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- **SHIMADA, Yoshinori**
Tokyo 100-8280 (JP)
- **OKAMOTO, Kenji**
Tokyo 100-8280 (JP)
- **KONISHI, Kenta**
Tokyo 100-8280 (JP)
- **FUJINAGA, Fumio**
Tokyo 100-8280 (JP)
- **NAKAYAMA, Kaname**
Tokyo 100-8280 (JP)

(71) Applicant: **Hitachi, Ltd.**
Chiyoda-ku
Tokyo 100-8280 (JP)

(72) Inventors:
• **HAYASHI, Tomoo**
Tokyo 100-8280 (JP)
• **FUJII, Motohiro**
Tokyo 100-8280 (JP)

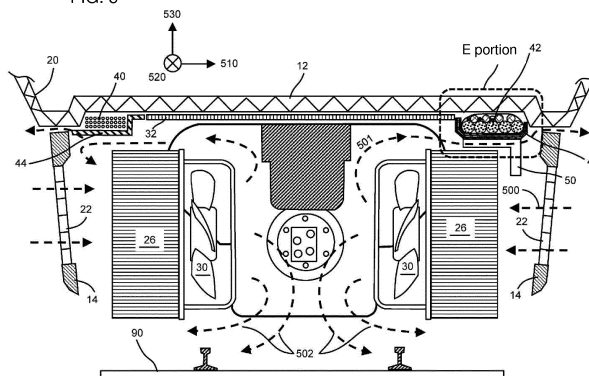
(74) Representative: **Gill, Stephen Charles et al**
Mewburn Ellis LLP
City Tower
40 Basinghall Street
London EC2V 5DE (GB)

(54) **MOVING VEHICLE**

(57) Under an underframe 12 of a vehicle body, an engine generator, coolers each of which includes a radiator 26 connected to this engine generator and a fan 30, and electrical wiring gutters 44 receiving main circuit electrical wires 42 and control electrical wires 40 are arranged along a vehicle-body longitudinal 520 direction at both end portions in a vehicle-body width direction. The coolers are arranged at both end portions in a vehicle-body width direction 510 under the underframe 12 so as to face to each other and form airflows 500 from the

both end portions in the vehicle-body width direction 510 toward the center of the vehicle body by using air blowers 30 and 30. The airflows 500 that have collided at the center of the vehicle body change directions as airflows 501 to be sent toward the electrical wiring gutters 44. With this, the electrical wiring gutters 44 are cooled, and the main circuit electrical wires 42 and the control electrical wires 40 received therein are prevented from overheating to a temperature at which insulation deterioration occurs.

FIG. 5



Description

Technical Field

5 **[0001]** The present invention relates to a moving vehicle and particularly relates to a railway vehicle including an engine generator and a main motor.

Background Art

10 **[0002]** A railway vehicle running directly through an electrified route and a non-electrified route includes a device for supplying electric power obtained from an overhead line or a third rail to a main motor and a device for supplying electric power obtained by operating a generator with the use of an engine to the above main motor. Such a railway vehicle is referred to as "DEMU (Diesel Electric Multiple Unit)", "Bi-mode", "EDC system", or the like. Hereinafter, those will be generally referred to as "DEMU". A device for operating the generator with the use of the engine will be referred to as "engine generator".

15 **[0003]** The DEMU is roughly classified into two kinds of systems. One system is a centralized power generation system composed of a power-generation vehicle on which an engine generator for generating electric power for the whole composition is mounted and a passenger car on which no engine generator is mounted. The other system is a distributed power generation system that does not include a power-generation vehicle and is composed of a plurality of passenger cars on which comparatively small engine generators are distributively mounted and a passenger car on which no engine generator is mounted.

20 **[0004]** In the centralized power generation system, the engine generator can be intensively mounted on the power-generation vehicle, and therefore, for example, the engine generator can be easily increased in size (increased in output), and the engine generator that tends to be a large vibration source and sound source can be provided away from the passenger car. However, in the case where a large engine generator is mounted, an axle weight (weight) of the power-generation vehicle tends to be excessively large.

25 **[0005]** Meanwhile, in the distributed power generation system, electric power necessary for vehicles of the composition to run is obtained by the engine generators which are distributively arranged, and therefore it is only necessary to prepare a plurality of engine generators each of which has small output. Further, it is possible to improve a degree of freedom of a recombination of the vehicle composition. Furthermore, the distributed power generation system has redundancy in which, even if a single engine generator is broken, operation can be continued by using engine generators mounted on other vehicles. Therefore, these days, the distributed power generation system is employed in most of the DEMUs.

30 **[0006]** However, in the distributed power generation system, in order to obtain a wide passenger space, it is necessary to provide each engine generator under a floor of the passenger car. In the case where output of the engine generator is increased to further increase speed thereof, the output of the engine generator is restricted by the size of the space under the floor of the vehicle, which is extremely difficult in many cases.

35 **[0007]** Further, main circuit electrical wires for supplying electric power generated in the engine generator to a device such as a main converter installed under the floor of the passenger car need to be laid in a limited small space under the floor of the passenger car. Therefore, the main circuit electrical wires are laid in the vicinity of the engine generator serving as a heat source in many cases. Thus, the main circuit electrical wires are exposed to a high-temperature environment due to not only heat generated by the main circuit electrical wires themselves but also heat from the engine generator, and a service life thereof may be reduced due to, for example, reduction in insulation performance thereof.

40 **[0008]** PTL 1 discloses a vehicle including main circuit electrical wires for transmitting electrical energy in a duct in order to prevent the electrical wires themselves from overheating, in which the main circuit electrical wires are cooled with air by supplying cooling air to this duct while the vehicle is being operated.

Citation List

Patent Literature

50 **[0009]** [PTL 1] WO2008/031752

Summary of Invention

55 Technical Problem(s)

[0010] In the case where a DEMU of the distributed power generation system which can be operated at a high speed is produced, it is necessary to provide, for example, an engine generator and main circuit electrical wires for supplying

electric power generated in this engine generator to a main converter and the like in a small space under a floor of a passenger car. The engine generator, the electrical wires, and the like are heat sources themselves. Therefore, a space for providing a device for cooling those devices needs to be secured under the floor of the passenger car. Thus, the space under the floor of the passenger car tends to be further reduced. In addition, in recent years, an amount of heat generated in the electrical wires because of Joule heat has tended to be increased in accordance with increase in an amount of current flowing through the electrical wires, which is caused by increase in output of the engine generator.

[0011] In some cases, as a countermeasure, a noise level in the passenger car is reduced by surrounding the engine generator mounted under the floor of the passenger car with, for example, a side cover having a sound insulation property to prevent a noise emitted from the engine generator from being propagated to the inside of the passenger space.

[0012] In this case, the side cover provided around the engine generator blocks a flow of cooling air around the engine generator and a wiring gutter receiving the wires. Therefore, heat tends to be stayed around the engine generator and the wiring gutter, which causes further overheating of the electrical wires.

[0013] Because the electrical wires are laid in the vicinity of the engine generator mounted under the floor as described above, the electrical wires are susceptible to a thermal influence of the engine generator, and, in addition, the electrical wires themselves are increased by Joule heat due to increase in current caused by increase in output of the engine generator in some cases. The electrical wires having a high temperature are quickly deteriorated over time in terms of an insulation performance and the like. Therefore, the insulation performance may be decreased to reduce a service life. Reduction in service life causes increase in maintenance costs because maintenance work such as replacement needs to be performed at a short cycle.

[0014] In view of this, an object of the invention is to provide a moving vehicle having a long service life by reducing a thermal influence from an engine generator on electrical wires provided under a floor in a DEMU of the distributed power generation system to prevent the electrical wires from being exposed to a high temperature.

Solution to Problem(s)

[0015] In order to achieve the above object, for example, features recited in CLAIMS are employed.

[0016] The present application includes a plurality of means for solving the above problems, and, as an example thereof, a moving vehicle of the invention includes: an engine generator provided under a vehicle body; coolers, each of which includes a radiator connected to the engine generator and an air blower; and electrical wiring gutters arranged under the vehicle body along a vehicle-body longitudinal direction, the electrical wiring gutters receiving electrical wires, wherein: the coolers are arranged at both end portions in a vehicle-body width direction under the vehicle body so as to face to each other and form airflows directed from the both end portions in the vehicle-body width direction toward the center of the vehicle body by using the respective air blowers; and the airflows that have collided at the center of the vehicle body change directions to be directed toward the electrical wiring gutters.

Advantageous Effects of Invention

[0017] According to the invention, it is possible to provide a moving vehicle having a long service life, the moving vehicle being capable of running directly through an electrified route and a non-electrified route and preventing increase in temperature of electrical wires provided in electrical wiring gutters by directing airflows formed by air blowers of coolers to the electrical wiring gutters.

Brief Description of Drawings

[0018]

[Fig. 1] Fig. 1 is a side view of a railway vehicle according to this example.

[Fig. 2] Fig. 2 is an enlarged view of an engine-generator mounting part (A portion in Fig. 1) under a floor of the railway vehicle according to this example.

[Fig. 3] Fig. 3 is a top view (B-B cross-sectional view in Fig. 2) of the engine-generator mounting part under the floor of the railway vehicle according to this example.

[Fig. 4] Fig. 4 is a cross-sectional view (C-C cross-sectional view in Fig. 2) of the engine-generator mounting part in this example.

[Fig. 5] Fig. 5 is a cross-sectional view (D-D cross-sectional view in Fig. 2) of a radiator mounting part in this example.

[Fig. 6] Fig. 6 is a cross-sectional view of an electrical wiring gutter (E portion in Fig. 4) in the vicinity of an engine in an engine generator.

[Fig. 7] Fig. 7 is a cross-sectional view of an electrical wiring gutter (corresponding to E portion in Fig. 4) in the vicinity of a radiator in an engine generator.

Description of Embodiments

[0019] Hereinafter, an example of the invention will be described with reference to the drawings.

[Example]

[0020] An example of the invention will be described with reference to Fig. 1 to Fig. 7.

[0021] Fig. 1 is a side view of a railway vehicle according to this example. First, directions related to a railway vehicle 1 will be defined. Three directions related to the railway vehicle 1 are a vehicle-body width direction 510, a vehicle-body longitudinal direction 520, and a vehicle-body height direction 530 of the railway vehicle 1 and will be hereinafter simply referred to as "width direction 510", "longitudinal direction 520", and "height direction 530" in some cases.

[0022] A vehicle body 10 of the railway vehicle 1 includes an underframe forming a floor surface, side structure bodies erected on both end portions of the underframe in the width direction 510, end structure bodies erected on both end portions of the underframe in the longitudinal direction 520, and a roof structure body provided on top end portions of the side structure bodies and the end structure bodies. The underframe and the structure bodies are basically made of a panel material connected to a hollow extruded shape material (double skin) made of aluminum alloy, the hollow extruded shape material being formed by connecting two facing faceplates via ribs.

[0023] As shown in Fig. 1, a bogie 16 including a plurality of wheelsets supported to be rollable on a track is provided under each of the both end portions in the longitudinal direction 520. A main motor (not shown) is mounted on the bogie 16, and the railway vehicle 1 runs by supplying electric power to this main motor to drive the wheelsets.

[0024] Although not shown, a power collection device for collecting electric power from an overhead line is provided on a roof of the railway vehicle 1 of a DEMU system, and a power collection shoe for collecting electric power from a third track provided along the track is provided on a side surface of the bogie 16. In an electrified route in which the overhead line or the third rail is laid, the railway vehicle 1 runs by collecting electric power by using the power collection device or the power collection shoe and then supplying the collected electric power to a main transformer and a main converter to drive the main motor. In a non-electrified route in which ground facilities of the overhead line and the third rail are not provided, the railway vehicle 1 runs by supplying electric power obtained by driving a generator with the use of an engine mounted on the railway vehicle 1 to the main converter to drive the main motor.

[0025] The railway vehicle 1 includes both the power collection device or power collection shoe and the engine generator and can therefore mutually run directly through the electrified route and the non-electrified route.

[0026] Fig. 2 is an enlarged view of an engine-generator mounting part (A portion in Fig. 1) under a floor of the railway vehicle 1 according to this example. Fig. 3 is a top view (B-B cross-sectional view in Fig. 2) of the engine-generator mounting part under the floor of the railway vehicle 1 according to this example.

[0027] The engine generator mounted under the floor of the railway vehicle 1 mainly includes an engine 24 and a generator 25 connected to the engine 24. The engine 24 is connected to a cooler including a radiator 26 for cooling cooling water having a temperature increased by circulating the cooling water on the inside thereof to cool various portions with water and a fan 30 for sending ambient air to the radiator 26 and is also connected to exhaust gas processing devices 34 for removing hazardous material from exhaust gas discharged from the engine 24. Those devices are integrally supported together with the engine 24 by using a frame or the like.

[0028] In this example, the engine 24 is a diesel engine using light fuel oil as a fuel, and the exhaust gas processing devices 34 are for removing nitrogen oxides and particulate matter (PM) in exhaust gas.

[0029] As shown in Fig. 5, two coolers, each of which includes the radiator 26 and the fan 30, are provided, and, also as shown in Fig. 3, the radiators 26 of the respective coolers are arranged along the longitudinal direction 520 on the both sides in the width direction 510 under the railway vehicle 1 and are also arranged so that the fans 30 of both the coolers are adjacent to each other along the longitudinal direction 520 of the engine 24 so as to face to each other.

[0030] Fig. 4 is a cross-sectional view (C-C cross-sectional view in Fig. 2) of the railway vehicle, which shows an engine mounting position in the engine generator according to this example. Side covers 14 are provided on both sides of the engine 24 in the width direction 510 so that a noise emitted from the engine generator is not propagated to the periphery of the railway vehicle 1. In the side covers 14, as shown in Fig. 5, each of the side covers 14 arranged along the radiators 26 on both sides thereof has a lattice 22 that does not interrupt sending of air from the fan 30 and prevents damage caused by a flying object or the like.

[0031] At one end portion of a lower surface of an underframe 12 of the railway vehicle 1 in a width direction thereof, an electrical wiring gutter 44 receiving control electrical wires 40 related to control of commands or the like to various devices is provided, and, at the other end portion thereof, an electrical wiring gutter 44 receiving main circuit electrical wires 42 through which a current or the like supplied to the main motor and the like flows is provided.

[0032] In order to allow the railway vehicle 1 to run at a high speed, each engine 24 has axis output of about 500 to 700 kW. The radiators 26 provided along with the engine generator have a capability of removing an amount of heat of about 300 kW in total for a single engine.

[0033] A temperature of a space surrounded by the underframe 12 and the side covers 44 tends to be increased at the time of an overload due to heat 540 or the like radiated from the engine 24 and the exhaust gas processing devices 34. Therefore, the electrical wiring gutters 44 provided in this space and the control electrical wires 40 and the main circuit electrical wires 42 received therein are also exposed to a high temperature.

[0034] Fig. 5 is a cross-sectional view (D-D cross-sectional view in Fig. 2) of the railway vehicle, which shows a radiator mounting part of the engine generator according to this example. The fan 30 sucks air around the railway vehicle 1 (hereinafter, referred to as "ambient air") through the lattice 22 provided in the side cover 14, thereby cooling the radiator 26 with ambient air. The coolers including the radiators 26 and the fans 30 are arranged on the both end portions in the width direction 510 under the railway vehicle 1 so that the radiators 26 are directed outward (in a direction away from the center in the width direction 510), the fans 30 are directed inward (in a direction toward the center in the width direction 510), and the fans 30 on both sides face to each other, thereby attracting ambient air inward from the outside.

[0035] A temperature of a flow (first airflow) 500 of ambient air linearly passing through the radiator 26 toward the center in the width direction 510 is increased by removing heat from the radiator 26.

[0036] The ambient air having an increased temperature collides at the center in the width direction 510, and therefore a direction thereof is changed upward and downward. A flow (second airflow) 501 whose direction has been changed upward collides with a heat shielding material 32 provided on the lower surface of the underframe 12 and becomes a flow (second airflow) directed from the center in the width direction 510 toward both sides thereof (direction of side cover 14), and the flow is discharged to the outside of the vehicle through a gap between the underframe 12 and a top end portion of the side cover 14.

[0037] The second airflow 501 flows at a position higher than that of the first airflow 500 (position closer to the lower surface of the underframe 12). The second airflow 501 collides with the shielding material 32 to cool the shielding material, changes a direction thereof, and flows through the gap between the lower surface of the underframe 12 and the top end portion of the side cover 14. During this process, the second airflow 501 cools the electrical wiring gutter 44.

[0038] Meanwhile, a flow (third airflow) 502, which has collided at the center in the width direction 510 and has changed a direction downward, becomes a flow directed toward a track 90 and flows between a portion below the radiator 26 and the track 90 in a direction away from the railway vehicle 1.

[0039] The flow 501 of the air that has passed the radiator 26 has a temperature of about 80 to 90 °C at the time of high-load operation in which the railway vehicle 1 departs from a station and accelerates. This temperature is satisfactorily lower than a temperature of the lower surface of the underframe 12 (heat shielding material 32) exposed to heat radiated from the engine 24 and a temperature of a region surrounded by the lower surface of the underframe 12 and the side covers 14.

[0040] Therefore, even in the case where a temperature of the main circuit electrical wires 42 is increased due to Joule heat of a current at the time of high-load operation, the electrical wiring gutter 44 can be effectively cooled by the flow 501 of the air that has passed the radiator 26, and the main circuit electrical wires 42 included therein can be securely prevented from having a high temperature at which insulation deterioration occurs. In addition, overheating of the heat shielding material 32 can also be prevented.

[0041] Note that forms of the flows 500 to 502 of the air described above are substantially symmetric about the center in the width direction 510 below the underframe 12, and therefore the flows 500 to 502 of the air only on one side have been described.

[0042] Hereinafter, cooling of the electrical wiring gutter 44 will be further described in detail.

Fig. 6 is a cross-sectional view (E portion in Fig. 4) of the electrical wiring gutter 44 in the vicinity of the engine of the engine generator. The railway vehicle 1 includes electrical devices such as the main motor, the main converter, and the generator and also includes electrical wire groups such as the control electrical wires 40 and the main circuit electrical wires 42 for transmitting electrical energy and signals between those electrical devices. Those electrical wire groups are collectively arranged in the electrical wiring gutters 44 provided along the longitudinal direction 520 on both sides in the width direction 510 below the underframe 12 and are fixed to the electrical wiring gutters 44 by using banding pairs 58 so that the electrical wire groups are prevented from shifting due to vibration or the like caused by running of the railway vehicle 1.

[0043] Each of the electrical wiring gutters 44 is made of material having a large thermal conductivity such as aluminum alloy, and, in this example, the electrical wiring gutter 44 is formed by bending a plate made of aluminum alloy.

[0044] As a procedure for fixing the main circuit electrical wires 42 to the electrical wiring gutter 44 (the same applies to the control electrical wires 40), first, a plurality of lifting devices such as hydraulic jacks are arranged along the longitudinal direction 520 below the underframe 12. Next, the electrical wiring gutter 44 is placed on the lifting devices, and the main circuit electrical wires 42 are placed in the electrical wiring gutter 44. Then, the electrical wire group is fixed to the electrical wiring gutter 44 by using the banding pair 58.

[0045] Finally, the lifting devices are lifted to pass bolts embedded in the lower surface of the underframe 12 through opening portions formed at regular intervals in a flange portion of the electrical wiring gutter 44, and lower end portions of the bolts are fastened with nuts. Thus, the electrical wiring gutter 44 is attached to the lower surface of the underframe 12.

[0046] As compared with a current flowing through the control electrical wires 40, a large current flows through the main circuit electrical wires 42, and therefore a temperature of the electrical wires themselves tends to be increased due to Joule heat. When the temperature of the electrical wires themselves is increased to be higher than a predetermined temperature, there may be caused malfunctions such as reduction in insulation performance of the electrical wires (dielectric breakdown) and damage to a coating of the electrical wires. Therefore, it is necessary to appropriately radiate (cool) heat generated in the electrical wire groups.

[0047] Meanwhile, because the engine 24 emits a large amount of heat, the temperature of the region surrounded by the underframe 12 and the side covers 14 shown in Fig. 3 and Fig. 4 is increased due to an influence of the heat 540 from a surface of the engine 24, the exhaust gas processing devices 34, and the like, and therefore a temperature around the electrical wiring gutters 44 is increased to about 100°C in some cases.

[0048] Note that heat transfer from the engine 24 is caused by convective heat transfer or is caused by radiative heat transfer. The convective heat transfer is such that air having a temperature increased by heat transferred from the engine 24 to air therearound flows to the vicinity of the electrical wires through the electrical wiring gutters 44. Meanwhile, the radiative heat transfer is such that heat is transferred to surfaces of the electrical wiring gutters 44 via electromagnetic waves emitted from the surface of the engine 24.

[0049] The periphery of the electrical wiring gutters 44 becomes a high-temperature atmosphere due to an influence of heat from the engine 24, and, in addition, the main circuit electrical wires 42 have a high temperature also due to Joule heat of the main circuit electrical wires 42 themselves. Therefore, those electrical wire groups have a specification to withstand a high temperature. However, in the case where high-load operation is continued, for example, in the case where the railway vehicle 1 accelerates on an upward slope, a large amount of heat is emitted from the engine 24 and the exhaust gas processing devices 34, and a large current flows through the main circuit electrical wires 42. Therefore, in particular, the main circuit electrical wires 42 may have a high temperature due to generation of heat caused by Joule heat in addition to increase in ambient temperature.

[0050] In view of this, the electrical wiring gutters 44 provided in the vicinity of the engine 24 and the exhaust gas processing devices 34 have a sandwiched (laminated) structure having a heat insulation property with which increase in the temperature of the electrical wiring gutters 44 caused by an influence of heat from the engine 24 and the like hardly occurs. Specifically, the electrical wiring gutters 44 are formed by inserting a heat insulation material 46 between two plates 48a and 48b made of aluminum alloy, have a substantially U-shaped cross-sectional shape in a direction across the longitudinal direction 520, and hold the control electrical wires 40 and the main circuit electrical wires 42 in recessed portions formed in upper surfaces thereof.

[0051] Even in the case where the plate 48b, which forms a part of the electrical wiring gutter 44 and is arranged on the side facing to the engine 24 and the exhaust gas processing device 34, is increased to a high temperature due to radiative heat or convective heat, the heat insulation material 46 prevents the above heat from being transmitted to the plate 48a on the side of the main circuit electrical wires 42.

[0052] Fig. 7 is a cross-sectional view of the electrical wiring gutter (E portion in Fig. 4) in the vicinity of the radiator of the engine generator.

[0053] The electrical wiring gutter 44 is provided in the vicinity of the radiator 26 and is arranged at a position exposed to the flow 501 of the air (second airflow) induced by the fan 30 as described above.

[0054] The electrical wiring gutter 44 having the substantially U-shaped cross-sectional shape in a direction across the longitudinal direction 520 does not include the heat insulation material 46 or the plate 48b shown in Fig. 6 and only includes the plate 48a, and a plurality of radiating fins 50 are provided to be laminated at predetermined intervals under the plate 48a along the longitudinal direction 520 of the railway vehicle 1.

[0055] The radiating fins 50 are made of material having a high thermal conductivity such as aluminum alloy, and each of the radiating fins includes a base 50b connected to the plate 48a forming the electrical wiring gutter 44 and an extension part 50a extending downward from one end portion of the base 50b. The radiating fins 50 are directly connected to a lower surface of the plate 48a forming the electrical wiring gutter 44.

[0056] Note that, in the case where the electrical wiring gutter 44 can be satisfactorily cooled, it is not always necessary to provide the radiating fins 50, and a surface of the plate 48a made of metal may be directly exposed to the flow 501 of the air, or a rib, unevenness, or the like may be provided.

[0057] The extension parts 50a of the cooling fins 50 are extended to a position exposed to low-temperature ambient air (flow 500 of air) to be sucked into the radiator 26. The bases 50b of the cooling fins 50 pass the radiator 26, then change directions, and are exposed to the flow 501 of the air discharged to the outside of the vehicle through the gap between the underframe 12 and the top end portion of the side cover 14.

[0058] The extension parts 50a are exposed to ambient air having a temperature lower than that of the flow 501 of the air having a temperature increased by passing the air through the radiator 26. Therefore, heat, which has been moved by heat transfer from the electrical wiring gutter 44 (plate 48a) to the bases 50b, is moved by thermal conduction through the inside of the radiating fins 50 to the extension parts 50a having a lower temperature. The heat transmitted to the extension parts 50a by thermal conduction is brought into contact with ambient air (flow 500 of air) having a low

temperature and is then cooled. Therefore, the heat is effectively removed from the radiating fins 50 toward ambient air.

[0059] As described above, because heat of the electrical wiring gutter 44 and the main circuit electrical wires 42 received therein is effectively removed, it is possible to reduce the temperature of the main circuit electrical wires 42 received inside the electrical wiring gutter 44 to a level at which insulation deterioration does not occur.

[0060] Although not shown, the electrical wiring gutter 44 may have both configurations shown in Fig. 6 and Fig. 7. Specifically, the electrical wiring gutter 44 having a length of both the engine 24 and the radiator 26 (sum of lengths L1 and L2 in Fig. 3) is formed by using a single plate 48a made of metal material having a high thermal conductivity.

[0061] In a range of the electrical wiring gutter 44, the range positioning on the side of the engine 24 and the exhaust gas processing devices 34 (part corresponding to L1 in Fig. 3), there is formed the sandwiched (laminated) structure shown in Fig. 6 in which the heat insulation material 46 is laminated on the lower surface of the plate 48a and the plate 48b is piled on the heat insulation material 46.

[0062] Then, in a generation range of the flows 500 to 502 of the air generated in accordance with operation of the fan 30 provided to the radiator 26 (part corresponding to L2 in Fig. 3, sides of the radiator 26), the bases 50b of the large number of cooling fins 50 are arranged at predetermined intervals in a direction along a flow direction of the flows 500 and 501 of the air. Thus, the electrical wiring gutter 44 including the cooling fins 50 shown in Fig. 7 is formed.

[0063] With this configuration, Joule heat, which has been generated by an electrical resistance of the main circuit electrical wires 42 received in the electrical wiring gutter 44 in the vicinity of the engine 24 and the exhaust gas processing device 34, is moved by heat transfer to the plate 48a and is then moved by thermal conduction through the plate 48a from the part corresponding to L1 along the longitudinal direction 520 thereof to the part corresponding to L2. Thereafter, heat, which has been moved by thermal conduction to the part corresponding to L2, is effectively removed by the flows 500 to 502 of the air generated by the fan 30 of the radiator 26 toward ambient air, and the electrical wiring gutter 44 is effectively cooled over the whole length (sum of L1 and L2) thereof. Therefore, the electrical wiring gutter 44 and the main circuit electrical wires 42 are maintained at a low temperature.

[0064] The electrical wiring gutter 44 and the main circuit electrical wires 42 can be maintained at a low temperature also by providing, instead of the radiating fins 50, a heat pipe (not shown) directly connected to the electrical wiring gutter 44 to effectively remove heat from the electrical wiring gutter 44 toward a flow of air.

[0065] As shown in Fig. 7, in the electrical wiring gutter 44 above the radiator 26, an opening portion 54a may be provided on an upstream side of the electrical wiring gutter 44 (near the center in the width direction 510) and an opening portion 54b may be provided on a downstream side of the electrical wiring gutter 44 (on the side of the side cover 14 in the width direction 510) so that the flow 501 of the air can pass through the inside of the electrical wiring gutter 44.

[0066] With this configuration, a part of air of the airflow 501 generated by the fan 30 of the radiator 26 can flow into the electrical wiring gutter 44, remove heat inside the electrical wiring gutter 44, and emit the heat to the outside of the vehicle through the opening portion 54b. Further, because heat of the electrical wiring gutter 44 and the main circuit electrical wires 42 can be effectively removed, it is possible to prevent the temperature of the electrical wiring gutter 44 and the main circuit electrical wires 42 from being excessively increased.

[0067] With the configuration described above, heat of the electrical wiring gutter 44 and the main circuit electrical wires 42 can be effectively removed, and therefore it is possible to reduce the temperature of the main circuit electrical wires 42 without maintaining the main circuit electrical wires 42 at an excessively high temperature.

[0068] Therefore, it is possible to provide a moving vehicle having a long service life, the moving vehicle being capable of running directly through an electrified route and a non-electrified route and preventing increase in temperature of electrical wires also in the non-electrified route.

[0069] Note that, although the main circuit electrical wires 42 and the electrical wiring gutter 44 in which the main circuit electrical wires 42 are arranged have been described in the above example, it is also possible to obtain a similar effect by applying those configurations to the electrical wiring gutter 44 in which the control electrical wires 40 are arranged.

[0070] As described above, the invention is not limited to the above example and includes various modification examples. For example, the above example has been described in detail to easily understand the invention, and therefore the invention is not necessarily limited to the example having all the configurations described above.

[0071] Further, a part of a configuration of a certain example can be replaced with a configuration of another example, and a configuration of another example can be added to a configuration of a certain example. Further, another configuration can be added to, removed from, or replaced with a part of the configuration of each example.

Reference Signs List

1 ...	railway vehicle	10 ...	vehicle body
12 ...	underframe	14 ...	side cover
16 ...	bogie	20 ...	side sill
22 ...	lattice	24 ...	engine
25 ...	generator	26 ...	radiator

(continued)

	30 ...	fan	32 ...	heat shielding material
	34 ...	exhaust gas processing device		
5	40 ...	control electrical wire		
	42 ...	main circuit electrical wire		
	44 ...	electrical wiring gutter		
	46 ...	heat insulation material	48 ...	plate
10	50 ...	radiating fin	52 ...	heat pipe
	54 ...	opening portion	56 ...	quasi-sealed portion
	58 ...	banding band	90 ...	track
	500 to 502 ...	flow of air	510 ...	width direction
	520 ...	longitudinal direction	530 ...	height direction
15	540 ...	flow of heat of engine		

Claims

1. A moving vehicle, comprising:

a vehicle body;
 an engine generator provided under the vehicle body;
 coolers, each of which includes a radiator connected to the engine generator and an air blower; and
 electrical wiring gutters arranged under the vehicle body along a vehicle-body longitudinal direction, the electrical wiring gutters receiving electrical wires, wherein:

the coolers are arranged at both end portions in a vehicle-body width direction under the vehicle body so as to face to each other and form airflows directed from the both end portions in the vehicle-body width direction toward the center of the vehicle body by using the respective air blowers; and
 the airflows that have collided at the center of the vehicle body change directions toward the electrical wiring gutters.

2. The moving vehicle according to claim 1, wherein:

each of the electrical wiring gutters provided at the both end portions on the sides of the coolers is made of a metal plate; and
 a heat radiation unit is provided on a lower surface of the metal plate.

3. The moving vehicle according to claim 2, wherein:

each of the electrical wiring gutters has the metal plate that continues in a range from the side of the cooler to the side of the engine generator; and
 a part of the metal plate, the part positioning on the side of the engine generator, is made of a laminated material including an intermediate layer made of a heat insulation material.

4. The moving vehicle according to claim 3, wherein:

the heat radiation unit is provided to a part of the metal plate, the part positioning on the side of the cooler, and has a base directly connected to the lower surface of the metal plate and a hanging portion connected to the base and hanging downward; and
 the base is directly exposed to the airflow toward the air blower, and the hanging portion is exposed to the airflow that has collided at the center of the vehicle body and has changed the direction.

5. The moving vehicle according to claim 4, wherein

the metal plate has a first opening portion in one end portion in the vehicle-body width direction and has a second opening portion in the other end portion.

FIG. 1

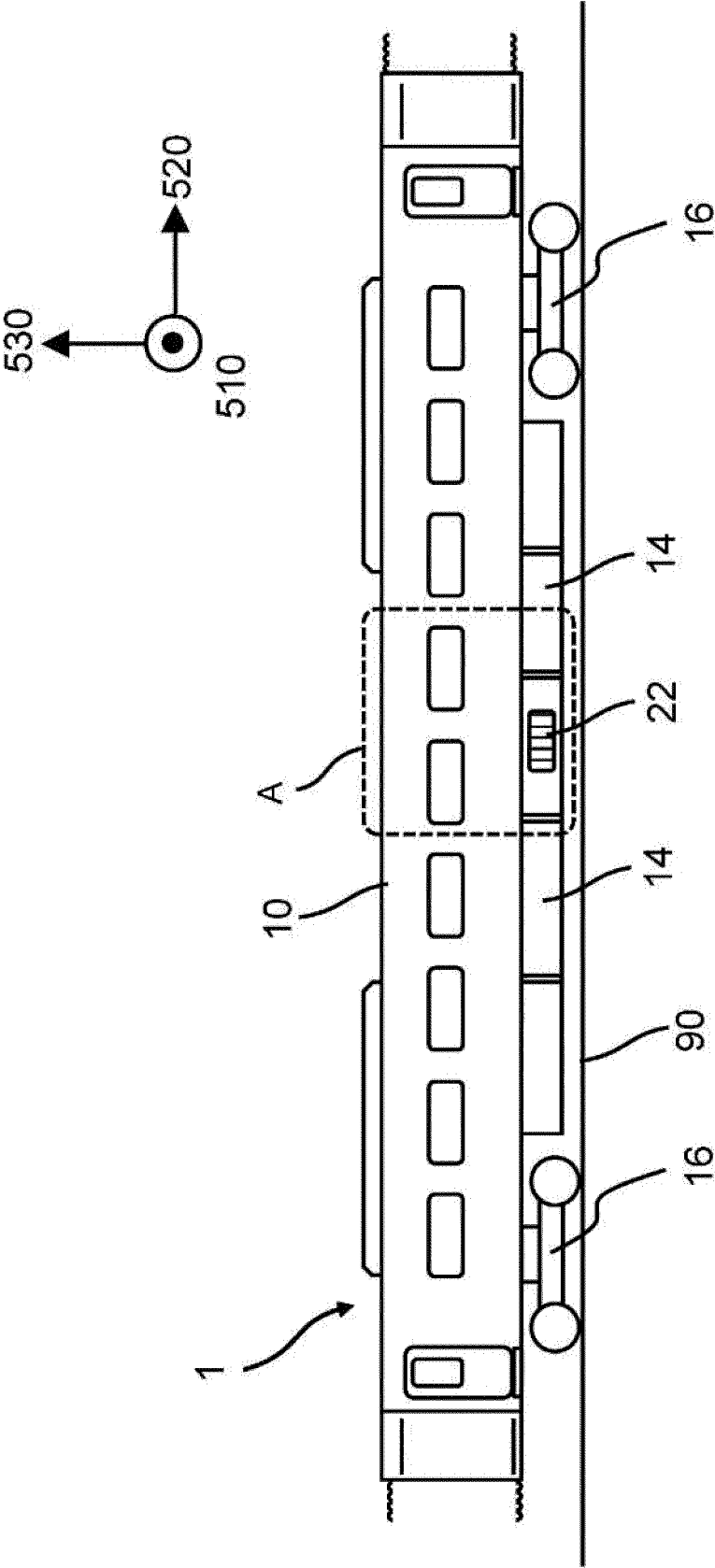


FIG. 2

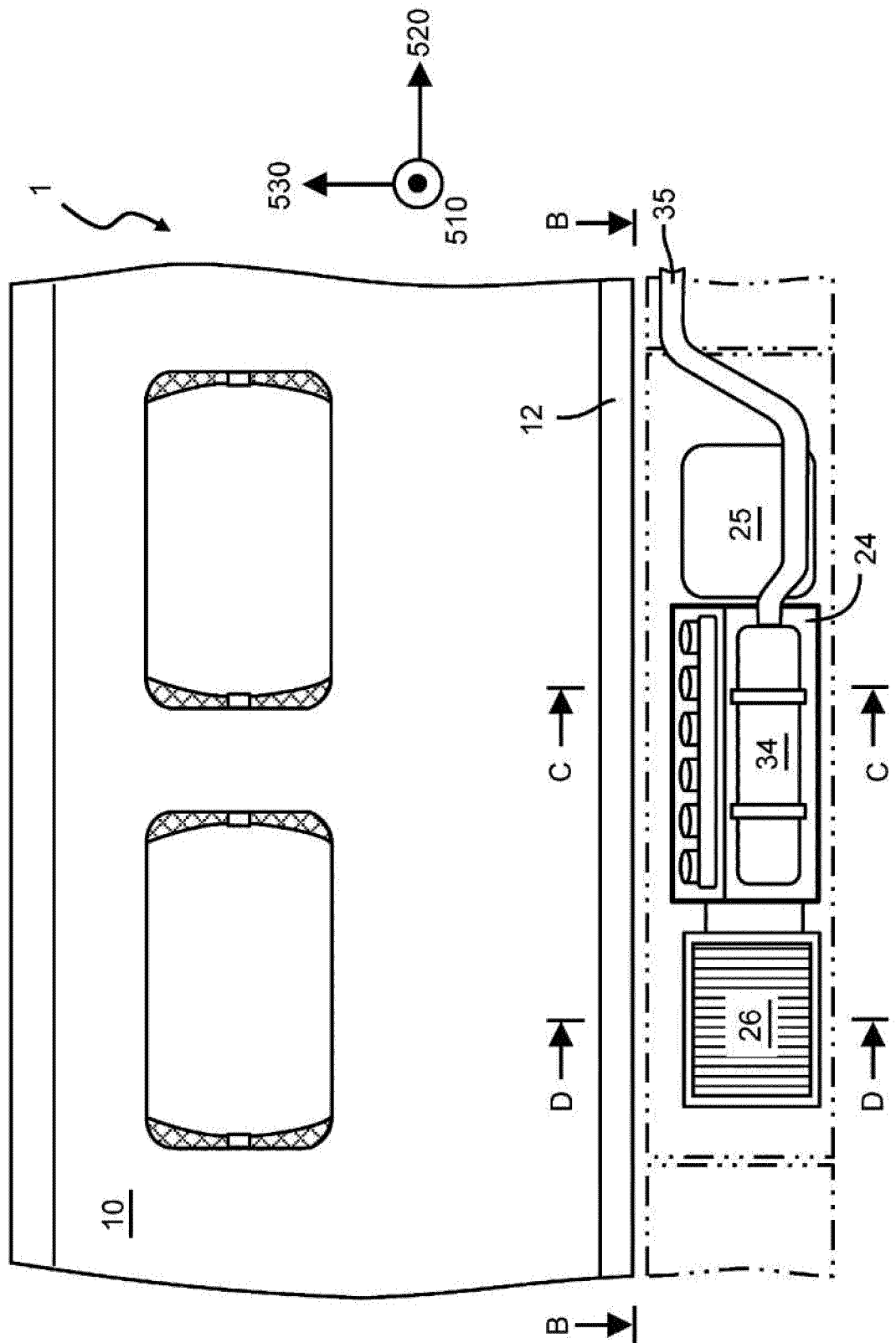


FIG. 3

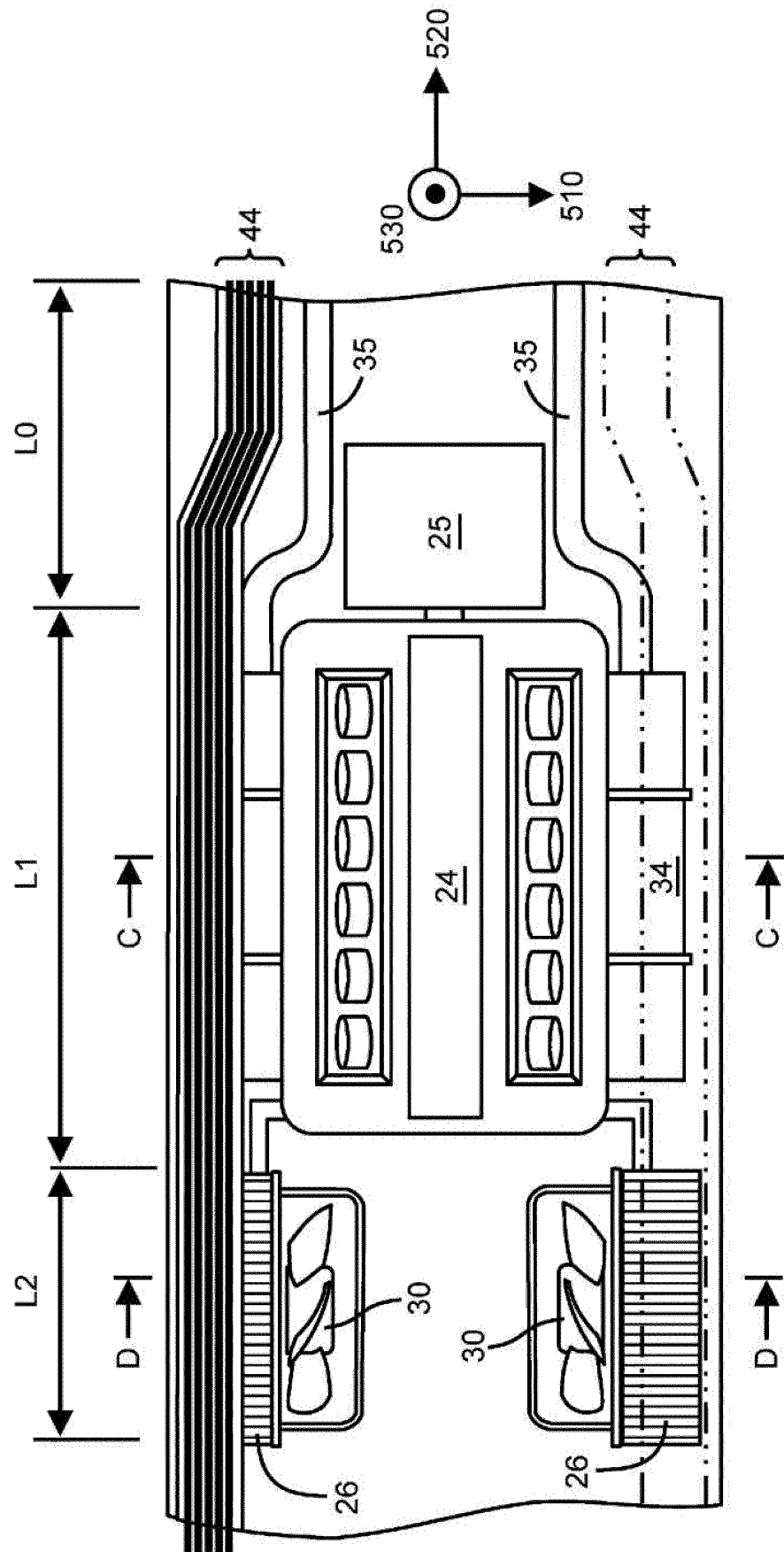


FIG. 4

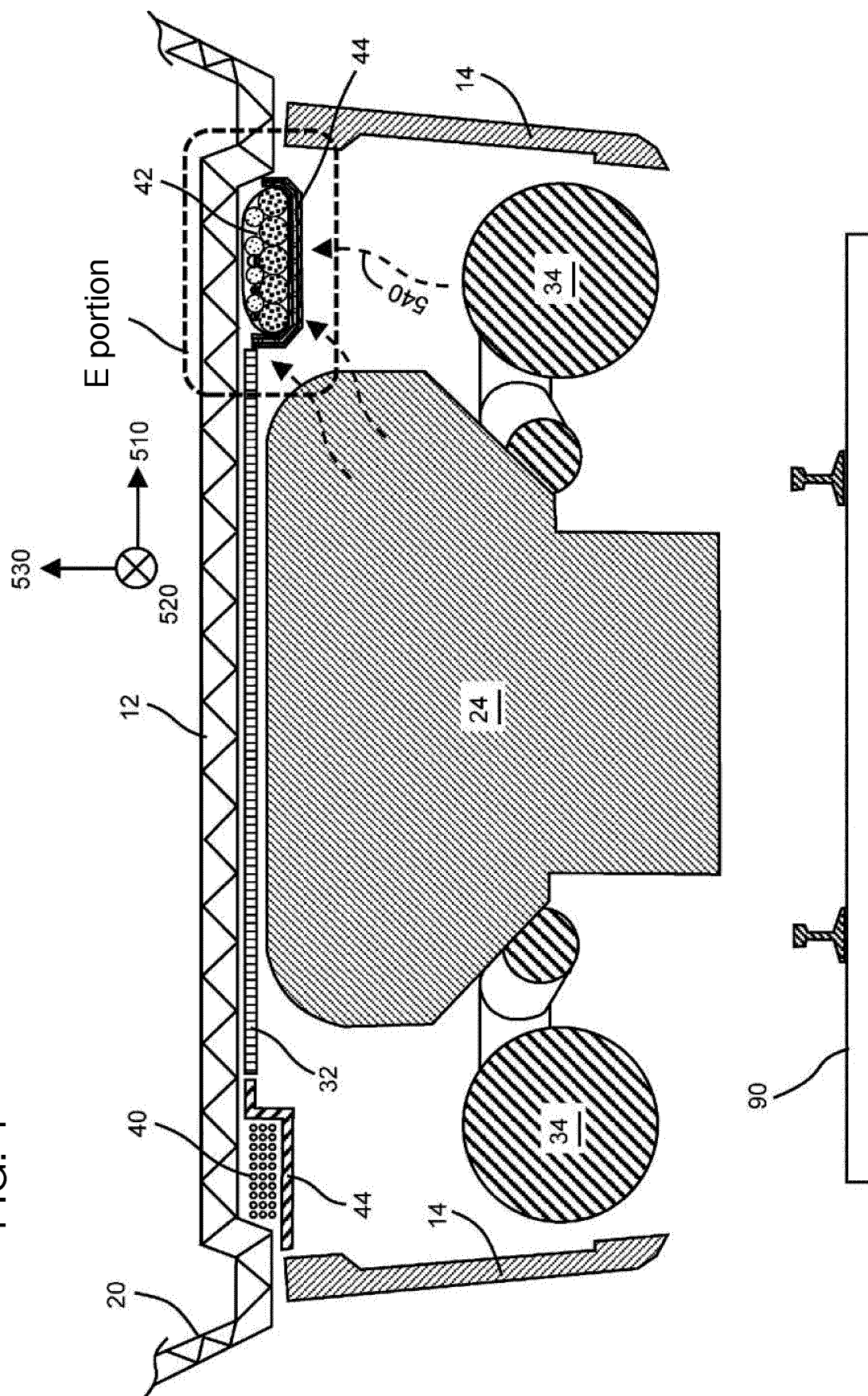


FIG. 5

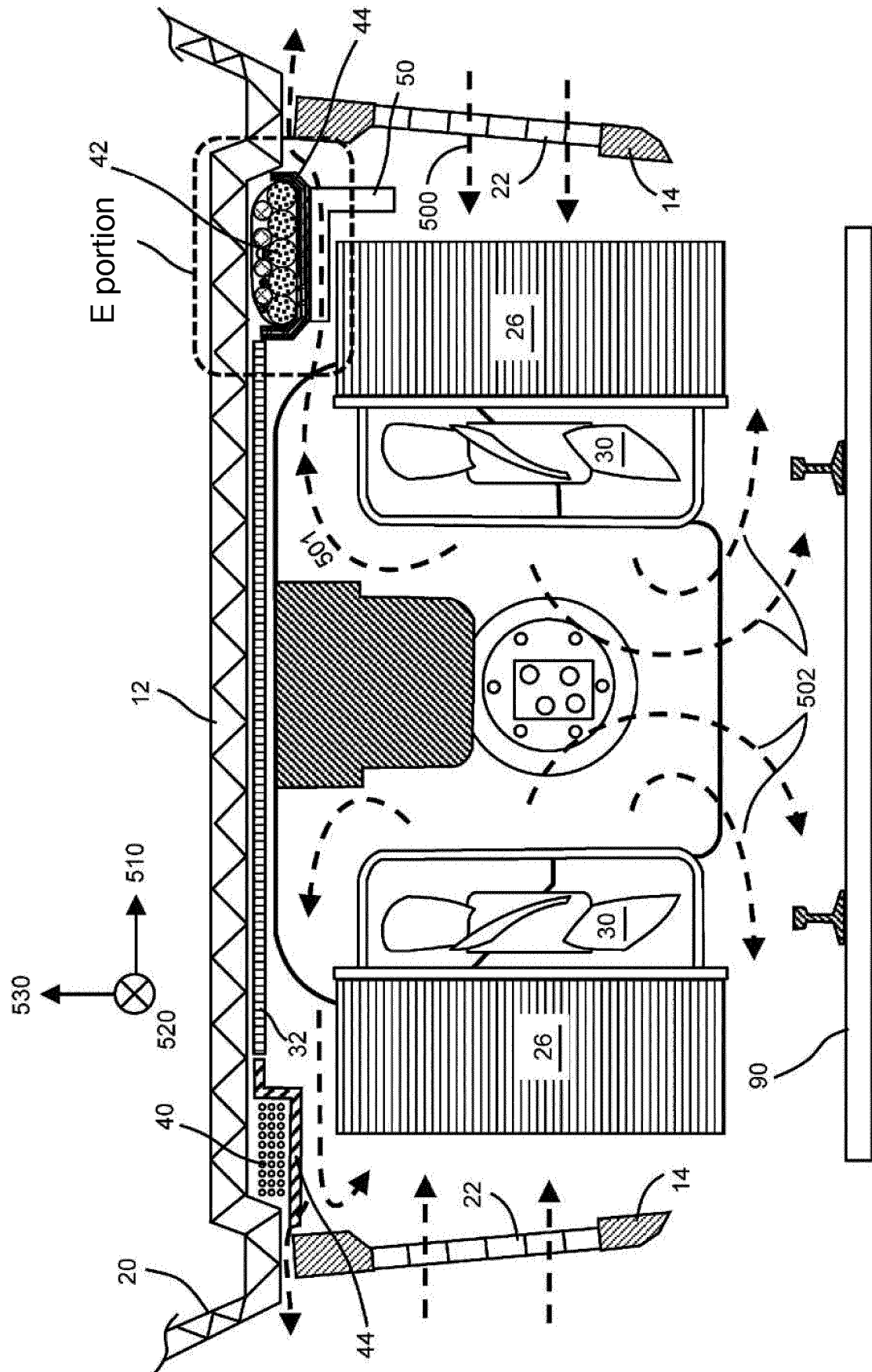


FIG. 6

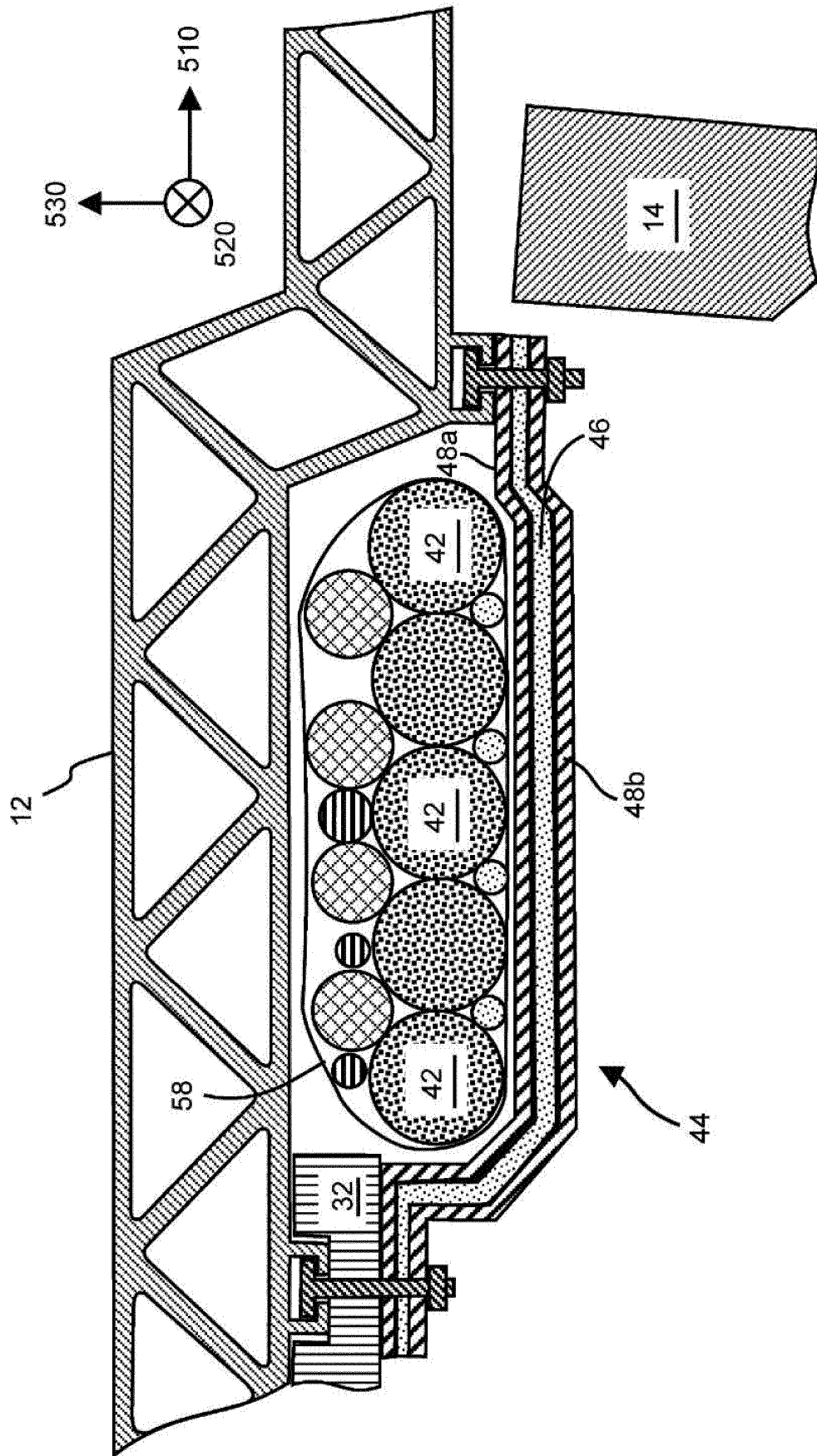
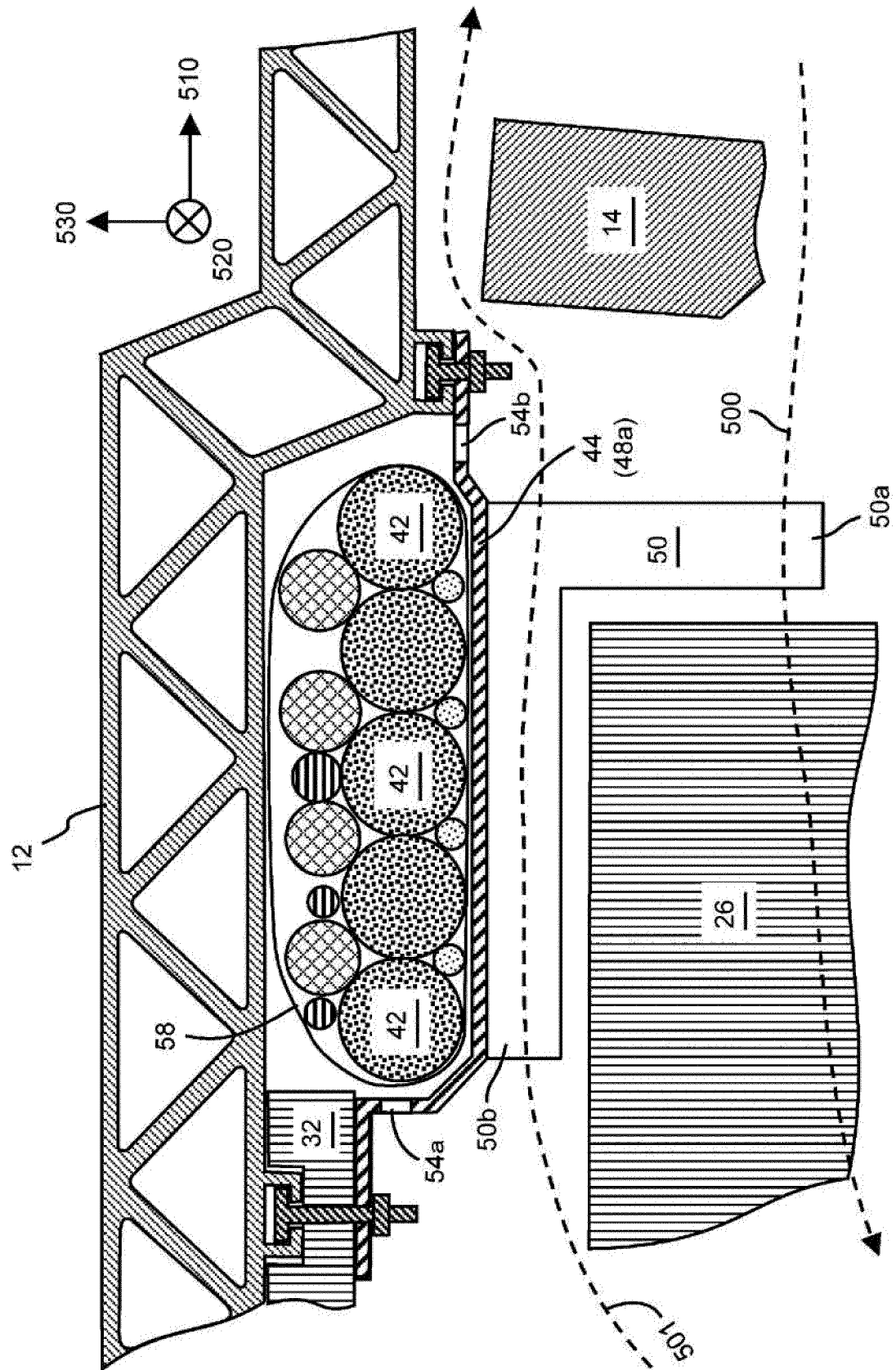


FIG. 7



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/060179

A. CLASSIFICATION OF SUBJECT MATTER

B61C7/04(2006.01)i

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)

B61C7/04

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2014

Kokai Jitsuyo Shinan Koho 1971-2014 Toroku Jitsuyo Shinan Koho 1994-2014

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.
A	GB 2495180 A (VOITH PATENT GMBH), 03 April 2013 (03.04.2013), entire text; all drawings & DE 102011114354 B	1-5
A	JP 2011-240747 A (Toshiba Corp.), 01 December 2011 (01.12.2011), entire text; all drawings (Family: none)	1-5
A	WO 2008/031752 A1 (BOMBARDIER TRANSPORTATION GMBH), 20 March 2008 (20.03.2008), entire text; all drawings & EP 2061688 A1 & DE 102006044224 A1 & AT 479589 T	1-5

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

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Date of the actual completion of the international search
18 June, 2014 (18.06.14)Date of mailing of the international search report
01 July, 2014 (01.07.14)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/060179

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2006-193154 A (Hitachi, Ltd.), 27 July 2006 (27.07.2006), entire text; all drawings (Family: none)	1-5

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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