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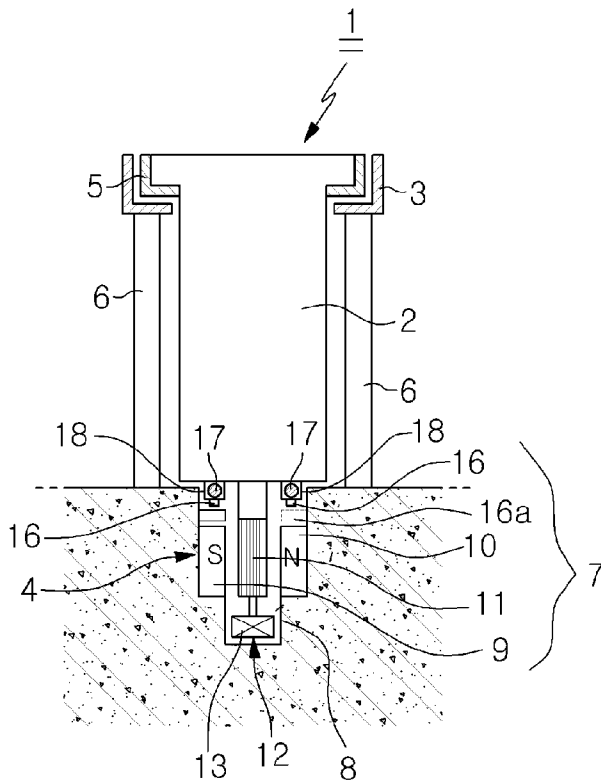
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[Fig. 1]



(57) Abstract: A magnetic levitation train is provided. The magnetic levitation train includes guides, upper guide rails, a drive unit, plural pairs of permanent magnets, field coils, and a guide means. The guides are mounted on the left and right sides of the upper portion of a train body. The upper guide rails are mounted to the left and right portions of the train body opposite the guides. The drive unit is mounted under the train body and is provided with a drive means and a lower guide rail. The permanent magnets are mounted on the left and right sides of the lower guide rail so as to be opposite each other. The field coils are located between the permanent magnets and are fixedly mounted below the train body. The guide means is mounted on a lower end of the field coils to be guided into the lower guide rail.

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# Description

## MAGLEV TRAIN

### Technical Field

- [1] The present invention relates to a magnetic levitation train, which enables a train body to be slightly levitated from a rail by the repulsive force of magnets and, at the same time, generates a drive force in the longitudinal direction of the rail, thus enabling high-speed traveling.

### Background Art

- [2] Currently, research into magnetic levitation trains is ongoing. In order to commercialize such magnetic levitation trains, a large number of nations are devoted to their research and development.
- [3] Such a magnetic levitation train is levitated by magnetic force so as to travel over rails. The support and locomotive functions, which were performed by the wheels of a typical railway vehicle, are performed by electromagnets that are mounted to the magnetic levitation train.
- [4] The above-described magnetic levitation train has advantages in that it can travel fast, in that it does not generate noise, in that it generates a small amplitude vibration, and in that it is environmentally friendly because no pollutants are discharged. Thanks to these advantages, the magnetic levitation train is expected to be used in urban areas as a next-generation transportation means.
- [5] However, the magnetic levitation trains which are known at present are problematic in that they cannot travel fast and have low traveling stability.
- [6] In greater detail, in an existing magnetic levitation train, rails, each of which is made of a permanent magnet, are mounted on the ground. In this case, the train, having field coils, travels in a levitated state in which the train is spaced part from the rails by a predetermined distance. However, in the above-described existing magnetic levitation train, field coils and permanent magnets are mounted in a ratio of 1 : 1, so that a problem occurs in that a great amount of energy is consumed. Furthermore, in the above-described existing magnetic levitation train, the gap between the rails and the train is wide. For this reason, when the train travels at high speed, a problem occurs in that the upper portion of the train may severely shake or vibrate due to wind blowing from the sides of the train or due to air resistance when traveling, with the result that the possibility of the train overturning or being moved off the track is higher. Accordingly, in order to afford commercialization, it is urgently required to develop a magnetic levitation train that can solve all the above-described problems.

### Disclosure of Invention

### **Technical Problem**

- [7] Accordingly, the present invention is directed to provide a magnetic levitation train that can solve various problems occurring in existing magnetic levitation trains and, more particularly, to provide a new type of magnetic levitation train which not only can achieve excellent stability when traveling but also which can travel at high speed and, in addition, can play a role in saving energy, thus greatly contributing to the commercialization of magnetic levitation trains.

### **Technical Solution**

- [8] The present invention provides a magnetic levitation train, which can achieve excellent stability, can travel at high speed, and can minimize energy costs.
- [9] To this end, the present invention provides a magnetic levitation train, including: guides mounted on the left and right sides of the upper portion of a train body and made of permanent magnets; upper guide rails mounted to the left and right portions of the train body opposite the guides and made of permanent magnets, the permanent magnets having a magnetic polarity identical to that of the guides; a drive unit mounted under the train body and provided with a drive means and a lower guide rail; plural pairs of permanent magnets mounted on the left and right sides of the lower guide rail so as to be opposite each other, each pair of permanent magnets being spaced apart from the neighboring pairs of permanent magnets by a predetermined distance and being magnetized to have opposite polarities; field coils located between the permanent magnets and fixedly mounted below the train body; and a guide means mounted on a lower end of the field coils to be guided into the lower guide rail; wherein the drive means comprises the permanent magnets mounted on the left and right sides of the lower guide rail so as to be spaced apart from each other by the predetermined distance, field coils mounted below the train body so as to be spaced apart from each other at regular intervals, proximity sensor mounted at regular intervals on a slide frame, which is guided by guide frames fixedly mounted under the train body and is controlled to slide forward and backward by the manipulation of a manipulation lever, and detection plates arranged in zigzag fashion along with the permanent magnets which are mounted on the left and right sides of the lower guide rail, and wherein a braking-generating means is mounted to one end of the train body so as to brake the train body and to generate electricity.

### **Advantageous Effects**

- [10] The magnetic levitation train according to the present invention is configured to use the force that is obtained when one field coil, which is mounted to a train body and two permanent magnets, which are mounted on a lower guide rail, are repelled from each other in a narrow gap by mutual magnetic force, thus not only acquiring a large amount

of torque when traveling but also reducing energy costs.

- [11] Furthermore, when traveling, the train body is reliably supported by the upper guide rails in a levitated state, and is guided such that the lateral shaking thereof is prevented from occurring thanks to the reliable drive of the lower guide rail, so that excellent traveling stability and high-speed traveling can be achieved. In addition, the magnetic levitation train is designed to travel along a tunnel, so that it can always travel regardless of weather or climate.

### **Brief Description of Drawings**

- [12] FIG. 1 is a front sectional view showing the construction of a magnetic levitation train according to the present invention;
- [13] FIG. 2 is a front sectional view showing the construction of a modification of the magnetic levitation train according to the present invention;
- [14] FIG. 3 is a sectional view showing the construction of an example of the upper and lower guide rails of the magnetic levitation train according to the present invention;
- [15] FIG. 4 is a sectional view showing the construction of another example of the upper and lower guide rails of the magnetic levitation train according to the present invention;
- [16] FIG. 5 is a view showing the construction of a slide frame, which is mounted in the lower portion of the magnetic levitation train according to the present invention;
- [17] FIG. 6 is a cut-away plan view showing the arrangement of permanent magnets, field coils and proximity sensors when the magnetic levitation train according to the present invention is moved forwards by a drive means;
- [18] FIG. 7 is a cut-away plan view showing the arrangement of permanent magnets, field coils and proximity sensors when the magnetic levitation train according to the present invention is moved backwards by the drive means;
- [19] FIG. 8 is a cut-away view showing the arrangement of permanent magnets, a field coil and proximity sensors when the magnetic levitation train according to the present invention is stopped by the drive means;
- [20] FIG. 9 is a cut-away view showing the arrangement of permanent magnets, a field coil and proximity sensors when the magnetic levitation train according to the present invention is moved forwards by the drive means;
- [21] FIG. 10 is a cut-away view showing the arrangement of permanent magnets, a field coil and proximity sensors when the magnetic levitation train according to the present invention is moved backwards by the drive means;
- [22] FIG. 11 is a sectional view showing the construction of a braking-generating means, which is mounted to the magnetic levitation train according to the present invention;
- [23] FIG. 12 is a sectional view illustrating the operation of the braking-generating means,

which is mounted to the magnetic levitation train according to the present invention;

[24] FIG. 13 is a front sectional view showing the construction of the braking-generating means, which is mounted to the magnetic levitation train according to the present invention;

[25] FIG. 14 is a longitudinal sectional view schematically showing the case where the magnetic levitation train according to the present invention moves through a tunnel;

[26] FIG. 15 is a transverse sectional view schematically showing the case where the magnetic levitation train according to the present invention moves through a tunnel;

[27] FIG. 16 is a view showing the construction of a manipulation lever, which functions to control the forward and backward drive of the drive means of the magnetic levitation train according to the present invention;

[28] FIG. 17 is a diagram showing a circuit configured by the manipulation lever, which functions to control the forward and backward drive of the drive means of the magnetic levitation train according to the present invention, and proximity sensors; and

[29] FIG. 18 is a diagram showing a circuit configured by the braking-generating means of the magnetic levitation train according to the present invention.

[30] <Description of characters of principal elements>

[31] 1: magnetic levitation train

[32] 2: train body 3: upper guide rail

[33] 4: drive unit 5: guide

[34] 6: support 7: drive means

[35] 8: lower guide rail 9,10: permanent magnet

[36] 11: field coil 12: guide means

[37] 13: bearing 14: permanent magnet

[38] 15: permanent magnet 16: proximity sensor

[39] 16a: detection plate 17: slide frame

[40] 18: guide frame 19: manipulation lever

[41] 19a: braking motor switch

[42] 20: braking-generating means

[43] 21: field coil 22: braking box

[44] 23: braking motor 24: pulley

[45] 25: connection member 25a: pinion

[46] 25b: rack gear 26: tunnel

[47] 27: partition wall 28: suction fan

[48] 29: sudden braking motor switch

[49] 30: opening detection sensor

[50] 31: closing detection sensor

[51] 32,33: detection part

## Best Mode for Carrying out the Invention

- [52] A magnetic levitation train according to the present invention may be configured as shown in FIGS. 1 to 18. The accompanying drawings are provided to help understanding of various embodiments. The present invention may be modified in various ways within a range that does not depart from the technical spirit of the present invention.
- [53] That is, it is apparent that the scope of the present invention is not limited by the drawings themselves, which are accompanied to illustrate embodiments, and that simple modifications or substitutions of components are included in the scope of the present invention.
- [54] The magnetic levitation train 1 according to the present invention includes upper guide rails 3, which are configured to safely guide the upper portion of a train body 2 by levitating the upper portion of the train body 2 so as to space it apart from the upper guide rails 3 by a predetermined distance using a magnetic repulsive force and preventing the upper portion of the train body 2 from being moved off the upper guide rails 3, and a drive unit 4, which is mounted under the train body 2 and is configured to selectively drive the forward or backward movement of the train body 2. Accordingly, the magnetic levitation train 1 according to the present invention can reliably travel at high speed.
- [55] To this end, as shown in FIGS. 1 to 4, guides 5, which are located on the left and right sides of the upper portion of the train body 2 and are made of permanent magnets, are mounted in the longitudinal direction of the train body 2. The upper guide rails 3, which have the same polarity as that of the permanent magnets constituting the guides 5, are mounted so as to be supported by respective supports 6. The upper guide rails 3 are spaced apart from the guides 5 due to magnetic force, thereby safely guiding the left and right upper portions of the train body 2.
- [56] Although not shown, the upper guide rails 3 may be mounted on the left and right upper ends of a tunnel structure, the upper portion of which is opened, without using any supports 6.
- [57] Furthermore, the drive unit 4 includes a drive means 7, which is mounted under the train body 2, and a lower guide rail 8 which is configured to provide a driving force for moving the train body 2 forwards or backward in conjunction with the drive means 7 and to safely guide the train body 2.
- [58] Plural pairs of permanent magnets 9 and 10 are mounted on both sides of the lower guide rail 8 so as to be opposite each other. Each pair of permanent magnets 9 and 10 are spaced apart from the neighboring pairs of permanent magnets, and are magnetized to have opposite polarities.

- [59] Furthermore, field coils 11 are fixedly mounted below the train body 2 at regular intervals, and are located between the plural pairs of permanent magnets 9 and 10. A guide means 12 is mounted to a lower end of the field coils 11 so as to prevent the train body 2 from colliding with the lower guide rail 8 when traveling and to minimize the lateral shaking of the train body 2.
- [60] The guide means 12 may be configured such that a bearing 13 is mounted to the lower end of the field coils 11, as shown in FIGS. 1 and 3, or may be configured such that permanent magnets 14 are mounted to the lower end of the field coils 11, and such that a permanent magnet 15, having the same polarities as those of the permanent magnets 14, is laterally mounted in the lower guide rail 8, as shown in FIGS. 2 and 4.
- [61] In addition to the permanent magnets 9 and 10 and the field coils 11 mounted below the train body 2, the drive means 7 includes a plurality of proximity sensors 16, which are mounted below the train body 2 on the left and right sides of the field coils 11, and detection plates 16a, which are arranged in zigzag fashion along with the permanent magnets 9 and 10, which are arranged on the left and right sides of the lower guide rail 8 as shown in FIGS. 6 and 11.
- [62] As shown in FIG. 5, the proximity sensors 16 are mounted at regular intervals on a slide frame 17, which is located under the train body 2 and which is configured to slide forwards and backwards below the train body 2 when the train body 2 is moved forward or backward or when the train body 2 is braked. The sliding of the slide frame 17 can be controlled in such a way that the slide frame 17 is guided on guide frames 18 in which respective bearings are provided. The slide frame 17 is connected with a manipulation lever 19 mounted in the control room (not shown) of the train body 2.
- [63] The manipulation lever 19 functions to selectively control the forward and backward movements of the train body 2. The slide frame 17 slides forwards or backwards under the train body 2 by the manipulation of the manipulation lever 19, and thus the location of the slide frame 17 can be controlled. A braking motor switch 19a, which will be described later, is mounted on the manipulation lever 19 so that the train body 2 can be braked.
- [64] When the location of the slide frame 17 is controlled, the locations of the proximity sensors 16 mounted on the slide frame 17 at regular intervals change with respect to the field coils 11 that are fixedly mounted below the train body 2, and thus the field coils 11 are placed in a nonpolar state or are magnetized to have N and S polarities due to the electromagnetic field of the field coils 11. Accordingly, the train body 2 can be normally braked or can be moved forwards or backwards (refer to FIGS. 6 to 10).
- [65] Furthermore, a braking-generating means 20 is mounted on the rear side of the train body 2 so as to generate electricity while performing normal braking or sudden braking, as shown in FIGS. 11 to 13.

- [66] A braking box 22, in which a plurality of field coils 21 is mounted, is connected with a braking motor 23 via a connection member 25. The connection member 25 includes a pinion 25a, which is fastened to the motor shaft 24 of the braking motor 23, which can be rotated in the forward and backward directions, and a rack gear 25b, which is engaged with the pinion 25a. Accordingly, when it is necessary to brake the train body 2, the braking-generating means 20 enables the braking to be achieved by the permanent magnets 9 and 10 and the magnetic force while the braking box 22, in which the field coils 21 are mounted, is lowered into the lower guide rail 8.
- [67] Furthermore, in addition to the braking motor 23, a sudden braking motor 23a is additionally mounted. The connection of the sudden braking motor 23a is also made via the connection member 25. Accordingly, when it is necessary to suddenly brake the train body 2, the sudden braking motor 23a is driven to rotate at high speed, and thus the sudden braking can be achieved.
- [68] The braking motor 23 is rotated in the forward and backward directions by the manipulation of the braking motor switch 19a, which is mounted on the manipulation lever 19 as shown in FIG. 16, thus braking the train body 2. The sudden braking motor 23a is used when it is necessary to suddenly brake the train body 2 by manipulating the sudden braking motor switch 29 shown in FIG. 18.
- [69] Meanwhile, as shown in FIGS. 14 to 15, the upper guide rails 3 and the drive unit 4, through which the train body 2 according to the present invention pass, are mounted in a tunnel 26, which is maintained in a vacuum by the discharging of air to the outside. Accordingly, when the train body 2 travels, accelerating force can be maximized by minimizing air resistance.
- [70] In the case where the section length of the tunnel 26 is long, partition walls 27 are mounted in the tunnel 26 for respective predetermined sections so as to be automatically raised and lowered. In order to maintain the tunnel 26 in a vacuum, one or more suction fans 28 are mounted in the tunnel so as to suck air and discharge the sucked air to the outside.
- [71] In order to automatically control the opening and closing operations of the partition walls 27 mounted in the tunnel 26, an opening detection sensor 30 and a closing detection sensor 31 are mounted in the respective front and rear ends of the train body 2, and detection parts 32 and 33, which are detected by the opening and closing detection sensors 30 and 31, are mounted close to the partition walls 27, which are mounted in the tunnel 26 (refer to FIG. 14 and 15).
- [72] Furthermore, a rear door of the train body 2 is opened in the state in which the tunnel 26 is maintained in a vacuum. Accordingly, the force that is required to drive the train body 2 can be assisted by the difference between vacuum and atmospheric pressure.
- [73] The manipulation lever 19, which is used to control the neutral (braking), drive and

reverse operations of the train body 2, and the sudden braking motor switch 29, which is used to brake or suddenly brake the train body 2, are mounted in the control room of the train body 2.

- [74] In FIG. 18, reference numeral 34 indicates a speed sensor, and reference numeral 35 indicates a power interruption sensor.
- [75] The magnetic levitation train 1 according to the present invention can travel at high speed by enabling the train body 2 to be levitated from the upper guide rails 3 by a predetermined distance using auxiliary driving force attributable to magnetic repulsive force and atmospheric pressure. The operation of the magnetic levitation train 1 is described in detail below.
- [76] When the train body 2 is stopped, the manipulation lever 19 is located at a neutral position. In this case, no power is supplied, the proximity sensors 16, which are mounted at regular intervals on the slide frame 17 that is located under the train body 2 and is connected with the manipulation lever 19 so as to slide, are placed on the same lines along with the field coils 11. In this case, no electromagnetic field is generated, and thus the field coils 11 enter a nonpolar state in which no polarity exists (refer to FIG. 8).
- [77] When an engineer rotates the manipulation lever 19 in the forward direction to make the train body move forwards, 2, the slide frame 17 is guided by the guide frames 18 to slide forwards, and thus the proximity sensors 16, which are mounted on the slide frame 17 at regular intervals, are located slightly ahead of the field coils 11. In this state, when the proximity sensors are located over the detection plates 16a, current flows to the field coils 11 due to the operation of the proximity sensors 16, and thus an electromagnetic field is generated. As a result, the field coils 11 are magnetized. In this case, each of the field coils 11 is magnetized to have the same polarity as that of its neighboring permanent magnets among the permanent magnets 9 and 10 that are mounted on the left and right sides of the lower guide rail 8 so as to be spaced apart from each other by a predetermined distance, and thus a repulsive force acts between them, while each of the field coils 11 is magnetized to have opposite polarities to those of permanent magnets that are located ahead of a corresponding field coil, and thus an attractive force acts on each other. Accordingly, the train body 2, to which the field coils 11 are fixedly mounted, can be moved forwards.
- [78] Here, since the technology for controlling current by operating the proximity sensors 16 is well known, detailed descriptions thereof are omitted.
- [79] Furthermore, when the manipulation lever 19 is rotated in the backward direction to make the train body 2 move backwards, as shown in FIGS. 7 and 10, the slide frame 17 is guided by the guide frames 18 so as to slide backwards, and thus the proximity sensors 16, which are mounted on the slide frame 17 at regular intervals, are located

slightly ahead of the field coils 11. In this state, when the proximity sensors are located over the detection plates 16a, current flows to the field coils 11 due to the operation of the proximity sensors 16, so the an electromagnetic field is generated, and thus the field coils 11 are magnetized. In this case, each of the field coils 11 is magnetized to have the same polarities as those of its neighboring permanent magnets among the permanent magnets 9 and 10 that are mounted on the left and right sides of the lower guide rail 8 so as to be spaced apart from each other by a predetermined distance, and thus a repulsive force acts between them, while each of the field coils 11 is magnetized to have polarities opposite those of permanent magnets that are located behind a corresponding field coil, and thus an attractive force acts between them. Accordingly, the train body 2, to which the field coils 11 are fixedly mounted, can be moved backwards.

[80] As described above, in the magnetic levitation train 1 according to the present invention, the forward and backward slides of the slide frame 17, on which the proximity sensors 16 are mounted, are controlled by the action between the proximity sensors 16, which are mounted on the slide frame 17, and the detection plates 16a and, thus, the electromagnetic field is controlled by controlling the current that flows to the field coils 11 mounted below the train body 2 at regular intervals. Based on a principle in which magnetic repulsive force is generated in the case where the polarities of the field coils 11 are the same as the polarities of the permanent magnets 9 and 10, which are mounted on the left and right sides of the lower guide rail 8 so as to be spaced apart from each other by a predetermined distance, the train body 2 is moved forwards when the field coils 11 are located at forward positions from the permanent magnets 9 and 10, but is moved backwards when the field coils 11 are located at backward positions from the permanent magnets 9 and 10. Accordingly, the train body 2 can selectively travel forwards or backwards.

[81] Meanwhile, as shown in FIG. 6, the speed of train body is controlled in proportion to the degree of rotation of the manipulation lever 16. When the lever is greatly rotated by the operation of a variable resistor, the resistance is decreased, so that a large amount of current flows to the field coils 11, and thus the magnetic force is increased, with the result that the speed can be increased. In this case, the slide frame 17 is greatly moved, so that the proximity sensors 16 are also greatly moved forwards or backwards compared with the field coils 11. In the case where the train body travels at high speed, the proximity sensors 16 encounters with the detection plates 16a before the field coils 11 reach the locations of the permanent magnets 9 and 10, so that the polarities of the field coils 11 are changed in advance before the field coils 11 reach the locations of the permanent magnets 9 and 10, and thus a large amount of force can be imparted to the train body when the train body is moving.

[82] The magnetic levitation train according to the present invention is configured to use

the force that is obtained when one field coil 11 and two permanent magnets 9 and 10, which are mounted to the lower guide rail 8 so as to be spaced apart from each other by a predetermined distance, are repelled from each other in a narrow gap by mutual magnetic force, thus not only acquiring a large amount of torque but also reducing energy costs, compared with conventional magnetic levitation trains.

[83] Furthermore, when it is necessary to decrease the speed of the traveling train body 2 and to brake the traveling train body 2, the braking-generating means 20, which is mounted on the rear side of the train body 2, must be operated by the manipulation of the braking motor switch 19a mounted on the manipulation lever 19 must be. When it is necessary to suddenly brake the traveling train body 2, the sudden braking can be achieved by the manipulation of the sudden braking motor switch 29.

[84] In greater detail, the field coils 21 are mounted in the braking box 22 constituting the braking-generating means 20. In the case where the braking motor switch 19a or the sudden braking motor switch 29 is selectively manipulated, the braking motor 23 or the sudden braking motor 23a are driven in the forward direction, and thus the pinion 25a, which is fastened to the motor shafts 24 and 24a, is rotated at high speed. In this case, the rack gear 25b, which is engaged with the pinion 25a, is lowered or suddenly lowered, so that the braking box 22, which is connected with the rack gear 25b, is lowered or suddenly lowered to the lower guide rail 8, and thus the field coils 21 are magnetized to have polarities opposite those of the permanent magnets 9 and 10 by the permanent magnets 9 and 10 and are attracted by magnetic force. Accordingly, the sudden braking can be achieved and, at the same time, the generation of electricity can be achieved due to the induced current that is generated by the field coils 21 and the permanent magnets 9 and 10 based on 'Fleming's right hand rule.'

[85] Meanwhile, the present invention is designed such that the rails are mounted in the tunnel 26 so that the train body 2 can travel, thus enabling traveling at high speed by minimizing the air resistance. To this end, the partition walls 27 are mounted in the tunnel 26 for respective predetermined sections. The tunnel 26 is maintained in a vacuum by sucking the air in the tunnel 26 and discharging the sucked air to the outside using the suction fans 28 before the train body 2 enters the tunnel.

[86] Furthermore, when the train body 2 passes through the vacuumed tunnel 26, the front and rear partition walls 27 are automatically opened and closed. That is, when the opening detection sensor 30, which is mounted in the front portion of the train body 2, detects the detection part 32 mounted in the tunnel 26, the front partition wall 27, which is located in the direction in which the train body 2 travels is opened. When the train body 2 passes through the section of the front and rear partition walls 27, the closing detection sensor 31, which is mounted in the rear portion of the train body 2, detects the detection parts 33, and thus the partition walls 27 are automatically opened.

[87] As described above, according to the present invention, the train body 2 travels along the vacuumed tunnel 26, and thus the decrease of the traveling acceleration performance of the train body 2 due to the air resistance of the train body 2 can be minimized. When a rear door of the train body 2 is opened in the state in which the tunnel 26 is maintained in a vacuum, the train body 2 is pushed by the atmospheric pressure acting on the interior of the tunnel 26, so that an auxiliary driving force attributable to the difference between the atmospheric pressure and the vacuum can be imparted, and thus the train body 2 can travel at higher speed.

[88] Furthermore, according to the present invention, the upper guide rails 3 and the guides 5 mounted to the upper portion of the train body are made of permanent magnets. Accordingly, when the train body 2 travels on the rails, the train body 2 travels in the state in which it is levitated from the upper guide rails 3, thus being safely guided. Accordingly, the possibility of the train body being moved off the track can be minimized.

[89] The guide means 12, including the bearing 13 or the permanent magnets 14 and 15, is additionally mounted to the lower guide rail, so that, when the train body 2 travels, the train body 2 can travel without colliding with the lower guide rail 8 and the lateral shaking of the train body 2 can also be minimized, with the result that a comfortable ride can be provided to passengers and reliable traveling can also be guaranteed.

### **Industrial Applicability**

[90] The magnetic levitation train according to the present invention can greatly contribute to the commercialization thereof if it is integrated with existing magnetic levitation trains that are under research and development.

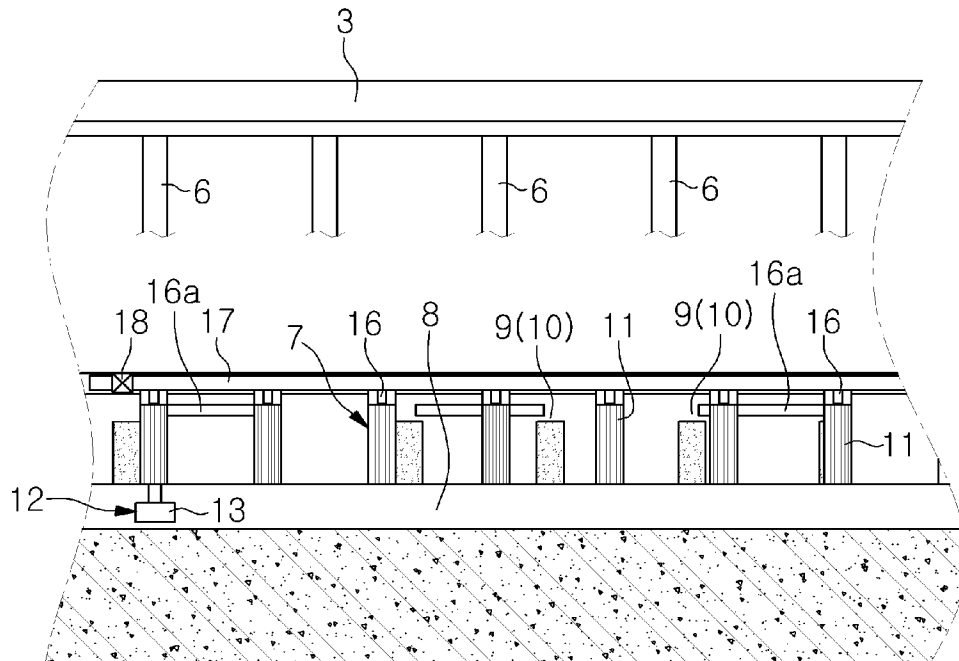
## Claims

- [1] A magnetic levitation train, comprising:  
guides (5) mounted on left and right sides of an upper portion of a train body (2) and made of permanent magnets;  
upper guide rails (3) mounted to left and right portions of the train body (2) opposite the guides (5) and made of permanent magnets, the permanent magnets having a magnetic polarity identical to that of the guides (5);  
a drive unit (4) mounted under the train body (2) and provided with drive means (7) and a lower guide rail (8);  
plural pairs of permanent magnets (9, 10) mounted on left and right sides of the lower guide rail (8) so as to be opposite each other, each pair of permanent magnets (9, 10) being spaced apart from the neighboring pairs of permanent magnets (9, 10) by a predetermined distance and being magnetized to have opposite polarities;  
field coils (11) located between the permanent magnets (9, 10) and fixedly mounted below the train body (2); and  
guide means (12) mounted on a lower end of the field coils (11) to be guided into the lower guide rail (8);  
wherein the drive means (7) comprises the permanent magnets (9, 10) mounted on the left and right sides of the lower guide rail (8) so as to be spaced apart from each other by the predetermined distance, field coils (11) mounted below the train body (2) so as to be spaced apart from each other at regular intervals, proximity sensor (16) mounted at regular intervals on a slide frame (17), which is guided by guide frames (18) fixedly mounted under the train body (2) and is controlled to slide forward and backward by manipulation of a manipulation lever (19), and detection plates (16a) arranged in zigzag fashion along with the permanent magnets (9, 10) which are mounted on the left and right sides of the lower guide rail (8), and  
wherein braking-generating means (20) is mounted to one end of the train body (2) so as to brake the train body (2) and to generate electricity.
- [2] The magnetic levitation train according to claim 1, wherein the guide means (12) is a bearing (13) that is mounted to the lower end of the field coils (11) so as to be guided into the lower guide rail (8).
- [3] The magnetic levitation train according to claim 1, wherein the guide means (12) comprises:  
permanent magnets (14) mounted to the lower end of the field coils (11); and  
a permanent magnet (15) configured to have polarities identical to those of the

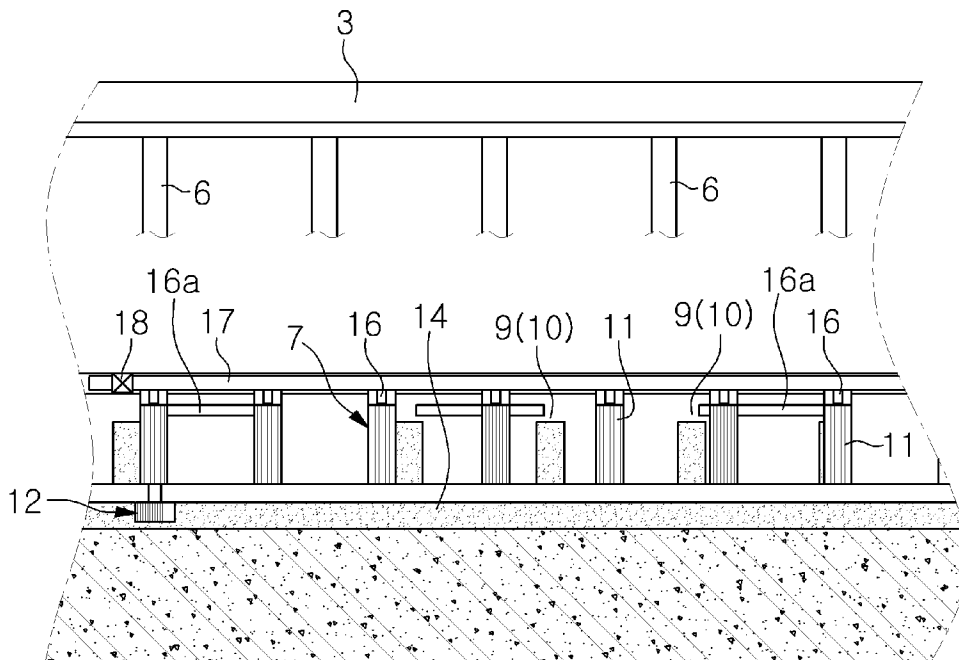
- permanent magnets (14) and laterally mounted in the lower guide rail (8).
- [4] The magnetic levitation train according to claim 1, wherein the braking-generating means (20) comprises:
- a braking box (22) provided with a plurality of field coils (21) mounted on a rear side of the train body (2);
  - a braking motor (23) and a sudden braking motor (23a) rotated in forward and backward directions by manipulation of a braking motor switch (19a) and a sudden braking motor switch (29); and
  - a connection member (25) comprising a pinion (25a) fastened to respective motor shafts (24, 24a) of the braking motor (23) and the sudden braking motor (23a), and a rack gear (25b) engaged with the pinion (25a) and configured such that one end thereof is fastened to the braking box (22);
- wherein, when the train body (2) is normally or suddenly braked, the field coils (21) in the braking box (22) connected with one end of the connection member (25) are lowered into the lower guide rail (8), so that the field coils (21) are magnetized to have polarities opposite those of the permanent magnets (9, 10), and thus the braking of the train body (2) and the generation of electricity are achieved.
- [5] The magnetic levitation train according to claim 1, wherein:
- the upper guide rails (3) and the drive unit (4), through which the train (2) passes, are mounted in a tunnel (26),
  - partition walls (27) are mounted in the tunnel (26) for respective predetermined sections so as to be automatically opened and closed by an opening detection sensor (30) and a closing detection sensor (31), which are mounted in respective front and rear ends of the train body (2), and detection parts (32, 33), which are mounted in the tunnel (26) so as to be detected by the opening and closing detection sensors (30, 31); and
  - one or more suction fans (28) are mounted so as to discharge air in the tunnel (26) to an outside.



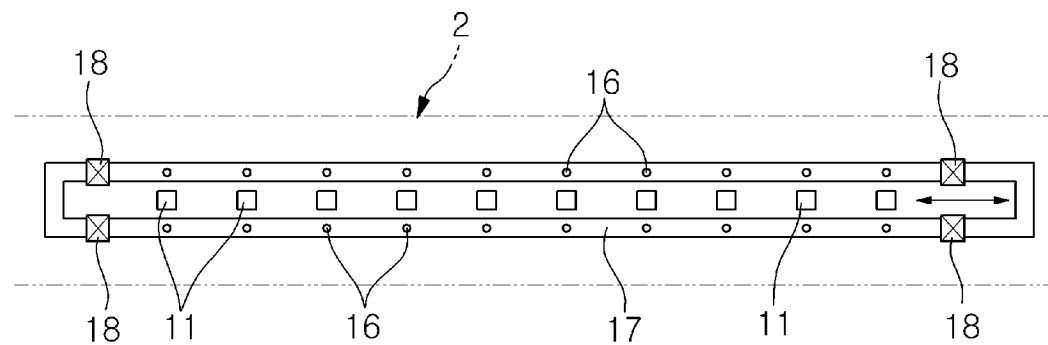
[Fig. 3]



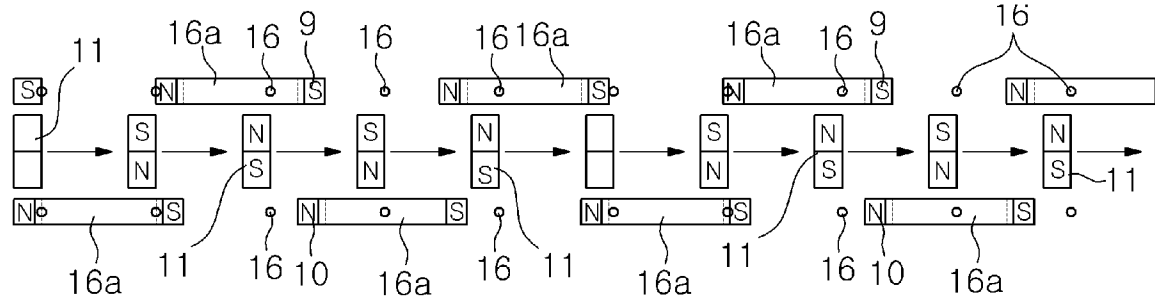
[Fig. 4]



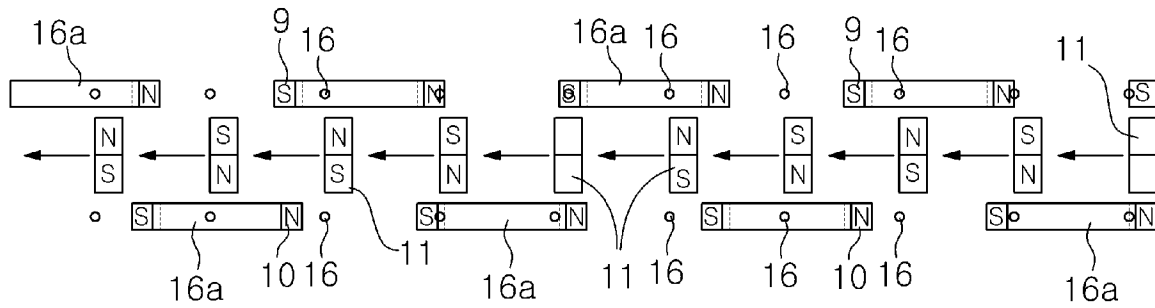
[Fig. 5]



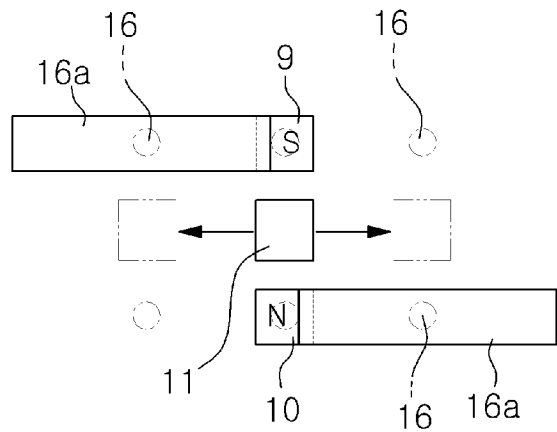
[Fig. 6]



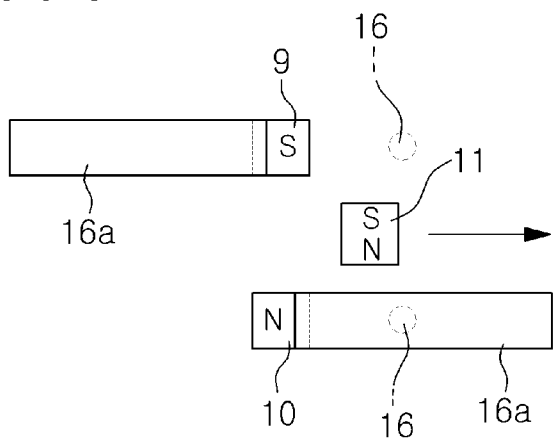
[Fig. 7]



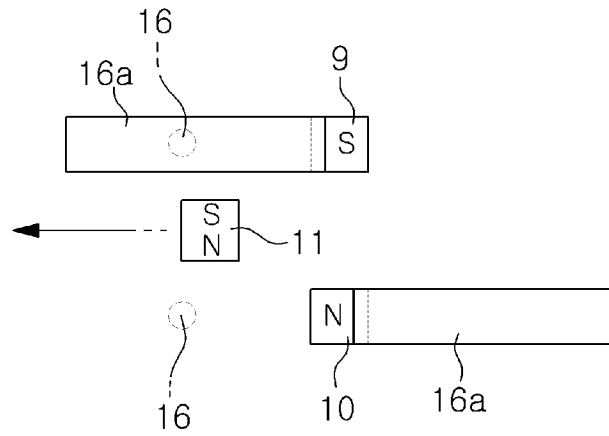
[Fig. 8]



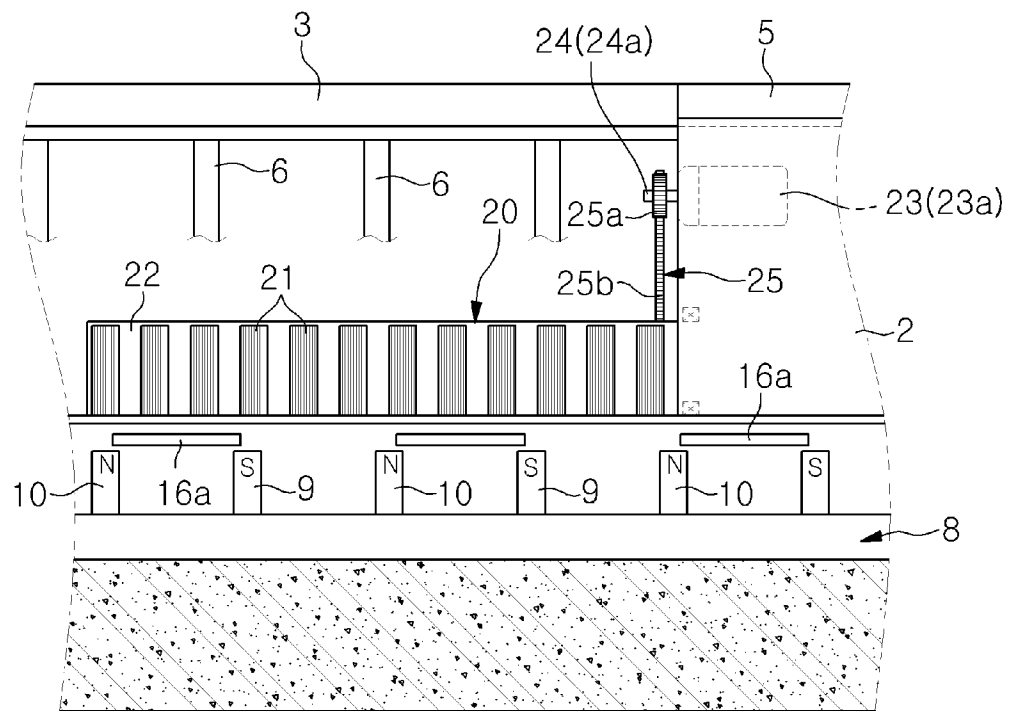
[Fig. 9]



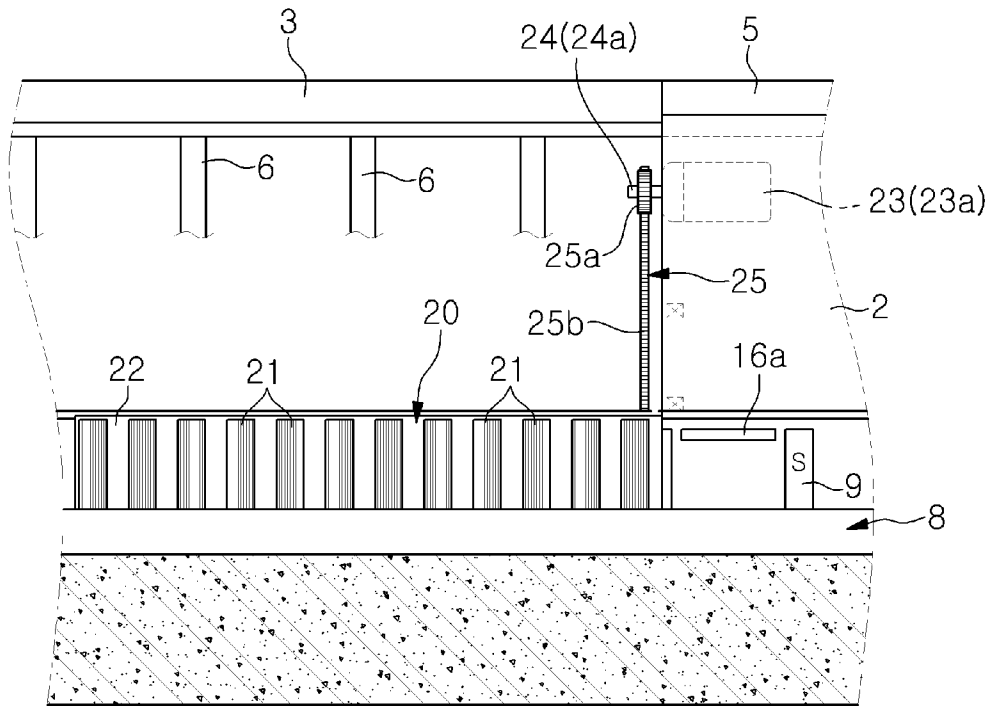
[Fig. 10]



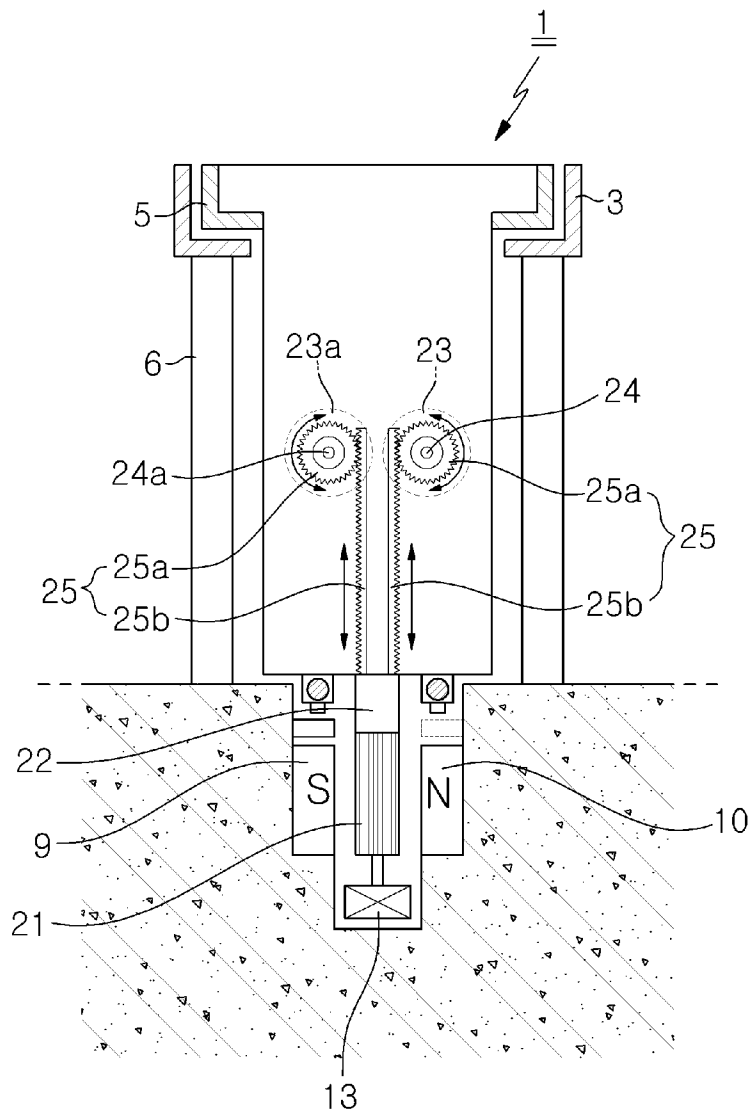
[Fig. 11]



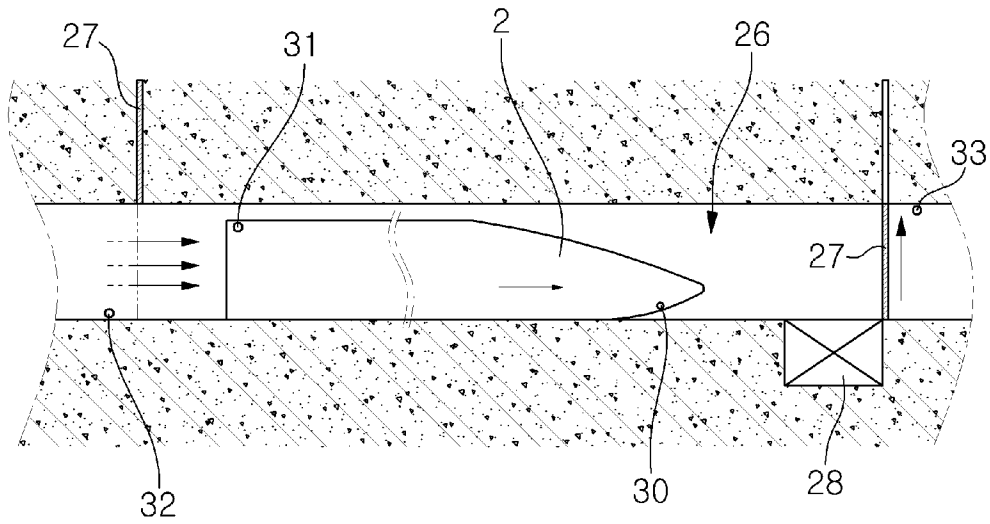
[Fig. 12]



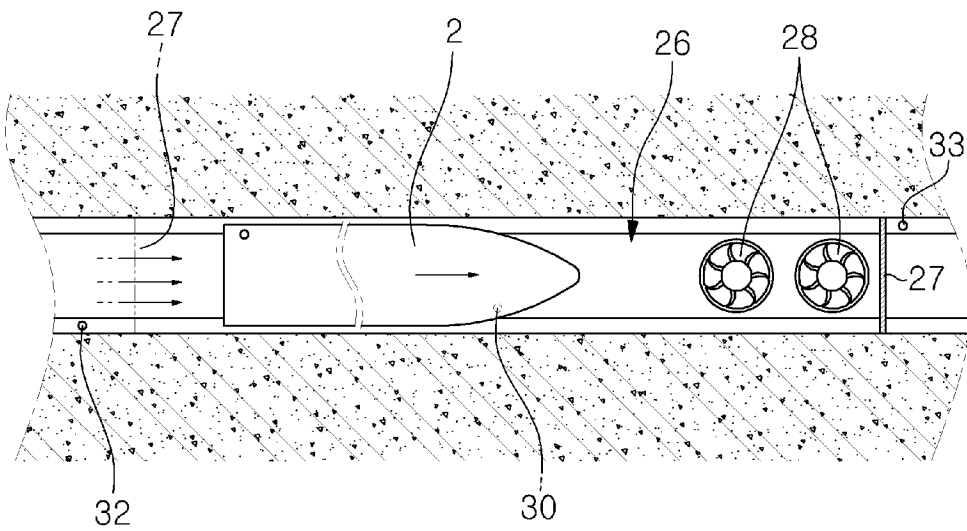
[Fig. 13]



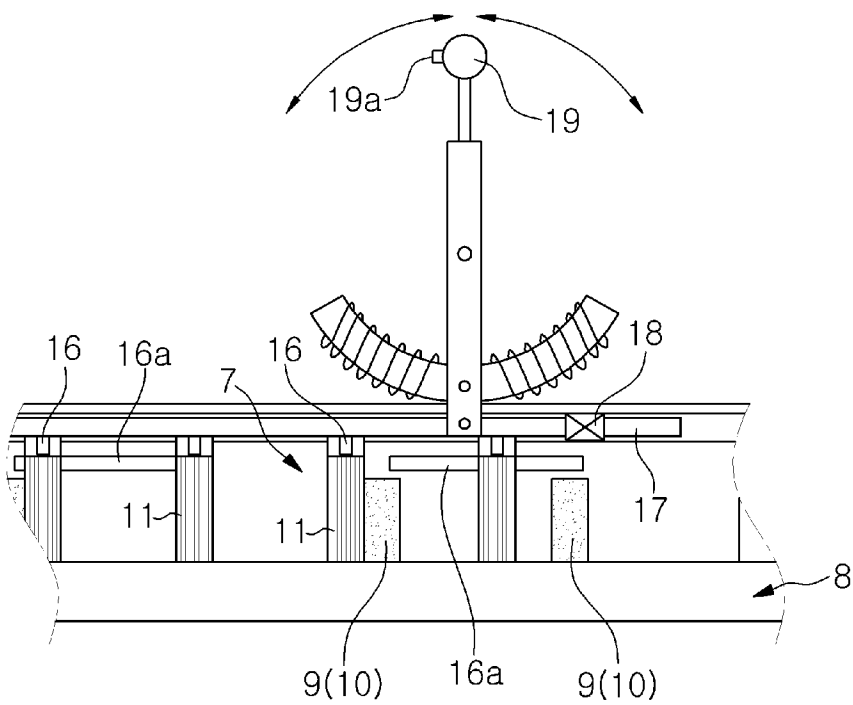
[Fig. 14]



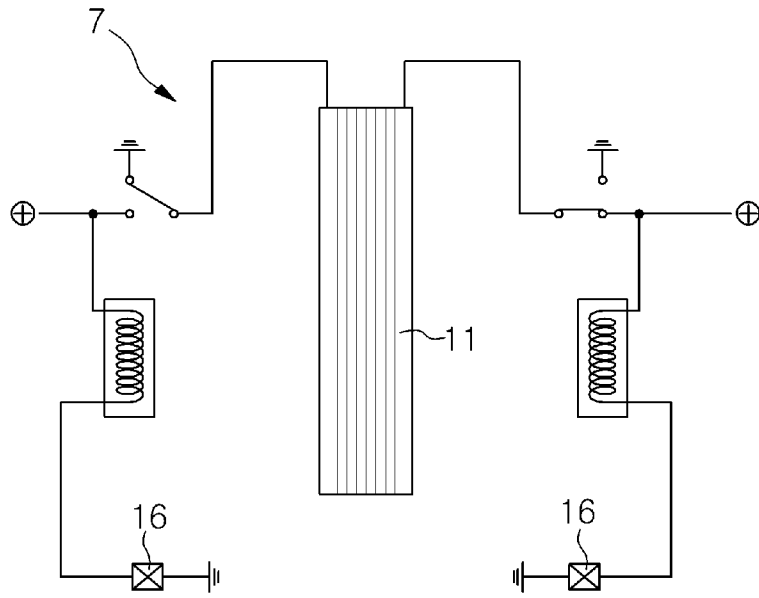
[Fig. 15]



[Fig. 16]



[Fig. 17]



[Fig. 18]

