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(54) **AN EXTINGUISHING DEVICE AND AN EXTINGUISHING METHOD**

(57) An extinguishing device comprises a body structure (101) having a vertical part (102) and a horizontal part (103), and a movable part (104) moveably supported to the vertical part to be above the horizontal part. The movable part is linearly moveable in a vertical direction to vary a distance between the movable part and the horizontal part so that an object in fire is between the movable part and the horizontal part. The extinguishing device comprises a hose connection (105) for receiving firefighting water from an external hose. The extinguishing device comprises first pipes (106) connected to the hose connection, attached to the horizontal part of the body structure, and provided with first nozzles (107) configured to spray the firefighting water upwards, and second pipes (108) connected to the hose connection, attached to the movable part, and provided with second nozzles (109) configured to spray the firefighting water downwards.

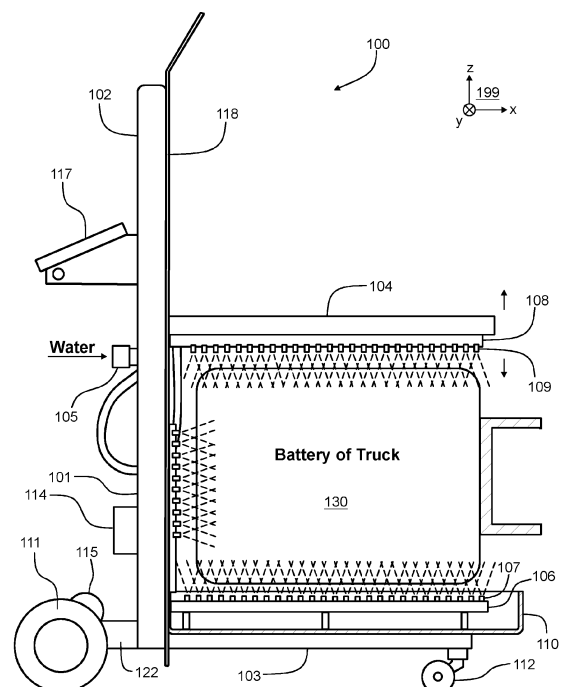


Figure 1a

Description

Technical field

[0001] The disclosure relates generally to extinguishing technology. More particularly, the disclosure relates to an extinguishing device that can be used for extinguishing e.g. a fire in a battery of an electric or hybrid truck. Furthermore, the disclosure relates to an extinguishing method.

Background

[0002] Over the last decade, development of electric and hybrid vehicles has significantly changed the car industry globally. The development has been mainly driven by the fast development of battery technology. However, a fire risk and hazard associated with high-energy batteries has become a significant safety concern for electric and hybrid vehicles. Thermal runaway or fire can occur as a result of extreme conditions that may be results of faulty operation. Failure of a battery may then be accompanied by release of toxic gases, fire, jet flames, and/or explosion. Extinguishing a fire on a battery of an electric or hybrid vehicle can be challenging because a burning battery can re-ignite without sufficient cooling. As a corollary, a significant amount of firefighting water is needed to cool the battery, extinguish fire, and prevent reignition.

[0003] A process where a burning battery of e.g. an electric or hybrid truck is extinguished with a traditional firehose can be problematic because firefighting water is typically directed to a single spot on a surface of the battery whereas there is a need to cool the whole surface of the battery to prevent harmful development of hot spots and to minimize release of toxic gases, fire, jet flames, and/or a risk of an explosion.

Summary

[0004] The following presents a simplified summary to provide a basic understanding of some aspects of various invention embodiments. The summary is not an extensive overview of the invention. It is neither intended to identify key or critical elements of the invention nor to delineate the scope of the invention. The following summary merely presents some concepts of the invention in a simplified form as a prelude to a more detailed description of exemplifying embodiments of the invention.

[0005] In this document, the word "geometric" when used as a prefix means a geometric concept that is not necessarily a part of any physical object. The geometric concept can be for example a geometric point, a straight or curved geometric line, a planar or non-planar geometric surface, a geometric space, or any other geometric entity that is zero, one, two, or three dimensional.

[0006] In accordance with the invention, there is provided a new extinguishing device that comprises:

- a body structure having a vertical part and a horizontal part,
- a movable part moveably supported to the vertical part of the body structure to be above the horizontal part of the body structure, the movable part being linearly moveable in a vertical direction to vary a distance between the movable part and the horizontal part of the body structure,
- a hose connection for receiving firefighting water from an external hose,
- first pipes connected to the hose connection, attached to the horizontal part of the body structure, and provided with first nozzles configured to spray the firefighting water upwards towards the movable part, and
- second pipes connected to the hose connection, attached to the movable part, and provided with second nozzles configured to spray the firefighting water downwards towards the horizontal part of the body structure.

[0007] In accordance with the invention, there is also provided a new method for extinguishing fire of an object, e.g. a battery of an electric or hybrid truck. The method comprises:

- positioning an extinguishing device according to the invention so that the first nozzles of the extinguishing device are below the object and the second nozzles of the extinguishing device are above the object, and
- spraying firefighting water to the object via the first and second nozzles.

[0008] In the above-described method, both upper and lower surfaces of the object are sprayed with the firefighting water and the firefighting water flows down along the side surfaces of the object. Therefore, all the surfaces of the object are cooled by the firefighting water. This reduces a risk of development of hot spots and minimizes release of toxic gases, fire, jet flames, and/or a risk of an explosion.

[0009] Exemplifying and non-limiting embodiments are described in accompanied dependent claims.

[0010] Various exemplifying and non-limiting embodiments both as to constructions and to methods of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific exemplifying and non-limiting embodiments when read in conjunction with the accompanying drawings.

[0011] The verbs "to comprise" and "to include" are used in this document as open limitations that neither exclude nor require the existence of unrecited features.

[0012] The features recited in dependent claims are

mutually freely combinable unless otherwise explicitly stated.

[0013] Furthermore, it is to be understood that the use of "a" or "an", i.e. a singular form, throughout this document does not exclude a plurality.

Brief description of figures

[0014] Exemplifying and non-limiting embodiments and their advantages are explained in greater detail below in the sense of examples and with reference to the accompanying drawings, in which:

figures 1a and 1b illustrate an extinguishing device according to an exemplifying and non-limiting embodiment,

figure 2 illustrates a use of an extinguishing device according to an exemplifying and non-limiting embodiment, and

figure 3 shows a flowchart of a method according to an exemplifying and non-limiting embodiment for extinguishing a fire in an object.

Description of exemplifying and non-limiting embodiments

[0015] The specific examples provided in the description below should not be construed as limiting the scope and/or the applicability of the accompanied claims. Lists and groups of examples provided in the description are not exhaustive unless otherwise explicitly stated.

[0016] Figure 1a shows a side view of an extinguishing device 100 according to an exemplifying and non-limiting embodiment. Figure 1b shows a top view of a part of the extinguishing device 100. The extinguishing device 100 comprises a body structure 101 that has a vertical part 102 and a horizontal part 103. The extinguishing device 100 comprises a movable part 104 that is moveably supported to the vertical part 102 of the body structure to be above the horizontal part 103 of the body structure. The movable part 104 is linearly moveable in a vertical direction to vary a distance between the movable part 104 and the horizontal part 103 of the body structure. In figure 1a, the movable part 104 is moveable in positive and negative z-directions of a coordinate system 199. The extinguishing device 100 comprises a hose connection 105 for receiving firefighting water from an external hose. The extinguishing device 100 comprises first pipes 106 connected to the hose connection 105, attached to the horizontal part 103 of the body structure, and provided with first nozzles configured to spray the firefighting water upwards towards the movable part 104. In figure 1a, one of the first nozzles is denoted with a reference 107. The extinguishing device 100 comprises second pipes 108 connected to the hose connection 105, attached to the movable part 104, and provided with second nozzles con-

figured to spray the firefighting water downwards towards the horizontal part 103 of the body structure. In figure 1a, one of the second nozzles is denoted with a reference 109.

[0017] As shown in figure 1a, the extinguishing device 100 is positioned so that the first nozzles of the extinguishing device are below an object 130 to be cooled and the second nozzles of the extinguishing device are above the object 130. The object 130 can be for example a battery of an electric or hybrid truck. Both upper and lower surfaces of the object 130 are sprayed with the firefighting water and the firefighting water flows down along the side surfaces of the object 130. Therefore, all the surfaces of the object 130 are cooled by the firefighting water. This reduces a risk of development of hot spots and minimizes release of toxic gases, fire, jet flames, and/or a risk of an explosion.

[0018] The exemplifying extinguishing device 100 illustrated in figures 1a and 1b comprises a water collecting pool 110 attached to the body structure so that the bottom of the collecting pool 110 is below the first nozzles. In figure 1a, the collecting pool 110 is presented as a section view where a geometric section plane is parallel with the xz-plane of the coordinate system 199.

[0019] The exemplifying extinguishing device 100 illustrated in figures 1a and 1b comprises a protective plate 118 attached to the vertical part 102 of the body structure and configured to protect a user of the extinguishing device from heat. In this exemplifying case, the extinguishing device 100 comprises pipes connected to the hose connection 105, attached to the protective plate 118, and provided with nozzles configured to spray the firefighting water forward. The width of the protective plate 118 in the y-direction of the coordinate system 199 can be about 1 meter, the height of the protective plate 118 in the z-direction of the coordinate system 199 can be about 1.8 meters, and the distance from the lower edge of the protective plate 118 to a floor can be about 10 cm. The protective plate 118 is advantageously provided with one or more viewing holes to enable the user to see ahead.

[0020] The exemplifying extinguishing device 100 illustrated in figures 1a and 1b comprises wheels for carrying the body structure 101. The wheels comprise rear wheels and front wheels so that the rear wheels are nearer to the vertical part 102 of the body structure than the front wheels which are attached to the horizontal part 103 of the body structure. In figure 1a, one of the rear wheels is denoted with a reference 111 and one of the front wheels denoted with a reference 112. In figure 1b, the rear wheels are denoted with references 111 and 113. In this exemplifying case, the diameter of the rear wheels is greater than the diameter of the front wheels and the front wheels are supported with respect to the horizontal part 103 of the body structure so that a direction of a rotation axis of each of the front wheels is changeable with respect to the horizontal part 103 of the body structure.

[0021] In the exemplifying extinguishing device 100 il-

illustrated in figures 1a and 1b, a position of the rear wheels 111 and 113 is vertically adjustable with respect to the body structure 101. Suspension beams 122 and 123 are vertically moveable with respect to the vertical part 102 of the body structure. There can be for example threaded rods for vertically adjusting the position of the suspension beams 122 and 123 with respect to the vertical part 102 of the body structure. Figure 1b shows section views of the threaded rods which are denoted with references 124 and 125. It is to be noted that the threaded rods are one example only, and different means can be used for vertically adjusting the position of the suspension beams 122 and 123 with respect to the vertical part 102 of the body structure. Furthermore, it is also possible that in an extinguishing device according to an exemplifying and non-limiting embodiment, the rear wheels have a fixed vertical position with respect to the body structure.

[0022] The exemplifying extinguishing device 100 illustrated in figures 1a and 1b comprises an electric drive system configured to drive the rear wheels 111 and 113. The electric drive system may comprise for example a first electric drive motor 115 configured to drive the rear wheel 111 and a second electric drive motor 116 configured to drive the rear wheel 113. The extinguishing device 100 can be steered by controlling a difference between rotational speeds of the rear wheels 111 and 113. It is also possible that a single electric drive motor is configured to drive both the rear wheels 111. In this exemplifying case, the steering can be implemented for example with the aid of the front wheels. It is also possible that an extinguishing device according to an exemplifying and non-limiting embodiment does not comprise an electric drive motor, but the extinguishing device is moved manually or by an external driving apparatus.

[0023] In the exemplifying extinguishing device 100 illustrated in figures 1a and 1b, the electric drive system comprises an electric motor 114 configured to move the movable part 104 vertically with respect to the body structure 101. A system for vertically moving the movable part 104 can be for example hydraulic or mechanical.

[0024] A mechanical system may comprise for example a threaded rod run by the electric motor 114 and configured to vertically move the movable part 104. It is also possible that an extinguishing device according to an exemplifying and non-limiting embodiment does not comprise an electric motor for moving the movable part 104, but the movable part 104 is moved manually with a hydraulic or mechanical system.

[0025] The exemplifying extinguishing device 100 illustrated in figures 1a and 1b comprises a controller 117 that comprises a user interface "UI" and is configured to control the electric drive system in accordance with commands received via the user interface. The control of the electric drive system can be implemented with one or more processor circuits, each of which can be a programmable processor circuit provided with appropriate software, a dedicated hardware processor such as for example an application specific integrated circuit "ASIC",

or a configurable hardware processor such as for example a field programmable gate array "FPGA". Furthermore, the implementation of the control may comprise one or more memory circuits each of which can be for example a random-access-memory "RAM" circuit.

[0026] Figure 2 illustrates a use of an extinguishing device 200 according to an exemplifying and non-limiting embodiment. The extinguishing device 200 comprises an electric drive system for steerable moving the extinguishing device 200 and for vertically moving the movable part 204. The extinguishing device 200 comprises a controller 217 that is a remote controller. Furthermore, the extinguishing device comprises a data transfer link 218 from the remote controller to the electric drive system of the extinguishing device 200. In this exemplifying case, the data transfer link 218 comprises a signal cable but a wireless data transfer link is also possible. The extinguishing device 200 is connected with a hose 219 to a source of firefighting water and with a power cable 220 to a source of electric power. The remote controller enables a user 221 of the extinguishing device 200 to control the extinguishing device 200 a distance away from an object 230 that may release toxic gases, fire, jet flames, and/or has a risk of an explosion.

[0027] Firefighting water that has been used may be poisonous and/or otherwise harmful. Thus, the used firefighting water should be prevented from spreading to the environment. Therefore, an extinguishing operation may further comprise erecting a collapsible pool 231 to surround the object 230 being cooled. The pool 231 makes it easier to collect the used firefighting water during and after the extinguishing operation.

[0028] Figure 3 shows a flowchart of a method according to an exemplifying and non-limiting embodiment for extinguishing fire of an object that can be for example a battery of an electric or hybrid truck. The method comprises the following actions:

- action 301: positioning an extinguishing device according to an exemplifying and non-limiting embodiment so that the first nozzles of the extinguishing device are below the object and the second nozzles of the extinguishing device are above the object, and
- action 302: spraying firefighting water to the object via the first and second nozzles.

[0029] A method according to an exemplifying and non-limiting embodiment comprises erecting a collapsible pool to surround the object.

[0030] The specific examples provided in the description given above should not be construed as limiting the applicability and/or interpretation of the appended claims. It is to be noted that lists and groups of examples given in this document are non-exhaustive lists and groups unless otherwise explicitly stated.

Claims

1. An extinguishing device (100, 200) comprising:

- a body structure (101) having a vertical part (102) and a horizontal part (103),
- a movable part (104) moveably supported to the vertical part of the body structure to be above the horizontal part of the body structure, the movable part being linearly moveable in a vertical direction to vary a distance between the movable part and the horizontal part of the body structure, and
- a hose connection (105) for receiving firefighting water from an external hose,

characterized in that the extinguishing device comprises:

- first pipes (106) connected to the hose connection, attached to the horizontal part of the body structure, and provided with first nozzles (107) configured to spray the firefighting water upwards towards the movable part, and
- second pipes (108) connected to the hose connection, attached to the movable part, and provided with second nozzles (109) configured to spray the firefighting water downwards towards the horizontal part of the body structure.

2. An extinguishing device according to claim 1, wherein the extinguishing device comprises a water collecting pool (110) attached to the body structure, a bottom of the collecting pool being below the first nozzles.

3. An extinguishing device according to claim 1 or 2, wherein the extinguishing device comprises wheels (111, 112, 113) for carrying the body structure.

4. An extinguishing device according to claim 3, wherein the wheels comprise rear wheels (111, 113) and front wheels (112) so that the rear wheels are nearer to the vertical part of the body structure than the front wheels which are attached to the horizontal part of the body structure.

5. An extinguishing device according to claim 4, wherein a diameter of the rear wheels (111, 113) is greater than a diameter of the front wheels (112).

6. An extinguishing device according to claim 4 or 5, wherein the front wheels (112) are supported with respect to the horizontal part (103) of the body structure so that a direction of a rotation axis of each of the front wheels is changeable with respect to the horizontal part of the body structure.

7. An extinguishing device according to any one of claims 4-6, wherein the extinguishing device comprises an electric drive system configured to drive the rear wheels (111, 113).

8. An extinguishing device according to claim 7, wherein the electric drive system comprises an electric motor (114) configured to move the movable part (104) vertically with respect to the body structure.

9. An extinguishing device according to claim 7 or 8, wherein the electric drive system comprises a first electric drive motor (115) configured to drive a first one (111) of the rear wheels and a second electric drive motor (116) configured to drive a second one (113) of the rear wheels.

10. An extinguishing device according to any one of claims 7-9, wherein the extinguishing device comprises a controller (117, 217) comprising a user interface and configured to control the electric drive system in accordance with commands received via the user interface.

11. An extinguishing device according to claim 10, wherein the controller is a remote controller, and the extinguishing device comprises a data transfer link (218) from the remote controller to the electric drive system.

12. An extinguishing device according to any one of claims 1-11, wherein the extinguishing device comprises a protective plate (118) attached to the vertical part (102) of the body structure and configured to protect a user of the extinguishing device from heat.

13. A method for extinguishing fire of an object, **characterized in that** the method comprises:

- positioning (301) an extinguishing device (100, 200) according to any one of claims 1-11 so that the first nozzles of the extinguishing device are below the object and the second nozzles of the extinguishing device are above the object, and
- spraying (302) firefighting water to the object via the first and second nozzles.

14. A method according to claim 13, wherein the object is a battery of an electric or hybrid truck.

15. A method according to claim 13 or 14, wherein the method comprises erecting a collapsible pool to surround the object to facilitate collecting used firefighting water.

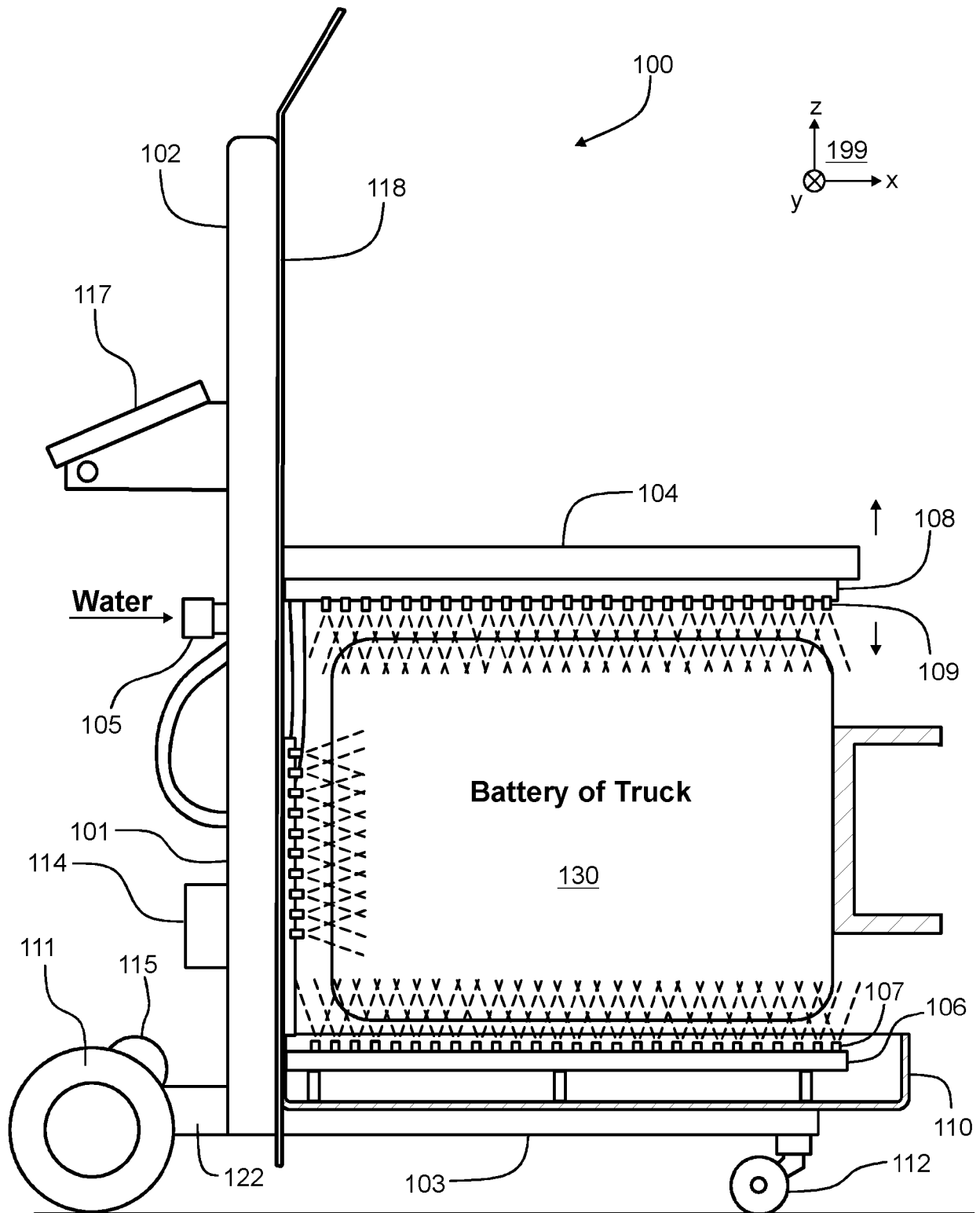


Figure 1a

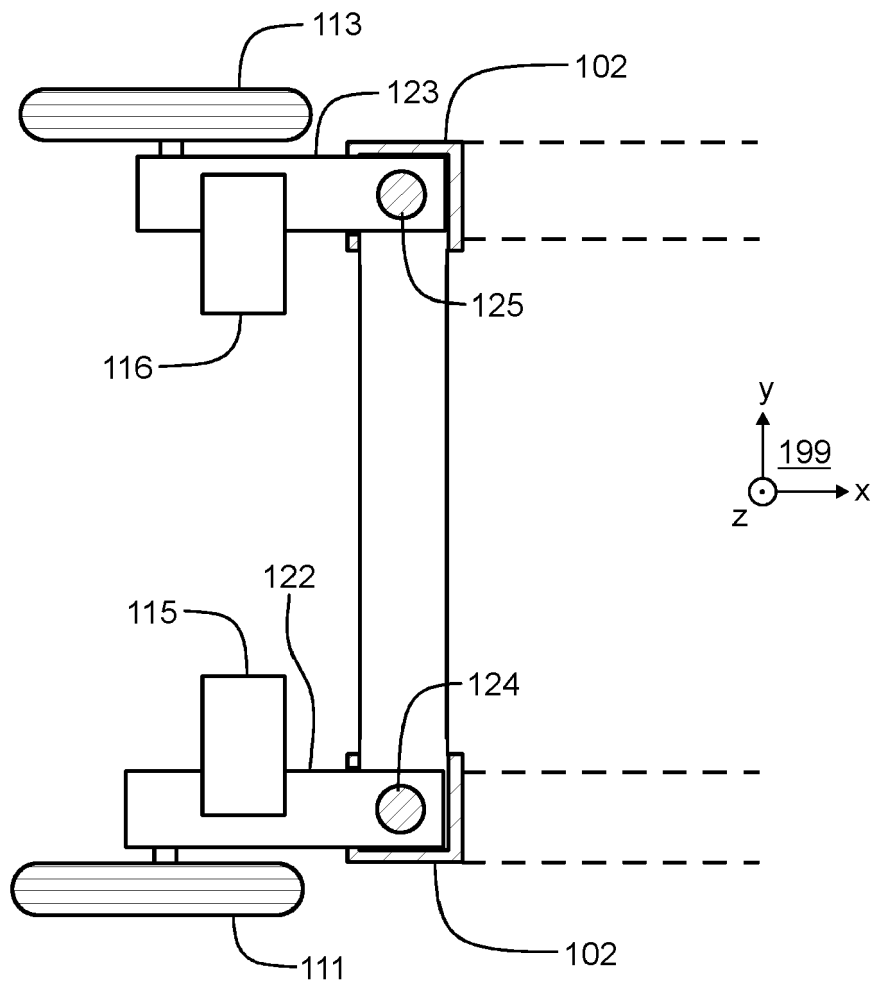


Figure 1b

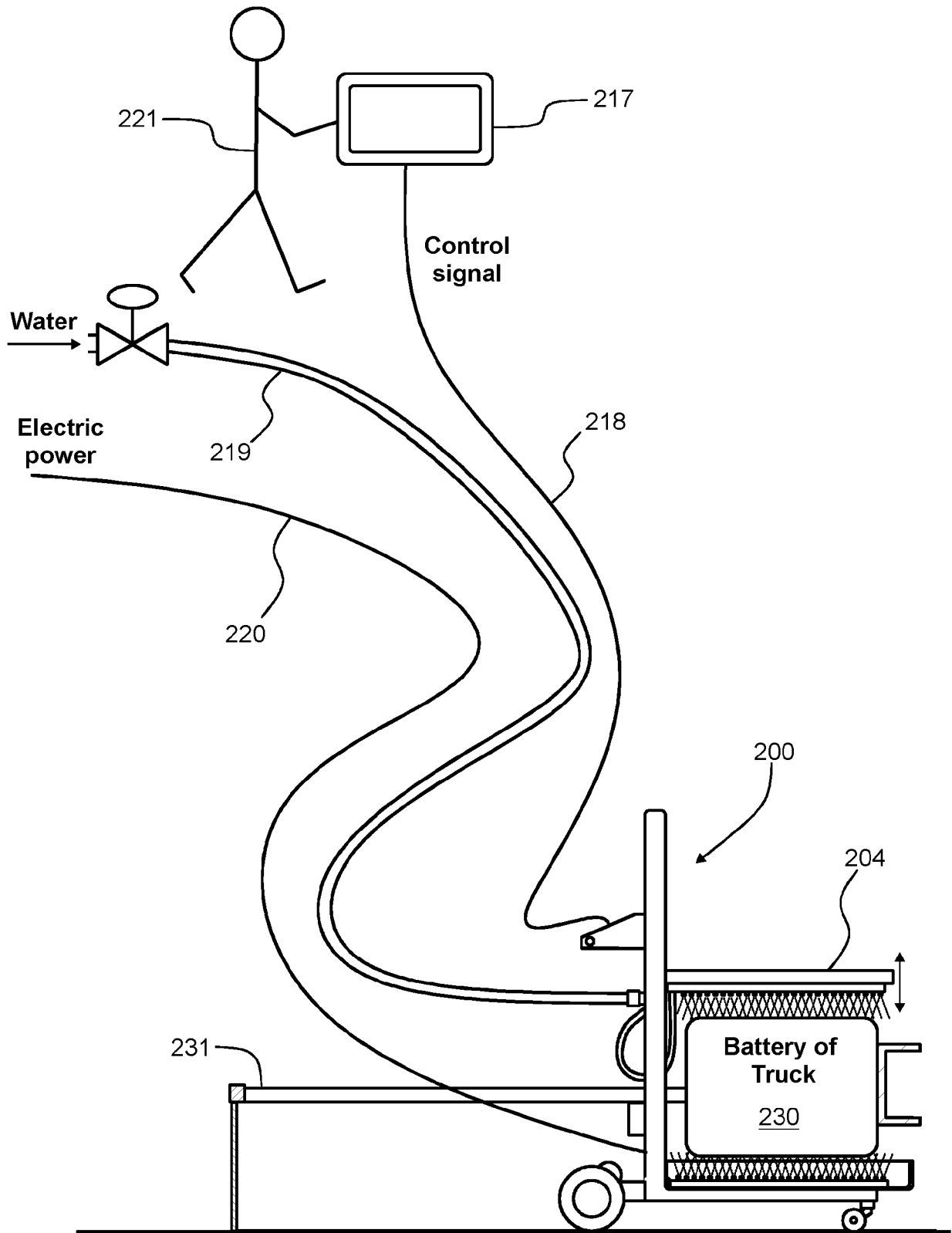


Figure 2

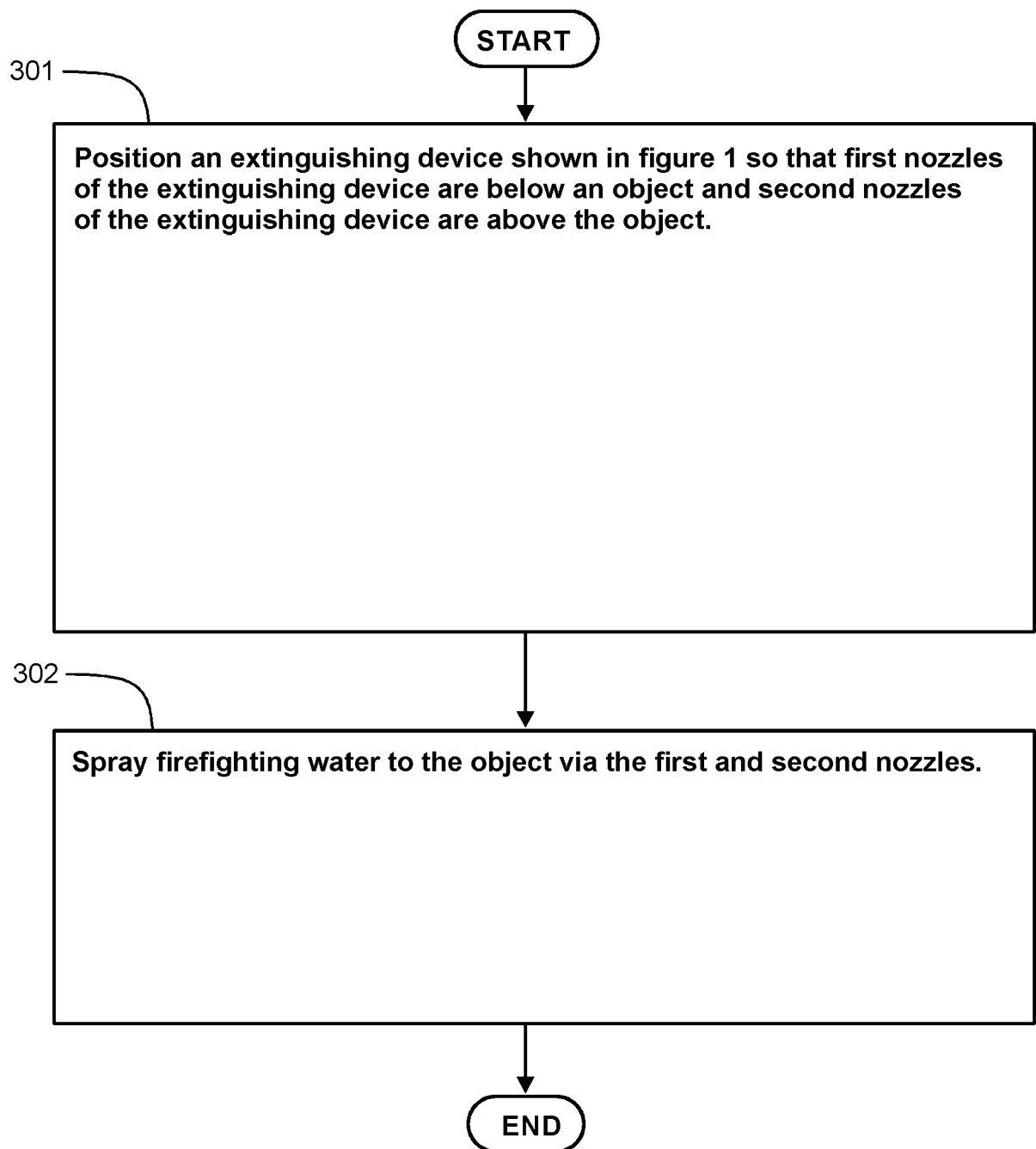


Figure 3



EUROPEAN SEARCH REPORT

Application Number

EP 24 15 2267

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	CN 216 092 001 U (NANCHANG ENG COLLEGE) 22 March 2022 (2022-03-22) * the whole document *	1-15	INV. A62C3/07 A62C3/16 A62C27/00
A	CN 115 105 770 A (BEIJING HUIZHIHUIZHONG AUTOMOTIVE TECH RESEARCH INSTITUTE) 27 September 2022 (2022-09-27) * the whole document *	1-15	A62C31/28 A62C99/00
A	CN 218 338 850 U (QUJING FIRE RESCUE DETACHMENT) 20 January 2023 (2023-01-20) * the whole document *	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			A62C
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		29 May 2024	Paul, Adeline
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EP 24 15 2267

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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10	Patent document cited in search report	Publication date	Patent family member(s)	Publication date
	CN 216092001 U	22-03-2022	NONE	
	-----	-----	-----	-----
15	CN 115105770 A	27-09-2022	NONE	
	-----	-----	-----	-----
	CN 218338850 U	20-01-2023	NONE	
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