(19) LE GOUVERNEMENT DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère de l'Économie

(11) N° de publication : **LU507377**

(12) **BREVET D'INVENTION** **B1**

(21) N° de dépôt: LU507377

(51) Int. Cl.:
H01M 4/00, A62C 2/00, H02J 1/00

(22) Date de dépôt: 30/05/2024

(30) Priorité:
20/05/2024 CN 202410624764.1

(43) Date de mise à disposition du public: 11/12/2024

(47) Date de délivrance: 11/12/2024

(73) Titulaire(s):
AKETAO HUANENG NEW ENERGY CO., LTD. – 845550 Kizilsu Kirghiz Autonomous Prefecture, Xinjiang (China)

(72) Inventeur(s):
CUI Yingying – China, LIU Hui – China, FENG Zhanguo – China, DUAN Zhao – China, LI Xin – China, GONG Jun – China, ZHAO Jingang – China, HU Fei – China, YAN Zhen – China, REN Qiyong – China

(74) Mandataire(s):
IP SHIELD – 1616 Luxembourg (Luxembourg)

(54) ENERGY STORAGE SYSTEM FOR A BATTERY COMPARTMENT.

(57) The present invention provides an energy storage system for a battery compartment, relating to the technical field of battery compartment energy storage. It includes a battery compartment divided into a first cavity and a second cavity by a partition. A fire early warning mechanism is connected to both the first cavity and the second cavity, and the second cavity is equipped with an energy storage mechanism. In this invention, the energy storage mechanism inside the battery compartment is integrally designed as a frame structure, facilitating the disassembly and replacement of the battery box by the operators, and making maintenance and repair easier. By setting up a fire early warning mechanism inside the battery compartment, the operational status of the energy storage system in the power compartment is monitored in real-time. It ensures timely handling of any fire incidents inside the battery compartment, while also transmitting early warning information to the staff and issuing an alarm. This effectively prevents significant damage caused by internal fires in the battery compartment, thereby improving the operational safety of the battery compartment energy storage system.

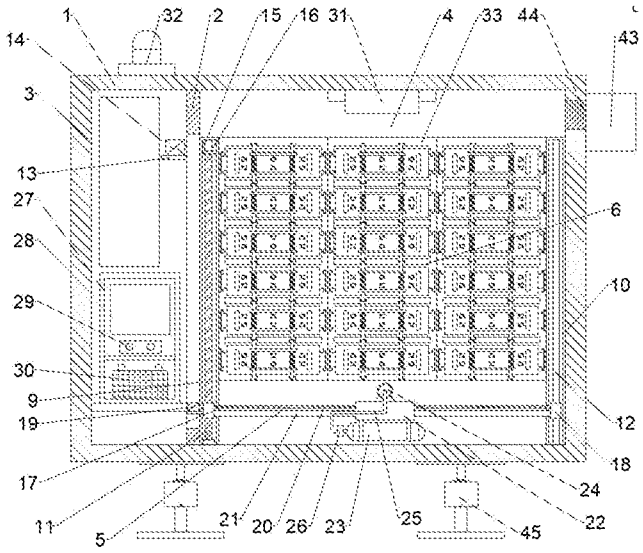

FIG.1

ENERGY STORAGE SYSTEM FOR A BATTERY COMPARTMENT

Technical Field

The present invention relates to the technical field of battery compartment energy storage, specifically to an energy storage system for a battery compartment.

Background Technology

Energy storage refers to the process of storing energy through a medium or device and releasing it when needed. Energy storage technology is crucial for solving issues related to the large-scale integration of renewable energy and the abandonment of wind and solar power. It is also essential for the development of distributed energy, smart grids, and the energy internet. Additionally, energy storage technology supports conventional power load shifting, enhancing the efficiency, safety, and economics of conventional energy generation and transmission.

Existing battery compartment energy storage systems have the following problems:

1. Existing battery compartment energy storage systems lack fire early warning mechanisms. This deficiency prevents timely warnings and effective handling of fires caused by overheating and thermal runaway inside the battery compartment, leading to significant economic losses due to internal fires.

2. Existing battery compartment energy storage systems lack buffer structures, failing to achieve cushioning between the battery compartment and its installation location.

Summary of the Invention

The present invention provides an energy storage system for a battery compartment to solve at least one of the problems mentioned in the background technology.

To address the above technical issues, the present invention discloses an energy

storage system for a battery compartment, including a battery compartment divided into a first cavity and a second cavity by a partition, a fire early warning mechanism connected to both the first cavity and the second cavity, and an energy storage mechanism arranged inside the second cavity.

Preferably, a first cabinet door is arranged on the front side of the first cavity, with one side of the first cabinet door hinged to the partition, and two second cabinet doors are arranged on the front side of the second cavity, with the two second cabinet doors respectively hinged to the partition and the side wall of the battery compartment.

Preferably, the fire early warning mechanism comprises: a first fixing frame and a second fixing frame, the first fixing frame and the second fixing frame being respectively fixedly connected to the inner walls on both sides of the second cavity, both ends of a first threaded rod being rotatably connected to the inner wall of the first fixing frame, both ends of a guide rod being fixedly connected to the inner wall of the second fixing frame, a first mounting plate being fixedly connected to the partition on the side of the first cavity, a forward and reverse driving motor being fixedly connected to the first mounting plate, the output shaft of the forward and reverse driving motor rotatably penetrating the partition and the left side wall of the first fixing frame and being fixedly connected to a first bevel gear, a second bevel gear being fixedly connected to the top end of the first threaded rod, and the first bevel gear meshing with the second bevel gear.

Preferably, it further comprises a first slider, the first slider being threadedly connected to the first threaded rod, a second slider being slidably connected to the guide rod, a driving motor being fixedly connected to the left side of the first slider, a second threaded rod being fixedly connected to the output shaft of the driving motor, the right end of the second threaded rod being rotatably connected to the second slider, both ends of a slide bar being respectively fixedly connected to the first slider and the second slider, a mounting base being threadedly connected to the second threaded rod, the mounting base being slidably connected to the slide bar, a fire extinguisher canister being fixedly connected to the bottom of the mounting base, a nozzle being fixedly connected to the top of the mounting base, the discharge port of

the fire extinguisher canister being connected to the nozzle via a delivery pipe, and a solenoid valve being fixedly connected to the discharge port of the fire extinguisher canister.

Preferably, the fire early warning mechanism further comprises: a control box, the control box being fixedly connected inside the first cavity, and the control box being connected to an operation screen, a communication receiver, and a power supply, a fire detector being fixedly connected to the top of the inner wall of the second cavity, a first alarm being fixedly connected to the top of the battery compartment, and the operation screen, communication receiver, power supply, fire detector, and first alarm being electrically connected to the control box.

Preferably, the energy storage mechanism comprises several mounting frames, the mounting frames being fixedly connected to the rear side wall of the second cavity, several first sliding grooves being embedded in the inner walls on both sides of the mounting frames, two first recesses being embedded in the top of the mounting frames, several partitions being fixedly connected at intervals to the inner walls of the mounting frames, and several first recesses being embedded in the top and bottom of the partitions, several battery boxes being correspondingly arranged between the mounting frames and the partitions, third sliders being fixedly connected to both sides of the battery boxes, the third sliders being slidably connected in the first sliding grooves, and handles being fixedly connected to the battery boxes.

Preferably, it further comprises several second recesses, the second recesses being embedded in the front side of the battery boxes, several first springs being correspondingly fixedly connected to the side walls of the second recesses, several latching blocks being correspondingly slidably connected in the second recesses, the latching blocks being fixedly connected to the first springs, the latching blocks being slidably connected in the first recesses and the second recesses, and two connecting plates being fixedly connected at intervals to the latching blocks.

Preferably, it further comprises a refrigerator, the refrigerator being fixedly connected to the right side wall of the battery compartment, a filter screen being embedded at the air inlet of the right side wall of the battery compartment, and the

air inlet of the refrigerator being connected to the air inlet of the right side wall of the battery compartment.

Preferably, it further comprises several mounting mechanisms, the mounting mechanisms being fixedly connected around the bottom of the battery compartment, the mounting mechanisms comprising:

a mounting base, first fixed sleeves being fixedly connected to both sides of the top of the mounting base, two second sliding grooves being embedded on both sides of the top of the mounting base, two transmission assemblies being symmetrically connected to the top of the mounting base;

the transmission assembly on the left side comprises a fourth slider, the fourth slider being fixedly connected to the side wall of the second sliding groove via a second spring, the fourth slider being slidably connected in the second sliding groove, the lower end of a first support rod being hinged to the top of the mounting base, the top of the first support rod being hinged to a fixing block, both ends of a connecting rod being respectively hinged to the fourth slider and the middle of the first support rod, the top of the fixing block being hinged to a second support rod, two guide columns being slidably connected inside the first fixed sleeves, a second mounting plate being fixedly connected to the tops of the two guide columns, and the top of the second support rod being hinged to the bottom of the second mounting plate;

the mounting mechanism further comprises: a sliding rod and a second fixed sleeve, the sliding rod being fixedly connected to the inside of the fixing block on the left side, the second fixed sleeve being fixedly connected to the inside of the fixing block of the transmission assembly on the right side, one end of the sliding rod being slidably connected inside the second fixed sleeve, a third spring being sleeved on the sliding rod and the second fixed sleeve, and both ends of the third spring being fixedly connected to the inside of the fixing block.

Preferably, it further comprises two sets of buffer assemblies, the two sets of buffer assemblies being respectively connected to the top of the first fixed sleeves, the buffer assembly comprising a buffer box, the buffer box being fixedly connected to the top of the first fixed sleeves, buffer fluid being arranged inside the buffer box, the

bottom of a rotating sleeve penetrating the buffer box from top to bottom and being rotatably connected to the guide columns, several buffer plates being fixedly connected at intervals along the circumferential direction of the rotating sleeve, a liquid filling port being fixedly connected to the top of the buffer box, and a liquid exchange port being fixedly connected to the bottom of the side wall of the buffer box.

Compared to the existing technology, the present invention has the following beneficial effects:

1. By setting up a fire early warning mechanism in the battery compartment energy storage system, timely warnings and effective handling of fires caused by overheating and thermal runaway inside the battery compartment can be achieved, thereby avoiding significant economic losses due to internal fires in the battery compartment.

2. By configuring the energy storage mechanism as a frame structure, the structure is simple, facilitating the disassembly and replacement of the battery box by the operators, and improving the efficiency of maintenance and repair.

3. By setting up the mounting mechanism, the battery compartment can be securely supported, effectively preventing damage to the battery compartment energy storage system due to severe vibrations.

Description of the Drawings

The drawings are provided to further understand the present invention and constitute a part of the description, used together with the embodiments of the present invention to explain the invention, and do not constitute a limitation on the present invention. In the drawings:

FIG.1 is a schematic structural view of the present invention;

FIG.2 is a right side schematic structural view of the present invention;

FIG.3 is a schematic structural view of the connection between the mounting frame and the battery box of the present invention;

FIG.4 is a schematic structural view of the connection between the mounting mechanism and the battery compartment of the present invention;

FIG.5 is a schematic structural view of the mounting mechanism of the present invention.

In the drawings: 1. Battery compartment; 2. Partition; 3. First cavity; 4. Second cavity; 5. Fire early warning mechanism; 6. Energy storage mechanism; 7. First cabinet door; 8. Second cabinet door; 9. First fixing frame; 10. Second fixing frame; 11. First threaded rod; 12. Guide rod; 13. First mounting plate; 14. Forward and reverse driving motor; 15. First bevel gear; 16. Second bevel gear; 17. First slider; 18. Second slider; 19. Driving motor; 20. Second threaded rod; 21. Slide bar; 22. Mounting base; 23. Fire extinguisher canister; 24. Nozzle; 25. Delivery pipe; 26. Solenoid valve; 27. Control box; 28. Operation screen; 29. Communication receiver; 30. Power supply; 31. Fire detector; 32. First alarm; 33. Mounting frame; 34. First sliding groove; 35. Partition; 36. First recess; 37. Battery box; 371. Handle; 38. Third Slider; 39. Second recess; 40. First spring; 41. Latching block; 42. Connecting plate; 43. Refrigerator; 44. Filter screen; 45. Mounting mechanism; 46. Mounting base; 47. First fixed sleeve; 48. Second sliding groove; 49. Fourth slider; 50. Second spring; 51. First support rod; 52. Fixing block; 53. Connecting rod; 54. Second support rod; 55. Sliding rod; 56. Second fixed sleeve; 57. Third spring; 58. Guide column; 59. Second mounting plate; 60. Buffer box; 61. Buffer fluid; 62. Rotating sleeve; 63. Buffer plate; 64. Liquid filling port; 65. Liquid exchange port.

Specific Embodiments

The following description of preferred embodiments of the present invention is provided in conjunction with the accompanying drawings. It should be understood that the described preferred embodiments are only for the purpose of illustrating and explaining the present invention and are not intended to limit the scope of the present invention.

Additionally, terms like "first" and "second" in this invention are used solely for descriptive purposes and are not meant to indicate a specific order or priority, nor are they intended to limit the present invention. These terms are merely used to distinguish components or operations described using the same technical terminology.

They should not be construed as indicating or implying relative importance or the number of technical features specified. Thus, features denoted as "first" or "second" may explicitly or implicitly include at least one such feature. Furthermore, technical solutions and technical features of different embodiments can be combined, provided they are implementable by those skilled in the field. If such combinations are mutually contradictory or unfeasible, they should be considered non-existent and outside the scope of protection claimed by the present invention.

The present invention provides the following embodiments:

Embodiment 1

The present invention provides an energy storage system for a battery compartment. As shown in FIG.1, it includes a battery compartment 1 divided into a first cavity 3 and a second cavity 4 by a partition 2, a fire early warning mechanism 5 connected to both the first cavity 3 and the second cavity 4, and an energy storage mechanism 6 arranged inside the second cavity 4.

Preferably, a first cabinet door 7 is arranged on the front side of the first cavity 3, with one side of the first cabinet door 7 hinged to the partition 2, and two second cabinet doors 8 are arranged on the front side of the second cavity 4, with the two second cabinet doors 8 respectively hinged to the partition 2 and the side wall of the battery compartment 1.

Preferably, the fire early warning mechanism 5 comprises: a first fixing frame 9 and a second fixing frame 10, the first fixing frame 9 and the second fixing frame 10 being respectively fixedly connected to the inner walls on both sides of the second cavity 4, both ends of a first threaded rod 11 being rotatably connected to the inner wall of the first fixing frame 9, both ends of a guide rod 12 being fixedly connected to the inner wall of the second fixing frame 10, a first mounting plate 13 being fixedly connected to the partition 2 on the side of the first cavity 3, a forward and reverse driving motor 14 being fixedly connected to the first mounting plate 13, the output shaft of the forward and reverse driving motor 14 rotatably penetrating the partition 2 and the left side wall of the first fixing frame 9 and being fixedly connected to a first

bevel gear 15, a second bevel gear 16 being fixedly connected to the top end of the first threaded rod 11, and the first bevel gear 15 meshing with the second bevel gear 16.

Preferably, it further comprises a first slider 17, the first slider 17 being threadedly connected to the first threaded rod 11, a second slider 18 being slidably connected to the guide rod 12, a driving motor 19 being fixedly connected to the left side of the first slider 17, a second threaded rod 20 being fixedly connected to the output shaft of the driving motor 19, the right end of the second threaded rod 20 being rotatably connected to the second slider 18, both ends of a slide bar 21 being respectively fixedly connected to the first slider 17 and the second slider 18, a mounting base 22 being threadedly connected to the second threaded rod 20, the mounting base 22 being slidably connected to the slide bar 21, a fire extinguisher canister 23 being fixedly connected to the bottom of the mounting base 22, a nozzle 24 being fixedly connected to the top of the mounting base 22, the discharge port of the fire extinguisher canister 23 being connected to the nozzle 24 via a delivery pipe 25, and a solenoid valve 26 being fixedly connected to the discharge port of the fire extinguisher canister 23.

Preferably, the fire early warning mechanism 5 further comprises: a control box 27, the control box 27 being fixedly connected inside the first cavity 3, and the control box 27 being connected to an operation screen 28, a communication receiver 29, and a power supply 30, a fire detector 31 being fixedly connected to the top of the inner wall of the second cavity 4, a first alarm 32 being fixedly connected to the top of the battery compartment 1, and the operation screen 28, communication receiver 29, power supply 30, fire detector 31, and first alarm 32 being electrically connected to the control box 27.

The beneficial effects of the above technical solution are as follows:

By dividing the battery compartment 1 into a first cavity 3 and a second cavity 4 with a partition 2, the battery boxes 37 in the energy storage mechanism 6 and the control system of the fire early warning mechanism 5 are installed in different cavities. This prevents fires caused by overheating and thermal runaway of the battery boxes 37 during the energy storage operation of the battery compartment 1, avoiding overall

damage to the battery compartment energy storage system and preventing significant economic losses. The fire early warning mechanism 5 monitors the internal fire situation of the battery compartment 1 in real-time. When the fire detector 31 fixed to the top of the battery compartment 1 detects a fire caused by overheating and thermal runaway, the first alarm 32 will sound, and the communication receiver in the control box 27 will transmit the warning information to the staff, enabling them to arrive on-site for handling. Simultaneously, the forward and reverse driving motor 14 fixed to the first mounting plate 13 will start operating. The forward and reverse driving motor 14 drives the first bevel gear 15 fixed to its output shaft to rotate, which engages with the second bevel gear 16 to rotate the first threaded rod 11 synchronously. The first slider 17 threadedly connected to the first threaded rod 11 will move up and down, while the second slider 18 fixedly connected to the first slider 17 through the slide bar 21 will slide up and down along the guide rod 12. The mounting base 22 threadedly connected to the second threaded rod 20 will move left and right along the slide bar 21 driven by the driving motor 19, adjusting the position of the mounting base 22 inside the battery compartment 1. When the mounting base 22 moves to the fire location, the solenoid valve 26 on the fire extinguisher canister 23 opens, releasing high-pressure gas from the fire extinguisher canister 23 through the delivery pipe 25 to the nozzle 24, which directs the high-pressure gas to the fire source to extinguish the fire. After extinguishing the fire, the solenoid valve 26 closes, and the mounting base 22 of the fire early warning mechanism 5 resets.

By setting up the fire early warning mechanism 5 in the battery compartment energy storage system, the present invention ensures timely warnings and effective handling of fires caused by overheating and thermal runaway inside the battery compartment 1, preventing significant economic losses due to internal fires and greatly improving the operational safety of the battery compartment energy storage system. The present invention addresses the following problems of the existing technology: the lack of a fire early warning mechanism 5 in existing battery compartment 1 energy storage systems, leading to untimely warnings and ineffective handling of fires caused by overheating and thermal runaway, resulting in significant

economic losses due to internal fires in the battery compartment 1.

Embodiment 2

Based on Embodiment 1, as shown in FIGS. 1-3, the energy storage mechanism 6 comprises several mounting frames 33, the mounting frames 33 being fixedly connected to the rear side wall of the second cavity 4, several first sliding grooves 34 being embedded in the inner walls on both sides of the mounting frames 33, two first recesses 36 being embedded in the top of the mounting frames 33, several partitions 35 being fixedly connected at intervals to the inner walls of the mounting frames 33, and several first recesses 36 being embedded in the top and bottom of the partitions 35, several battery boxes 37 being correspondingly arranged between the mounting frames 33 and the partitions 35, third sliders 38 being fixedly connected to both sides of the battery boxes 37, the third sliders 38 being slidably connected in the first sliding grooves 34, and handles 371 being fixedly connected to the battery boxes 37.

Preferably, it further comprises several second recesses 39, the second recesses 39 being embedded in the front side of the battery boxes 37, several first springs 40 being correspondingly fixedly connected to the side walls of the second recesses 39, several latching blocks 41 being correspondingly slidably connected in the second recesses 39, the latching blocks 41 being fixedly connected to the first springs 40, the latching blocks 41 being slidably connected in the first recesses 36 and the second recesses 39, and two connecting plates 42 being fixedly connected at intervals to the latching blocks 41.

Preferably, it further comprises a refrigerator 43, the refrigerator 43 being fixedly connected to the right side wall of the battery compartment 1, a filter screen 44 being embedded at the air inlet of the right side wall of the battery compartment 1, and the air inlet of the refrigerator 43 being connected to the air inlet of the right side wall of the battery compartment 1.

Battery bodies are placed inside the battery boxes 37; the battery boxes 37 may also be frame-structured boxes.

The beneficial effects of the above technical solution are as follows:

In the initial state of installation of the battery boxes 37 in the energy storage mechanism 6, several battery boxes 37 are slidably connected in the first sliding grooves 34 on the mounting frames 33 through third sliders 38 fixedly connected to both sides. Several latching blocks 41 are fixedly connected in the second recesses 39 by first springs 40, with the elastic force of the first springs 40 causing the latching blocks 41 to engage with the first recesses 36, further securing the battery boxes 37 on the mounting frames 33. The elastic force of the first springs 40 effectively buffers the battery boxes 37 on the mounting frames 33, preventing shaking caused by vibrations of the battery compartment 1 that could affect the normal operation of the battery compartment energy storage system. When it is necessary to repair or replace the battery bodies in the battery boxes 37 on the mounting frames 33, operators can press the connecting plates 42 fixedly connected to the latching blocks 41, causing the two connecting plates 42 on the battery boxes 37 to move inward, disengaging the latching blocks 41 from the first recesses 36, and simultaneously pull the two handles 371 on the battery boxes 37 to remove the battery boxes 37 from the mounting frames 33 for repair or replacement of the battery bodies inside the battery boxes 37.

The energy storage mechanism 6 is designed as a frame structure, which is simple in structure, facilitating the disassembly and replacement of the battery boxes 37 during the installation process, improving the maintenance efficiency of the battery compartment energy storage system, greatly reducing the work intensity of the operators, and providing good usage effects.

Embodiment 3

Based on Embodiment 1 or 2, as shown in FIGS. 4-5, it further comprises several mounting mechanisms 45, which are fixedly connected around the bottom of the battery compartment 1. The mounting mechanisms 45 comprise:

a mounting base 46, with first fixed sleeves 47 fixedly connected to both sides of the top of the mounting base 46, and two second sliding grooves 48 embedded on both sides of the top of the mounting base 46. Two transmission assemblies are symmetrically connected to the top of the mounting base 46.

The transmission assembly on the left side comprises a fourth slider 49, which is fixedly connected to the side wall of the second sliding groove 48 via a second spring 50 and is slidably connected within the second sliding groove 48. The lower end of a first support rod 51 is hinged to the top of the mounting base 46, and the top of the first support rod 51 is hinged to a fixing block 52. Both ends of a connecting rod 53 are respectively hinged to the fourth slider 49 and the middle of the first support rod 51. The top of the fixing block 52 is hinged to a second support rod 54. Two guide columns 58 are slidably connected inside the first fixed sleeves 47, and a second mounting plate 59 is fixedly connected to the tops of the two guide columns 58. The top of the second support rod 54 is hinged to the bottom of the second mounting plate 59.

The mounting mechanism 45 further comprises: a sliding rod 55 and a second fixed sleeve 56. The sliding rod 55 is fixedly connected to the inside of the fixing block 52 on the left side, and the second fixed sleeve 56 is fixedly connected to the inside of the fixing block 52 of the transmission assembly on the right side. One end of the sliding rod 55 is slidably connected inside the second fixed sleeve 56, a third spring 57 is sleeved on the sliding rod 55 and the second fixed sleeve 56, and both ends of the third spring 57 are fixedly connected to the inside of the fixing block 52.

Preferably, it further comprises two sets of buffer assemblies, which are respectively connected to the top of the first fixed sleeves 47. The buffer assembly comprises a buffer box 60, which is fixedly connected to the top of the first fixed sleeves 47, with buffer fluid 61 inside the buffer box 60. The bottom of a rotating sleeve 62 penetrates the buffer box 60 from top to bottom and is rotatably connected to the guide columns 58. Several buffer plates 63 are fixedly connected at intervals along the circumferential direction of the rotating sleeve 62. A liquid filling port 64 is fixedly connected to the top of the buffer box 60, and a liquid exchange port 65 is fixedly connected to the bottom of the side wall of the buffer box 60.

The beneficial effects of the above technical solution are as follows:

By setting several mounting mechanisms 45 around the bottom of the battery compartment 1, the battery compartment 1 can be installed and fixed. The fourth slider 49 in the transmission assembly is slidably connected within the second sliding

groove 48 embedded in the mounting base 46. The elastic force of the second spring 50 causes the fourth slider 49 to move inward within the second sliding groove 48, while the first support rod 51 hinged to the top of the mounting base 46 swings inward through the connecting rod 53 hinged to the fourth slider 49, driving the fixing block 52 hinged to the first support rod 51 to move inward. The lower end of the second support rod 54 hinged to the fixing block 52 also retracts inward, causing the second mounting plate 59 hinged to the top of the second support rod 54 to lift upward. The guide columns 58 fixedly connected to both sides of the second mounting plate 59 slide upward within the first fixed sleeves 47. Simultaneously, the sliding rod 55 fixedly connected to the fixing block 52 slides within the second fixed sleeve 56, compressing the third spring 57. This achieves stable support for the battery compartment 1 through the mounting mechanisms 45. When the battery compartment 1 experiences severe vibrations, the elastic force of the second spring 50 and the third spring 57 in the mounting mechanisms 45 causes the fourth slider 49 to drive the connecting rod 53 to keep the first support rod 51 swinging inward, while the fixing block 52 moves outward under the influence of the elastic force, ensuring that the second support rod 54 hinged to the fixing block 52 keeps the second mounting plate 59 lifted upward, providing stable support for the battery compartment 1 during severe vibrations and reducing the impact of vibrations on the internal energy storage system of the battery compartment 1. Furthermore, the rotating sleeve 62 in the buffer assembly, which is rotatably connected to the guide columns 58, provides resistance through the several buffer plates 63 fixedly connected to the rotating sleeve 62 rotating in the buffer fluid 61 inside the buffer box 60. The buffer fluid 61, which can be viscous liquids like glycerin, increases the rotational friction between the rotating sleeve 62 and the guide columns 58, providing buffering for the up-and-down movement of the guide columns 58 within the second fixed sleeves 56. The buffer assembly and the mounting mechanisms 45 work together to ensure that the battery compartment 1 mounted on the mounting mechanisms 45 is not only stably supported but also effectively protected from damage to the energy storage system of the battery compartment 1 caused by severe vibrations (such as the battery compartment 1 detaching from its

installation position and causing damage to the entire device), enhancing the operational stability and energy storage efficiency of the battery compartment energy storage system, making it safer and more reliable with good usage effects. Additionally, when transporting the battery compartment, the mounting structure can be used for mounting on the transportation device, avoiding the impact of vibrations from the transportation device on the performance of the battery compartment.

Embodiment 4

Based on any of Embodiments 1-3, it further comprises:

Timer: Used for timing the working duration of the refrigerator 43;

First Temperature Sensor: Installed on the inner wall of the battery compartment 1 to detect the temperature inside the battery compartment 1;

Second Temperature Sensors: Installed at critical points in the battery boxes 37 of the energy storage mechanism 6 (at least one critical point for each battery box 37). The second temperature sensors are used for detecting the temperature at these critical points in the battery boxes 37 of the energy storage mechanism 6;

Third Temperature Sensor: Used to detect the temperature outside the battery compartment 1;

Control Device: The control device is electrically connected to the timer, the first temperature sensor, the second temperature sensors, the third temperature sensor, and a second alarm. The control device controls the second alarm based on data from the timer, the first temperature sensor, the second temperature sensors, and the third temperature sensor. This includes:

Calculating the current status coefficient Q of the refrigerator based on formula (1). If the current status coefficient is not within the corresponding preset range, the second alarm will activate:

$$Q=\frac{(t_{max}-t)*ln(e-0.015\frac{t_3}{t_1}*e^{-\frac{t_0}{t_2}})}{\frac{\sqrt{(T_a-T_b)(T_a-T_c)}}{P\left(\frac{1}{h_1}+\frac{1}{h_2}+\frac{1}{\lambda d}\right)}S*t_0\left[1+0.07\sum_{i=1}^{M}\left(\in_i\frac{T_i-T_{i0}}{T_{i0}}\right)\right]};\qquad(1)$$

where t is the current working duration of the refrigerator in this cycle; t_{max} is

the maximum allowable working duration for a single cycle of the refrigerator; M is the number of critical points; T_i is the actual detected value of the second temperature sensor at the i-th critical point; T_{i0} is the rated reference value of T_i; $\in_i$ is the temperature anomaly influence coefficient at the i-th critical point (greater than 0 and less than 1); T_a is the actual detected value of the first temperature sensor for the internal temperature of the battery compartment; T_b is the actual detected value of the third temperature sensor for the external temperature of the battery compartment; t_1 is the time interval between the current and the last power-on cycle of the refrigerator; t_2 is the total working duration of the previous power-on cycle of the refrigerator before the current cycle; t_3 is the required time interval between the current and the previous power-on cycle of the refrigerator (varies based on t_2); h_1 is the heat convection coefficient on the inner surface of the battery compartment; h_2 is the heat convection coefficient on the outer surface of the battery compartment; λ is the average thermal conductivity coefficient of the battery boxes and battery materials; e is the natural constant; ln is the natural logarithm; t_0 is the unit time; d is the wall thickness of the battery box; S is the heat dissipation area inside the battery compartment; P is the power of the refrigerator; T_c is the target working temperature of the battery.

The term $(t_{max}-t)*ln(e-0.015\frac{t_3}{t_1}*e^{-\frac{t_0}{t_2}})$ is used to determine the remaining working duration of the refrigerator based on the first temperature sensor.

The beneficial effects of the above technical solution are as follows:

The timer is used to time the working duration of the refrigerator in real-time. Before cooling the interior of the battery compartment each time, it determines the current energy storage status of the battery compartment energy storage system. When the performance status is abnormal e.g., if the remaining working duration of the refrigerator in the current cycle is less than the required working duration for current heat dissipation $\frac{\sqrt{(T_a-T_b)(T_a-T_c)}}{P\left(\frac{1}{h_1}+\frac{1}{h_2}+\frac{1}{\lambda d}\right)}S*t_0\left[1+0.07\sum_{i=1}^{M}\left(\in_i\frac{T_i-T_{i0}}{T_{i0}}\right)\right]$, the second alarm signals for maintenance of the refrigerator or uses other cooling methods to ensure the safety of the battery compartment energy storage system.

Specifically: To determine the current single maximum allowable remaining working duration of the refrigerator, it is based on: the current working duration of the refrigerator, the maximum allowable working duration for a single cycle of the refrigerator, the total working duration of the previous cycle before the current cycle, and the time interval between the current and the last power-on cycle of the refrigerator; this determines the duration for which the refrigerator can continue to operate in its current state, and the calculation is reliable;

To determine the required working duration for current heat dissipation, it is based on: the heat convection coefficient on the outer surface of the battery compartment, the heat convection coefficient on the inner surface of the battery compartment, the average thermal conductivity coefficient of the battery boxes and battery materials, the target working temperature of the battery, the ambient temperature, and the temperature at critical points. This determines the required working duration for heat dissipation based on the heating status at critical points, the heat dissipation status of related parameters of the battery compartment, the ambient temperature, and the target working temperature of the battery, ensuring the calculation is reliable.

It is evident that those skilled in the art can make various modifications and changes to the present invention without departing from its spirit and scope. Thus, if these modifications and changes fall within the scope of the present invention and its equivalent technical range, the present invention intends to include these modifications and changes.

CLAIMS

1. An energy storage system for a battery compartment, wherein it comprises a battery compartment (1) divided into a first cavity (3) and a second cavity (4) by a partition (2), a fire early warning mechanism (5) connected to both the first cavity (3) and the second cavity (4), and an energy storage mechanism (6) arranged inside the second cavity (4).

2. The energy storage system for a battery compartment according to claim 1, wherein a first cabinet door (7) is arranged on the front side of the first cavity (3), with one side of the first cabinet door (7) hinged to the partition (2), and two second cabinet doors (8) are arranged on the front side of the second cavity (4), with the two second cabinet doors (8) respectively hinged to the partition (2) and the side wall of the battery compartment (1).

3. The energy storage system for a battery compartment according to claim 1, wherein the fire early warning mechanism (5) comprises: a first fixing frame (9) and a second fixing frame (10), the first fixing frame (9) and the second fixing frame (10) being respectively fixedly connected to the inner walls on both sides of the second cavity (4), both ends of a first threaded rod (11) being rotatably connected to the inner wall of the first fixing frame (9), both ends of a guide rod (12) being fixedly connected to the inner wall of the second fixing frame (10), a first mounting plate (13) being fixedly connected to the partition (2) on the side of the first cavity (3), a forward and reverse driving motor (14) being fixedly connected to the first mounting plate (13), the output shaft of the forward and reverse driving motor (14) rotatably penetrating the partition (2) and the left side wall of the first fixing frame (9) and being fixedly connected to a first bevel gear (15), a second bevel gear (16) being fixedly connected to the top end of the first threaded rod (11), and the first bevel gear (15) meshing with the second bevel gear (16).

4. The energy storage system for a battery compartment according to claim 3, wherein it further comprises a first slider (17), the first slider (17) being threadedly connected to the first threaded rod (11), a second slider (18) being slidably connected to the guide rod (12), a driving motor (19) being fixedly connected to the left side of the first slider (17), a second threaded rod (20) being fixedly connected to the output shaft of the driving motor (19), the right end of the second threaded rod (20) being rotatably connected to the second slider (18), both ends of a slide bar (21) being respectively fixedly connected to the first slider (17) and the second slider (18), a mounting base (22) being threadedly connected to the second threaded rod (20), the mounting base (22) being slidably connected to the slide bar (21), a fire extinguisher canister (23) being fixedly connected to the bottom of the mounting base (22), a nozzle (24) being fixedly connected to the top of the mounting base (22), the discharge port of the fire extinguisher canister (23) being connected to the nozzle (24) via a delivery pipe (25), and a solenoid valve (26) being fixedly connected to the discharge port of the fire extinguisher canister (23).

5. The energy storage system for a battery compartment according to claim 1, wherein the fire early warning mechanism (5) further comprises: a control box (27), the control box (27) being fixedly connected inside the first cavity (3), and the control box (27) being connected to an operation screen (28), a communication receiver (29), and a power supply (30), a fire detector (31) being fixedly connected to the top of the inner wall of the second cavity (4), a first alarm (32) being fixedly connected to the top of the battery compartment (1), and the operation screen (28), communication receiver (29), power supply (30), fire detector (31), and first alarm (32) being electrically connected to the control box (27).

6. The energy storage system for a battery compartment according to claim 1, wherein the energy storage mechanism (6) comprises several mounting frames (33), the mounting frames (33) being fixedly connected to the rear side wall of the second cavity (4), several first sliding grooves (34) being embedded in the inner walls on both

sides of the mounting frames (33), two first recesses (36) being embedded in the top of the mounting frames (33), several partitions (35) being fixedly connected at intervals to the inner walls of the mounting frames (33), and several first recesses (36) being embedded in the top and bottom of the partitions (35), several battery boxes (37) being correspondingly arranged between the mounting frames (33) and the partitions (35), third sliders (38) being fixedly connected to both sides of the battery boxes (37), the third sliders (38) being slidably connected in the first sliding grooves (34), and handles (371) being fixedly connected to the battery boxes (37).

7. The energy storage system for a battery compartment according to claim 6, wherein it further comprises several second recesses (39), the second recesses (39) being embedded in the front side of the battery boxes (37), several first springs (40) being correspondingly fixedly connected to the side walls of the second recesses (39), several latching blocks (41) being correspondingly slidably connected in the second recesses (39), the latching blocks (41) being fixedly connected to the first springs (40), the latching blocks (41) being slidably connected in the first recesses (36) and the second recesses (39), and two connecting plates (42) being fixedly connected at intervals to the latching blocks (41).

8. The energy storage system for a battery compartment according to claim 1, wherein it further comprises a refrigerator (43), the refrigerator (43) being fixedly connected to the right side wall of the battery compartment (1), a filter screen (44) being embedded at the air inlet of the right side wall of the battery compartment (1), and the air inlet of the refrigerator (43) being connected to the air inlet of the right side wall of the battery compartment (1).

9. The energy storage system for a battery compartment according to claim 1, wherein it further comprises several mounting mechanisms (45), the mounting mechanisms (45) being fixedly connected around the bottom of the battery compartment (1), the mounting mechanisms (45) comprising:

a mounting base (46), first fixed sleeves (47) being fixedly connected to both sides of the top of the mounting base (46), two second sliding grooves (48) being embedded on both sides of the top of the mounting base (46), two transmission assemblies being symmetrically connected to the top of the mounting base (46);

the transmission assembly on the left side comprises a fourth slider (49), the fourth slider (49) being fixedly connected to the side wall of the second sliding groove (48) via a second spring (50), the fourth slider (49) being slidably connected in the second sliding groove (48), the lower end of a first support rod (51) being hinged to the top of the mounting base (46), the top of the first support rod (51) being hinged to a fixing block (52), both ends of a connecting rod (53) being respectively hinged to the fourth slider (49) and the middle of the first support rod (51), the top of the fixing block (52) being hinged to a second support rod (54), two guide columns (58) being slidably connected inside the first fixed sleeves (47), a second mounting plate (59) being fixedly connected to the tops of the two guide columns (58), and the top of the second support rod (54) being hinged to the bottom of the second mounting plate (59);

the mounting mechanism (45) further comprises: a sliding rod (55) and a second fixed sleeve (56), the sliding rod (55) being fixedly connected to the inside of the fixing block (52) on the left side, the second fixed sleeve (56) being fixedly connected to the inside of the fixing block (52) of the transmission assembly on the right side, one end of the sliding rod (55) being slidably connected inside the second fixed sleeve (56), a third spring (57) being sleeved on the sliding rod (55) and the second fixed sleeve (56), and both ends of the third spring (57) being fixedly connected to the inside of the fixing block (52).

10. The energy storage system for a battery compartment according to claim 9, wherein it further comprises two sets of buffer assemblies, the two sets of buffer assemblies being respectively connected to the top of the first fixed sleeves (47), the buffer assembly comprising a buffer box (60), the buffer box (60) being fixedly connected to the top of the first fixed sleeves (47), buffer fluid (61) being arranged inside the buffer box (60), the bottom of a rotating sleeve (62) penetrating the buffer

box (60) from top to bottom and being rotatably connected to the guide columns (58), several buffer plates (63) being fixedly connected at intervals along the circumferential direction of the rotating sleeve (62), a liquid filling port (64) being fixedly connected to the top of the buffer box (60), and a liquid exchange port (65) being fixedly connected to the bottom of the side wall of the buffer box (60).

REVENDICATIONS

1. Système de stockage d'énergie pour compartiment de batterie, caractérisé en ce qu'il comprend : un compartiment de batterie (1), divisé en une première chambre (3) et une deuxième chambre (4) par une cloison (2), un dispositif de détection d'incendie (5) connecté aux chambres (3) et (4), un dispositif de stockage d'énergie (6) étant situé dans la deuxième chambre (4).

2. Système de stockage d'énergie pour compartiment de batterie selon la revendication 1, caractérisé en ce que : une première porte (7) est disposée sur le devant de la première chambre (3), ladite première porte (7) étant articulée sur la cloison (2), deux deuxièmes portes (8) sont disposées sur le devant de la deuxième chambre (4), chacune des deuxièmes portes (8) étant articulée respectivement sur la cloison (2) et sur la paroi latérale du compartiment de batterie (1).

3. Système de stockage d'énergie pour compartiment de batterie selon la revendication 1, caractérisé en ce que : le dispositif de détection d'incendie (5) comprend : un premier support fixe (9) et un deuxième support fixe (10), le premier support fixe (9) et le deuxième support fixe (10) étant fixés sur les parois intérieures latérales de la deuxième chambre (4), les extrémités de la première tige filetée (11) étant rotativement connectées à la paroi intérieure du premier support fixe (9), les extrémités de la tige de guidage (12) étant fixées à la paroi intérieure du deuxième support fixe (10), une première plaque de montage (13) étant fixée sur la cloison (2) du côté de la première chambre (3), un moteur réversible (14) étant fixé sur la première plaque de montage (13), l'arbre de sortie du moteur réversible (14) passant à travers la cloison (2) et la paroi latérale gauche du premier support fixe (9) et étant fixé à un premier pignon conique (15), un deuxième pignon conique (16) étant fixé à l'extrémité supérieure de la première tige filetée (11), le premier pignon conique (15) engrenant avec le deuxième pignon conique (16).

4. Système de stockage d'énergie pour compartiment de batterie selon la revendication 3, caractérisé en ce que : il comprend également un premier coulisseau (17), le premier coulisseau (17) étant fileté sur la première tige filetée (11), un deuxième coulisseau (18) étant coulissant sur la tige de guidage (12), un moteur d'entraînement (19) étant fixé sur le côté gauche du premier coulisseau (17), une deuxième tige filetée (20) étant fixée à l'arbre de sortie du moteur d'entraînement (19), l'extrémité droite de la deuxième tige filetée (20) étant rotativement connectée au deuxième coulisseau (18), les deux extrémités de la tige coulissante (21) étant respectivement fixées aux premier et deuxième coulisseaux (17) et (18), un support de montage (22) étant fileté sur la deuxième tige filetée (20), le support de montage (22) étant coulissant sur la tige coulissante (21), un réservoir d'extinction (23) étant fixé au bas du support de montage (22), une buse (24) étant fixée au sommet du support de montage (22), la sortie du réservoir d'extinction (23) étant reliée à la buse (24) par un tuyau de transfert (25), une vanne électromagnétique (26) étant fixée à la sortie du réservoir d'extinction (23).

5. Système de stockage d'énergie pour compartiment de batterie selon la revendication 1, caractérisé en ce que : le dispositif de détection d'incendie (5) comprend également : un boîtier de contrôle (27), le boîtier de contrôle (27) étant fixé dans la première chambre (3), et étant connecté à un écran de commande (28), un récepteur de communication (29) et une source d'alimentation (30), un détecteur d'incendie (31) étant fixé au sommet de la paroi intérieure de la deuxième chambre (4), une première alarme (32) étant fixée au sommet du compartiment de batterie (1), l'écran de commande (28), le récepteur de communication (29), la source d'alimentation (30), le détecteur d'incendie (31) et la première alarme (32) étant électriquement connectés au boîtier de contrôle (27).

6. Système de stockage d'énergie pour compartiment de batterie selon la

revendication 1, caractérisé en ce que : le dispositif de stockage d'énergie (6) comprend plusieurs supports de montage (33), plusieurs supports de montage (33) étant fixés à la paroi arrière de la deuxième chambre (4), des premières rainures coulissantes (34) étant encastrées dans les parois latérales gauche et droite des supports de montage (33), deux premiers renfoncements (36) étant encastrés dans le sommet des supports de montage (33), plusieurs cloisons (35) étant fixées aux parois intérieures des supports de montage (33) à des intervalles de distance verticale, les sommets et les bases des cloisons (35) étant encastrés dans des premiers renfoncements (36), plusieurs boîtes de batteries (37) étant placées entre les supports de montage (33) et les cloisons (35), les deux côtés des boîtes de batteries (37) étant fixés à des troisièmes coulisseaux (38), les troisièmes coulisseaux (38) étant coulissants dans les premières rainures coulissantes (34), une poignée (371) étant fixée sur les boîtes de batteries (37).

7. Système de stockage d'énergie pour compartiment de batterie selon la revendication 6, caractérisé en ce que : il comprend également plusieurs deuxièmes renfoncements (39), plusieurs deuxièmes renfoncements (39) étant encastrés à l'avant des boîtes de batteries (37), plusieurs premiers ressorts (40) étant fixés à la paroi latérale des deuxièmes renfoncements (39), plusieurs blocs de verrouillage (41) étant coulissants dans les deuxièmes renfoncements (39), les blocs de verrouillage (41) étant fixés aux premiers ressorts (40), plusieurs blocs de verrouillage (41) étant coulissants dans les premiers (36) et les deuxièmes renfoncements (39), deux plaques de connexion (42) étant fixées à intervalles de distance verticale sur les blocs de verrouillage (41).

8. Système de stockage d'énergie pour compartiment de batterie selon la revendication 1, caractérisé en ce que : il comprend également un réfrigérateur (43), le réfrigérateur (43) étant fixé à la paroi latérale droite du compartiment de batterie (1), un filtre (44) étant encastré à l'entrée d'air de la paroi latérale droite du compartiment de batterie (1), l'entrée d'air du réfrigérateur (43) étant connectée à

l'entrée d'air de la paroi latérale droite du compartiment de batterie (1).

9. Système de stockage d'énergie pour compartiment de batterie selon la revendication 1, caractérisé en ce que : il comprend également plusieurs dispositifs de montage (45), plusieurs dispositifs de montage (45) étant fixés aux alentours de la base du compartiment de batterie (1), chaque dispositif de montage (45) comprenant :

une base de montage (46), les deux côtés du sommet de la base de montage (46) étant fixés à un premier manchon de fixation (47), deux deuxièmes rainures coulissantes (48) étant encastrées sur les deux côtés du sommet de la base de montage (46), deux ensembles de transmission étant symétriquement connectés aux deux côtés du sommet de la base de montage (46) ;

l'ensemble de transmission de gauche comprenant un quatrième coulisseau (49), le quatrième coulisseau (49) étant fixé à la paroi latérale de la deuxième rainure coulissante (48) par un deuxième ressort (50), le quatrième coulisseau (49) étant coulissant dans la deuxième rainure coulissante (48), l'extrémité inférieure de la première tige de support (51) étant articulée au sommet de la base de montage (46), le sommet de la première tige de support (51) étant articulé à un bloc de fixation (52), les deux extrémités de la tige de connexion (53) étant articulées respectivement au quatrième coulisseau (49) et au milieu de la première tige de support (51), le sommet du bloc de fixation (52) étant articulé à une deuxième tige de support (54), les deux colonnes de guidage (58) étant coulissantes dans les premiers manchons de fixation (47), la deuxième plaque de montage (59) étant fixée au sommet des deux colonnes de guidage (58), le sommet de la deuxième tige de support (54) étant articulé au bas de la deuxième plaque de montage (59) ;

le dispositif de montage (45) comprend également : une tige coulissante (55) et un deuxième manchon de fixation (56), la tige coulissante (55) étant fixée à l'intérieur du bloc de fixation gauche (52), le deuxième manchon de fixation (56) étant fixé à l'intérieur du bloc de fixation de l'ensemble de transmission droit, une extrémité de la tige coulissante (55) étant coulissante dans le deuxième manchon de fixation (56), un

troisième ressort (57) étant enroulé autour de la tige coulissante (55) et du deuxième manchon de fixation (56), les deux extrémités du troisième ressort (57) étant fixées à l'intérieur du bloc de fixation (52).

10. Système de stockage d'énergie pour compartiment de batterie selon la revendication 9, caractérisé en ce que : il comprend également deux ensembles d'amortissement, les deux ensembles d'amortissement étant connectés au sommet des premiers manchons de fixation (47), chaque ensemble d'amortissement comprenant une boîte d'amortissement (60), la boîte d'amortissement (60) étant fixée au sommet des premiers manchons de fixation (47), un liquide d'amortissement (61) étant contenu dans la boîte d'amortissement (60), le bas d'un manchon rotatif (62) passant de haut en bas à travers la boîte d'amortissement (60) et étant rotativement connecté aux colonnes de guidage (58), plusieurs plaques d'amortissement (63) étant fixées à des intervalles de distance verticale autour du manchon rotatif (62), un orifice de remplissage (64) étant fixé au sommet de la boîte d'amortissement (60), un orifice de vidange (65) étant fixé au bas de la paroi latérale de la boîte d'amortissement (60).

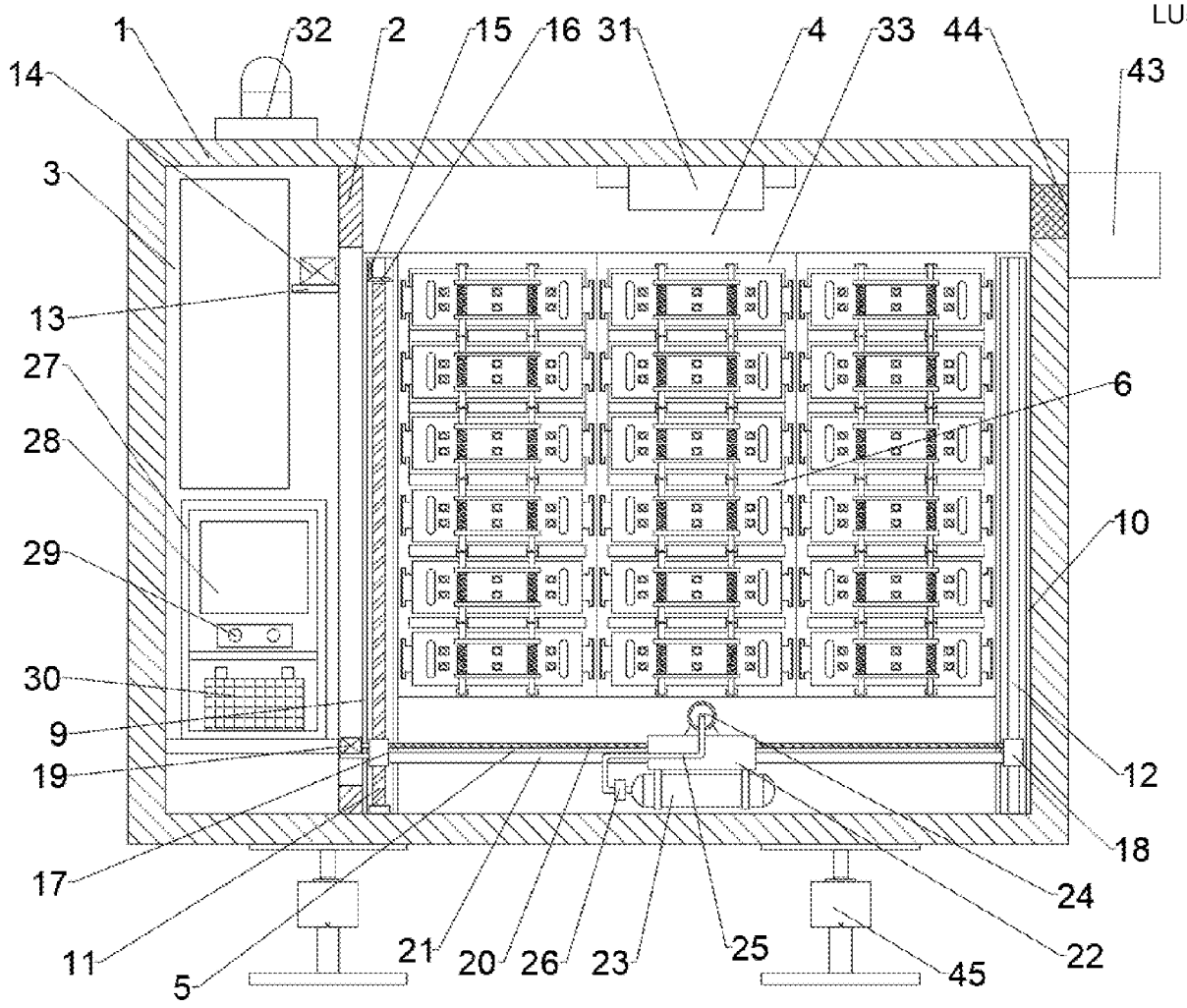
1
32
2
15
16
31
4
33
44
43
14
3
13
27
28
29
30
9
19
17
11
5
21
20
26
23
25
45
22
24
18
12
10
6

FIG.1

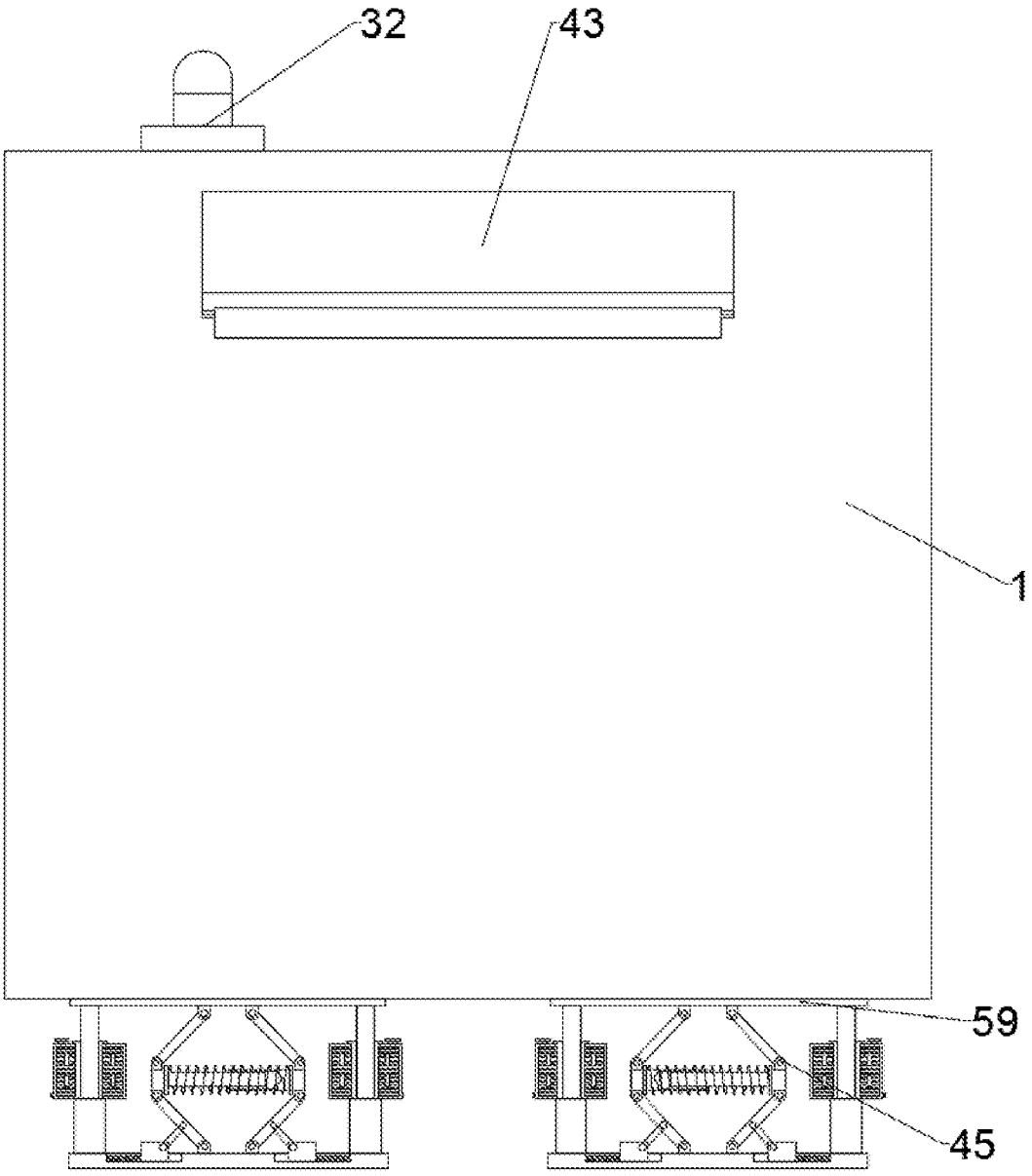

FIG.2

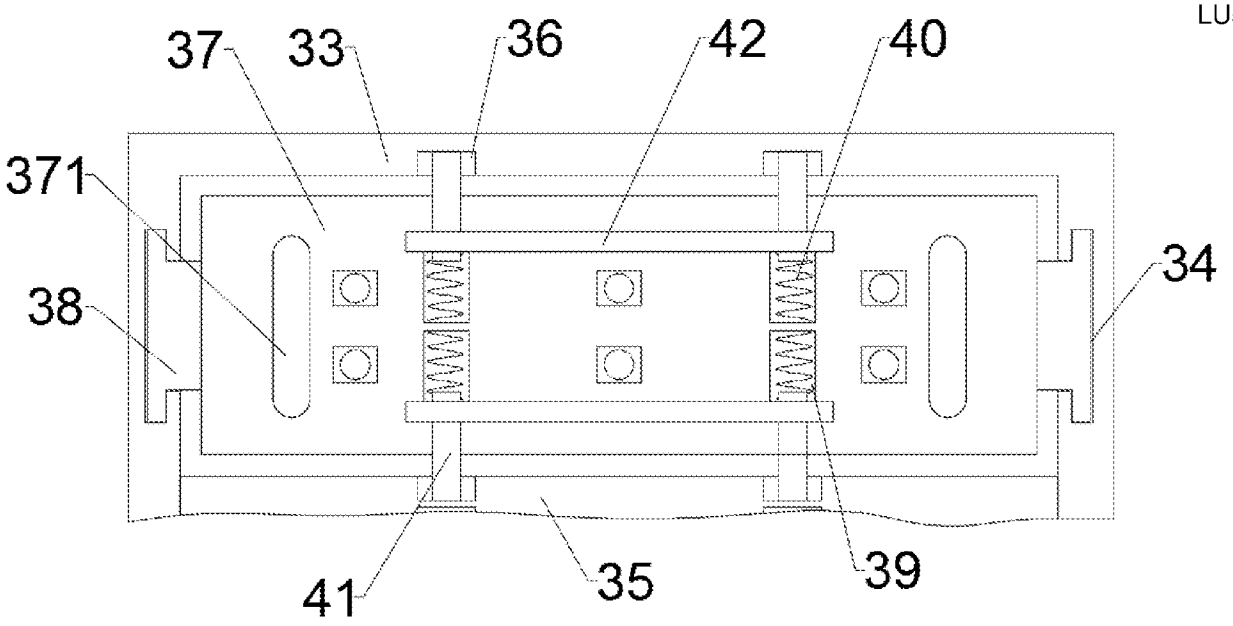

FIG.3

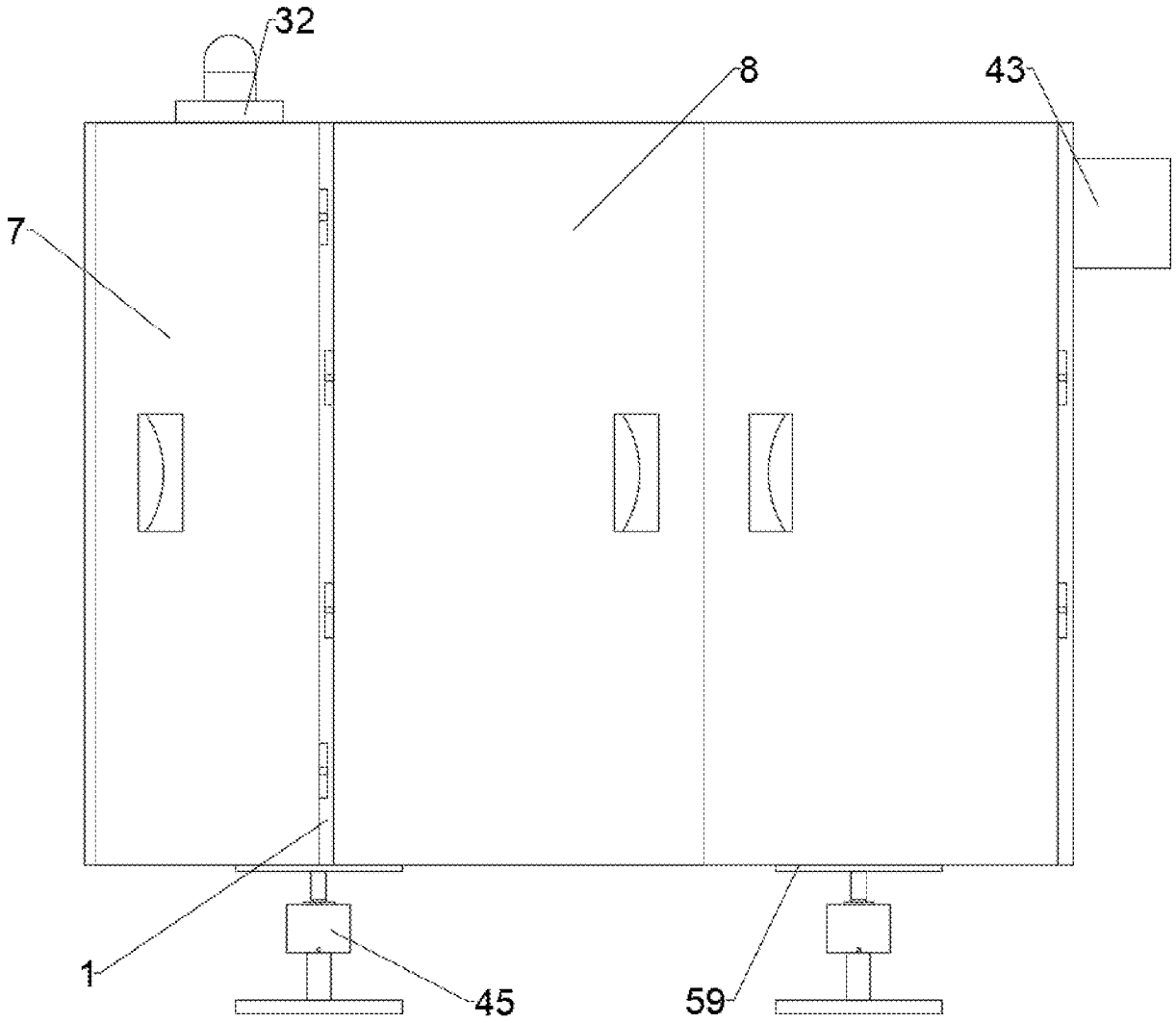

FIG.4

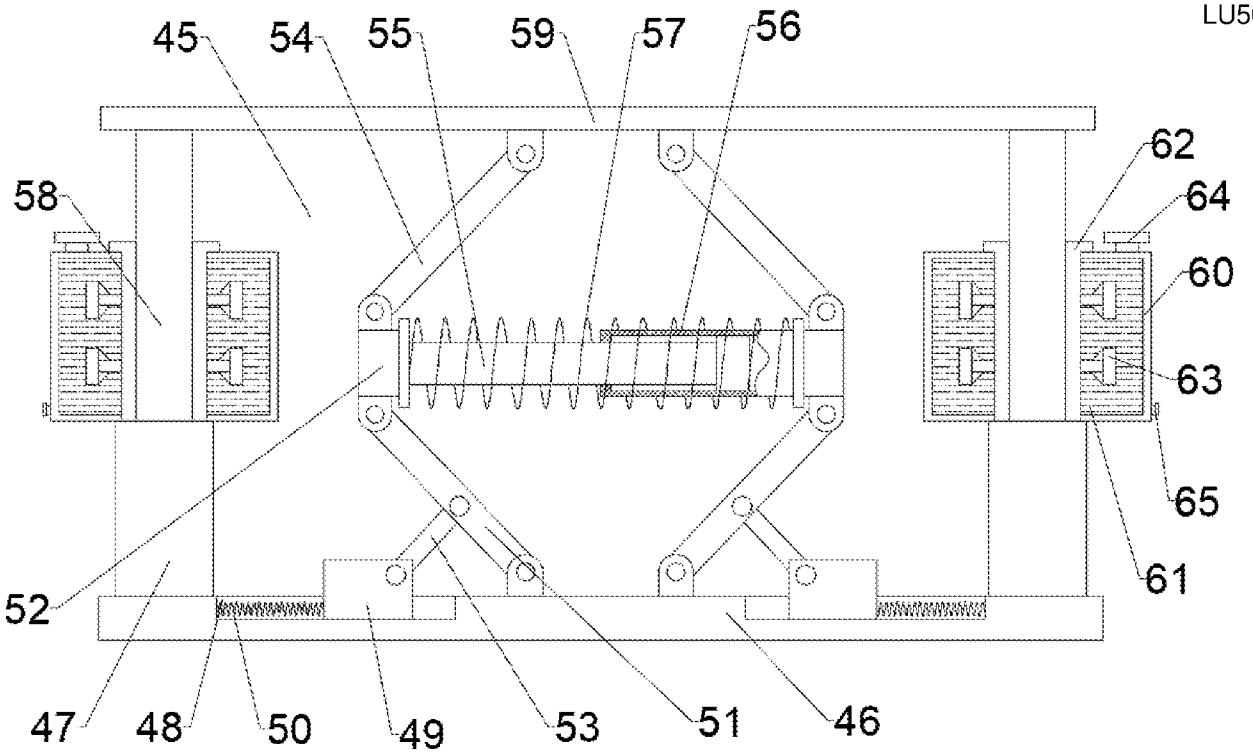

FIG.5