling.

Specifically, the magnetic levitation train is not realized as a public transportation means yet. And, the preparation of the train and rails needs considerable economical and time-consuming loads, whereby a testing system for the magnetic levitation train is prepared. And, the testing system is mostly divided into a levitation module, a traveling module, and a control module, and the like.

To carry out an overall simulation for a service test of the magnetic levitation train, the data respectively collected from the levitation, traveling, and control modules are inputted to a computer to be operated into a virtual result.

And, to visualize the virtual result, a method of

displaying a service state of the magnetic levitation train, which is simulated by a computer graphic and the like on a monitor and the like based on virtual numerical values, is provided.

5

DISCLOSURE OF THE INVENTION

TECHNICAL PROBLEM

However, the related art testing system for the magnetic levitation train needs to be manufactured per
10 levitation, traveling, and control, thereby needing economical and time-consuming loads.

And, since the data attained by the testing system for the magnetic levitation train are acquired as the virtual result values, it is difficult to apply the virtual
15 result values to optimal data of a real magnetic levitation train. Hence, after the data have been applied to a simulated service of the real magnetic levitation train, data correction needs to be separately performed.

20 TECHNICAL SOLUTION

Accordingly, the present invention is directed to a testing system for a magnetic levitation train that substantially obviate one or more of the problems due to limitations and disadvantages of the related art.

25 An object of the present invention is to provide a testing system for a magnetic levitation train, by which levitation, traveling, and control configurations synthetically required for a service test of the magnetic levitation train are implemented by the single testing
30 system for the magnetic levitation train and by which a result value that service test data are closest to service data of the real magnetic levitation train can be acquired.

ADVANTAGEOUS EFFECTS

35 Accordingly, the present invention synthetically acquires the result data of the levitation, traveling, and

control from the single model, thereby reducing the costs for preparing the testing system for the magnetic levitation train.

And, the present invention enables the result data to be applied to the service of the real magnetic levitation train without separate combination and correction of the result data, thereby avoiding economical/time-consuming loss according to the data application.

10 BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

In the drawings:

FIG. 1 is a front diagram of a testing system for a magnetic levitation train according to the present invention;

FIG. 2 is a lateral diagram of a testing system for a magnetic levitation train according to the present invention;

FIG. 3 is a layout of a track of a testing system for a magnetic levitation train according to the present invention;

FIG. 4 is a front diagram of a track of a testing system for a magnetic levitation train according to the present invention;

FIG. 5 is a cross-sectional diagram of a track of a testing system for a magnetic levitation train according to the present invention;

FIG. 6 is a front diagram of a truck of a testing system for a magnetic levitation train according to the present invention;

FIG. 7 is a layout of a truck of a testing system for

a magnetic levitation train according to the present invention;

FIG. 8 is a lateral diagram of a truck of a testing system for a magnetic levitation train according to the present invention; and

FIG. 9 is a block diagram of a controller of a testing system for a magnetic levitation train according to the present invention.

<brief description of principal cord part of figures>

10 track 10
rail 11
columns 12
rail body 13
guide rail 14
15 power rail 15
reaction plate 16
carriage 20
truck 30
main frame 31
20 levitation mechanism 32
traveling mechanism 33
pantograph 34
landing roller 37
guide roller 38
25 control mechanism 50
power supply unit 51
detection unit 52
control unit 53
drive unit 54.

30

BEST MODE FOR CARRYING OUT THE INVENTION

To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described, a testing system for a magnetic levitation train according to the present invention includes a track provided with a rail to be used

as a service track and a plurality of columns coupled with a bottom of the rail to set up a service height and a carriage provided with a truck coupled with the rail to levitate to travel over the rail along the service track of the rail and a carriage body coupled with an upper part of the truck to form an exterior of the magnetic levitation train.

Preferably, the rail includes a rail body extending to be connected to the respective columns along the service track of the train and to be provided with a reaction plate loaded on the rail body to enable the truck to travel, a guide rail coupled with left and right sides of the rail body each to enable the truck to levitate, the guide rail installed to lie inside the truck to guide a section for a traveling of the train, and a power rail installed under both sides of the guide rail of the rail body to supply power to the truck guided by the guide rail to proceed.

More preferably, the truck includes a main frame enclosing an outside of the guide rail provided to both sides of the rail body and having the carriage body coupled to an upper side of the main frame, a levitation mechanism installed to confront a lower side of the guide rail on the main frame, the levitation mechanism generating an attractive force attributed to an electromagnetic field together with the guide rail to sustain a levitation of the main frame, a traveling mechanism installed at an upper side of the rail body confronting the reaction plate to generate a traveling force attributed to the electromagnetic field, and a control mechanism electrically connected to the levitation mechanism and the traveling mechanism to detect to control a levitating gap and traveling speed of the main frame on the guide rail.

MODE FOR CARRYING OUT THE INVENTION

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are

illustrated in the accompanying drawings.

FIG. 1 is a front diagram of a testing system for a magnetic levitation train according to the present invention and FIG. 2 is a lateral diagram of a testing system for a magnetic levitation train according to the present invention.

Referring to FIG. 1 and FIG. 2, a testing system for a magnetic levitation train according to the present invention basically includes a track 10 and a carriage 20.

The track 10 is provided with a rail 11 configuring the track along which the carriage 20 travels. And, a plurality of columns 12 are coupled with a bottom of the rail 11 to sustain the rail 11 to a predetermined height, whereby a height at which the carriage 20 travels is set.

The carriage 20 includes a truck 30 coupled with the rail 11 to levitate to travel over the rail 11 along the track of the rail 11 and a carriage body 40 coupled with an upper part of the truck 30 to form an exterior of the magnetic levitation train.

FIG. 3 is a layout of a track of a testing system for a magnetic levitation train according to the present invention, FIG. 4 is a front diagram of a track of a testing system for a magnetic levitation train according to the present invention, and FIG. 5 is a cross-sectional diagram of a track of a testing system for a magnetic levitation train according to the present invention.

Referring to FIGs. 3 to 5, the rail 11 of the track 10 includes a rail body 13, a guide rail 14, and a power rail 15.

The rail body 13 extends to be connected to the respective columns 12 along a service track of the train. A reaction plate 16 is loaded on the rail body 13 to enable the truck 30 to travel. And, the reaction plate 16 is installed to confront a traveling mechanism 33 to reciprocally react with the traveling mechanism of the truck 30.

The guide rail 14 is coupled with left and right sides of the rail body 13 each to enable the truck 30 to levitate. Hence, the guide rail 14 is installed to lie inside the truck 30, thereby guiding a section on which the train travels.

In doing so, the guide rail 14 is formed to have a '∩' shape. Hence, a lower side of the guide rail 14 is installed to enable an attractive action by reaction with a levitation mechanism 32 of the truck 30 that will be explained later.

And, the power rail 15 is installed under both sides of the guide rail 14 of the rail body 13 to supply power to the truck 30 that is guided by the guide rail 14 to proceed. Moreover, the power rail 15 is installed to come into contact with a pantograph 34 of the truck 30 for power supply.

FIG. 6 is a front diagram of a truck of a testing system for a magnetic levitation train according to the present invention, FIG. 7 is a layout of a truck of a testing system for a magnetic levitation train according to the present invention, and FIG. 8 is a lateral diagram of a truck of a testing system for a magnetic levitation train according to the present invention.

Referring to FIGs. 6 to 8, the carriage 20 includes the carriage body 40 coupled with an upper part of the truck 30. And, the truck 30 includes a main frame 31, a levitation mechanism 32, a traveling mechanism 33, and a control mechanism 50.

The main frame 31 includes a housing enclosing an outside of the guide rail 14 provided to both sides of the rail body 13 each and a connecting member 36 having both ends fixed to the housing 35.

In doing so, a landing roller 37 is provided to a portion of the housing 35 of the main frame 31 confronting a topside of the guide rail 14. Hence, the landing roller 37 provides a stable support force when the truck 30

descends to be put on the guide rail 14.

And, a guide roller 38 is provided to a portion of the housing 35 of the main frame 31 confronting each lateral side of the guide rail 14. Hence, the guide roller
5 38 can prevent a collision (direct collision between the housing and the guide rail) on the guide rail 14 when the truck 30 is traveling.

The levitation mechanism 32, which is installed to confront a lower side of the guide rail 14 of the housing
10 35 each, is an electromagnetic levitation circuit, and more particularly, an electromagnet generating an attractive force attributed to an electromagnetic field together with the guide rail 14 to sustain a levitation of the main frame 31.

15 The traveling mechanism 33, which is installed at an upper side of the connecting member 36 confronting the reaction plate 16, is a linear induction motor generating a traveling force attributed to an electromagnetic field.

FIG. 9 is a block diagram of a controller of a
20 testing system for a magnetic levitation train according to the present invention.

Referring to FIG. 9, the control mechanism 50, which is configured to be electrically connected to the levitation mechanism 32 and the traveling mechanism 33,
25 detects to control a levitating gap and traveling speed of the main frame 31 on the guide rail 14.

Specifically, the control mechanism 50 includes a power supply unit 51, a detection unit 52, a control unit 53, and a drive unit 54.

30 The power supply unit 51 includes a power supply that receives to convert power supplied from outside to a specific power state (DC/AC, current, voltage) requested by each of the elements (truck, rail) to the corresponding elements.

35 The detection unit 52 includes a gap sensing circuit 55 detecting a gap occurring when the truck 30 is levitated

on the rail 11 by the power supplied from the power supply unit 51 and an acceleration sensing circuit 56 sensing to detect a speed at which the truck 30 is traveling along the rail 11.

5 The control unit 53 is a control circuit such as a microprocessor generating correction data in a manner of receiving the detected gap and speed data, comparing the received gap and speed data to predefined and stored gap and speed (hereinafter called references) of the truck 30,
10 and converting the received data if the gap between the truck 30 and rail 11 and the traveling speed of the truck 30 are smaller than or greater than the references, respectively.

 And, the drive unit 54 includes a drive circuit
15 driving the levitation mechanism 32 and the traveling mechanism 33 of the truck 30 by receiving the correction data of the control unit 53.

 In doing so, the drive unit 54 is implemented by a circuit for adjusting magnetic forces of the levitation and
20 traveling mechanisms 32 and 33 in a manner of raising/lowering the power applied to the levitation and traveling mechanisms 32 and 33 according to the correction data of the control unit 53.

 Meanwhile, in the above-configured testing system for
25 the magnetic levitation train according to the present invention, once the power is supplied via the power supply unit, the levitation mechanism 32 is preferentially driven to levitate the truck 30 over the rail 11 to the predefined height. The traveling mechanism 33 is then driven to enable
30 the truck 30 to travel along the rail 11 of the track 10 while the truck 30 is levitated over the rail 11.

 In doing so, the levitation mechanism 32 levitates the truck 30 by the attractive force (attributed to the magnetic force) to the guide rail 14 to generate the
35 levitation gap. And, the levitation gap is detected by gap sensing circuit 52 to be more accurately sustained by the

control unit 53.

Moreover, the traveling mechanism 33 enables the truck 30 to travel at a specific speed using the traveling force (attributed to the magnetic induction) for the reaction plate 16. And, the traveling speed is detected by the speed sensing circuit 56 to be more accurately sustained by the control unit 53.

Therefore, the testing system for the magnetic levitation train according to the present invention implements the real state that the magnetic levitation train substantially levitates to travel to secure the data of the service states according to the internal and external train factors occurring on the traveling of the test system for the magnetic levitation train.

INDUSTRIAL APPLICABILITY

The present invention provides a testing system for a magnetic levitation train, by which an optimal configuration for testing a real state of a magnetic levitation train service is implemented to facilitate an acquisition of various data resulting from a service test as most ideal result values.

WHAT IS CLAIMED IS:

1. A testing system for a magnetic levitation train, comprising:

a track provided with a rail to be used as a service track and a plurality of columns coupled with a bottom of the rail to set up a service height; and

a carriage provided with a truck coupled with the rail to levitate to travel over the rail along the service track of the rail and a carriage body coupled with an upper part of the truck to form an exterior of the magnetic levitation train.

2. The system of claim 1, the rail comprising:

a rail body extending to be connected to the respective columns along the service track of the train and to be provided with a reaction plate loaded on the rail body to enable the truck to travel;

a guide rail coupled with left and right sides of the rail body each to enable the truck to levitate, the guide rail installed to lie inside the truck to guide a section for a traveling of the train; and

a power rail installed under both sides of the guide rail of the rail body to supply power to the truck guided by the guide rail to proceed.

3. The system of claim 2, the truck comprising:

a main frame enclosing an outside of the guide rail provided to both sides of the rail body and having the carriage body coupled to an upper side of the main frame;

a levitation mechanism installed to confront a lower side of the guide rail on the main frame, the levitation mechanism generating an attractive force attributed to an electromagnetic field together with the guide rail to sustain a levitation of the main frame;

a traveling mechanism installed at an upper side of the rail body confronting the reaction plate to generate a

traveling force attributed to the electromagnetic field;
and

5 a control mechanism electrically connected to the
levitation mechanism and the traveling mechanism to detect
to control a levitating gap and traveling speed of the main
frame on the guide rail.

4. The system of claim 3, wherein a pantograph is
provided to a lower side of the main frame confronting the
10 power rail of the rail body to be contacted with the power
rail for power supply.

5. The system of claim 3, wherein at least one
landing roller is provided to an upper confronting side of
15 the guide rail to provide a stable support force when the
truck descends to be put on the guide rail and wherein at
least one guide roller is provided each confronting outside
of the guide rail to prevent a collision with the guide
rail when the truck is traveling.

20

6. The system of claim 3, the control mechanism
comprising:

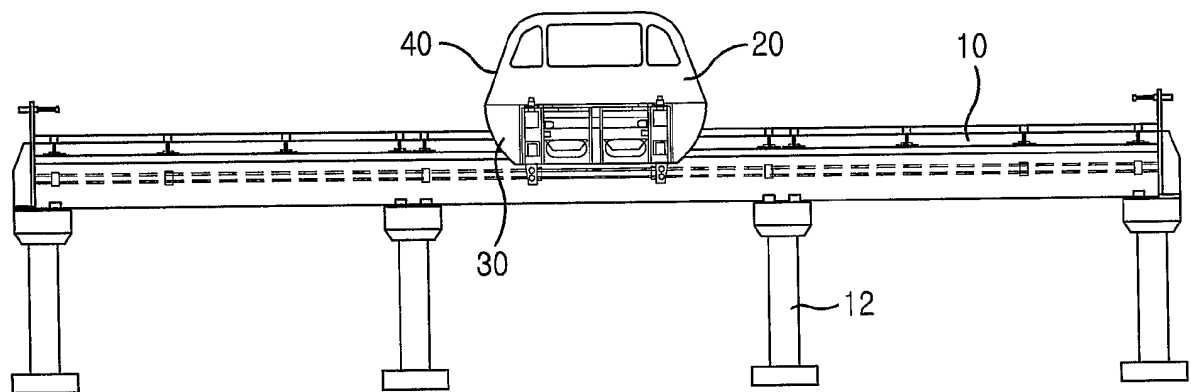
a power supply unit supplying power to the truck and
the rail;

25 a detection unit detecting a gap occurring when the
truck is levitated on the rail by the power supplied from
the power supply unit and sensing to detect a speed at
which the truck is traveling along the rail;

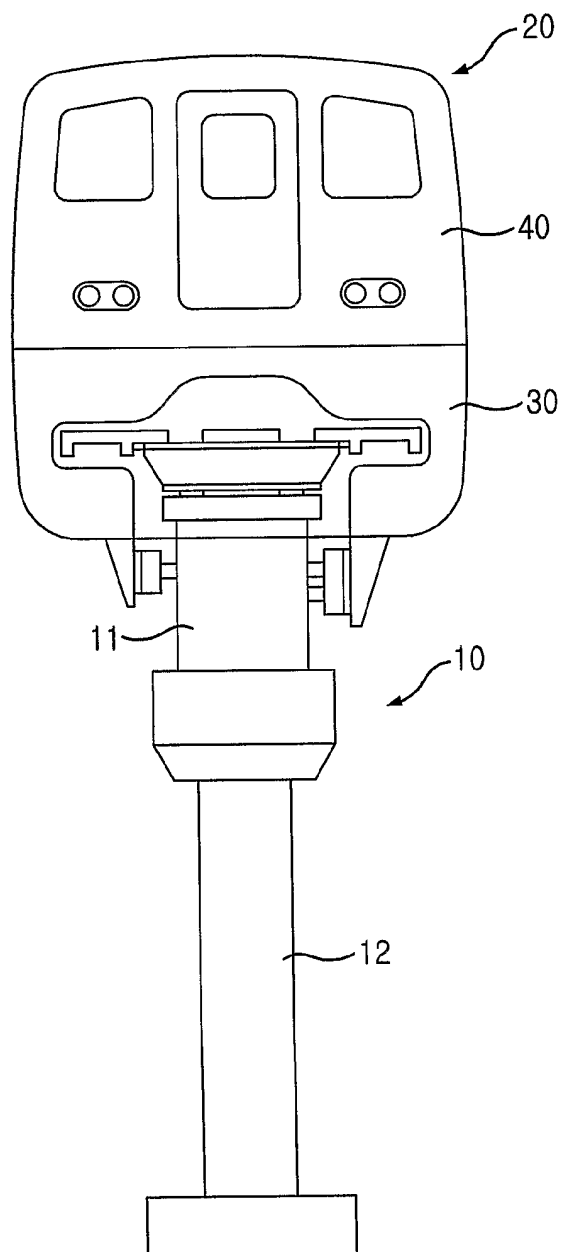
a control unit computing data of a normal service
30 state of the truck by receiving the detected gap and speed
data and by comparing the received gap and speed data to
predefined gap and speed of the truck; and

a drive unit driving the levitation mechanism and the
traveling mechanism of the truck by receiving the data of
35 the control unit.

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FIG. 1



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FIG. 2



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FIG. 3

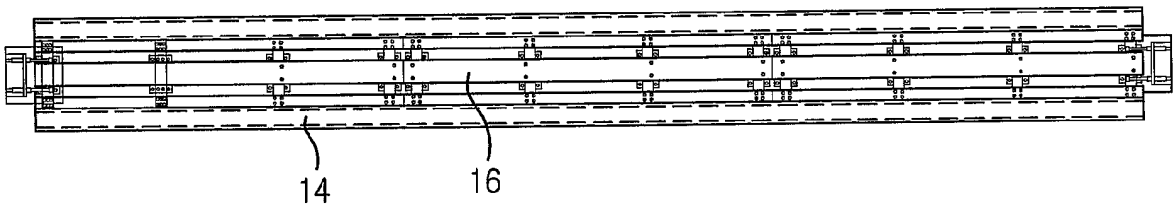
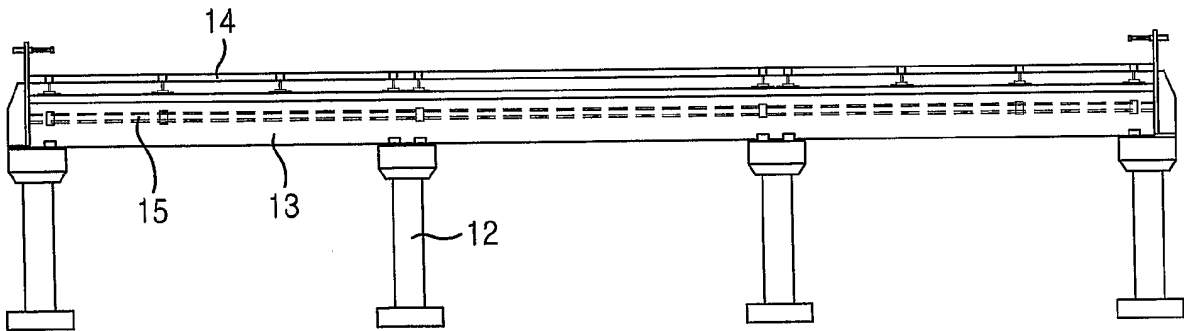
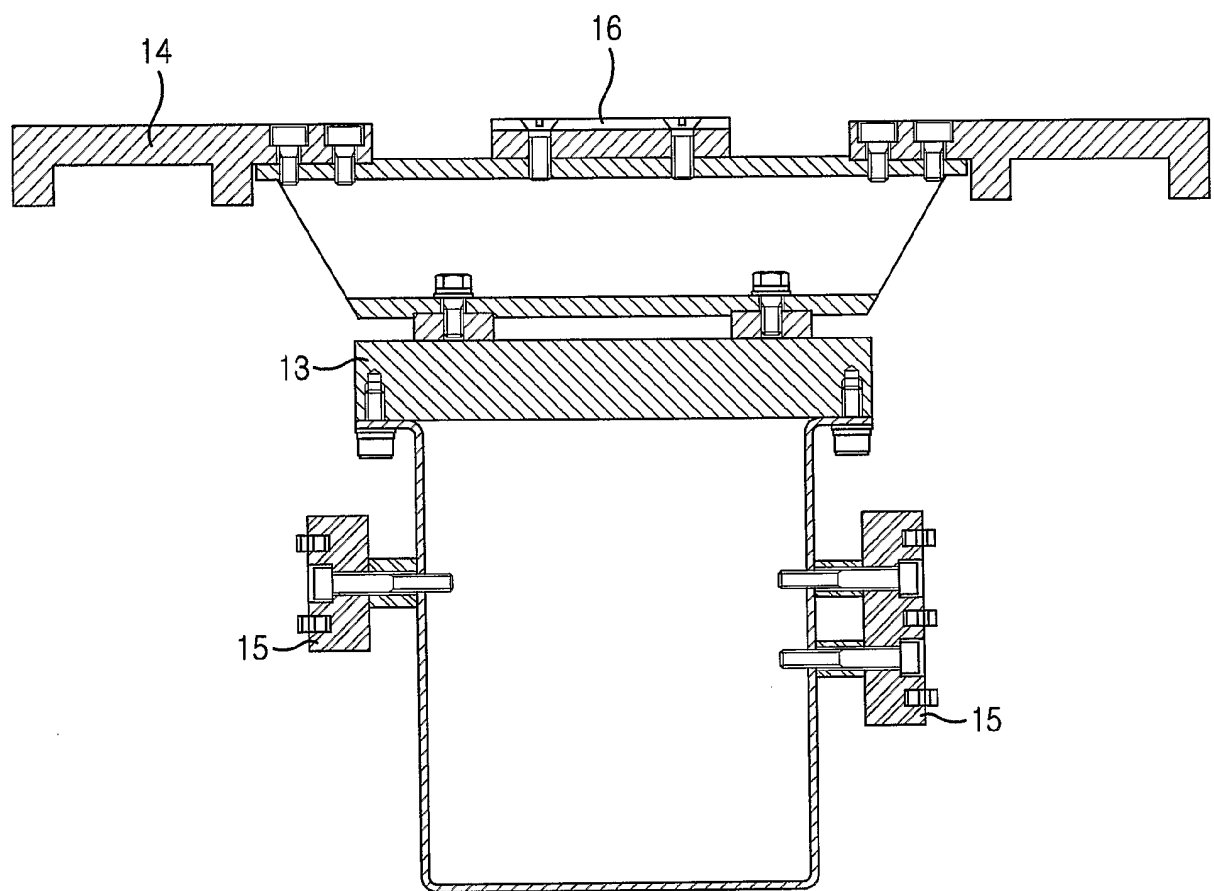


FIG. 4

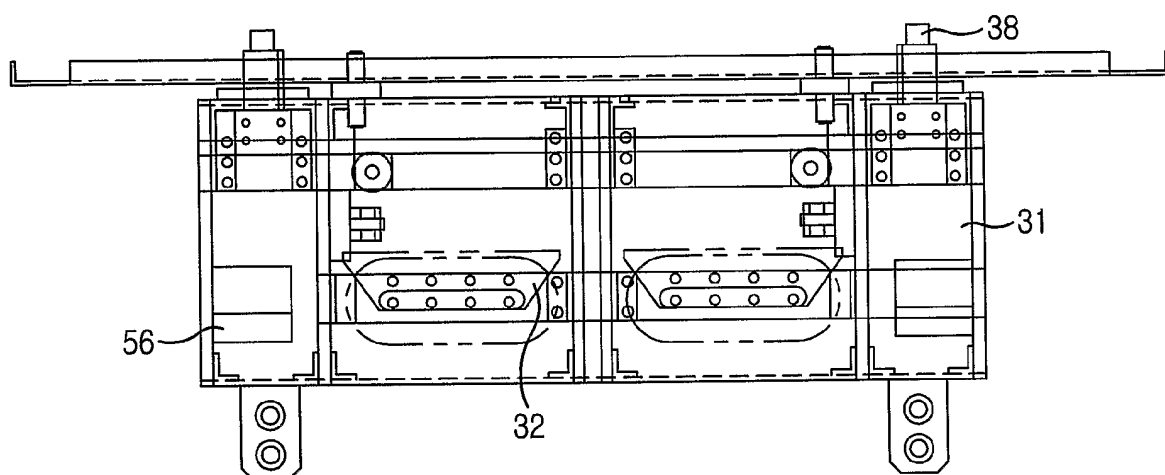


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FIG. 5

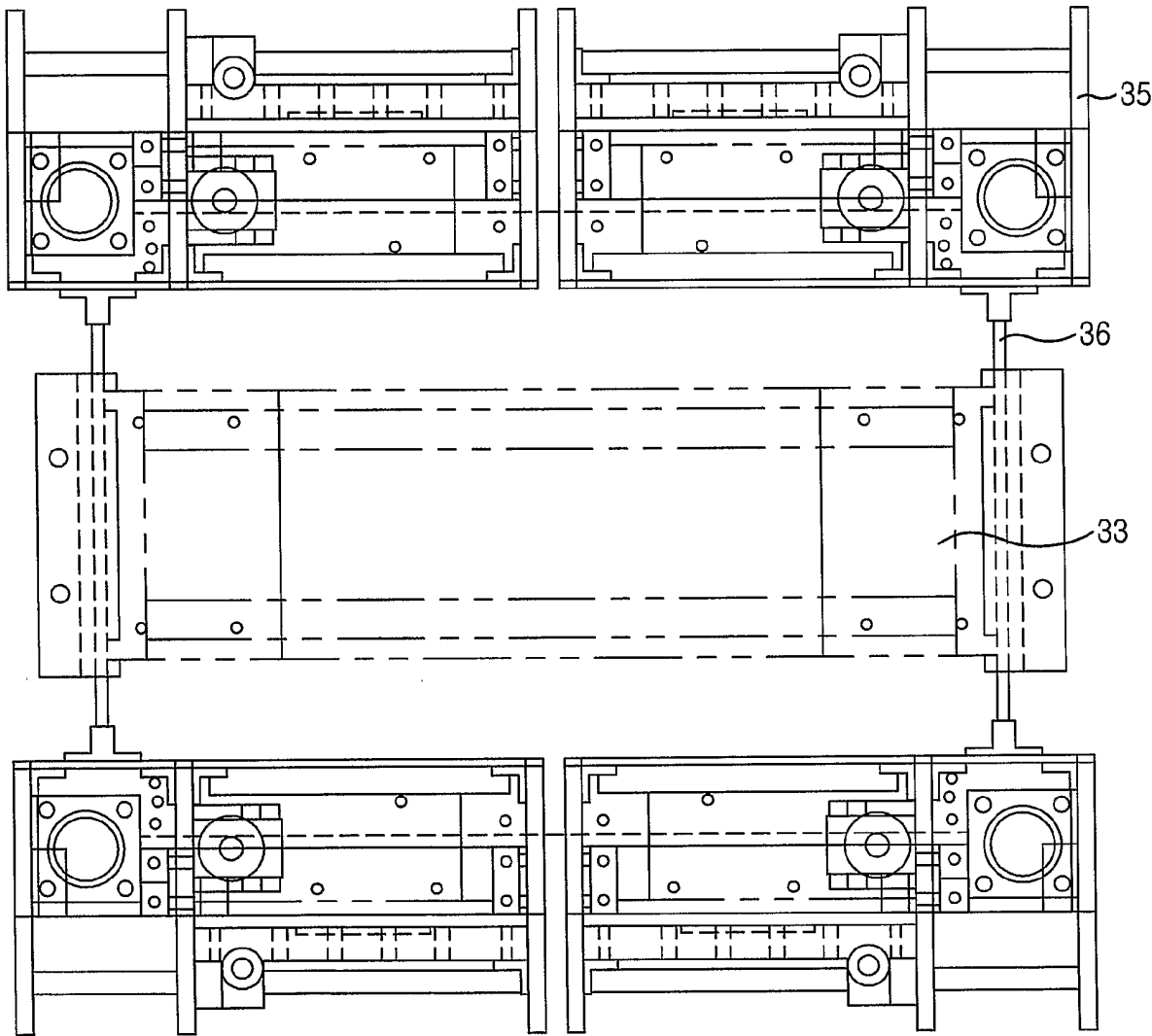


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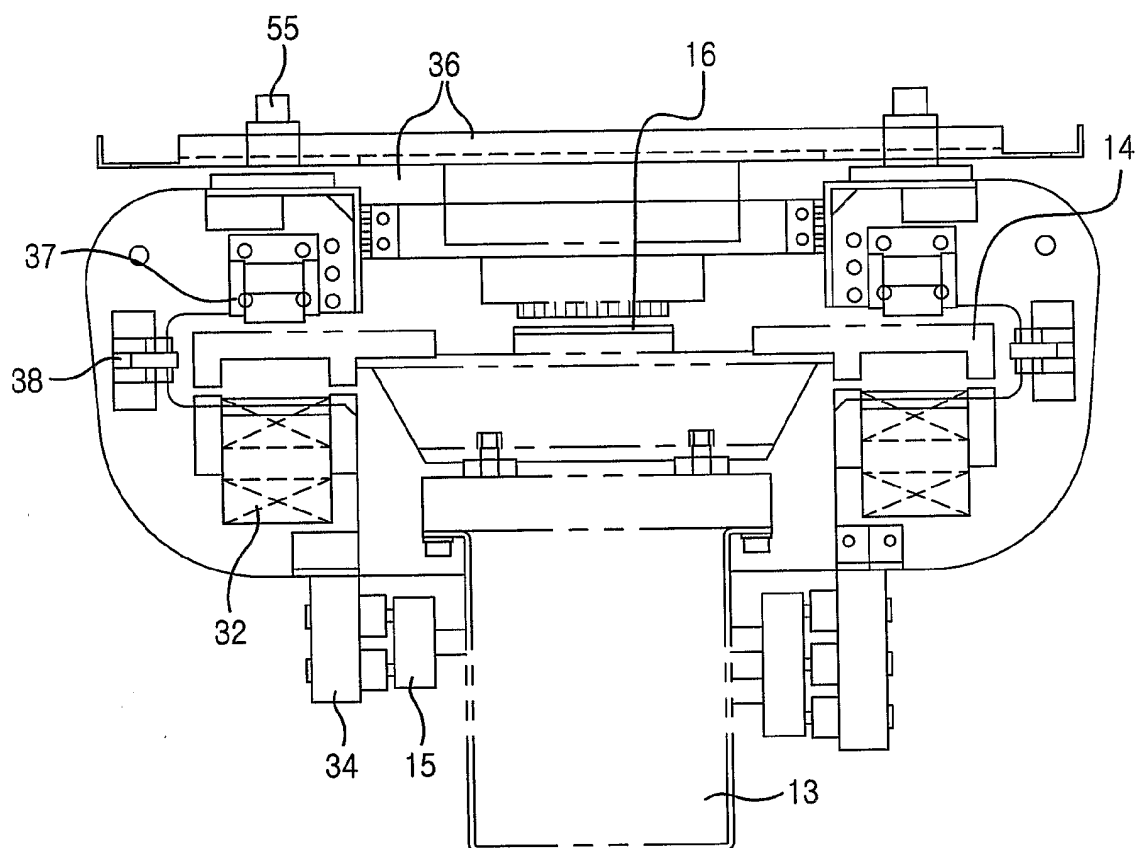
FIG. 6

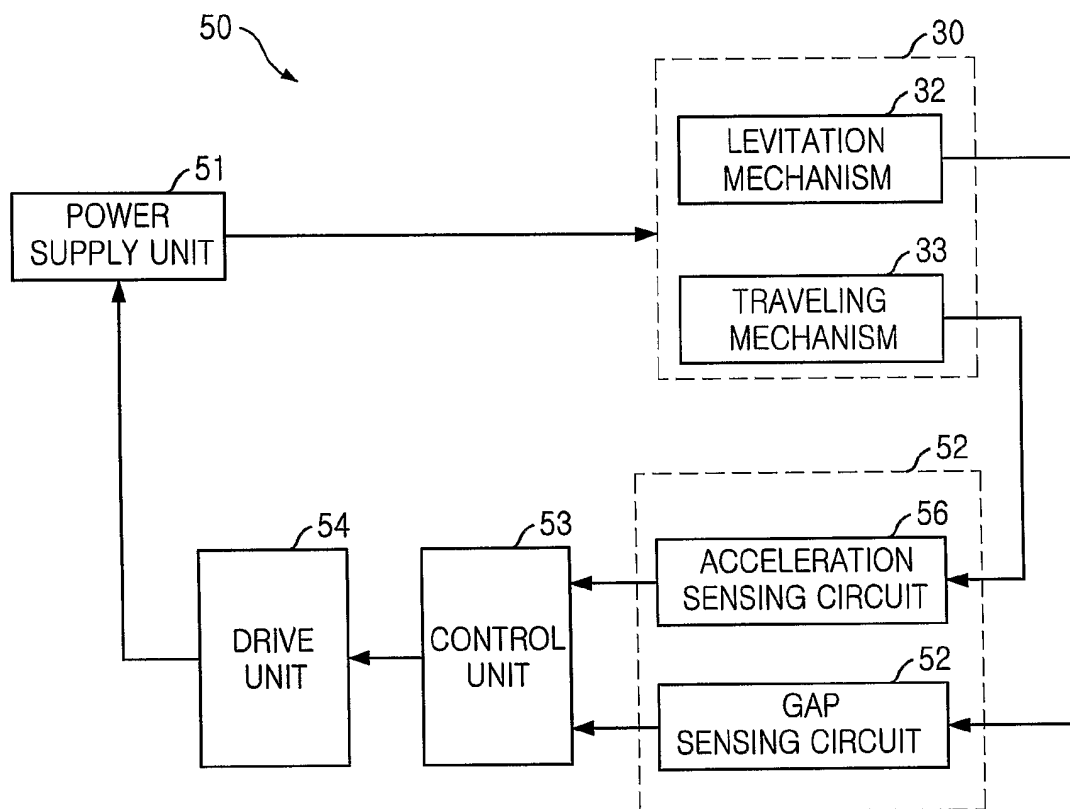


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FIG. 7



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FIG. 8



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FIG. 9

INTERNATIONAL SEARCH REPORT

 International application No.
PCT/KR2004/003558
A. CLASSIFICATION OF SUBJECT MATTER**IPC7 B60L 13/06**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7 B60L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Patents and applications for inventions since 1975

Korean Utility models and applications for Utility models since 1975

Japanese Utility models and application for Utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 60148303 A (SUMITOMO ELECTRIC IND. LTD.) 5 AUG. 1985 Abstract, pages 2 left column lines 2 - pages 3 left column lines 31, figs 1-5	1, 2
A	JP 07172301 A (FUJI HEAVY IND. LTD.) 11 JUL. 1995 Claims 1-3, figs 1, 2, 5	1-3
A	JP 53061803 A (TOSHIBA CORP.) 2 JUN. 1978 Abstract, fig. 1	1-3
A	US 5253591 A (THE UNITED STATES OF AMERICA AS REPRESENTED BY THE UNITED STATES DEPARTMENT OF ENERGY) 19 OCT. 1993 Figs 1-3, claims 1-4	1, 2
A	US 6286434 B1 (SIEMENS AKTIENGESELLSCHAFT) 11 SEP. 2001 See the whole document	1
A	US 5213047 A (RAILWAY TECHNICAL RESEARCH INSTITUTE) 25 MAY 1993 Abstract, fig. 2, claims 1-3	1

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search

16 JUNE 2005 (16.06.2005)

Date of mailing of the international search report

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