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(54) OPERATING MODE CONTROL SYSTEM AND METHOD FOR CONTAINER TRACK POWER FLATCAR

(57) An operating mode control system and method for a powered rail flatcar for containers. The operating mode control system (7) comprises an operating mode switching module (71) provided in an in-vehicle control system (1) of the powered rail flatcar for containers. The operating mode switching module (71) is used for issuing a corresponding operating instruction to the powered rail flatcar for containers according to an operating mode instruction issued by a container automatic control system, to control the powered rail flatcar for containers to switch among a single flatcar operating mode, a coupled operating mode, and a train operating mode. The operating mode control system and method can implement the switching of the powered rail flatcar for containers among a single flatcar operating mode, a coupled operating mode and a train operating mode, is simple to switch, and can be controlled full-automatically, so that the manpower is reduced and the efficiency is improved. The various operating modes fit various demands in the container transportation process, different operating modes are controlled by different control methods, and each powered rail flatcar for containers or coupled flatcar group is taken as a control object, so that the control mode is flexible.

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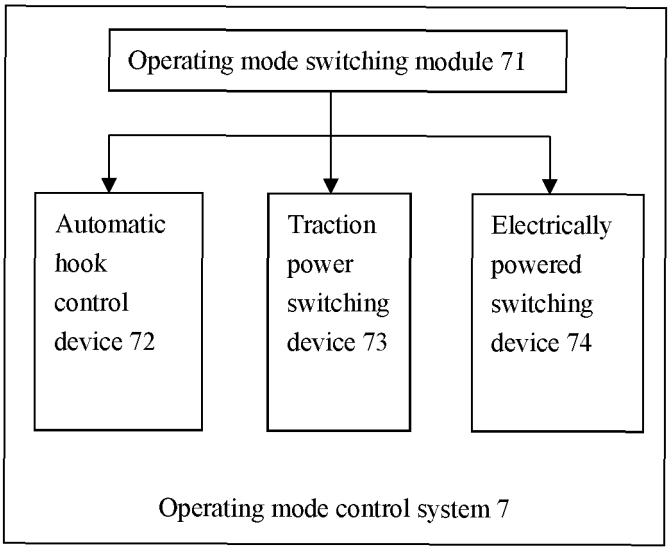
Operating mode switching module 71
Automatic hook control device 72
Traction power switching device 73
Electrically powered switching device 74
Operating mode control system 7

FIG.2

Description

Technical Field

[0001] The invention relates to the field of transport by containers, in particular to an operating mode control system and method for a powered rail flatcar for containers.

Background Art

[0002] Transport by containers can reduce damage to and loss of goods and ensure transportation quality. The goods are loaded into a standard container in a production factory, and the goods can be directly transported to a user through road, railway and water transportation without opening the container. Therefore, the damage to and loss of goods during transportation can be reduced, and the packaging cost can be saved. Container multimodel transportation has the advantages of long industrial chain, high efficiency, rapidness, intensive economy, safety, reliability and the like, and is an important direction for the development of transportation of goods.

[0003] Transport by containers can realize automatic loading and unloading operation and management, which has been realized in port container management system at present. Railway container management and loading and unloading automatic control is still under development in China. Automatic control of railway loading vehicles is required in the automation of loading and unloading operations.

[0004] The existing operating mode of railway loading vehicles is primarily a train operating mode, namely a powered locomotive is coupled up to an unpowered walking mechanism to form a train for operation. Because the whole train is only powered by the locomotive, only the locomotive can be used as a control object of the in-vehicle automatic control system. Other unpowered compartments are respectively distinguished only by the flatcar numbers as identifiers, and can only be operated and controlled by being coupled up to the locomotive. This type of operation is advantageous in the case of passenger trains or long-distance trucks, but as a container loading and uploading station with a complicated working mode, unpowered vehicles require a large number of disorganizing and grouping operations because of different destination information of containers loaded thereon. All the operations need to be completed through hump sliding and shunting operations, a large-area field is needed, and the improvement of the operation efficiency is limited. Both railway loading vehicles and single flatcar operating modes are adopted, the operating destination of the vehicles is clear, but each flatcar is independently controlled, and the transportation efficiency is low.

[0005] It is therefore necessary to achieve railway loading vehicles operating in a variety of operating modes to accommodate a variety of requirements during tansport by containers.

Summary of the Invention

[0006] The invention aims to provide an operating mode control system and method for a powered rail flatcar for containers, and aims to solve the problems that an existing railway loading vehicle is single in operating mode and cannot meet various requirements for transport by containers.

[0007] The invention is implemented as follows:

In one aspect, the invention provides an operating mode control system for a powered rail flatcar for containers, which comprises an operating mode switching module provided in an in-vehicle control system of the powered rail flatcar for containers. The operating mode switching module is used for issuing a corresponding operating instruction to the powered rail flatcar for containers according to an operating mode instruction issued by a container automatic control system, to control the powered rail flatcar for containers to switch among a single flatcar operating mode, a coupled operating mode, and a train operating mode.

[0008] Further, the operating mode switching module also comprises an automatic coupler control device in communication connection with the operating mode switching module, the automatic coupler control device is used for controlling the coupler of the powered rail flatcar for containers to be automatically coupled or uncoupled with the coupler of the adjacent flatcar according to an instruction issued by the operating mode switching module, and when an instruction of executing a single flatcar operating mode is issued, the coupler of the powered rail flatcar for containers is controlled to be automatically uncoupled with the coupler of the adjacent flatcar; and when an instruction of executing a coupled operating mode or a train operating mode is issued, the coupler of the powered rail flatcar for containers is controlled to be automatically coupled with the coupler of the adjacent flatcar.

[0009] Further, the operating mode control system also comprises a traction power switching device in communication connection with the operating mode switching module, the traction power switching device is used for switching a power source of the powered rail flatcar for containers according to an instruction issued by the operating mode switching module, and when an instruction of executing a single flatcar operating mode or coupled operating mode is issued, the powered rail flatcar for containers is controlled to be driven by a power and traction system of the flatcar; and when an instruction of executing a single flatcar owhen an instruction of executing a train operating mode is issued, the powered rail flatcar for containers is controlled to exit from being driven by the power tractionainers is controlled to store energy itself.

[0010] Further, the controlling the powered rail flatcar for containers to be driven by a power and traction system of the flatcar particularly comprises controlling a power module of the power and traction system of the powered

rail flatcar for containers to be connected with a walking mechanism, and the controlling the powered rail flatcar for containers to exit from being driven by the power and traction system of the flatcar particularly comprises controlling a power module of the power and traction system of the powered rail flatcar for containers to be separated from the walking mechanism.

[0011] Further, the operating mode control system further comprises an electrically powered switching device in communication connection with the operating mode switching module, the electrically powered switching device is used for switching the energy storage form of the powered rail flatcar for containers according to an instruction issued by the operating mode switching module, and when an instruction of executing a single flatcar operating mode or coupled operating mode is issued, the power module of the power and traction system of the powered rail flatcar for containers is controlled to store energy itself; and controlling the power module of the power and traction system of the powered rail flatcar for containers to be charged by the locomotive through a power cable.

[0012] On the other hand, the invention also provides a method for controlling operating modes of powered rail flatcar for containers, which comprises the following steps:

receiving, by the in-vehicle control system of the powered rail flatcar for containers, an instruction of executing a single flatcar operating mode, a coupled operating mode or a train operating mode of the powered rail flatcar for containers issued by the container automatic control system, and issuing, by the operating mode switching module, a corresponding operating instruction to the powered rail flatcar for containers according to the instruction of executing the operating mode control the powered rail flatcar for containers to operate in the single flatcar operating mode, coupled operating mode or train operating mode.

[0013] Further, when a single flatcar operating mode of the powered rail flatcar for containers is received by the in-vehicle control system, the method comprises the following steps:

issuing, by the operating mode switching module, an instruction corresponding to a single flatcar operating mode to an automatic coupler control device, a traction power switching device and an electrically powered switching device of the powered rail flatcar for containers according to an instruction of executing the single flatcar operating mode of the powered rail flatcar for containers; controlling, by the automatic coupler control device, the coupler of the flatcar to be automatically uncoupled from couplers of other flatcars; and controlling, by the traction power switching device, the powered rail flatcar for containers to be driven by flatcar power and traction system; controlling, by the electrically powered switching device, the power module of the power and traction system of the powered rail flatcar for containers to store energy itself; and controlling by the in-vehicle control system, the powered rail flatcar for containers to travel to a destination according to a transportation starting point, an operation destination and an operation permission instruction of the container.

[0014] Further, when an instruction of executing a coupled operating mode of a powered rail flatcar for containers is received by the in-vehicle control system, the method comprises the following steps: controlling, by the operating mode switching module, the powered rail flatcar for containers to reach a designated coupled position according to an instruction of executing a coupled operating mode and a coupled master-slave relationship instruction of the powered rail flatcar for containers, and sending an instruction corresponding to a coupled operating mode to an automatic coupler control device, a traction power switching device and an electrically powered switching device of the powered rail flatcar for containers; and controlling, by the automatic coupler device, the coupler of the flatcar to be automatically connected with a coupler of an adjacent flatcar; controlling, by the traction power switching device, the powered rail flatcar for containers to be driven by the flatcar power and traction system; and controlling, by the electrically powered switching device, the power module of the power and traction system of the powered rail flatcar for containers to store energy itself; controlling, by an in-vehicle control system of the master control flatcar, the power and traction system and the brake system of the slave control flatcar; and controlling, by the in-vehicle control system of the master control flatcar, the powered rail flatcar group for containers to travel to a destination according to a transportation starting point, an operation destination and an operation permission instruction of the container.

[0015] Further, when a train operating mode instruction for a powered rail flatcar for containers is received by the in-vehicle control system, the method comprises the following steps:

controlling, by the operating mode switching module, the powered rail flatcar for containers to reach a designated connection position according to an instruction of executing a train operating mode of the powered rail flatcar for containers; issuing an instruction corresponding to a train operating mode to automatic coupler control device, a traction power switching device and an electrically powered switching device of the powered rail flatcar for containers; controlling, by the automatic coupler control device, the coupler of the flatcar to be automatically connected with couplers of adjacent flatcars; connecting groups by a plurality of powered rail flatcar for containers, and coupling up a locomotive to form a train; controlling, by the traction power switching device, the power and traction system of the powered rail flatcar for containers to exit from being driven; and controlling, by the electrically powered switching device, the power module of the power and traction system of the powered rail flatcar for containers to be charged by the locomotive through the power cable; and pulling, by the locomotive, the powered rail flatcar group for containers to travel to a destination according to a transportation starting point, an operation

destination and an operation permission instruction of the container.

[0016] Furthermore, when a plurality of powered rail flatcar for containers are connected through couplers, the brake system, the power cable and the in-vehicle internet of each flatcar of the coupled flatcar group are automatically connected, the in-vehicle control system of each flatcar is connected through the in-vehicle internet, and the brake system of the slave control flatcar is controlled by the in-vehicle control system of the master control flatcar.

[0017] Compared with the prior art, the invention has the following beneficial effects:

the operating mode control system and method for a powered rail flatcar for containers provided by the present invention can implement the switching of the powered rail flatcar for containers among a single flatcar operating mode, a coupled operating mode and a train operating mode, is simple to switch, and can be controlled full-automatically, so that the manpower is reduced and the efficiency is improved. The various operating modes meet various demands in the container transportation process, which is convenient for disorganizing and grouping the containers and improving the transportation efficiency; different operating modes are controlled by different control methods, and each powered rail flatcar for containers or coupled flatcar group is taken as a control object, so that the control mode is flexible, which is a suitable container operating mode, and can greatly improve the efficiency of exchanging the goods in the container during the coupled transportation.

Brief Description of the Drawings

[0018]

FIG. 1 is an overall structural block diagram of a powered rail flatcar for containers according to an embodiment of the present invention;

FIG. 2 is a block diagram of an operating mode control system for powered rail flatcar for containers according to an embodiment of the present invention.

Detailed Description of the Invention

[0019] The technical solutions in the embodiments of the present invention will be clearly and completely described below with reference to the drawings in the embodiments of the present invention, and it is obvious that the described embodiments are only a part of but not all of the embodiments of the present invention. Based on the embodiments of the present invention, all other embodiments obtained by a person skilled in the art without involving any inventive effort are within the scope of the present invention.

[0020] As shown in FIG. 1, the embodiment of the invention provides an operating mode control system for a powered rail flatcar for containers, wherein the powered rail flatcar for containers comprises a frame structure, a walking mechanism is provided at the bottom of the frame structure, and automatic couplers are provided at two ends of the frame structure and used for being automatically coupled with or uncoupled from couplers of other flatcars. The powered rail flatcar for containers further comprises an in-vehicle control system 1, a power and traction system 2, a brake system 3, a positioning system 4 and a loading state detection system 5 which are provided on the frame structure, wherein the in-vehicle control system 1 is in communication connection with the power and traction system 2, the brake system 3, the positioning system 4 and the loading state detection system 5 through an in-vehicle bus for acquiring the state information of each system in communication connection therewith, and issuing operating instructions to each system according to an operation plan issued by the container automatic control system. The power and traction system 2 comprises a power module for supplying power to the walking mechanism, the power module and the walking mechanism can be coupled or uncoupled, the power mode of the power module is an internal combustion power mode, a storage battery mode or a super capacitor mode, and energy can be stored by the power module or charged by a locomotive through a power cable. The brake system 3 comprises a brake and a brake control device, wherein the brake is controlled by the brake control device to operate according to instructions of the in-vehicle control system 1. The positioning system 4 is used for positioning the powered rail flatcar for containers and comprises an autonomous positioning module and a relative positioning module. The loading state detection system 5 comprises a container loading state detection module and a container number identification module, wherein the container loading state detection module is used for detecting the loading state of the powered rail flatcar for containers and comprises the number and the loading position of the containers loaded on the powered rail flatcar for containers, and the container number identification module is used for identifying the numbers of the containers loaded on the powered rail flatcar for containers. The powered rail flatcar for containers further comprises a communication system 6, wherein the communication system comprises an in-vehicle wireless communication device used for communicating transmission of control data and state information between the powered rail flatcar for containers and the container automatic control system, a vehicle-to-vehicle wireless communication device used for exchanging close-range control information between the two flatcars during coupling or uncoupling between the powered rail flatcars for containers, and in-vehicle internet used for communication between the powered rail flatcars for containers.

[0021] The operating mode control system 7 for powered rail flatcar for containers provided by the embodiment of the invention is used for controlling the operating mode of the powered rail flatcar for containers, and com-

prises an operating mode switching module 71 provided in an in-vehicle control system 1 of the powered rail flatcar for containers, wherein the operating mode switching module 71 is used for issuing a corresponding operating instruction to the powered rail flatcar for containers according to the operating mode instruction issued by the container automatic control system to control the powered rail flatcar for containers to switch among a single flatcar operating mode, a coupled operating mode and a train operating mode.

[0022] Specifically, the operating mode switching module further comprises automatic coupler control device 72 in communication connection with the operating mode switching module 71, the automatic coupler control device 72 is used for controlling the coupler of the powered rail flatcar for containers to be automatically coupled or uncoupled with the coupler of the adjacent flatcar according to an instruction issued by the operating mode switching module, and when an instruction of executing a single flatcar operating mode is issued, the coupler of the powered rail flatcar for containers is controlled to be automatically uncoupled with the coupler of the adjacent flatcar; and when an instruction of executing a coupled operating mode or a train operating mode is issued, the coupler of the powered rail flatcar for containers is controlled to be automatically coupled with the coupler of the adjacent flatcar.. The powered rail flatcar for containers can be controlled to be coupled or uncoupled by the automatic coupler control device 72 according to different operating mode instructions.

[0023] The operating mode control system 7 further comprises a traction power switching device 73 in communication connection with the operating mode switching module 71, the traction power switching device 73 is used for switching a power source of the powered rail flatcar for containers according to an instruction issued by the operating mode switching module 71, and when an instruction of executing a single flatcar operating mode or coupled operating mode is issued, the powered rail flatcar for containers is controlled to be driven by a power and traction system of the flatcar; the controlling the powered rail flatcar for containers to be driven by a power and traction system of the flatcar particularly comprises controlling a power module of the power and traction system of the powered rail flatcar for containers to be connected with a walking mechanism, the device is used for controlling the power and traction system of the flatcar to exit from being driven and pulled by a locomotive when an instruction of executing a train operating mode is issued and the controlling the powered rail flatcar for containers to exit from being driven by the power and traction system of the flatcar particularly comprises controlling the power module of the power and traction system of the powered rail flatcar for containers to be separated from the walking mechanism. The traction power switching device can control the powered rail flatcar for containers to be driven by different powers according to different operating mode instructions. Further, the operating mode control system 7 further comprises an electrically powered switching device 74 in communication connection with the operating mode switching module 71, the electrically powered switching device 74 is used for switching the energy storage form of the powered rail flatcar for containers according to an instruction issued by the operating mode switching module, and when an instruction of executing a single flatcar operating mode or coupled operating mode is issued, the power module of the power and traction system of the powered rail flatcar for containers is controlled to store energy itself; and controlling the power module of the power and traction system of the powered rail flatcar for containers to be charged by the locomotive through a power cable. The traction power switching device can control the powered rail flatcar for containers to store energy itself in different ways according to different operating mode instructions.

[0024] The embodiment of the invention also provides an operating mode control method for the powered rail flatcar for containers, which comprises the following steps:

an instruction of executing a single flatcar operating mode, a coupled operating mode or a train operating mode of the powered rail flatcar for containers issued by the container automatic control system are received by the in-vehicle control system of the powered rail flatcar for containers, and a corresponding operating instruction is issued by the operating mode switching module to the powered rail flatcar for containers according to the instruction of executing the operating mode control the powered rail flatcar for containers to operate in the single flatcar operating mode, coupled operating mode or train operating mode.

[0025] Specifically, when an instruction of executing a single flatcar operating mode of the powered rail flatcar for containers is received by an in-vehicle control system, the method comprises the following steps:

an instruction corresponding to a single flatcar operating mode is issued by the operating mode switching module to an automatic coupler control device, a traction power switching device and an electrically powered switching device of the powered rail flatcar for containers according to an instruction of executing the single flatcar operating mode of the powered rail flatcar for containers; the coupler of the flatcar is controlled by the automatic coupler control device to be automatically uncoupled from couplers of other flatcars; the powered rail flatcar for containers being controlled by the traction power switching device to be driven by the flatcar power and traction system particularly comprises controlling a power module of the power and traction system to be connected with the walking mechanism, and the power module of the power and traction system of the powered rail flatcar for containers is controlled by the electrically powered switching device to store energy itself; the power and traction system, the brake system and the positioning system are controlled by the in-vehicle control system according to the transportation starting point, the operating destina-

tion and the operating permission instruction of the container, to implement advancing, retreating, accelerating, decelerating, reversing, parking and the like of the powered rail flatcar for containers, the powered rail flatcar for containers is controlled to reach a designated position, and continuously report the execution progress and position to the container automatic control system through the communication system.

[0026] In the single flatcar operating mode, the powered rail flatcar for containers operates as an independent transportation unit and and a self-contained in-vehicle control system, a power and traction system, a brake system, a positioning system and a communication system are adopted for operation; a single flatcar is controlled by the railway container automatic control system as an independent unit to operate under a single flatcar operating mode. A single flatcar operation by the control system is identified when the number of the first flatcar is the same as the number of the last flatcar.

[0027] Further, when an instruction of executing a coupled operating mode of a powered rail flatcar for containers is received by the in-vehicle control system, the method comprises the following steps: the powered rail flatcar for containers is controlled by the operating mode switching module to reach a designated coupled position according to an instruction of executing a coupled operating mode and a coupled master-slave relationship instruction of the powered rail flatcar for containers, and an instruction corresponding to a coupled operating mode is sent to an automatic coupler control device, a traction power switching device and an electrically powered switching device of the powered rail flatcar for containers; and the coupler of the flatcar is controlled by the automatic coupler device to be automatically connected with a coupler of an adjacent flatcar, meanwhile, the power cable and the in-vehicle internet of each flatcar of the coupled flatcar group are automatically connected, the in-vehicle control system of each flatcar is connected through the in-vehicle internet; the powered rail flatcar for containers being controlled by the traction power switching device to be driven by the flatcar power and traction system particularly comprises controlling a power module of the power and traction system to be connected with the walking mechanism, and the power module of the power and traction system of the powered rail flatcar for containers is controlled by the electrically powered switching device to store energy itself. The powered rail flatcar group for containers is controlled by the in-vehicle control system of the master control flatcar to travel to a destination according to a transportation starting point, an operation destination and an operation permission instruction of the container, and instructions of operating direction, operating speed, acceleration, deceleration, braking and the like are issued to the power and traction system, the brake system and the positioning system of the master control flatcar through an in-vehicle bus of the master control flatcar according to a transportation starting point, an operation destination and an operation permission instruction of a container. Meanwhile, synchronous operating instructions such as operating direction, operating speed, acceleration, deceleration, braking and the like are issued to all in-vehicle control systems of slave control flatcars of the flatcar group through in-vehicle internet; and the power and traction system and the brake system are adjusted by a slave control flatcar according to the instruction of the master control flatcar so as to synchronously operate with the flatcar group until the slave control flatcar parks at a designated position, and the master control flatcar and the slave control flatcar continuously report the execution progress and position to the container automatic control system through the communication system in the operation process.

[0028] When in a coupled operating mode, the first flatcar in the operation direction of the coupled flatcar group is automatically regarded as a master control flatcar, other flatcars are automatically defined as slave control flatcars controlled by the master control flatcar in operation; when the flatcar group reverses operation, the last flatcar automatically turns into the master control flatcar from the slave control flatcar, and the original first flatcar turns into the last flatcar, then it is automatically regarded as a slave control flatcar; the coupled flatcar group is controlled by the automatic control system for railway containers to operate as an integral unit. A coupled operation by the control system is identified when the number of the first flatcar is the same as the number of the last flatcar of the flatcar group.

[0029] Further, when a train operating mode instruction for a powered rail flatcar for containers is received by the in-vehicle control system, the method comprises the following steps:

The powered rail flatcar for containers is controlled by the operating mode switching module to reach a designated position according to an instruction of executing the train operating mode of the powered rail flatcar for containers; an instruction corresponding to a train operating mode is issued to an automatic coupler control device, a traction power switching device and an electrically powered switching device of the powered rail flatcar for containers; the coupler of the flatcar is controlled by the automatic coupler control device to be automatically connected with couplers of adjacent flatcars, a plurality of powered rail flatcar for containers are connected to the group, and are coupled up to a locomotive to form a train. Meanwhile, the brake system, the power cable and the in-vehicle internet of each flatcar are automatically connected, and the in-vehicle control system of each flatcar is connected through the in-vehicle internet; the power and traction system of the powered rail flatcar for containers is controlled by the traction power switching device to exit from being driven, which specifically comprises controlling a power module of the power and traction system to be uncoupled from the walking mechanism, and the power module of the power and traction system of the powered rail flatcar for containers is controlled by

the electrically powered switching device to be charged by the locomotive through a power cable. The brake system of the slave control flatcar is controlled by the locomotive which pulls the powered rail flatcar group for containers to travel to a destination according to a transportation starting point, an operation destination and an operation permission instruction of the container, and continuously reports the execution progress and position to the container automatic control system through the communication system in the operating process of the locomotive.

[0030] The first flatcar in the operating direction of the train is a locomotive, which is automatically regarded as a main control flatcar after being connected; the first powered rail flatcar for containers and other powered rail flatcar for containers are automatically defined as slave control flatcars which are controlled by a locomotive of the master control flatcar in operation; when the train reverses operation, the locomotive is still the main control flatcar; the train is controlled by the automatic control system for railway containers to operate as an integral unit. The number of the locomotive, the number of the first flatcar and the number of the last flatcar together are identified as operation of the train by the control system.

[0031] While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by a person skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

Claims

1. An operating mode control system for powered rail flatcar for containers, **characterized by** comprising an operating mode switching module provided in an in-vehicle control system of the powered rail flatcar for containers, wherein the operating mode switching module is used for issuing a corresponding operating instruction to the powered rail flatcar for containers according to an operating mode instruction issued by a container automatic control system, to control the powered rail flatcar for containers to switch among a single flatcar operating mode, a coupled operating mode, and a train operating mode.

2. The operating mode control system for powered rail flatcar for containers of claim 1, **characterized in that**: the operating mode switching module further comprises an automatic coupler control device in communication connection with the operating mode switching module, the automatic coupler control device is used for controlling the coupler of the powered rail flatcar for containers to be automatically coupled or uncoupled with the coupler of the adjacent flatcar according to an instruction issued by the operating mode switching module, and when an instruction of executing a single flatcar operating mode is issued, the coupler of the powered rail flatcar for containers is controlled to be automatically uncoupled with the coupler of the adjacent flatcar; and when an instruction of executing a coupled operating mode or a train operating mode is issued, the coupler of the powered rail flatcar for containers is controlled to be automatically coupled with the coupler of the adjacent flatcar..

3. The operating mode control system for powered rail flatcar for containers of claim 1, **characterized in that**: the operating mode control system further comprises a traction power switching device in communication connection with the operating mode switching module, the traction power switching device is used for switching a power source of the powered rail flatcar for containers according to an instruction issued by the operating mode switching module, and when an instruction of executing a single flatcar operating mode or coupled operating mode is issued, the powered rail flatcar for containers is controlled to be driven by a power and traction system of the flatcar; and when an instruction of executing a train operating mode is issued, the powered rail flatcar for containers is controlled to exit from being driven by the power and traction system of the flatcar and pulled by a locomotive.

4. The operating mode control system for powered rail flatcar for containers of claim 3, **characterized in that** the controlling the powered rail flatcar for containers to be driven by a power and traction system of the flatcar particularly comprises controlling a power module of the power and traction system of the powered rail flatcar for containers to be connected with a walking mechanism, and the controlling the powered rail flatcar for containers to exit from being driven by the power and traction system of the flatcar particularly comprises controlling a power module of the power and traction system of the powered rail flatcar for containers to be separated from the walking mechanism.

5. The operating mode control system for powered rail flatcar for containers of claim 1, **characterized in that**: the operating mode control system further comprises an electrically powered switching device in communication connection with the operating mode switching module, the electrically powered switching device is used for switching the energy storage form of the powered rail flatcar for containers according to an instruction issued by the operating mode switching module, and when an instruction of executing a single flatcar operating mode or coupled operating mode is issued, the power module of the power and traction system of the powered rail flatcar for containers is controlled to store energy itself; and

controlling the power module of the power and traction system of the powered rail flatcar for containers to be charged by the locomotive through a power cable.

6. A control method for operating modes of powered rail flatcar for containers, **characterized by** comprising the following steps:
receiving, by the in-vehicle control system of the powered rail flatcar for containers, an instruction of executing a single flatcar operating mode, a coupled operating mode or a train operating mode of the powered rail flatcar for containers issued by the container automatic control system, and issuing, by the operating mode switching module, a corresponding operating instruction to the powered rail flatcar for containers according to the instruction of executing the operating mode control the powered rail flatcar for containers to operate in the single flatcar operating mode, coupled operating mode or train operating mode.

7. The control method for the operating modes of the powered rail flatcar for containers of claim 6, **characterized in that** when a single flatcar operating mode of the powered rail flatcar for containers is received by the in-vehicle control system, the method comprises the following steps:

issuing, by the operating mode switching module, an instruction corresponding to a single flatcar operating mode to an automatic coupler control device, a traction power switching device and an electrically powered switching device of the powered rail flatcar for containers according to an instruction of executing the single flatcar operating mode of the powered rail flatcar for containers;
controlling, by the automatic coupler control device, the coupler of the flatcar to be automatically uncoupled from couplers of other flatcars; and controlling, by the traction power switching device,
the powered rail flatcar for containers to be driven by flatcar power and traction system;
controlling, by the electrically powered switching device, the power module of the power and traction system of the powered rail flatcar for containers to store energy itself; and controlling by the in-vehicle control system, the powered rail flatcar for containers to travel to a destination according to a transportation starting point, an operation destination and an operation permission instruction of the container.

8. The control method for the operating modes of the powered rail flatcar for containers of claim 6, **characterized in that** when an instruction of executing a coupled operating mode of a powered rail flatcar for containers is received by the in-vehicle control system, the method comprises the following steps:
controlling, by the operating mode switching module, the powered rail flatcar for containers to reach a designated coupled position according to an instruction of executing a coupled operating mode and a coupled master-slave relationship instruction of the powered rail flatcar for containers, and sending an instruction corresponding to a coupled operating mode to an automatic coupler control device, a traction power switching device and an electrically powered switching device of the powered rail flatcar for containers; and controlling, by the automatic coupler device, the coupler of the flatcar to be automatically connected with a coupler of an adjacent flatcar; controlling, by the traction power switching device, the powered rail flatcar for containers to be driven by the flatcar power and traction system; and controlling, by the electrically powered switching device, the power module of the power and traction system of the powered rail flatcar for containers to store energy itself; controlling, by an in-vehicle control system of the master control flatcar, the power and traction system and the brake system of the slave control flatcar; and controlling, by the in-vehicle control system of the master control flatcar, the powered rail flatcar group for containers to travel to a destination according to a transportation starting point, an operation destination and an operation permission instruction of the container.

9. The control method for the operating modes of the powered rail flatcar for containers of claim 6, **characterized in that** when a train operating mode instruction for a powered rail flatcar for containers is received by the in-vehicle control system, the method comprises the following steps: controlling, by the operating mode switching module, the powered rail flatcar for containers to reach a designated connection position according to an instruction of executing the train operating mode of the powered rail flatcar for containers; issuing an instruction corresponding to a train operating mode to automatic coupler control device, a traction power switching device and an electrically powered switching device of the powered rail flatcar for containers; controlling, by the automatic coupler control device, the coupler of the flatcar to be automatically connected with couplers of adjacent flatcars; connecting groups by a plurality of powered rail flatcar for containers, and coupling up a locomotive to form a train; controlling, by the traction power switching device, the power and traction system of the powered rail flatcar for containers to exit from being driven; and controlling, by the electrically powered switching device, the power module of the power and traction system of the powered rail flatcar for containers to be charged by the locomotive

through the power cable; and pulling, by the locomotive, the powered rail flatcar group for containers to travel to a destination according to a transportation starting point, an operation destination and an operation permission instruction of the container.

10. The control method for the operating modes of the powered rail flatcar for containers of claim 8 or 9, **characterized in that**: when a plurality of powered rail flatcar for containers are connected through couplers, the brake system, the power cable and the in-vehicle internet of each flatcar of the coupled flatcar group are automatically connected, the in-vehicle control system of each flatcar is connected through the in-vehicle internet, and the brake system of the slave control flatcar is controlled by the in-vehicle control system of the master control flatcar.

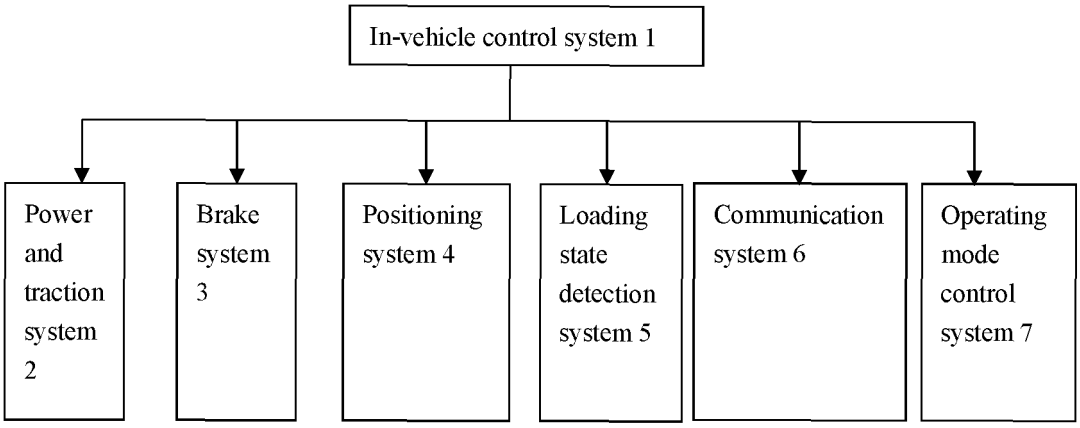
In-vehicle control system 1
Power and traction system 2
Brake system 3
Positioning system 4
Loading state detection system 5
Communication system 6
Operating mode control system 7

FIG.1

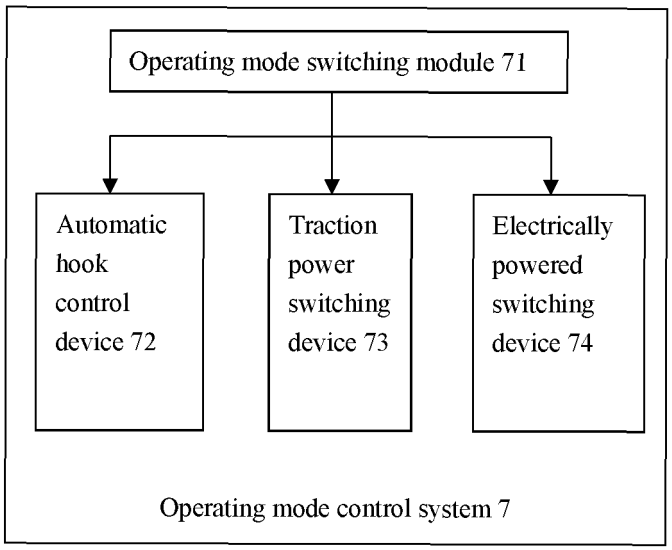
Operating mode switching module 71
Automatic hook control device 72
Traction power switching device 73
Electrically powered switching device 74
Operating mode control system 7

FIG.2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2019/071955

A. CLASSIFICATION OF SUBJECT MATTER

B61C 17/00(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)

B61C

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

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

CNABS, CNKI, VEN: 集装箱, 平车, 运行, 操作, 模块, 模式, container, flatcar, operat+, modular, module, mode

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 105398458 A (ZHUZHOU CSR TIMES ELECTRIC CO., LTD.) 16 March 2016 (2016-03-16) description, paragraphs [0006]-[0013] and [0023]-[0035] and figures 1-5	1-10
A	CN 106379339 A (ZHUZHOU CRRC TIMES ELECTRIC CO., LTD.) 08 February 2017 (2017-02-08) entire document	1-10
A	US 9045148 B2 (ELECTRO MOTIVE DIESEL INC.) 02 June 2015 (2015-06-02) entire document	1-10
A	CN 103158722 A (CSR NANJING PUZHEN CO., LTD.) 19 June 2013 (2013-06-19) entire document	1-10
A	US 7302895 B2 (GENERAL ELECTRIC COMPANY) 04 December 2007 (2007-12-04) entire document	1-10
A	EP 2708405 A3 (BOMBARDIER TRANSP GMBH) 10 May 2017 (2017-05-10) entire document	1-10

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

* Special categories of cited documents:

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"E" earlier application or patent but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 February 2019	**21 March 2019**
Name and mailing address of the ISA/CN **State Intellectual Property Office of the P. R. China (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088** **China** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2019/071955

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 105398458 A	16 March 2016	CN 105398458 B	15 December 2017
CN 106379339 A	08 February 2017	CN 106379339 B	11 December 2018
US 9045148 B2	02 June 2015	US 2015088344 A1	26 March 2015
CN 103158722 A	19 June 2013	CN 103158722 B	18 November 2015
US 7302895 B2	04 December 2007	US 2005120904 A1	09 June 2005
EP 2708405 A3	10 May 2017	DE 102012216464 A1	20 March 2014
		EP 2708405 A2	19 March 2014

Form PCT/ISA/210 (patent family annex) (January 2015)