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 • **The inventor has waived his right to be thus mentioned.**

Remarks:
 Amended claims in accordance with Rule 137(2) EPC.

(54) **FIRE FIGHTING AIRSHIP**

(57) • The FFFA is a machine composed of a modern 10 - 60 tons cargo-airship, a parallelepiped steel frame (around 3000x3000x6000 mm size) holding a Ø_3m motorized hose-reel with Ø_80mm hose 680m long, a 10m³ plus water cylinder, a diesel powered water pump (40 to

500psi and 150 to 5000Gpm) and a remote-control fire monitor (2500 to 40 000 l/min). The FFFA also includes a fire caterpillar (Figure 12) and a series of conventional fire trucks with water tanks, pumps and hoses.

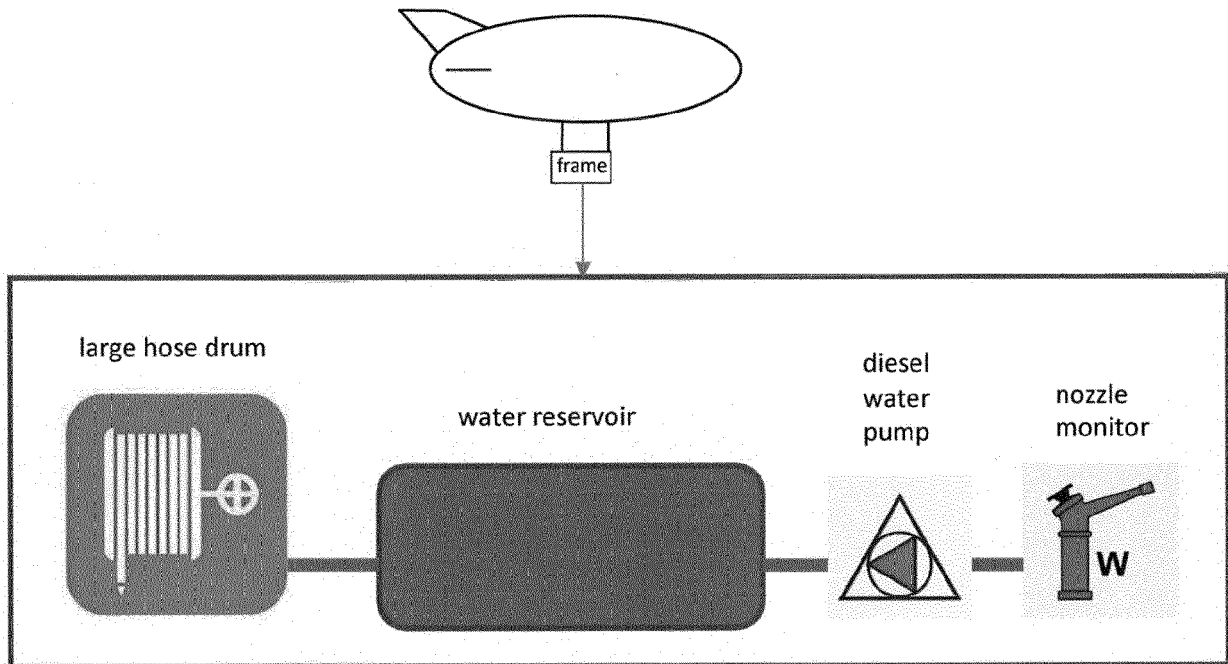
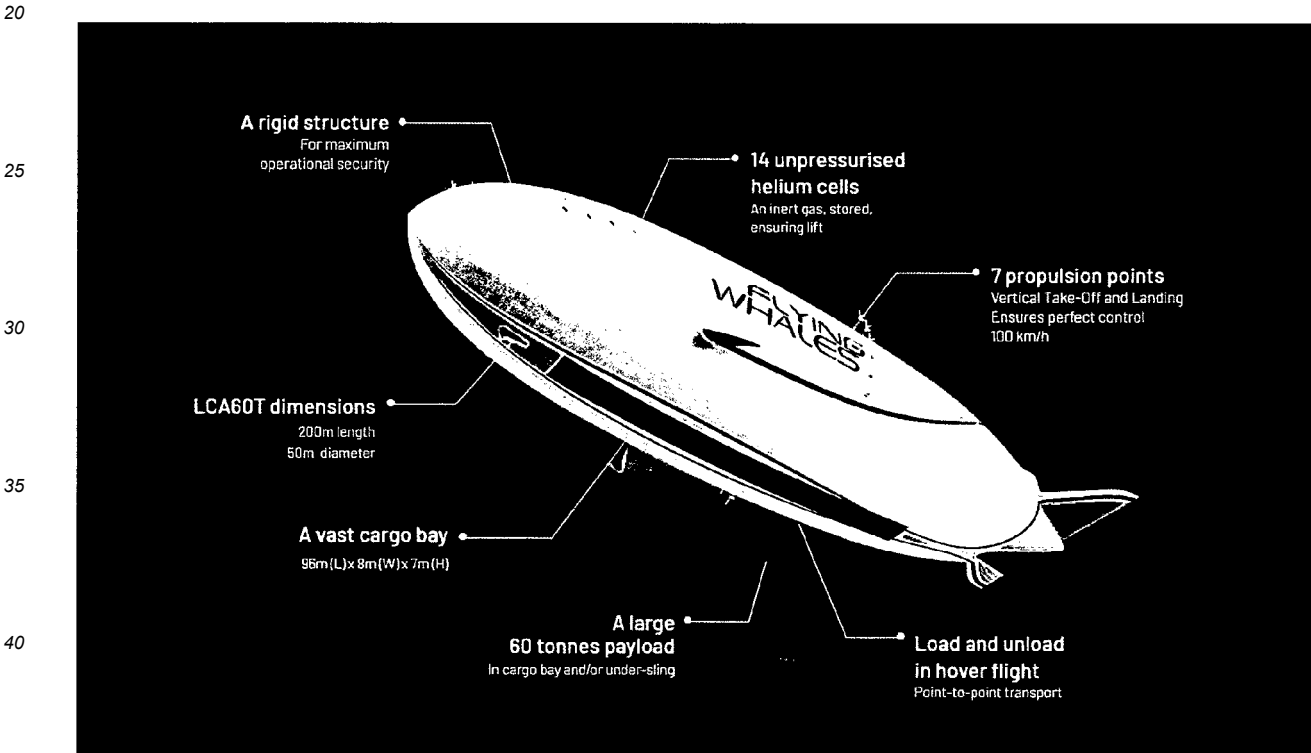


Figure 1 - Frame contents

Description

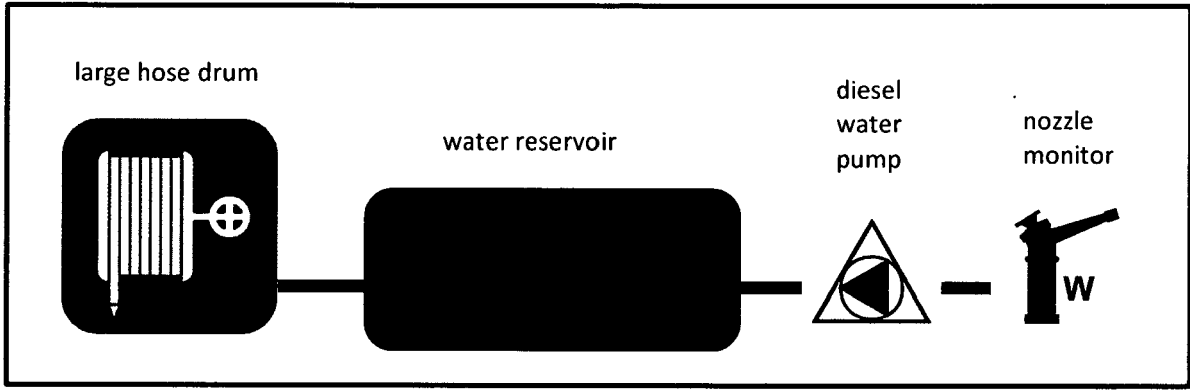
Introduction.

- 5 **[0001]** The idea for this machine is to explore the possibility of using modern airships to fight large forest fires as an alternative or in co-operation with conventional fire-fighting helicopters and airplanes. As detailed in the description below the main advantage of this system over the existing equipments is the ability to deliver a continuous, high flowrate of water both hovering over difficult access areas and with high mobility not only between different fires fronts but also from base to the fire site.
- 10 **[0002]** The system is presented in four options, that must be further tested to evaluate which is more effective, although all four can be very effective in specific conditions. All models are an assembly and make use of different parts that are already well developed, proven and available in the market, some examples of which are listed below.
- 15 **[0003]** Modern airships makers like Lockheed Martin, Flyingwhales Cargo-lifter and others offer a wide range of models complying with the highest airworthiness requirements, enabling transport of very heavy cargo up to 200 tonnes, with much lower maintenance and operation costs relative to conventional helicopters and aircraft. Their ability to hover in the air (stationary float) at different heights, for long periods without much fuel consumption except for maneuvering purposes is a major asset for fighting large forest fires. Despite their large dimensions, modern airships can reach speeds up to 100 km/h which enables them to reach remote and difficult access regions very promptly.



- 45 **[0004]** To allow the airship to be used for different purposes other than the fire fighting, all the components are assembled in a portable structure or chassis and suspended from the airship.

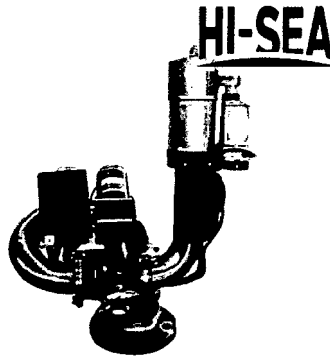




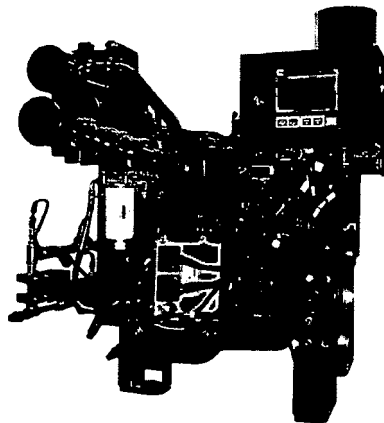
Frame contents

[0005] Depending on the model in consideration this structure can hold:

- a remote control - 100 (litres/second) fire monitor with a horizontal jet range up to 80 meters. If water is discharged from altitude above the fire, range is not an issue.



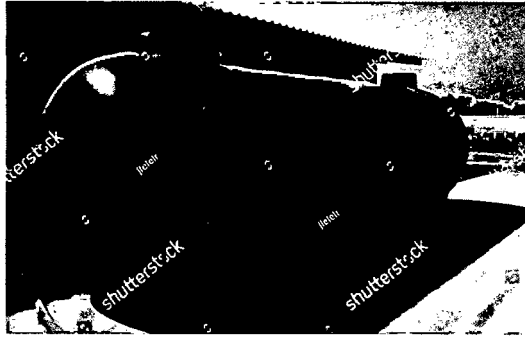
- a 90 HP / 2,5 (m3/min) fire engine/pump



- A 30 m3 water cylinder for ballast and water supply purposes

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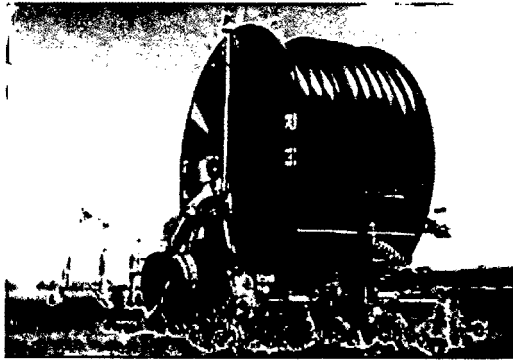


- A Ø 3 (m) motorised hose-drum with 150(m) long 2" hose

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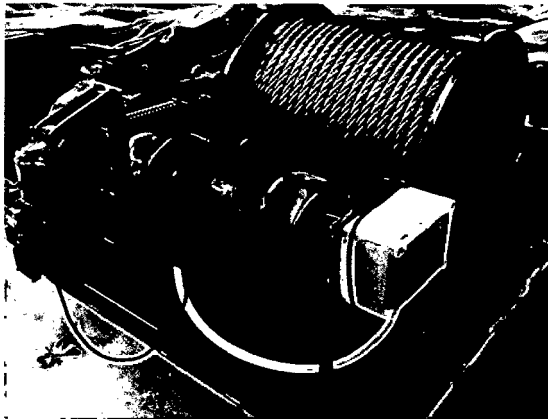


- a 5 tonne winch

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- a fire-fighting bulldozer

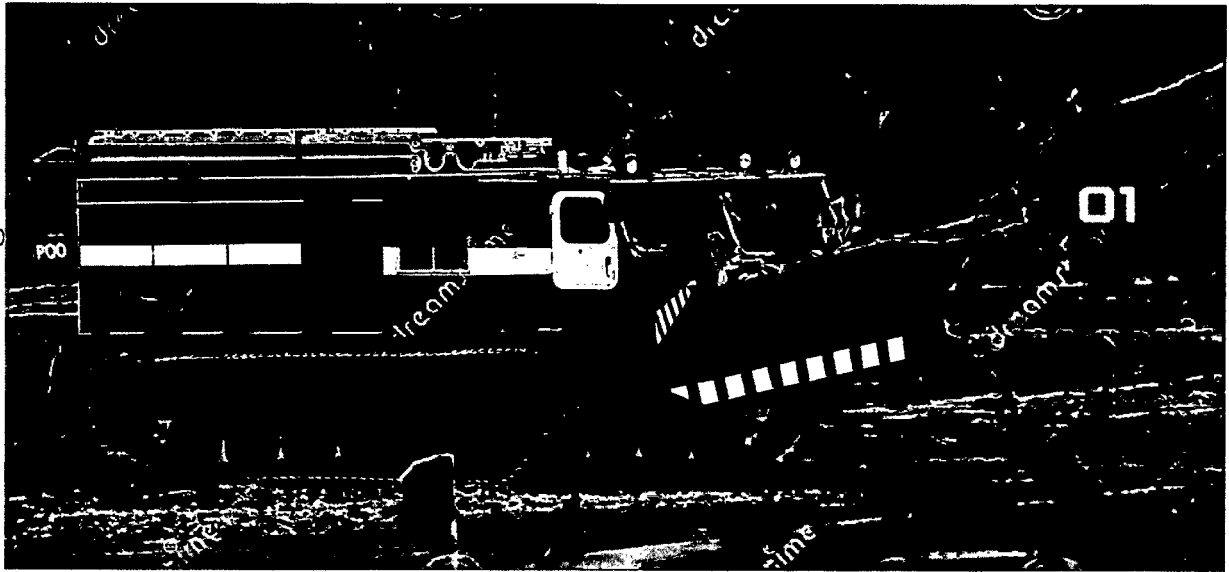
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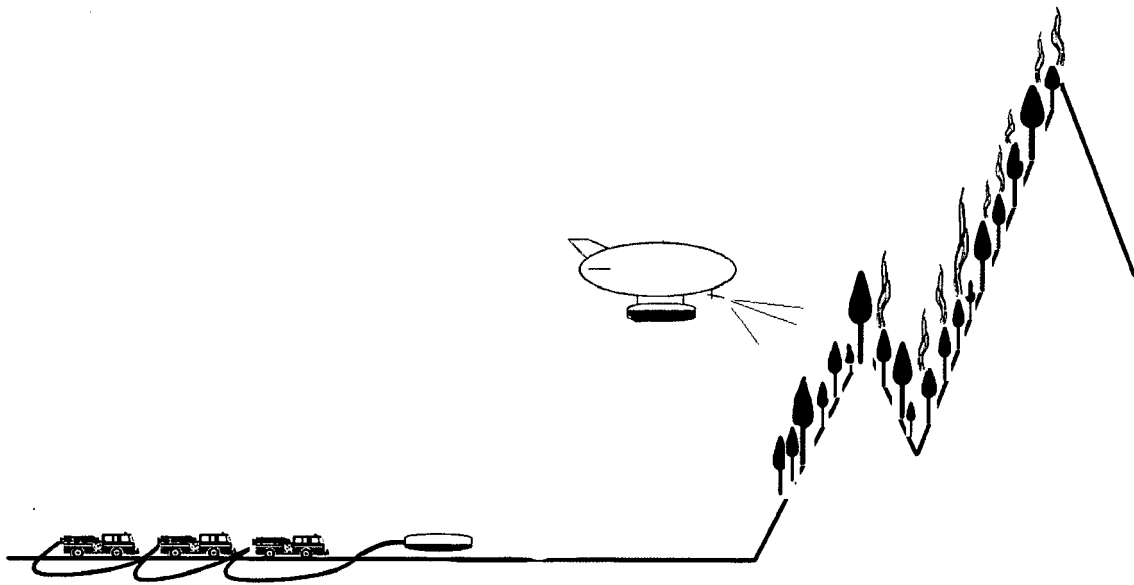
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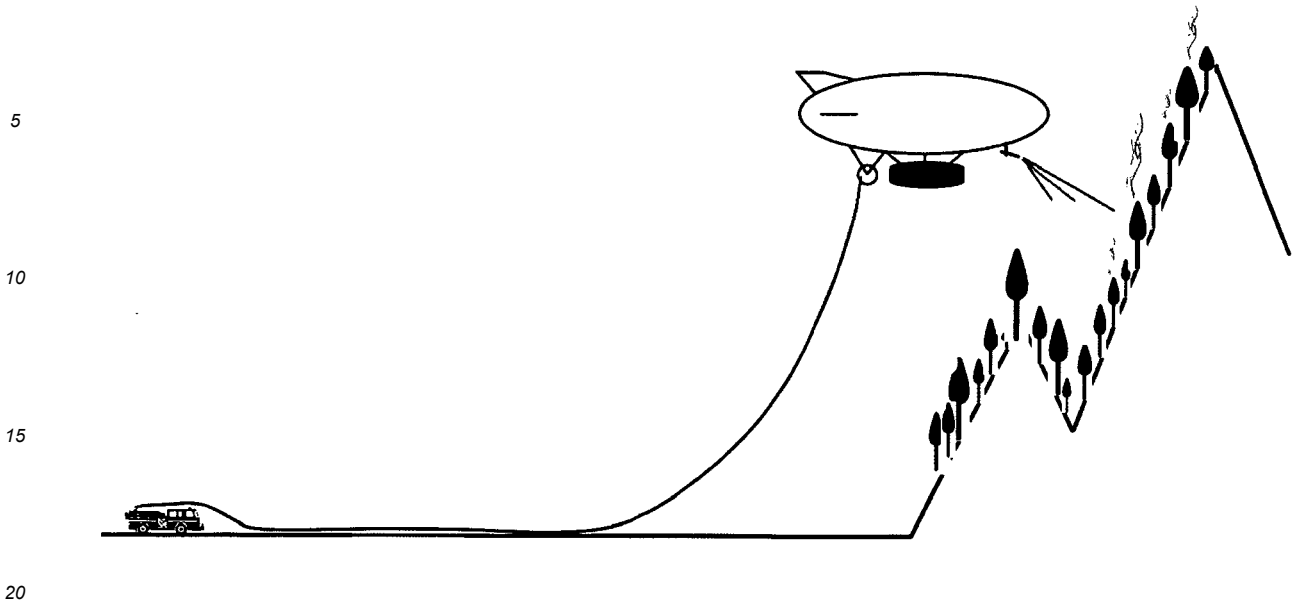
Model A

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[0006] Model A consists of an airship with two 40 m³ deposits. While the airship is using one deposit to extinguish the fire the other deposit is refilled on the ground by water trucks. When the airship deposit runs empty the airship goes back to base and switches the empty for the full deposit. The permanent frame of the airship holds, beside the switching deposits, the fire monitor, diesel water pump, and the winch. The main advantages of this model are the highest freedom of movement all around the fire front and in hover altitude and the closer proximity to water supply (one tank is refilled on the ground while using the other) relative to a lake or a dam. The disadvantages are the high weight (buoyancy) variation during operation, between 5 and 45 tons. a 40 m³ (Ø 2,5 × L 8,0 m) stainless steel cylinder dryweight is 3000 kg.

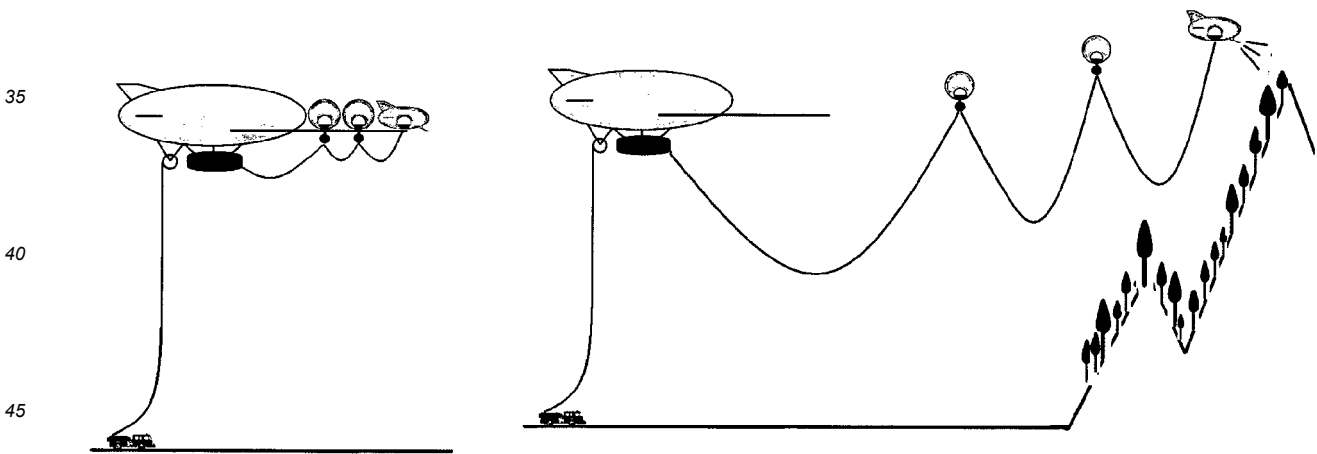
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Model B

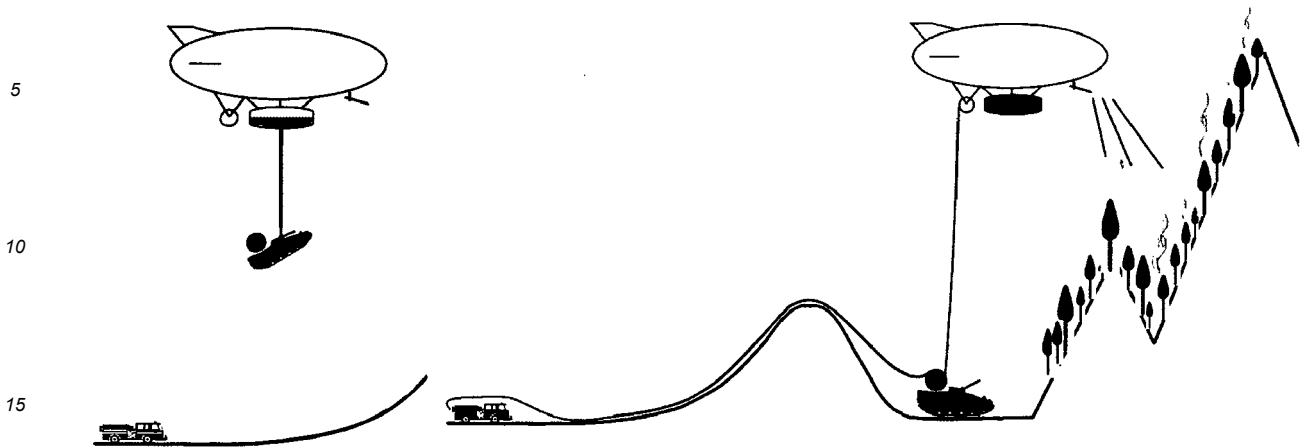
25 **[0007]** Model B consists of an airship with a single permanent deposit and a large hose drum. In this design the long hose (over 200 meters long) connects the fire monitor of the airship to a fire truck cistern on the ground allowing for a continuous supply of water. The 'pros' are the continuous water feed to the airship and the smaller water tank relative to model A, which makes available more lifting power for cable & hose pulling and maneuvering. In open fields the hose can be laid on the ground to enable longer reach. The main disadvantage is the reduction in freedom of movement due to the permanent connection of the airship to a fixed point on the ground (the cistern truck) although an anchor to the ground is not a big issue with regards to airships namely for the safety of operation.

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50 Model C

55 **[0008]** Model C consists of a large airship and a smaller more maneuverable airship and a set of suspension helium balloons. This configuration allows for the large airship to hover over the water source while the satellite balloons allow for the suspension of a long water hose enabling the smaller airship to reach longer and with more freedom of movement. The advantages are the longer reach relative to model B allowing for continuous water feed whilst the hose tensile stresses can be greatly reduced (6 times). The disadvantages are technically more challenging in order to control/balance/stabilize the intermediate elements, and the smaller airship (holding the fire nozzle) needs more thrust power to deal with the hose-pull and water jet reaction force.



[0009] Model D is an extension of model B where the airship transports a bulldozer that is landed on the ground and makes an intermediate connection between the water supply trucks and the airship. The bulldozer is able to move quickly in all kinds of difficult terrain, where the conventional fire trucks cannot reach, whilst bringing the water hose vertically closer to the airship enabling a continuous water supply. The airship remains hovering over the bulldozer at a safe height from the ground. The 5 m³ water tank is intended to work as both inertia and ballast enabling an emergency upward retreat of the airship by dropping the water.

[0010] The example of the 5500 GPM super pumper below is obviously an exaggeration and surely, besides all the power required, such a highflow might result in a waste of water.

[0011] The advantages of the airship are multiple, namely because of the speed it can move from a hangar to a fire location, the position from where it can point the hose, the ability to discharge a continuous highflow of water, to swiftly move from one spot to another only needing the ground gear (bulldozer and fire truck) to be in position at the required location (for instance an airship hovering over a village under threat might keep the fire from coming in).

[0012] The turbulence of the atmosphere for an airship near a wildfire presents a challenge that might be overcome if the ship hovers at a safe altitude @100meters above the ground, upwind from the fire where the air is cooler, smoke free, which also helps to draw the water over the fire.

Claims

1. • The claim is for a machine combining, in the arrangement described in **Discription of the FFFA**, a modern cargo-airship, a fire-frame containing a monitor, water pump, reservoir and an extendable hose to the ground, and an all-road fire-proof vehicle connecting hoses from the airship and from fire trucks on the ground to provide a continuous, high flow discharge of water from altitude, resulting in a highly effective tool to extinguish large forest, industrial and urban fires.

Amended claims in accordance with Rule 137(2) EPC.

1. What is already known from the prior art is the direct connection of a hose from a water station or a moveable nitrogen making machine, to an airship or helicopter in the air. The claim is for the technical effect **characterized in that** it is a new combination of known elements, designed to provide a continuous, high flowrate of water over a forest fire occurring in a remote and difficult access location, comprising:

- A modern airship [1], carrying a frame [2] containing a 150m-plus fire hose in a motorized hose drum [3], a 5 m³ water tank [4], a 2.5 m³/min-plus fire engine pump [5], and a 50 liter/second-plus remote controlled fire monitor [6])
- A fire bulldozer [10] carrying a long 200m-plus fire hose in a motorized hose-drum, able to move in steep and difficult terrain to reach a locus on the ground vertically below the hovering airship, and connecting to a long hose [3] unrolled from the airship
- A series of fire water trucks [7] enabling a continuous supply of water through the fire hose extended on the ground by the fire bulldozer, to the airship.

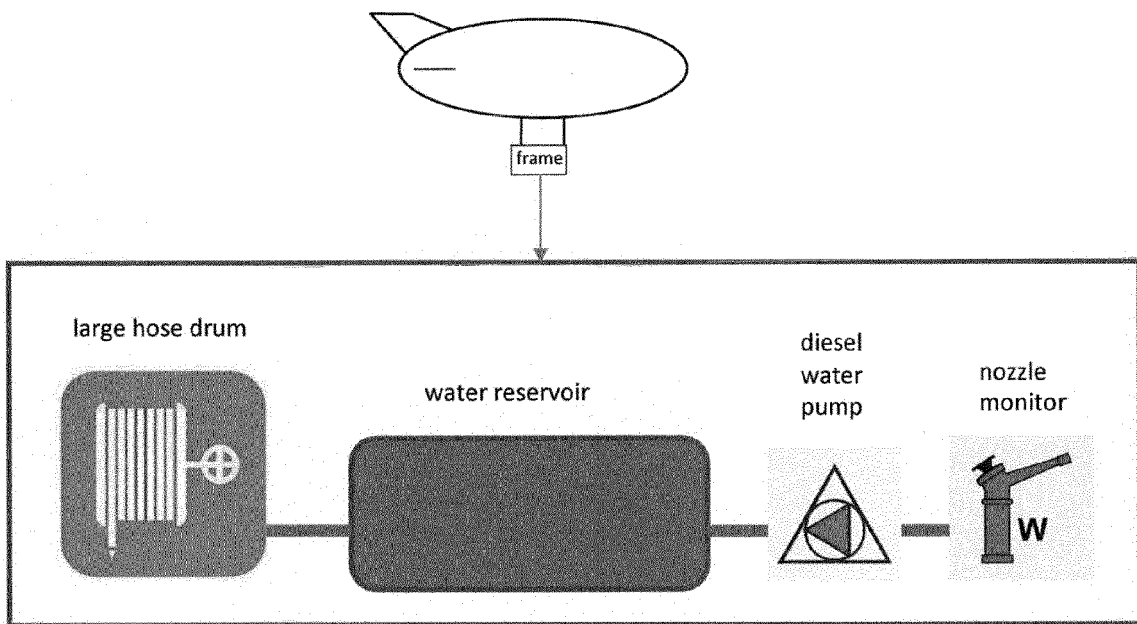


Figure 1 - Frame contents

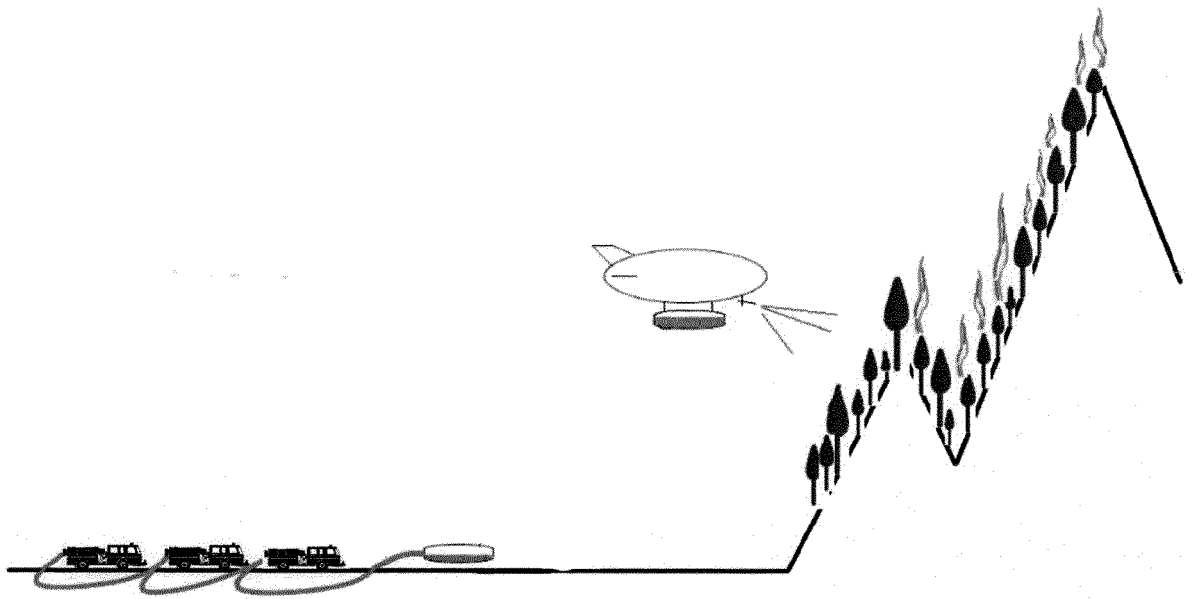


Figure 2 - Model A

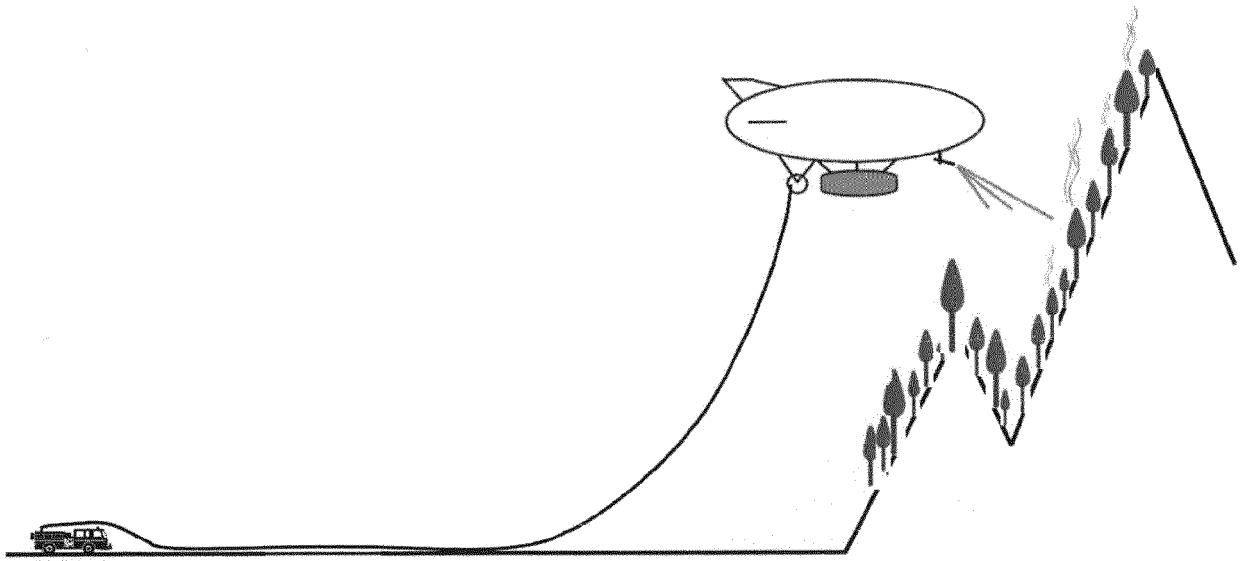


Figure 3 - Model B

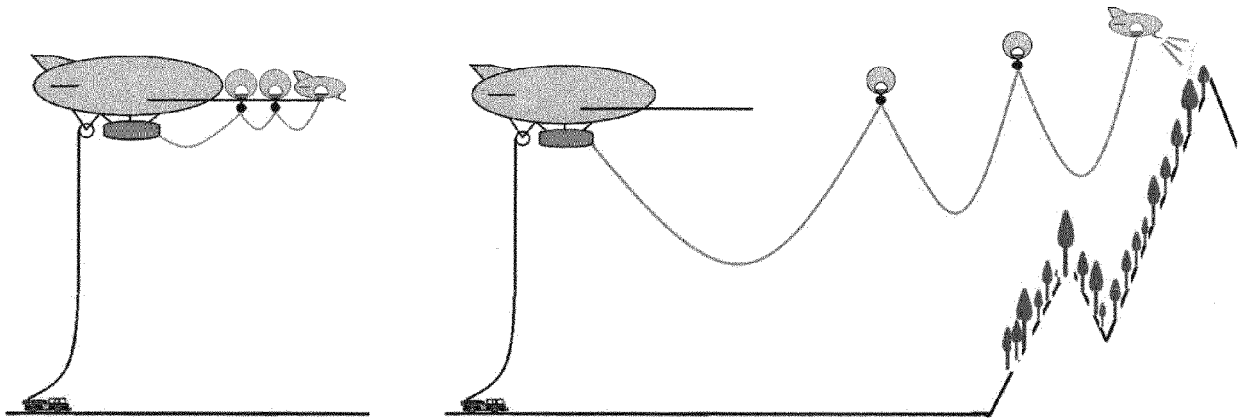


Figure 4 - Model C

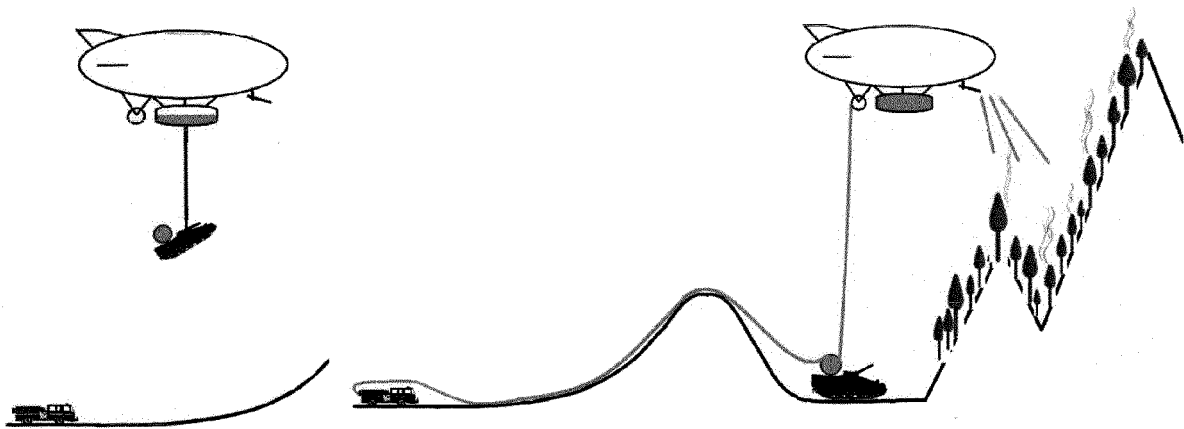


Figure 5 - Model D



EUROPEAN SEARCH REPORT

Application Number
EP 23 39 8009

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	CN 101 301 515 B (BEIJING HAI AN HI TECH FIRE TECHNOLOGY CO LTD) 15 June 2011 (2011-06-15) * abstract; figure * -----	1	INV. A62C3/02
A	DE 10 2019 129837 A1 (ROTH EDUARD [DE]) 6 May 2021 (2021-05-06) * paragraph [0032]; figure * -----	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			A62C
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 27 November 2023	Examiner Vervenne, Koen
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 23 39 8009

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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27-11-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 101301515 B	15-06-2011	NONE	
DE 102019129837 A1	06-05-2021	NONE	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82