

TRAIN END CHANGING METHOD AND SYSTEM, AND TRAIN

Field of the Invention

The present invention relates to the field of rail transit, in particular to a train end changing method and system, and a train.

Background of the Invention

A rail transit train generally has front and rear driver cabs, and a driver can drive the train at either end. When the driver cab needs to be switched, an activation key of the driver cab at an occupied end (the end operated by the driver) needs to be taken off, and then the key is inserted again in the driver cab at the other end to activate the corresponding driver cab, and the train can be driven normally after being reoccupied, so that the operation is relatively cumbersome, and the cost of the key switch is also relatively high.

As shown in FIG. 1, the activation of the driver cab of the rail transit train is controlled by the key of the driver cab. For a fixedly marshaled train (such as a subway train), the activation of the two driver cabs is interlocked through a train line (hard line), and when the driver key is inserted at one end, even if the key is inserted in the driver cab at the other end, the driver cab at the other end cannot be activated by means of the train line. In FIG. 1, if the key is inserted in the driver cab 1, S1 is closed, a relay K1 is energized through the normally closed contact of K2, and the normally open contact K1-1 of K1 is closed, so that the relay K1 is self-locked and is continuously energized, and the power supply is transmitted to the driver cab 2 at the other end through the train line by means of the contact K1-2 of the driver cab 1 (after K1 is energized, the pair of contacts is closed), so as to supply power to K4. After K4 is powered on, the rightmost normally closed contact K4 is disconnected. At this time, even if the key of the driver cab is inserted in the driver cab 2 (S2 is closed), the relay K3 cannot be energized, thus realizing the hard line interlocking of the activation control of the driver cabs.

For a reconnected and marshaled train (such as a locomotive), the hard line interlocking between the two driver cabs is not realized (no train line), the activation signals of the driver cabs are acquired by a IO module of a train control network system, and the key state is sent to reconnection data. When a train control unit (CCU) detects that more than one driver cab is activated, the train judges an occupancy conflict of the driver cabs through the reconnection data, and reports a fault.

From the above analysis, it can be seen that the current rail transit vehicles basically need to activate the driver cabs through the keys. If the driver cab needs to be switched, the key of the activated driver cab needs to be taken off at first, and then the key is inserted in the driver cab at the other end. In this way, the operation is relatively cumbersome, a relatively expensive key switch of the driver cab also needs to be configured, and even multiple relays and train lines (such as the fixedly marshaled train in FIG. 1) are required.

Summary of the Invention

The technical problem to be solved by the present invention is to provide a train end changing method and system, and a train in view of the shortcomings of the prior art, so as to automatically identify and activate corresponding driver cabs, simplify the end changing operation and reduce the cost.

In order to solve the above-mentioned technical problems, the technical solution adopted by the present invention is: a train end changing method. The main implementation process of the method is as follows:

- 1) mounting an activation switch in each of two driver cabs of a train; and
- 2) in the case that one driver cab of the train has been activated, if it is detected that the activation switch in the other driver cab is turned on for a period of time T_1 , and that a driver controller handle is at a zero position, and that the train is in a rest state, then resetting an activation signal of the driver cab at an occupied end, and activating the other driver cab.

After step 1), the following operations are further executed: when the driver controller handle is at the zero position and the train is in the rest state, and if it is detected that the activation switch in a driver cab is turned on for a period of time T_1 , then activating the driver cab and locking the driver cab.

After step 1), the following operations are further executed: when the driver controller handle is at the zero position, the train is in the rest state, and the on-time of the switch of the driver cab at the occupied end exceeds T_2 , then resetting the activation signal of the driver cab at the occupied end.

In the present invention, $T_1 \neq T_2$, $T_1 = 2s$; and $T_2 = 5s$. Setting $T_1 = 2s$ is to prevent accidental touch of the switch or interference signals, so it is considered that if the signal lasts for 2s, it is an effective signal. Setting $T_2 = 5s$ is to distinguish a reset signal from the activation signal by the duration of the time.

The activation switch is electrically connected to a train control network system, and the train control network system is used for detecting whether the activation switch is turned on and controlling the on-off of the activation switch of the corresponding driver cab.

Correspondingly, the present invention further provides a train end changing system, including:

two activation switches, respectively installed in two driver cabs of a train; and a switching unit, configured to reset an activation signal of the driver cab at an occupied end and activate the other driver cab if it is detected that the activation switch in the other driver cab is turned on for a period of time T1, and that a driver controller handle is at a zero position, and that the train is in a rest state, in the case that one driver cab of the train has been activated.

The system of the present invention further includes: a driver cab activation control unit, configured to activate a driver cab and lock the driver cab when the driver controller handle is at the zero position, the train is in the rest state, and it is detected that the activation switch in the driver cab is turned on for a period of time T1; and a driver cab activation resetting control unit, configured to reset the activation signal of the driver cab at the occupied end when the driver controller handle is at the zero position, the train is in the rest state, and the on-time of the switch of the driver cab at the occupied end exceeds T2.

As an inventive concept, the present invention further provides a train using the above-mentioned train end changing system, including a train control network system, and the activation switches in the two driver cabs are both connected to the train control network system.

Compared with the prior art, the present invention has the following beneficial effects:

1. By using the method and system of the present invention, it is not necessary to first disable the activated driver cab at one end, instead, an activation button at the other end can be directly pressed, and the corresponding driver cab can be automatically identified and activated, thereby simplifying the end changing procedure, and making the operation more convenient and flexible; and
2. The key switch of the driver cab, the train line and the relay in the traditional design are canceled and replaced with cheaper activation switches, thereby greatly reducing the cost.

Brief Description of the Drawings

FIG. 1 is a schematic diagram of activation control of driver cabs of a fixedly marshaled train;

FIG. 2 is a flow chart of end changing control of driver cabs of the present invention;

FIG. 3 is a flow chart of activation control of the driver cabs of the present invention; and

FIG. 4 is a flow chart of control process for resetting the activation signal of the driver cabs of the present invention.

Detailed Description of Embodiments

The train of the present invention does not need to be provided with a driver cab occupancy key switch, instead, a more economical and practical self-reset button (an activation switch) is used. The signal of an activation button of a driver cab is acquired by a train control network system (TCMS), and when it is acquired that the button at an end is pressed, it is judged that the driver cab at this end is activated, and the driver cab is locked as an occupied end. When end changing is required, a driver can directly go to the driver cab at the other end and press the activation button of the driver cab (under the premise that the other end changing conditions are met), and at this time, the TCMS acquires the activation signal, it will automatically disable the previously occupied driver cab and activate the current driver cab to realize the end changing of the train; and when the driver cab of the train does not need to be occupied, the activation button of the driver cab at the occupied end can be pressed for a long time (for 5s) to disable the occupancy of the current driver cab. This method not only simplifies the operation of the driver, but also reduces the design cost.

In the present invention, the existing key switch of the driver cab is replaced with a self-reset button, the signal of the activation button of the driver cab is acquired by an IO module of the TCMS (train lines and related relays are canceled), and the specific control method is as follows:

under the condition that ① a driver controller handle is at a zero position, and ② the train is in a rest state:

when it is detected that the activation button of the driver cab is pressed (for 2s), activating and locking the current driver cab; and

in the case that one driver cab of the train has been activated, if it is detected that the

activation button of the driver cab at the other end is pressed (for 2s), and the conditions ① and ② are simultaneously met, resetting an activation signal of the current activated driver cab, and activating the driver cab at the other end; and if the button of the driver cab at the activated end is continuously pressed for more than 5s, then resetting the activation signal of the current driver cab. The control flows are as shown in FIG. 2, FIG. 3 and FIG. 4.

As shown in FIG. 2, the end changing control method of the present invention includes the following steps:

- 1) judging whether the driver controller handle is at the zero position and whether the train is in the rest state, if so, proceeding to step 2); otherwise, prohibiting end changing, and proceeding to step 3);
- 2) judging whether the activation button (the self-reset button) of the driver cab at the inactive end (i.e., the non-occupied end) is pressed for more than 2s, if so, resetting the driver cab at the occupied end (i.e., the currently activated driver cab), and activating the driver cab at the other end, and proceeding to step 3); otherwise, prohibiting end changing, and proceeding to step 3); and
- 3) ending.

As shown in FIG. 3, the activation control process of the driver cabs includes the following steps:

- 1) judging whether the driver controller handle is at the zero position and whether the train is in the rest state, if so, proceeding to step 2); otherwise, prohibiting the current driver cab from being activated, and proceeding to step 3); and
- 2) judging whether the activation button of the driver cab is pressed for more than 2s, if so, activating the current driver cab, and proceeding to step 3); otherwise, prohibiting the current driver cab from being activated, and proceeding to step 3).

As shown in FIG. 4, the control process for resetting the activation signal of the driver cabs includes the following steps:

- 1) judging whether the driver controller handle is at the zero position and whether the train is in the rest state, if so, proceeding to step 2); otherwise, prohibiting the current driver cab from being activated, and proceeding to step 3);
- 2) judging whether the activation button of the activated driver cab (i.e., the driver cab at the occupied end) is pressed for more than 5s, if so, resetting the driver cab at the occupied end (i.e., becoming a inactive state), and proceeding to step 3); otherwise,

setting the driver cab at the occupied end in an active state, and proceeding to step 3);
and

3) ending.

The present invention has good applicability to rail transit vehicles. The rail transit vehicle generally has two driver cabs and needs to switch the operating end frequently. The train control unit judges whether to activate/reset the driver cab and whether end changing is required according to the signal of the activation button of the driver cab, the rest state of the train, the position of the driver controller handle and other information. The key switch of the driver cab in the traditional design is canceled and is replaced with the cheaper self-reset button. When the driver cab is switched, it is not necessary to first disable the activation of the driver cab at one end, instead, the activation button at the other end can be directly pressed, and therefore, the operation is more convenient and flexible.

Claims

1. A train end changing method, characterized in that the main implementation process of the method is as follows:

1) mounting an activation switch in each of two driver cabs of a train; and
2) in the case that one driver cab of the train has been activated, if it is detected that the activation switch in the other driver cab is turned on for a period of time T1, and that a driver controller handle is at a zero position, and that the train is in a rest state, then resetting an activation signal of the driver cab at an occupied end, and activating the other driver cab.

2. The train end changing method according to claim 1, wherein after step 1), the following operations are further executed: when the driver controller handle is at the zero position and the train is in the rest state, and if it is detected that the activation switch in a driver cab is turned on for a period of time T1, then activating the driver cab and locking the driver cab.

3. The train end changing method according to claim 1, wherein after step 1), the following operations are further executed: when the driver controller handle is at the zero position, the train is in the rest state, and the on-time of the switch of the driver cab at the occupied end exceeds T2, then resetting the activation signal of the driver cab at the occupied end.

4. The train end changing method according to claim 3, wherein $T1 \neq T2$.

5. The train end changing method according to claim 1, wherein the activation switch is electrically connected to a train control network system.

6. A train end changing system, characterized in that the train end changing system comprises:

two activation switches, respectively installed in two driver cabs of a train; and
a switching unit, configured to reset an activation signal of the driver cab at an occupied end and activate the other driver cab if it is detected that the activation switch in the other driver cab is turned on for a period of time T1, and that a driver controller handle is at a zero position, and that the train is in a rest state, in the case that one driver cab of the train has been activated.

7. The train end changing system according to claim 6, further comprising:
a driver cab activation control unit, configured to activate a driver cab and lock the driver cab when the driver controller handle is at the zero position and the train is in the

rest state, and it is detected that the activation switch in the driver cab is turned on for a period of time T1.

8. The train end changing system according to claim 6, further comprising:

a driver cab activation resetting control unit, configured to reset the activation signal of the driver cab at the occupied end when the driver controller handle is at the zero position, the train is in the rest state, and the on-time of the switch of the driver cab at the occupied end exceeds T2.

9. The train end changing system according to any one of claims 6-8, whether the activation switch is turned on is detected by a train control network system of the train.

10. A train using the train end changing system according to any one of claims 6-9, comprising a train control network system, characterized in that the activation switches in the two driver cabs are both connected to the train control network system.