

FIRE-FIGHTING DEVICE AND FIRE-FIGHTING METHOD FOR RAIL TRAIN AND ELECTRICAL CABINET

[0001] The application claims the priorities to Chinese patent application No.
5 201811481529.4 titled "FIRE-FIGHTING DEVICE AND FIRE-FIGHTING METHOD FOR
RAIL TRAIN AND ELECTRICAL CABINET", filed with the China National Intellectual
Property Administration on December 05, 2018, and Chinese patent application No.
201822045246.7, titled "FIRE-FIGHTING DEVICE AND FIRE-FIGHTING METHOD FOR
10 RAIL TRAIN AND ELECTRICAL CABINET", filed with the China National Intellectual
Property Administration on December 05, 2018, both of which are incorporated herein by
reference in their entireties.

FIELD

[0002] The present application relates to the technical field of rail transport, and in particular
15 to a fire-fighting device and a fire-fighting method of a rail train and an electrical cabinet.

BACKGROUND

[0003] As an important part of a rail train, an electrical cabinet has complex and important
internal devices and a small space. Once the fire breaks out, if it is not put out in time, the
20 consequence will be unimaginable. In the conventional technology, only a smoke and
temperature combination detector is arranged in the electrical cabinet. When the smoke and
temperature combination detector detects a fire, it will alarm; when the staff hears the alarm and
confirms that there is a fire, the staff needs to take out the fire extinguisher and extinguish the
fire in the electrical cabinet. However, in the conventional technology, it is not easy to
25 extinguish the fire quickly, and the life and property of the passenger cannot be ensured.

[0004] In summary, how to effectively increase the fire extinguishing speed is an urgent
problem to be solved by those skilled in the art at present.

SUMMARY

[0005] In view of this, a first object of the present application is to provide a fire-fighting device of an electrical cabinet, the structural design of the fire-fighting device of the electrical cabinet can effectively improve the fire extinguishing speed, and a second object of the present application is to provide a fire-fighting method using the above fire-fighting device of the electrical cabinet and a rail train including the above fire-fighting device of the electrical cabinet.

[0006] In order to achieve the above first object, the following technical solutions are provided according to the present application.

[0007] A fire-fighting device of an electrical cabinet is provided, which includes:

an electrical cabinet body and a smoke and temperature combination detector provided in the electrical cabinet body;

a nozzle provided in the electrical cabinet body; and

an agent tank in communication with the nozzle through a pipeline for storing an agent configured to extinguish fire after being sprayed.

[0008] Preferably, the above fire-fighting device of the electrical cabinet further includes a flame detector provided in the electrical cabinet body, and the smoke and temperature combination detector and the flame detector are both provided at a top of the electrical cabinet body.

[0009] Preferably, in the above fire-fighting device of the electrical cabinet, a first column of nozzles and a second column of nozzles are provided in the electrical cabinet body, and the first column of the nozzles and the second column of the nozzles each include multiple nozzles arranged from top to bottom.

[0010] Preferably, in the above fire-fighting device of the electrical cabinet, an uppermost side nozzle of the first column of the nozzles and an uppermost side nozzle of the second column of the nozzles are located at the top of the electrical cabinet body; and

remaining nozzles of the first column of the nozzles and remaining nozzles of the second

column of the nozzles are arranged alternately with each other and are respectively provided on opposite sidewalls of the electrical cabinet body.

[0011] Preferably, the above fire-fighting device of the electrical cabinet further includes a controller and an alarm, and a signal output end of the smoke and temperature combination
5 detector and a signal output end of the flame detector are both communicatively connected to a signal input end of the controller, and a signal output end of the controller is communicatively connected to a signal input end of the alarm; and

the controller is configured to control the nozzle to spray the agent and control the alarm to start in a case that smoke concentration detected by the smoke and temperature combination
10 detector reaches a first set value, internal temperature of the electrical cabinet body reaches a second set value, and a flame state detected by the flame detector reaches a set state.

[0012] Preferably, in the above fire-fighting device of the electrical cabinet, the controller is configured to control the alarm to start in a case that smoke concentration detected by the smoke and temperature combination detector reaches the first set value, the internal temperature
15 of the electrical cabinet body reaches the second set value, and the flame state detected by the flame detector reaches the set state.

[0013] Preferably, in the above fire-fighting device of the electrical cabinet, the controller is further communicatively connected to a main controller of a rail train, and the controller is configured to send the smoke concentration detected by the smoke and temperature
20 combination detector, the internal temperature of the electrical cabinet body and the flame state detected by the flame detector to the main controller of the rail train.

[0014] A fire-fighting method using a fire-fighting device for an electrical cabinet according to any one of the above is provided, which includes a step of:

determining whether the smoke concentration detected by the smoke and temperature
25 combination detector reaches the first set value, the internal temperature of the electrical cabinet body reaches the second set value, and the flame state detected by the flame detector reaches the set state, and if so, the nozzle is controlled to spray the agent.

[0015] Preferably, the above fire-fighting method for the electrical cabinet further includes a

step of:

sending the smoke concentration detected by the smoke and temperature combination detector, the internal temperature of the electrical cabinet body, and the flame state detected by the flame detector to the main controller of the rail train.

5 [0016] A rail train is provided, which includes a fire-fighting device for an electrical cabinet according to any one of the above.

[0017] The fire-fighting device of the electrical cabinet according to the present application includes the electrical cabinet body, the smoke and temperature combination detector, the nozzle and the agent tank. The electrical cabinet body is the cabinet for placing electrical
10 elements. The smoke and temperature combination detector is provided in the electrical cabinet body, and the smoke and temperature combination detector is configured to detect the smoke concentration and temperature in the electrical cabinet body. The nozzle is also provided in the electrical cabinet body, and the agent tank is in communication to the nozzle through a pipeline. The agent tank is configured to store the agent that can extinguish fire after being sprayed, that
15 is, the agent that can extinguish fire after being sprayed can be stored in the agent tank.

[0018] When the fire-fighting device of the electrical cabinet according to the above embodiment is used, in a case that the smoke concentration in the electrical cabinet body detected by the smoke and temperature combination detector reaches the first set value, and the temperature in the electrical cabinet body reaches the second set value, it is indicated that a fire
20 has broken out in an interior of the electrical cabinet body. At this time, it only needs to start the nozzle, and the fire can be put out by spraying the agent in the agent tank into the inside of the electrical cabinet body through the nozzle. It can be seen from the above that when the fire-fighting device of the electric cabinet according to the above embodiment is applied to the fire extinguishing, it is only necessary to start the nozzle, the fire-extinguishing agent can be
25 quickly sprayed into the inside of the electrical cabinet body, which can effectively increase the fire extinguishing speed.

[0019] In order to achieve the above second object, a rail train is further provided according to the present application, which includes the fire-fighting device of the electrical cabinet

according to any one of the above. Since the above fire-fighting device of the electrical cabinet has the above technical effects, the rail train having the fire-fighting device of the electrical cabinet should also have corresponding technical effects.

5 **BRIEF DESCRIPTION OF THE DRAWINGS**

[0020] For clearer illustration of the technical solutions according to embodiments of the present application or conventional techniques, hereinafter are briefly described the drawings to be applied in embodiments of the present application or conventional techniques. Apparently, the drawings in the following descriptions are only some embodiments of the present application, and other drawings may be obtained by those skilled in the art based on the provided drawings without creative efforts.

[0021] Figure 1 is a schematic view showing the structure of a fire-fighting device of an electrical cabinet according to an embodiment of the present application; and

[0022] Figure 2 is a front view of the fire-fighting device of the electrical cabinet according to the embodiment of the present application.

[0023] Reference numerals in Figures 1 to 2.

- | | | | |
|---|---|---|-----------------|
| 1 | electrical cabinet body, | 2 | flame detector, |
| 3 | smoke and temperature combination detector, | 4 | nozzle, |
| 5 | agent tank. | | |

20 **DETAILED DESCRIPTION**

[0024] A first object of the present application is to provide a fire-fighting device of an electrical cabinet. The structural design of the fire-fighting device of the electrical cabinet can effectively improve the fire extinguishing speed. A second object of the present application is to provide a fire-fighting method using the fire-fighting device of the electrical cabinet and a rail train including the fire-fighting device of the electrical cabinet.

[0025] The technical solutions according to embodiments of the present application are described clearly and completely hereinafter in conjunction with the drawings in the embodiments of the present application. Apparently, the described embodiments are only a part of the embodiments of the present application, rather than all embodiments. Based on the
5 embodiments in the present application, all of other embodiments, made by the person skilled in the art without any creative efforts, fall into the scope of the present application.

[0026] In the description of the present application, it should be understood that the orientation or positional relationship of the terms "upper", "lower", "front", "back", "left", and "right" is based on the drawings, which is merely for the convenience of the description of the
10 present application and the simplification of the description, and is not intended to indicate or imply that the position or element referred to must have a specific orientation and must be constructed and operated in a specific orientation, and thus it cannot be understood as a limitation of the present application. Moreover, the terms "first" and "second" are only used for descriptive purposes and are not to be understood as indicating or implying relative importance.

[0027] Referring to Figures 1 to 2, the fire-fighting device of the electrical cabinet according to the present application includes an electrical cabinet body 1, a smoke and temperature combination detector 3, a nozzle 4 and an agent tank 5. The electrical cabinet body 1 is a cabinet for placing electrical elements. The smoke and temperature combination detector 3 is provided in the electrical cabinet body 1, and the smoke and temperature combination detector
15 3 is configured to detect the smoke concentration and temperature in the electrical cabinet body 1. The nozzle 4 is also provided in the electrical cabinet body 1, and the agent tank 5 and the nozzle 4 are in communication through a pipeline. The agent tank 5 is configured to store an agent that can extinguish fire after being sprayed, that is, the agent that can extinguish fire after being sprayed can be stored in the agent tank 5.
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[0028] When the fire-fighting device of the electrical cabinet according to the embodiment is applied, in a case that the smoke concentration inside the electrical cabinet body 1 detected by the smoke and temperature combination detector 3 reaches a first set value, and the temperature in the electrical cabinet body 1 reaches a second set value, it is indicated that a fire has broken out in the electrical cabinet body 1. At this time, only the nozzle 4 needs to be activated, and the
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fire can be put out during the agent in the agent tank 5 being sprayed into an interior of the electrical cabinet body 1 through the nozzle 4. It can be seen from the above that when the fire-fighting device of the electric cabinet according to the above embodiment is used for fire extinguishing, only the nozzle 4 needs to be activated, thus the agent can be quickly sprayed into the interior of the electrical cabinet body 1, which can effectively increase the fire extinguishing speed.

[0029] The above agent may be a perfluoroethyl isopropyl ketone fire extinguishing agent, water, a dry powder extinguishing agent, and a carbon dioxide extinguishing agent, which is not limited herein.

[0030] The above fire-fighting device of the electrical cabinet may further include a pressure tank for pressurizing the agent tank 5 to spray the agent in the agent tank 5 from the nozzle 4 by a high pressure. When fire extinguishing is required, the pressure tank can be directly started to generate a high pressure in the agent tank 5, thereby the agent is sprayed from the nozzle 4.

[0031] In order to further determine whether a fire has broken out or not, the above fire-fighting device of the electrical cabinet further includes a flame detector 2 provided in the electrical cabinet body 1, and the flame detector 2 can detect the flame state in the electrical cabinet body 1.

[0032] Preferably, the smoke and temperature combination detector 3 and the flame detector 2 are both provided at the top of the electrical cabinet body 1. Since the flame and the smoke move toward the top of the electrical cabinet body 1 when a fire is broken out, the smoke and temperature combination detector 3 and the flame detector 2 can be provided on the top of the electrical cabinet body 1, which can more quickly detect whether or not the fire has broken out.

[0033] Of course, the smoke and temperature combination detector 3 and the flame detector 2 can also be provided on an inner side wall or a bottom wall of the electrical cabinet body 1, which is not limited herein.

[0034] In order to facilitate quick fire extinguishing, multiple nozzles 4 may be provided, and the multiple nozzles 4 can quickly fill the interior of the electrical cabinet body 1 with the agent.

[0035] Further, a first column of nozzles and a second column of nozzles are provided in the electrical cabinet body 1, and the first column of the nozzles and the second column of the nozzles each include multiple nozzles 4 arranged from top to bottom. In this way, the two columns of the nozzles 4 simultaneously spray the agent, which can quickly fill the interior of the electrical cabinet body 1 with the agent.

[0036] Further, the uppermost side nozzle 4 of the first column of the nozzles and the uppermost side nozzle 4 of the second column of the nozzles are located at the top of the electrical cabinet body 1. The remaining nozzles of the first column of the nozzles and the remaining nozzles of the second column of the nozzles are arranged alternately with each other and are respectively provided on opposite sidewalls of the electrical cabinet body 1, which facilitates more evenly filling the interior of the electrical cabinet body 1 with the agent.

[0037] Preferably, the first column of the nozzles includes two nozzles 4, one of which is provided on the top of the electrical cabinet body 1 and the other of which is provided on the side wall of the electrical cabinet body 1. The second column of the nozzles includes three nozzles 4, one of which is provided on the top of the cabinet body 1 and the other two of which are provided on the side wall of the cabinet body 1.

[0038] In the above embodiment, a total of five nozzles 4 are provided. The agent of 1.5kg can be sprayed out within 10 seconds, the agent can be dispersed into the whole space within 3 seconds, and the fire can be put out in 4 to 6 seconds through the five nozzles.

[0039] Of course, the multiple nozzles 4 can also be arranged in other forms, which is not limited herein.

[0040] In order to further improve the fire extinguishing speed, the above fire-fighting device of the electrical cabinet further includes a controller and an alarm. A signal output end of the smoke and temperature combination detector 3 and a signal output end of the flame detector 2 are both communicated to a signal input end of the controller, and a signal output end of the controller is communicated to a signal input end of the alarm.

[0041] The controller is configured to control the nozzle 4 to spray the agent and control the alarm to start in a case that the smoke concentration detected by the smoke and temperature

combination detector 3 reaches a first set value, the internal temperature of the electrical cabinet body 1 detected by the smoke and temperature combination detector 3 reaches a second set value, and a flame state detected by the flame detector 2 reaches a set state. That is, when the smoke concentration in the electrical cabinet body 1 reaches the first set value, the temperature reaches the second set value, and the flame state reaches the set state, it is indicated that the fire has broken out, the controller controls the nozzles 4 to spray the agent for automatic fire extinguishing, at the same time, the controller controls the alarm to start to notify the staff for subsequent processing. In this embodiment, when the fire breaks out, an automatic fire extinguishing can be achieved without the requirement for the staff to activate the nozzle 4, thereby ensuring the fire to be put out timely and guaranteeing the life and the property of the passenger.

[0042] In addition, the controller is configured to control the alarm to start in a case that smoke concentration detected by the smoke and temperature combination detector 3 reaches the first set value, the internal temperature of the electrical cabinet body 1 reaches the second set value, and the flame state detected by the flame detector 2 reaches the set state. When any one or any two of the three situations that the smoke concentration inside the electrical cabinet body 1 reaches the first set value, the temperature reaches the second set value, and the flame state reaches the set state occur, it is uncertain whether or not the fire has broken out. At this time, it is only required that the controller controls the alarm to start, and the staff can detect whether a fire has broken out.

[0043] The above alarm may be a buzzer, which is not specifically limited herein.

[0044] In order to achieve the real-time detection, the controller is further communicated to a main controller of a rail train, and the controller is configured to send the smoke concentration detected by the smoke and temperature combination detector 3, the internal temperature of the electrical cabinet body 1 and the flame state detected by the flame detector 2 to the main controller of the rail train. The main controller of the rail train displays the above smoke concentration information, temperature information and flame state information to the driver or the staff, the driver or the staff determines whether a fire has broken out according to the smoke concentration detected by the smoke and temperature composite detector 3, the internal

temperature of the electrical cabinet body 1 and the flame state detected by the flame detector 2, and if the fire breaks out, the fire-fighting device starts.

[0045] Specifically, a start button may be provided, and when the start button is pressed, the nozzle 4 starts to spray the agent.

5 [0046] A fire-fighting method using the above fire-fighting device of the electrical cabinet is provided according to the present application, which includes a step of:

determining whether the smoke concentration detected by the smoke and temperature combination detector 3 reaches the first set value, the internal temperature of the electrical cabinet body 1 reaches the second set value, and the flame state detected by the flame detector 2 reaches the set state, and if so, the nozzle 4 is controlled to spray the agent.

10 [0047] That is, when the smoke concentration in the electrical cabinet body 1 reaches the first set value, the temperature reaches the second set value, and the flame state reaches the set state, it is indicated that the fire breaks out, the controller controls the nozzle 4 to spray the agent for automatic fire extinguishing, at the same time, the controller controls the alarm to start to notify the staff for subsequent processing.

15 [0048] In addition, the above fire-fighting method for the electrical cabinet further includes a step of:

sending the smoke concentration detected by the smoke and temperature combination detector 3, the internal temperature of the electrical cabinet body 1, and the flame state detected by the flame detector 2 to the main controller of the rail train. The main controller of the rail train displays the above smoke concentration information, temperature information and flame state information to the driver or the staff, the driver or the staff determines whether a fire has broken out according to the smoke concentration detected by the smoke and temperature composite detector 3, the internal temperature of the electrical cabinet body 1 and the flame state detected by the flame detector 2, and if the fire breaks out, the fire-fighting device starts.

25 [0049] According to the fire-fighting device of the electrical cabinet in the above embodiments, a rail train is further provided according to the present application, which includes the fire-fighting device of the electrical cabinet according to any one of the above

embodiments. Since the rail train is embodied with the fire-fighting device of the electrical cabinet in the above embodiments, the beneficial effects of the rail train refer to the above embodiments.

[0050] The above embodiments are described in a progressive manner. Each of the
5 embodiments is mainly focused on describing its differences from other embodiments, and references may be made among these embodiments with respect to the same or similar sections among these embodiments.

[0051] Based on the above description of the disclosed embodiments, the person skilled in the art can carry out or use the present application. It is obvious for the person skilled in the art to
10 make many modifications to these embodiments. The general principle defined herein may be applied to other embodiments without departing from the spirit or scope of the present application. Therefore, the present application is not limited to the embodiments illustrated herein, but should be defined by the broadest scope consistent with the principle and novel features disclosed herein.

CLAIMS

1. A fire-fighting device of an electrical cabinet, comprising:

an electrical cabinet body (1) and a smoke and temperature combination detector (3) provided in the electrical cabinet body (1);

a nozzle (4) provided in the electrical cabinet body (1); and

an agent tank (5) in communication with the nozzle (4) through a pipeline for storing an agent configured to extinguish fire after being sprayed,

wherein the fire-fighting device of an electrical cabinet further comprises a flame detector (2) provided in the electrical cabinet body (1), wherein the smoke and temperature combination detector (3) and the flame detector (2) are both provided at a top of the electrical cabinet body (1),

wherein the fire-fighting device of an electrical cabinet further comprises a controller and an alarm, wherein a signal output end of the smoke and temperature combination detector (3) and a signal output end of the flame detector (2) are both communicated to a signal input end of the controller, and a signal output end of the controller is communicated to a signal input end of the alarm; and

the controller is configured to control the nozzle (4) to spray the agent and control the alarm to start in a case that smoke concentration detected by the smoke and temperature combination detector (3) reaches a first set value, internal temperature of the electrical cabinet body (1) reaches a second set value, and a flame state detected by the flame detector (2) reaches a set state.

2. The fire-fighting device of the electrical cabinet according to claim 1, wherein a first column of nozzles and a second column of nozzles are provided in the electrical cabinet body (1), and the first column of nozzles and the second column of nozzles each comprise a plurality of nozzles (4) arranged from top to bottom.

3. The fire-fighting device of the electrical cabinet according to claim 2, wherein

an uppermost side nozzle (4) of the first column of the nozzles and an uppermost side nozzle (4) of the second column of the nozzles are located at the top of the electrical cabinet body (1); and

remaining nozzles of the first column of the nozzles and remaining nozzles of the second column of the nozzles are arranged alternately with each other and are respectively provided on opposite sidewalls of the electrical cabinet body (1).

4. The fire-fighting device of the electrical cabinet according to claim 1, wherein the controller is configured to control the alarm to start in a case that smoke concentration detected by the smoke and temperature combination detector (3) reaches the first set value, the internal temperature of the electrical cabinet body (1) reaches the second set value, or the flame state detected by the flame detector (2) reaches the set state.

5. The fire-fighting device of the electrical cabinet according to claim 1, wherein the controller is further communicated to a main controller of a rail train, and the controller is configured to send the smoke concentration detected by the smoke and temperature combination detector (3), the internal temperature of the electrical cabinet body (1) and the flame state detected by the flame detector (2) to the main controller of the rail train.

6. A fire-fighting method in application with a fire-fighting device for an electrical cabinet according to any one of claims 1 to 5, comprising a step of:

determining whether the smoke concentration detected by the smoke and temperature combination detector (3) reaches the first set value, the internal temperature of the electrical cabinet body (1) reaches the second set value, and the flame state detected by the flame detector (2) reaches the set state, and if the smoke concentration detected by the smoke and temperature combination detector (3) reaches the first set value, the internal temperature of the electrical cabinet body (1) reaches the second set value, and the flame state detected by the flame detector (2)

reaches the set state, the nozzle (4) is controlled to spray the agent.

7. The fire-fighting method for the electrical cabinet according to claim 6, further comprising a step of:

sending the smoke concentration detected by the smoke and temperature combination detector (3), the internal temperature of the electrical cabinet body (1), and the flame state detected by the flame detector (2) to the main controller of the rail train.

8. A rail train, comprising a fire-fighting device for an electrical cabinet according to any one of claims 1 to 5.