An Intelligent Fire-Fighting and Rescue System for a Building

Technical Field

The present invention relates to the technical field of fire protection for buildings, and in particular to an intelligent fire-fighting and rescue system for a building.

Background Art

With the development of cities, the land available in cities is decreasing day by day. High-rise buildings can effectively save land area, but at the same time the population density in high-rise buildings is relatively high. The consequences after a fire occurs are very serious. A fire belongs to a type of major environmental safety accident, and has extremely great destructive power with respect to the safety of life and property of people.

Chinese invention patent document No. CN115845288B discloses an intelligent fire extinguishing apparatus and method for a building. When a fire occurs in a building, an open-flame sensor and a smoke sensor both transmit signals to a background control terminal. When a water delivery system is damaged, a turnover motor is started. The turnover motor drives a blocking plate to rotate through a turnover shaft, so that the blocking plate is gradually separated from a fire extinguishing powder storage pipe. Fire extinguishing powder inside the fire extinguishing powder storage pipe is gradually scattered into a space below. While the fire extinguishing powder is scattered, a compression spring rod is quickly reset so as to drive an ejection block to be quickly ejected. The impact carried by the ejection block accelerates scattering of the fire extinguishing powder, thereby improving the scattering effect of the fire extinguishing powder and improving the technical effect of emergency protection.

Although the above intelligent fire extinguishing apparatus and method for a building can solve corresponding technical problems, it can only perform a fire extinguishing operation. When a dangerous situation is serious, trapped persons in the building can only wait for a fire engine to perform rescue, thereby causing the best rescue opportunity to be missed. In addition, fire-fighting and rescue for high-rise buildings mostly relies on fire ladders and aerial ladder trucks. Due to structural limitations, fire-fighting and rescue are difficult to carry out for higher buildings which are difficult for fire ladders and aerial ladder trucks to reach. Therefore, an intelligent fire-fighting and rescue system for a building is proposed.

Summary of the Invention

The technical task of the present invention is to provide, in view of the above deficiencies, an intelligent fire-fighting and rescue system for a building. Through cooperation of a rescue mechanism, a fire extinguishing system, a water storage tank, a guide rail mechanism, a central control system and a backup power supply system, rapid rescue and fire extinguishing are achieved and an optimal escape route is provided, so as to solve the above problems.

To achieve the above objective, the present invention provides the following technical solution:

An intelligent fire-fighting and rescue system for a building comprises:

a rescue mechanism, configured to carry out a rescue operation for persons trapped by fire in the building, wherein the rescue mechanism is fixedly arranged on a roof of the building;

a fire extinguishing system, configured to carry out a fire extinguishing operation on a fire source in the building, wherein the fire extinguishing system is movably arranged on the roof of the building, and at least two of the rescue mechanism and the fire extinguishing system are provided on the roof of the building;

a water storage tank, configured to store a fire extinguishing liquid for the fire extinguishing system, wherein the water storage tank is fixedly connected to the roof of the building;

a guide rail mechanism, configured to limit the fire extinguishing system so as to prevent the fire extinguishing system from rolling over, wherein the guide rail mechanism is arranged between the roof of the building and the fire extinguishing system;

a central control system, configured to adjust an operating state or parameter of the rescue mechanism and the fire extinguishing system and configured to be connected to a fire alarm system of the building, wherein the central control system is mounted on the roof of the building, and the rescue mechanism and the fire extinguishing system are both controlled by the central control system;

a backup power supply system, configured to supply power to the rescue mechanism, the fire extinguishing system and the central control system, wherein the backup power supply system is mounted on the roof of the building.

Further, the rescue mechanism comprises a rescue cabin, a first lifting mechanism and a first guiding mechanism. The rescue cabin is arranged below the first lifting mechanism. The first lifting mechanism is configured to drive the rescue cabin to move up and down. The first guiding mechanism is arranged between the first lifting

mechanism and the ground, and the first guiding mechanism is configured to guide movement of the rescue cabin.

The first lifting mechanism comprises a fixed platform arranged on the roof of the building. A first winch is mounted on a top of the fixed platform. A first wire rope is wound on the first winch, and a free end of the first wire rope passes through to a position below the fixed platform and is fixedly connected to the rescue cabin.

The first guiding mechanism comprises first flexible cables movably connected at four corners of the rescue cabin. A top end of each first flexible cable is fixedly connected to a bracket. The bracket is mounted on the top of the fixed platform, and a bottom end of each first flexible cable is fixedly connected to a fastener embedded in the ground.

The fire extinguishing system comprises a fire extinguishing cabin, a second lifting mechanism and a second guiding mechanism. The fire extinguishing cabin is arranged below the second lifting mechanism. The second lifting mechanism is configured to drive the fire extinguishing cabin to move up and down. The second guiding mechanism is arranged between the second lifting mechanism and the ground, and the second guiding mechanism is configured to guide movement of the fire extinguishing cabin. Stabilising mechanisms configured to cut door and window glass are mounted at both an upper side and a lower side of an inner cavity of the fire extinguishing cabin.

The second lifting mechanism comprises a first automated guided vehicle movably arranged on the guide rail mechanism. A hydraulic lifting arm is mounted on a top of the first automated guided vehicle. A second winch is mounted on a top of the hydraulic lifting arm. A second wire rope is wound on the second winch. A free end of the second wire rope passes through to a position below the hydraulic lifting arm and is fixedly connected to the fire extinguishing cabin. A high-pressure water pump is mounted on the first automated guided vehicle. A water inlet end of the high-pressure water pump is in communication with an inner cavity of the water storage tank through a water pipe. A fire monitor is mounted in an inner cavity of the fire extinguishing cabin. A water outlet end of the high-pressure water pump is in communication with the fire monitor through a hose.

The second guiding mechanism comprises a third winch mounted on the top of the first automated guided vehicle. A second flexible cable is wound on the third winch. A bottom end of the second flexible cable movably passes through to a position below the fire extinguishing cabin and is provided with a second automated guided vehicle. A steel plate embedded in the ground is provided below the second automated guided vehicle.

The second automated guided vehicle comprises a vehicle body suspended from a free end of the second flexible cable. A support block is fixedly connected to a bottom of the vehicle body. A plurality of first magnetic attraction devices cooperating with the steel plate are mounted on a bottom of the support block.

Further, four support rods distributed in a rectangular array are mounted at a bottom of the fixed platform, and a height of the support rods is adapted to a height of the rescue cabin.

Further, a first guide roller configured to guide the first wire rope is mounted on the fixed platform.

Further, a roller configured to guide the hose is mounted on the hydraulic lifting arm, and a second guide roller configured to guide the second wire rope and the third winch is further mounted on the hydraulic lifting arm.

Further, guide steel tubes are mounted in both the fire extinguishing cabin and the rescue cabin, and the second flexible cable and the first flexible cable respectively movably pass through inner cavities of corresponding guide steel tubes.

Further, track bearings are mounted at both a top and a bottom of the inner cavity of each guide steel tube, and the first flexible cable and the second flexible cable are respectively slidingly connected to inner walls of corresponding track bearings.

Further, brake devices are provided on both the first flexible cable and the second flexible cable. A top of the rescue cabin is fixedly connected to the corresponding brake device, and a top of the fire extinguishing cabin is fixedly connected to the corresponding brake device.

Further, the guide rail mechanism comprises a reinforcing beam fixedly connected to the roof of the building. Reinforcing columns are integrally formed on two sides of the reinforcing beam. The water storage tank is fixedly connected to one of the reinforcing columns. T-shaped rail beams are integrally formed on a top of the reinforcing beam and on another of the reinforcing columns. Moving wheels of the first automated guided vehicle are arranged on corresponding T-shaped rail beams, and a guide wheel cooperating with the T-shaped rail beam is mounted at a bottom of the first automated guided vehicle.

Further, the first winch, the stabilising mechanism, the first automated guided vehicle, the hydraulic lifting arm, the second winch, the high-pressure water pump, the fire monitor, the third winch, the vehicle body and the first magnetic attraction device are respectively electrically connected to the central control system. The first winch, the stabilising mechanism, the first automated guided vehicle, the hydraulic lifting arm, the second winch, the high-pressure water pump, the fire monitor, the third winch, the vehicle body, the first magnetic attraction device and the central

control system are respectively electrically connected to the backup power supply system.

Compared with the prior art, the advantages and positive effects of the present invention are as follows:

1. In the present invention, the rescue mechanism is additionally provided on the roof of the building. When a fire occurs, the rescue cabin suspended at a fixed position on the roof of the building is lowered by the first lifting mechanism to a rescue-cabin landing door at the fire source in the building, so that trapped persons in the building can be evacuated and rescued through the rescue cabin, thereby achieving the purpose of rescuing persons.

2. In the present invention, the fire extinguishing system and the water storage tank are additionally provided on the roof of the building. When a fire occurs, through cooperation of the second lifting mechanism and the second guiding mechanism, the fire extinguishing cabin suspended on the roof of the building is lowered to a height position of the fire source in the building, a window is broken by the stabilising mechanism, and the fire source is extinguished by the fire monitor. Meanwhile, through cooperation of the first automated guided vehicle, the second automated guided vehicle and the guide rail mechanism, the fire extinguishing cabin can be driven to move horizontally on an outer wall of the building, thereby increasing the fire extinguishing range and achieving the purpose of extinguishing the fire source.

3. In the present invention, the central control system and the backup power supply system are additionally provided on the roof of the building. When a fire occurs, the central control system calculates a three-dimensional map according to a fire alarm signal of an ignition point, generates an optimal escape route to the rescue cabin, and sends the route to trapped persons in the building through mobile phone information. At the same time, the rescue mechanism and the fire extinguishing system are started for rapid rescue and fire extinguishing, so as to achieve the effects of saving physical strength of firefighters and improving fire-fighting and rescue efficiency.

Brief Description of the Drawings

In order to more clearly describe the embodiments of the present invention or the technical solutions in the prior art, the drawings required for use in the embodiments are briefly introduced below. It is apparent that the drawings described below are merely some embodiments of the present invention. For a person of ordinary skill in the art, other drawings can also be obtained on the basis of these drawings without creative effort.

Fig. 1 is a structural schematic diagram of an intelligent fire-fighting and rescue system for a building according to an embodiment of the present invention;

Fig. 2 is a structural schematic diagram of a rescue mechanism and a side surface of a building of the intelligent fire-fighting and rescue system for a building according to an embodiment of the present invention;

Fig. 3 is a structural schematic diagram of the rescue mechanism of the intelligent fire-fighting and rescue system for a building according to an embodiment of the present invention;

Fig. 4 is a structural schematic diagram of a fire extinguishing system and a side surface of a building of the intelligent fire-fighting and rescue system for a building according to an embodiment of the present invention;

Fig. 5 is a first structural schematic diagram of the fire extinguishing system in a standby state of the intelligent fire-fighting and rescue system for a building according to an embodiment of the present invention;

Fig. 6 is a first structural schematic diagram of the fire extinguishing system in a use state of the intelligent fire-fighting and rescue system for a building according to an embodiment of the present invention;

Fig. 7 is a first structural schematic diagram of a second automated guided vehicle and a steel plate of the intelligent fire-fighting and rescue system for a building according to an embodiment of the present invention;

Fig. 8 is a structural schematic diagram of a rescue cabin, a guide steel tube and a brake device of the intelligent fire-fighting and rescue system for a building according to an embodiment of the present invention;

Fig. 9 is an enlarged structural schematic diagram of point A in Fig. 8 of the intelligent fire-fighting and rescue system for a building according to an embodiment of the present invention;

Fig. 10 is a second structural schematic diagram of the fire extinguishing system in a standby state of the intelligent fire-fighting and rescue system for a building according to an embodiment of the present invention;

Fig. 11 is a second structural schematic diagram of the fire extinguishing system in a use state of the intelligent fire-fighting and rescue system for a building according to an embodiment of the present invention;

Fig. 12 is a second structural schematic diagram of the second automated guided vehicle, the steel plate and a hanger mechanism of the intelligent fire-fighting and rescue system for a building according to an embodiment of the present invention;

Fig. 13 is a structural schematic diagram of the rescue cabin and a crawler robot of the intelligent fire-fighting and rescue system for a building according to an embodiment of the present invention;

Fig. 14 is a structural schematic diagram of the fire extinguishing cabin and the crawler robot of the intelligent fire-fighting and rescue system for a building according to an embodiment of the present invention.

In the drawings:

reference numeral 1 denotes the rescue mechanism; 11 denotes the rescue cabin; 12 denotes the first lifting mechanism; 121 denotes the fixed platform; 1211 denotes the support rod; 122 denotes the first winch; 123 denotes the first wire rope; 13 denotes the first guiding mechanism; 131 denotes the first flexible cable; 132 denotes the bracket; and 133 denotes the fastener;

reference numeral 2 denotes the fire extinguishing system; 21 denotes the fire extinguishing cabin; 211 denotes the stabilising mechanism; 212 denotes the telescopic support plate; 22 denotes the second lifting mechanism; 221 denotes the first automated guided vehicle; 222 denotes the hydraulic lifting arm; 223 denotes the second winch; 224 denotes the second wire rope; 225 denotes the high-pressure water pump; 226 denotes the fire monitor; 23 denotes the second guiding mechanism; 231 denotes the third winch; 232 denotes the second flexible cable; 233 denotes the second automated guided vehicle; 2331 denotes the vehicle body; 2332 denotes the support block; 2333 denotes the first magnetic attraction device; 234 denotes the steel plate; 235 denotes the hanger mechanism; 2351 denotes the hanging plate; 2352 denotes the hydraulic support rod; and 2353 denotes the second magnetic attraction device;

reference numeral 3 denotes the water storage tank;

reference numeral 4 denotes the guide rail mechanism; 41 denotes the reinforcing beam; 42 denotes the reinforcing column; 43 denotes the T-shaped rail beam; and 44 denotes the guide wheel;

reference numeral 5 denotes the central control system;

reference numeral 6 denotes the backup power supply system;

reference numeral 7 denotes the guide steel tube;

reference numeral 8 denotes the track bearing;

reference numeral 9 denotes the brake device; and

reference numeral 10 denotes the crawler robot.

Detailed Description of the Embodiments

In order that the above objectives, features and advantages of the present invention can be more clearly understood, the present invention is further described below with reference to the drawings and embodiments. It should be noted that,

provided that no conflict occurs, the embodiments of the present application and features in the embodiments may be combined with each other.

The present invention is further described below with reference to the drawings and specific embodiments.

Embodiment 1

As shown in Figs. 1 to 9, an intelligent fire-fighting and rescue system for a building according to an embodiment of the present invention comprises: a rescue mechanism 1, a fire extinguishing system 2, a water storage tank 3, a guide rail mechanism 4, a central control system 5 and a backup power supply system 6.

The rescue mechanism 1 is configured to carry out a rescue operation for persons trapped by fire in the building, and the rescue mechanism 1 is fixedly arranged on a roof of the building.

The fire extinguishing system 2 is configured to carry out a fire extinguishing operation on a fire source in the building, and the fire extinguishing system 2 is movably arranged on the roof of the building. At least two of the rescue mechanism 1 and the fire extinguishing system 2 are provided on the roof of the building.

The water storage tank 3 is configured to store fire extinguishing liquid for the fire extinguishing system 2, and the water storage tank 3 is fixedly connected to the roof of the building. The top of the water storage tank 3 has an open structure, which can not only ensure that the high-pressure water pump 225 can normally draw liquid from the inner cavity of the water storage tank 3 when the fire extinguishing system 2 moves on the roof of the building, but can also recycle rainwater, thereby achieving the purpose of saving resources.

The guide rail mechanism 4 is configured to limit the fire extinguishing system 2 so as to prevent the fire extinguishing system 2 from rolling over, and the guide rail mechanism 4 is arranged between the roof of the building and the fire extinguishing system 2.

The central control system 5 is configured to adjust an operating state or parameter of the rescue mechanism 1 and the fire extinguishing system 2 and is configured to be connected to the fire alarm system of the building. The central control system 5 is mounted on the roof of the building, and the rescue mechanism 1 and the fire extinguishing system 2 are both controlled by the central control system 5.

The backup power supply system 6 is configured to supply power to the rescue mechanism 1, the fire extinguishing system 2 and the central control system 5, and the backup power supply system 6 is mounted on the roof of the building.

Embodiment 2

As shown in Figs. 2 to 3, the intelligent fire-fighting and rescue system for a building provided in this embodiment differs from Embodiment 1 in that:

the rescue mechanism 1 comprises a rescue cabin 11, a first lifting mechanism 12 and a first guiding mechanism 13. The rescue cabin 11 is arranged below the first lifting mechanism 12. The first lifting mechanism 12 is configured to drive the rescue cabin 11 to move up and down. The first guiding mechanism 13 is arranged between the first lifting mechanism 12 and the ground, and the first guiding mechanism 13 is configured to guide movement of the rescue cabin 11.

The first lifting mechanism 12 comprises a fixed platform 121 horizontally arranged on the roof of the building. A first winch 122 is mounted on a top of the fixed platform 121. A first wire rope 123 is wound on the first winch 122, and a free end of the first wire rope 123 passes through to a position below the fixed platform 121 and is fixedly connected to the rescue cabin 11. By starting the first winch 122, the first wire rope 123 can be wound and unwound, thereby enabling up-and-down movement of the rescue cabin 11. Four support rods 1211 distributed in a rectangular array are mounted at a bottom of the fixed platform 121. The height of the support rods 1211 is adapted to the height of the rescue cabin 11. The support rods 1211 can elevate the fixed platform 121, so that the rescue cabin 11 is prevented from shielding a rescue-cabin landing door of the building in the standby state and affecting appearance. A first guide roller configured to guide the first wire rope 123 is mounted on the fixed platform 121.

The first guiding mechanism 13 comprises first flexible cables 131 movably connected at four corners of the rescue cabin 11. A top end of each first flexible cable 131 is fixedly connected to a bracket 132. The bracket 132 is mounted on the top of the fixed platform 121, and a bottom end of each first flexible cable 131 is fixedly connected to a fastener 133 embedded in the ground. When the rescue cabin 11 moves up and down, the first flexible cables 131 can guide the rescue cabin 11, preventing the rescue cabin 11 from swinging during up-and-down movement and helping to improve stability during up-and-down movement of the rescue cabin 11.

Embodiment 3

As shown in Figs. 4 to 7, the intelligent fire-fighting and rescue system for a building provided in this embodiment differs from Embodiment 2 in that:

the fire extinguishing system 2 comprises a fire extinguishing cabin 21, a second lifting mechanism 22 and a second guiding mechanism 23. The fire extinguishing cabin 21 is arranged below the second lifting mechanism 22. The second lifting mechanism 22 is configured to drive the fire extinguishing cabin 21 to move up and down. The second guiding mechanism 23 is arranged between the second lifting mechanism 22 and the ground, and the second guiding mechanism 23 is configured to

guide movement of the fire extinguishing cabin 21. A stabilising mechanism 211 configured to cut door and window glass is mounted in the inner cavity of the fire extinguishing cabin 21. One stabilising mechanism 211 is mounted at each of an upper side and a lower side of the inner cavity of the fire extinguishing cabin 21. By using the stabilising mechanism 211, an opening into which liquid can be sprayed toward the fire source can be opened.

The second lifting mechanism 22 comprises a first automated guided vehicle 221 movably arranged on the guide rail mechanism 4. A hydraulic lifting arm 222 is mounted on a top of the first automated guided vehicle 221. A second winch 223 is mounted on a top of the hydraulic lifting arm 222. A second wire rope 224 is wound on the second winch 223. A free end of the second wire rope 224 passes through to a position below the hydraulic lifting arm 222 and is fixedly connected to the fire extinguishing cabin 21. By starting the second winch 223, the second wire rope 224 can be wound and unwound, thereby enabling up-and-down movement of the fire extinguishing cabin 21. A high-pressure water pump 225 is mounted on the first automated guided vehicle 221. A water inlet end of the high-pressure water pump 225 is in communication with an inner cavity of the water storage tank 3 through a water pipe. A fire monitor 226 is mounted in an inner cavity of the fire extinguishing cabin 21. A water outlet end of the high-pressure water pump 225 is in communication with the fire monitor 226 through a hose. By starting the high-pressure water pump 225, liquid stored in the water storage tank 3 can be drawn and sprayed to a desired position through the fire monitor 226. A roller configured to guide the hose is mounted on the hydraulic lifting arm 222.

The second guiding mechanism 23 comprises a third winch 231 mounted on the top of the first automated guided vehicle 221. A second flexible cable 232 is wound on the third winch 231. A bottom end of the second flexible cable 232 movably passes through to a position below the fire extinguishing cabin 21 and is provided with a second automated guided vehicle 233. A steel plate 234 embedded in the ground is provided below the second automated guided vehicle 233. A second guide roller configured to guide the second wire rope 224 and the third winch 231 is further mounted on the hydraulic lifting arm 222.

The second automated guided vehicle 233 comprises a vehicle body 2331 suspended from a free end of the second flexible cable 232. A support block 2332 is fixedly connected to a bottom of the vehicle body 2331. A plurality of first magnetic attraction devices 2333 which are equally spaced and cooperate with the steel plate 234 are mounted on a bottom of the support block 2332. By turning on the first magnetic attraction devices 2333, they can be firmly attracted to the steel plate 234, thereby enabling the second automated guided vehicle 233 to be fixed. When a fire alarm occurs, the third winch 231 is started, so that the second automated guided vehicle 233 can be lowered to the ground. The second automated guided vehicle 233

on the ground and the first automated guided vehicle 221 on the roof automatically position and align themselves with the orientation of the fire source. The second automated guided vehicle 233 is fixed through cooperation between the steel plate 234 and the first magnetic attraction devices 2333. The third winch 231 is started again to wind and tension the second flexible cable 232. The second flexible cable 232 can thereby guide the fire extinguishing cabin 21, avoiding swinging of the second flexible cable 232 during up-and-down movement and helping to improve stability during up-and-down movement of the fire extinguishing cabin 21. At the same time, the free end of the second flexible cable 232 can move up and down through the second automated guided vehicle 233, so that when the fire extinguishing cabin 21 is in the standby state, the second guiding mechanism 23 and the fire extinguishing cabin 21 will not shield doors and windows of the building and affect appearance.

Embodiment 4

As shown in Figs. 8 to 9, the intelligent fire-fighting and rescue system for a building provided in this embodiment differs from Embodiment 3 in that:

guide steel tubes 7 are mounted in both the fire extinguishing cabin 21 and the rescue cabin 11. The second flexible cable 232 and the first flexible cable 131 respectively movably pass through inner cavities of corresponding guide steel tubes 7. When the rescue cabin 11 and the fire extinguishing cabin 21 respectively move up and down on the surfaces of the first flexible cable 131 and the second flexible cable 232, the guide steel tubes 7 can be driven to move synchronously. The guide steel tubes 7 can therefore be used as rails for the first flexible cable 131 and the second flexible cable 232, so that operation of the rescue cabin 11 and the fire extinguishing cabin 21 is smoother.

Track bearings 8 are mounted at both a top and a bottom of the inner cavity of each guide steel tube 7. The first flexible cable 131 and the second flexible cable 232 are respectively slidingly connected to inner wall surfaces of corresponding track bearings 8. When the rescue cabin 11 and the fire extinguishing cabin 21 respectively move up and down on the surfaces of the first flexible cable 131 and the second flexible cable 232, the track bearings 8 can be driven to move synchronously. This can reduce the friction between the first flexible cable 131 and the rescue cabin 11 and between the second flexible cable 232 and the fire extinguishing cabin 21, and improve flexibility during movement.

Brake devices 9 are provided on both the first flexible cable 131 and the second flexible cable 232. A top of the rescue cabin 11 is fixedly connected to the corresponding brake device 9, and a top of the fire extinguishing cabin 21 is fixedly connected to the corresponding brake device 9. The brake devices 9 can timely brake

the rescue cabin 11 and the fire extinguishing cabin 21, so that the rescue cabin 11 and the fire extinguishing cabin 21 can reliably stop at a required height.

Embodiment 5

As shown in Figs. 5 to 6, the intelligent fire-fighting and rescue system for a building provided in this embodiment differs from Embodiment 4 in that:

the guide rail mechanism 4 comprises a reinforcing beam 41 fixedly connected to the roof of the building. Reinforcing columns 42 are integrally formed on two sides of the reinforcing beam 41. The water storage tank 3 is fixedly connected to one of the reinforcing columns 42. T-shaped rail beams 43 are integrally formed on a top of the reinforcing beam 41 and on another reinforcing column 42. Moving wheels of the first automated guided vehicle 221 are arranged on corresponding T-shaped rail beams 43. A guide wheel 44 cooperating with the T-shaped rail beam 43 is mounted at a bottom of the first automated guided vehicle 221. When the first automated guided vehicle 221 moves on the top of the T-shaped rail beam 43, the guide wheel 44 can be driven to move on a surface of the T-shaped rail beam 43. This can not only limit movement of the first automated guided vehicle 221 so that the first automated guided vehicle 221 moves stably on the guide rail mechanism 4, but can also avoid rollover caused by the relatively large gravity on one side of the fire extinguishing system 2.

Embodiment 6

The intelligent fire-fighting and rescue system for a building provided in this embodiment differs from Embodiment 5 in that:

the first winch 122, the stabilising mechanism 211, the first automated guided vehicle 221, the hydraulic lifting arm 222, the second winch 223, the high-pressure water pump 225, the fire monitor 226, the third winch 231, the vehicle body 2331 and the first magnetic attraction device 2333 are respectively electrically connected to the central control system 5. The first winch 122, the stabilising mechanism 211, the first automated guided vehicle 221, the hydraulic lifting arm 222, the second winch 223, the high-pressure water pump 225, the fire monitor 226, the third winch 231, the vehicle body 2331, the first magnetic attraction device 2333 and the central control system 5 are respectively electrically connected to the backup power supply system 6.

Embodiment 7

As shown in Figs. 10 to 12, the intelligent fire-fighting and rescue system for a building provided in this embodiment differs from Embodiment 6 in that:

the second guiding mechanism 23 comprises a third winch 231 mounted on the top of the first automated guided vehicle 221. A second flexible cable 232 is wound on the third winch 231. A bottom end of the second flexible cable 232 movably passes through to a position below the fire extinguishing cabin 21 and is provided with a hanger mechanism 235. A steel plate 234 embedded in the ground is provided below

the hanger mechanism 235, and a second automated guided vehicle 233 is provided on the steel plate 234. A second guide roller configured to guide the second wire rope 224 and the third winch 231 is further mounted on the hydraulic lifting arm 222.

The second automated guided vehicle 233 comprises a vehicle body 2331 arranged on the steel plate 234. A support block 2332 is fixedly connected to a bottom of the vehicle body 2331. A plurality of first magnetic attraction devices 2333 which are equally spaced and cooperate with the steel plate 234 are mounted on a bottom of the support block 2332. By turning on the first magnetic attraction devices 2333, they can be firmly attracted to the steel plate 234, thereby enabling the second automated guided vehicle 233 to be fixed.

The hanger mechanism 235 comprises a hanging plate 2351 suspended from a free end of the second flexible cable 232. Hydraulic support rods 2352 are mounted at four corners of a bottom of the hanging plate 2351. A plurality of second magnetic attraction devices 2353 which are equally spaced and cooperate with the vehicle body 2331 are mounted on a bottom of the hanging plate 2351. By turning on the second magnetic attraction devices 2353, they can be firmly attracted to the vehicle body 2331, thereby enabling the hanger mechanism 235 to be fixed. When a fire alarm occurs, the third winch 231 is started, so that the hanger mechanism 235 can be lowered to the ground. The second automated guided vehicle 233 moves to a position below the hanger mechanism 235. The hanger mechanism 235 is fixed through cooperation between the second magnetic attraction devices 2353 and the vehicle body 2331. The second automated guided vehicle 233 on the ground and the first automated guided vehicle 221 on the roof automatically position and align themselves with the orientation of the fire source. The second automated guided vehicle 233 is fixed through cooperation between the steel plate 234 and the first magnetic attraction devices 2333. The third winch 231 is started again to wind and tension the second flexible cable 232. The second flexible cable 232 thereby guides the fire extinguishing cabin 21, avoiding swinging of the second flexible cable 232 during up-and-down movement and helping to improve stability during up-and-down movement of the fire extinguishing cabin 21. At the same time, the free end of the second flexible cable 232 can move up and down through the second automated guided vehicle 233, so that when the fire extinguishing cabin 21 is in the standby state, the second guiding mechanism 23 and the fire extinguishing cabin 21 will not shield doors and windows of the building or affect appearance.

Embodiment 8

As shown in Figs. 13 to 14, the intelligent fire-fighting and rescue system for a building provided in this embodiment differs from Embodiment 7 in that:

crawler robots 10 are placed in the inner cavities of both the rescue cabin 11 and the fire extinguishing cabin 21. The crawler robots 10 can assist in performing a fire

extinguishing operation. The stabilising mechanism 211 is mounted at an upper side of the inner cavity of the fire extinguishing cabin 21, and a telescopic support plate 212 is mounted at a lower side of the inner cavity of the fire extinguishing cabin 21. By starting the telescopic support plate 212 so that its free end overlaps a door/window break opening, the crawler robot 10 can conveniently move into the building to approach the fire source in place of firefighters and perform a fire extinguishing operation.

The working principle of the present invention is briefly described below.

Generation of an escape route: the central control system 5 is connected to the fire alarm system of the building. According to a fire alarm signal of an ignition point, the central control system 5 calculates a three-dimensional map, generates an optimal escape route to the rescue cabin 11, and sends the route to trapped persons in the building through mobile phone information. At the same time, the rescue mechanism 1 and the fire extinguishing system 2 are started.

Rescue of trapped persons: the first winch 122 is started, and the first winch 122 unwinds the first wire rope 123. At this time, the rescue cabin 11 descends under its own weight. The rescue cabin 11 moves downward on the surface of the first flexible cable 131 until the rescue cabin 11 descends from a high altitude to a height position of the fire source. Then, the rescue-cabin landing door of the building is opened, so that trapped persons in the building can be evacuated and rescued through the rescue cabin 11, thereby achieving the purpose of rescuing trapped persons.

Extinguishing the fire source: the third winch 231 is started, and the third winch 231 unwinds the second flexible cable 232. At this time, the second automated guided vehicle 233 descends under its own weight until the second automated guided vehicle 233 lands on the ground. The second automated guided vehicle 233 on the ground and the first automated guided vehicle 221 on the roof automatically position and align themselves with the orientation position of the fire source. After automatic positioning is completed, the first magnetic attraction devices 2333 are turned on, so that the first magnetic attraction devices 2333 are firmly attracted to the steel plate 234 embedded in the ground, thereby fixing the second automated guided vehicle 233. The third winch 231 is started again, and the third winch 231 winds the second flexible cable 232 so that the second flexible cable 232 is in a tensioned state. Then, the second winch 223 is started, and the second winch 223 unwinds the second wire rope 224. At this time, the fire extinguishing cabin 21 descends under its own weight. The fire extinguishing cabin 21 moves downward on the surface of the second flexible cable 232 until the fire extinguishing cabin 21 descends from a high altitude to a height position of the fire source. Door and window glass is cut by the stabilising mechanism 211 and an opening into which liquid can be sprayed toward the fire source is opened. Finally, the high-pressure water pump 225 is started, so that liquid stored in the water

storage tank 3 can be delivered into the hose and sprayed for fire extinguishing by the fire monitor 226 aiming at this opening, thereby achieving the purpose of extinguishing the fire source.

In summary, in the intelligent fire-fighting and rescue system for a building, by additionally providing the rescue mechanism 1 on the roof of the building, when a fire occurs, the rescue cabin 11 suspended at a fixed position on the roof of the building is lowered by the first lifting mechanism 12 to a rescue-cabin landing door at the fire source in the building, so that trapped persons in the building can be evacuated and rescued through the rescue cabin 11, thereby achieving the purpose of rescuing persons. By additionally providing the fire extinguishing system 2 and the water storage tank 3 on the roof of the building, when a fire occurs, through cooperation of the second lifting mechanism 22 and the second guiding mechanism 23, the fire extinguishing cabin 21 suspended on the roof of the building is lowered to a height position of the fire source in the building, a window is broken by the stabilising mechanism 211, and the fire source is extinguished by the fire monitor 226. Meanwhile, through cooperation of the first automated guided vehicle 221, the second automated guided vehicle 233 and the guide rail mechanism 4, the fire extinguishing cabin 21 can be driven to move horizontally on an outer wall of the building, thereby expanding a fire extinguishing range and achieving the purpose of extinguishing the fire source. By additionally providing the central control system 5 and the backup power supply system 6 on the roof of the building, when a fire occurs, the central control system 5 calculates a three-dimensional map according to a fire alarm signal of an ignition point, generates an optimal escape route to the rescue cabin 11, and sends the route to trapped persons in the building through mobile phone information. At the same time, the rescue mechanism 1 and the fire extinguishing system 2 are started to rapidly carry out rescue and fire extinguishing, so as to achieve the effects of saving physical strength of firefighters and improving fire-fighting and rescue efficiency.

Through the above specific embodiments, a person skilled in the art can readily implement the present invention. It should be understood, however, that the present invention is not limited to the above specific embodiments. On the basis of the disclosed embodiments, a person skilled in the art may arbitrarily combine different technical features so as to implement different technical solutions.

Claims.

1. An intelligent fire-fighting and rescue system for a building, comprising:

a rescue mechanism (1), configured to carry out a rescue operation for persons trapped by fire in the building, wherein the rescue mechanism (1) is fixedly arranged on a roof of the building;

a fire extinguishing system (2), configured to carry out a fire extinguishing operation on a fire source in the building, wherein the fire extinguishing system (2) is movably arranged on the roof of the building, and wherein at least two of the rescue mechanism (1) and the fire extinguishing system (2) are provided on the roof of the building;

a water storage tank (3), configured to store a fire extinguishing liquid for the fire extinguishing system (2), wherein the water storage tank (3) is fixedly connected to the roof of the building;

a guide rail mechanism (4), configured to limit the fire extinguishing system (2) so as to prevent the fire extinguishing system (2) from rolling over, wherein the guide rail mechanism (4) is arranged between the roof of the building and the fire extinguishing system (2);

a central control system (5), configured to adjust an operating state or parameter of the rescue mechanism (1) and the fire extinguishing system (2) and configured to be connected to a fire alarm system of the building, wherein the central control system (5) is mounted on the roof of the building, and the rescue mechanism (1) and the fire extinguishing system (2) are both controlled by the central control system (5); and

a backup power supply system (6), configured to supply power to the rescue mechanism (1), the fire extinguishing system (2) and the central control system (5), wherein the backup power supply system (6) is mounted on the roof of the building.

2. The intelligent fire-fighting and rescue system for a building according to claim 1, wherein the rescue mechanism (1) comprises a rescue cabin (11), a first lifting mechanism (12) and a first guiding mechanism (13), wherein the rescue cabin (11) is arranged below the first lifting mechanism (12), the first lifting mechanism (12) is configured to drive the rescue cabin (11) to move up and down, the first guiding mechanism (13) is arranged between the first lifting mechanism (12) and the ground, and the first guiding mechanism (13) is configured to guide movement of the rescue cabin (11);

wherein the first lifting mechanism (12) comprises a fixed platform (121) arranged on the roof of the building, a first winch (122) is mounted on a top of the fixed platform (121), a first wire rope (123) is wound on the first winch (122), and a free end of the

first wire rope (123) passes through to a position below the fixed platform (121) and is fixedly connected to the rescue cabin (11);

wherein the first guiding mechanism (13) comprises first flexible cables (131) movably connected at four corners of the rescue cabin (11), a top end of each first flexible cable (131) is fixedly connected to a bracket (132), the bracket (132) is mounted on the top of the fixed platform (121), and a bottom end of each first flexible cable (131) is fixedly connected to a fastener (133) embedded in the ground;

wherein the fire extinguishing system (2) comprises a fire extinguishing cabin (21), a second lifting mechanism (22) and a second guiding mechanism (23), wherein the fire extinguishing cabin (21) is arranged below the second lifting mechanism (22), the second lifting mechanism (22) is configured to drive the fire extinguishing cabin (21) to move up and down, the second guiding mechanism (23) is arranged between the second lifting mechanism (22) and the ground, the second guiding mechanism (23) is configured to guide movement of the fire extinguishing cabin (21), and stabilising mechanisms (211) configured to cut door and window glass are mounted at both an upper side and a lower side of an inner cavity of the fire extinguishing cabin (21);

wherein the second lifting mechanism (22) comprises a first automated guided vehicle (221) movably arranged on the guide rail mechanism (4), a hydraulic lifting arm (222) is mounted on a top of the first automated guided vehicle (221), a second winch (223) is mounted on a top of the hydraulic lifting arm (222), a second wire rope (224) is wound on the second winch (223), a free end of the second wire rope (224) passes through to a position below the hydraulic lifting arm (222) and is fixedly connected to the fire extinguishing cabin (21), a high-pressure water pump (225) is mounted on the first automated guided vehicle (221), a water inlet end of the high-pressure water pump (225) is in communication with an inner cavity of the water storage tank (3) through a water pipe, a fire monitor (226) is mounted in an inner cavity of the fire extinguishing cabin (21), and a water outlet end of the high-pressure water pump (225) is in communication with the fire monitor (226) through a hose;

wherein the second guiding mechanism (23) comprises a third winch (231) mounted on the top of the first automated guided vehicle (221), a second flexible cable (232) is wound on the third winch (231), a bottom end of the second flexible cable (232) movably passes through to a position below the fire extinguishing cabin (21) and is provided with a second automated guided vehicle (233), and a steel plate (234) embedded in the ground is provided below the second automated guided vehicle (233);

wherein the second automated guided vehicle (233) comprises a vehicle body (2331) suspended from a free end of the second flexible cable (232), a support block (2332) is fixedly connected to a bottom of the vehicle body (2331), and a plurality of first

magnetic attraction devices (2333) cooperating with the steel plate (234) are mounted on a bottom of the support block (2332).

3. The intelligent fire-fighting and rescue system for a building according to claim 2, wherein four support rods (1211) distributed in a rectangular array are mounted at a bottom of the fixed platform (121), and a height of the support rods (1211) is adapted to a height of the rescue cabin (11).

4. The intelligent fire-fighting and rescue system for a building according to claim 2, wherein a first guide roller configured to guide the first wire rope (123) is mounted on the fixed platform (121).

5. The intelligent fire-fighting and rescue system for a building according to claim 2, wherein a roller configured to guide the hose is mounted on the hydraulic lifting arm (222), and a second guide roller configured to guide the second wire rope (224) and the third winch (231) is further mounted on the hydraulic lifting arm (222).

6. The intelligent fire-fighting and rescue system for a building according to claim 2, wherein guide steel tubes (7) are mounted in both the fire extinguishing cabin (21) and the rescue cabin (11), and the second flexible cable (232) and the first flexible cable (131) respectively movably pass through inner cavities of corresponding guide steel tubes (7).

7. The intelligent fire-fighting and rescue system for a building according to claim 6, wherein track bearings (8) are mounted at both a top and a bottom of the inner cavity of each guide steel tube (7), and the first flexible cable (131) and the second flexible cable (232) are respectively slidingly connected to inner wall surfaces of corresponding track bearings (8).

8. The intelligent fire-fighting and rescue system for a building according to claim 7, wherein brake devices (9) are provided on both the first flexible cable (131) and the second flexible cable (232), a top of the rescue cabin (11) is fixedly connected to the corresponding brake device (9), and a top of the fire extinguishing cabin (21) is fixedly connected to the corresponding brake device (9).

9. The intelligent fire-fighting and rescue system for a building according to claim 7, wherein the guide rail mechanism (4) comprises a reinforcing beam (41) fixedly connected to the roof of the building, reinforcing columns (42) are integrally formed

on two sides of the reinforcing beam (41), the water storage tank (3) is fixedly connected to one of the reinforcing columns (42), T-shaped rail beams (43) are integrally formed on a top of the reinforcing beam (41) and on another of the reinforcing columns (42), moving wheels of the first automated guided vehicle (221) are arranged on corresponding T-shaped rail beams (43), and a guide wheel (44) cooperating with the T-shaped rail beam (43) is mounted at a bottom of the first automated guided vehicle (221).

10. The intelligent fire-fighting and rescue system for a building according to claim 9, wherein the first winch (122), the stabilising mechanism (211), the first automated guided vehicle (221), the hydraulic lifting arm (222), the second winch (223), the high-pressure water pump (225), the fire monitor (226), the third winch (231), the vehicle body (2331) and the first magnetic attraction device (2333) are respectively electrically connected to the central control system (5), and the first winch (122), the stabilising mechanism (211), the first automated guided vehicle (221), the hydraulic lifting arm (222), the second winch (223), the high-pressure water pump (225), the fire monitor (226), the third winch (231), the vehicle body (2331), the first magnetic attraction device (2333) and the central control system (5) are respectively electrically connected to the backup power supply system (6).