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(54) **An automatic fire extinguishing apparatus and a method for operating the same**

(57) The present invention relates to an automatic fire extinguishing apparatus which is adapted to be remote controlled by the firefighters. Moreover, the present invention relates to a method of extinguishing a fire by providing a mist of an inflammable liquid at an under-pressure inlet of a fire.

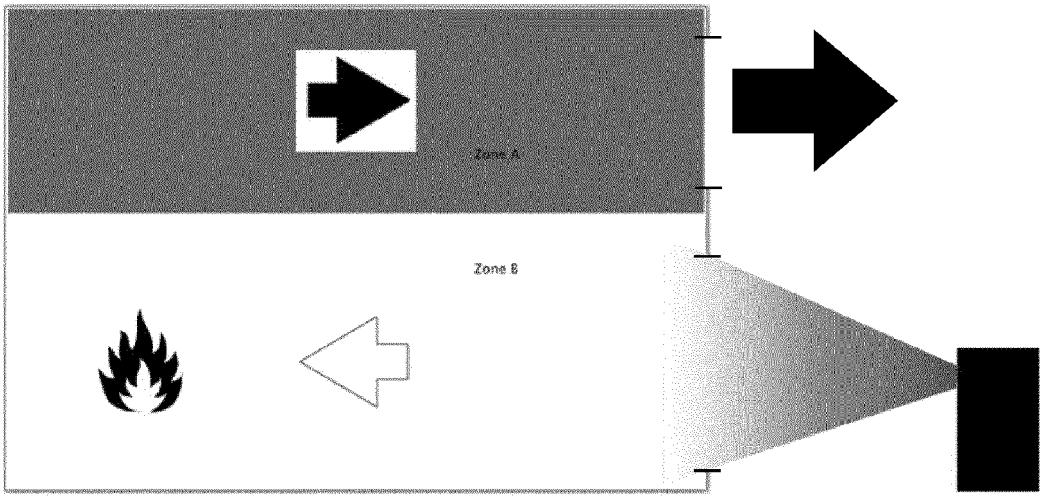

Fig. 2

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to an automatic fire extinguishing apparatus. In particular, the present invention relates to an automatic fire extinguishing apparatus which is adapted to be remote controlled by the firefighters. Moreover, the present invention relates to a method of extinguishing a fire. In particular the present invention relates to a method of extinguishing a fire by providing a mist of an inflammable liquid at an under-pressure inlet of a fire.

BACKGROUND OF THE INVENTION

[0002] Fundamentally, fire fighting can be seen as an attempt of stopping a running engine. Like an engine, a fire has an inlet and an outlet. Blocking either of the inlet and the outlet will cause an engine to die. The same is the case for a fire. If you manage to block either of the inlet or outlet, the fire dies. Today fires are fought at the outlet side of the fire, as currently, there are no tools available for attacking the inlet of a fire. High pressure systems, which are the most commonly used systems for creating small droplets, are not sufficient, due to the high velocity of the droplets. When the droplets are forced through the nozzle, a significant drag of oxygen is created, which unfortunately fuels the fire and makes it even more unpredictable e.g. due to flashover or even backdrafts.

[0003] A backdraft is an explosive event at a fire resulting from rapid re-introduction of oxygen to combustion in an oxygen-starved environment. One example is when a window is broken into an oxygen-starved environment, thus causing oxygen to restart the combustion of un-burned gasses. This often results in an explosive effect as the gases are heated by the combustion and expand rapidly because of the rapidly increasing temperature. Backdrafts are very dangerous situations (often lethal), often surprising fire-fighters, regardless of their level of experience.

[0004] It is an object of one or more embodiments of the present invention, to provide a means for fighting fires at the inlet side - especially which is safe for the fire-fighters..

[0005] It is an object of one or more embodiments of the present invention, to provide a means for fighting fire which reduces the use of the often limited resources of water.

[0006] It is an object of one or more embodiments of the present invention, to provide a means for fighting fires which minimises the risk of cancer.

[0007] It is an object of one or more embodiments of the present invention, to provide a method which reduces or even eliminates the number of times which a fire fighter must enter a burning building to fight a fire.

DESCRIPTION OF THE INVENTION

[0008] In a FIRST aspect, the present invention relates to an automatic fire extinguishing apparatus for extinguishing a fire in a construction which defines an under-pressure inlet at which the fire defines an under-pressure by means of which oxygen is sucked into the fire and an over-pressure outlet through which smoke is expelled during the fire, the apparatus comprising:

- a discharge unit;
    - an discharge compartment adapted to contain a predetermined amount of an inflammable substance, the discharge compartment comprising:
        - an inlet through which the inflammable substance is supplied to the discharge compartment,
        - an inlet valve for controlling a flow of the inflammable substance into the discharge compartment,
        - an outlet trough which the inflammable substance is ejected,
        - an outlet valve for controlling the flow of the inflammable substance out of the discharge compartment, and
        - a sensor adapted to determine one or more predetermined thermodynamic conditions in the compartment;
    - wherein the apparatus is adapted to determine by means of the sensor when a predetermined thermodynamic condition is achieved and to open the outlet valve in response thereto such that the inflammable substance contained in the compartment is discharged through the outlet
- a stand for supporting the discharge unit; and
- a controller unit for remotely controlling one or more parameters of the automatic fire extinguishing apparatus.

[0009] The automatic fire extinguishing apparatus according to the present invention provides a plurality of advantages.

[0010] Firstly, the automatic apparatus may be positioned as close to an under-pressure inlet of a fire in a construction as possible. Due to the controller unit the apparatus may be controlled at a safe distance. Thus any explosion (e.g. due to flashover or backdraft) in the area of the inlet will not harm the fire-fighters.

[0011] Secondly, the automatic apparatus may be positioned at a position which subsequently is change into

an under-pressure inlet, i.e. before the risk of explosion increases. As an example the apparatus according to the present invention may be placed in front of a window which is not yet broken. Once in place and when the fire-fighters have retracted to a safe position, the window may be broken to create a passage which turns into an under-pressure inlet. However, often this passage may temporarily turn into an over-pressure outlet causing a flashover or backdraft and thus flames to exit the passage before the fire has found a new equilibrium in which the passage is an under-pressure inlet. It will be appreciated that it is dangerous to for the fire-figthers to stay in the area of the passage prior to the new equilibrium being found.

[0012] Thirdly, the automatic apparatus reduces the need for fire-fighters to enter buildings or other objects which reduces the number of primary/direct causes of deaths and injuries caused by the fire.

[0013] Fourthly, the automatic apparatus reduces the secondary causes of deaths and injuries such as cancer caused by repeated entry by fire-fighters into burning buildings or other objects.

[0014] Fifthly, the automatic apparatus reduces the usage of fire fighting liquid (e.g. water) as a limited volume of liquid is required to create a large volume mist. Liquid is often a limited recourse in relation to a fire - especially in cases where the firefighting vehicle carries the liquid.

[0015] Sixthly, by reducing the amount of liquid which is used, the amount of water which must be removed after the fire has been extinguished is reduced. In most countries this liquid must subsequently be treated as harmful liquid which not only is time consuming but also is expensive.

[0016] Seventhly, the automatic apparatus reduces the damage on the burning construction. As fire today is fought by pouring large quantities of water into the over-pressure outlet, the water damage on the burning construction is huge. By providing a mist at the under-pressure inlet the fire is extinguished in a simple manner and with very small quantities being poured into the construction.

[0017] In the context of the present invention, the term 'under-pressure inlet' shall be understood as an opening in the construction through which air is supplied to the fire, i.e. through which air flows from the outside environment and into the construction. Moreover, in the context of the present invention, the term 'over-pressure outlet' shall be understood as an opening in the construction through which gasses and/or smoke from the fire exit the construction.

[0018] It will be appreciated that during a fire in a room in a construction, the room will typically be divided in to an upper zone and a lower zone which is defined below the upper zone. In the upper zone the temperature is very high, as the very hot smoke and un-combusted gasses are collected in this area. In the lower zone, the temperature is significantly lower as fresh and relatively cool air (containing oxygen) flows toward to the fire in the lower zone. The transition between the two zones is often very distinct and may easily be seen with the naked eye or with an infrared camera. The pressure in this transition zone corresponds to the atmospheric pressure outside the construction. If the lower zone is filled with a mist of an inflammable liquid or gas or powder, the fire is extinguished.

[0019] In one embodiment, the inflammable substance is an inflammable liquid such as water. An inflammable powder and/or an inflammable gas may be added to the inflammable substance. In one embodiment the inflammable powder and/or the inflammable gas is added to an inflammable liquid.

[0020] In one embodiment, the inflammable powder discharged by the discharge compartment constitutes 5 percent of the total volume of what is expelled by the discharge compartment, or 10 percent or 15 percent or 20 percent or 25 percent or 30 percent or 35 percent or 40 percent or 50 percent.

[0021] In one embodiment, the inflammable gasses discharged by the discharge compartment constitutes 5 percent of the total volume of what is expelled by the discharge compartment, or 10 percent or 15 percent or 20 percent or 25 percent or 30 percent or 35 percent or 40 percent or 50 percent.

[0022] In one embodiment, the inflammable liquid discharged by the discharge compartment constitutes 5 percent of the total volume of what is expelled by the discharge compartment, or 10 percent or 15 percent or 20 percent or 25 percent or 30 percent or 35 percent or 40 percent or 50 percent.

[0023] The automatic fire extinguishing apparatus may be adapted to discharge the inflammable substance 360 degrees about a vertical axis extending through the automatic fire extinguishing apparatus, such as 300 degrees about the vertical axis, such as 270 degrees about the vertical axis, such as 240 degrees about the vertical axis, such as 210 degrees about the vertical axis, such as 180 degrees about the vertical axis, such as 150 degrees about the vertical axis, such as 120 degrees about the vertical axis, such as 90 degrees about the vertical axis, such as 60 degrees about the vertical axis, such as 30 degrees about the vertical axis.

[0024] The discharge compartment comprises one or more inlets each of which may comprise a separate inlet valve. In one embodiment, one inlet is used for supplying the inflammable liquid to the discharge compartment, another inlet is used for supplying an inflammable gas to the discharge compartment, finally a third inlet may be used for supplying an inflammable powder to the discharge compartment. In another embodiment, the discharge compartment comprises one single inlet through which the inflammable liquid and/or the inflammable gas and/or the inflammable powder are supplied.

[0025] Similarly, the discharge compartment may comprise a plurality of outlet valves, e.g. for discharging the inflammable substance in different directions.

[0026] The discharge unit comprises a sensor adapted to determine one or more predetermined thermodynamic

conditions in the compartment. The predetermined thermodynamic conditions may comprise a predetermined temperature and/or a predetermined pressure in the compartment.

[0027] The stand may be a tripod like structure or any other suitable means for supporting the discharge unit according to the present invention. In one embodiment, the stand is adapted to stand on or be inserted into the ground. The stand may comprise means for securing the stand to the ground such that it may remain in the same position even in the event of a backdraf. In one embodiment, the stand comprises fastening means for fastening the stand to a structure., such as a clamp.

[0028] The controller unit is provided for remotely controlling one or more parameters of the automatic fire extinguishing apparatus. In one embodiment, one of the controllable parameters is one or more of the thermodynamic parameters such as the temperature of the inflammable liquid inside the discharge compartment. Alternatively, or as a supplement, one of the controllable parameters is a pressure in the discharge unit. In one embodiment, the temperature and/or the pressure at which the outlet valve(s) open is/are controllable.

[0029] In one embodiment, the apparatus according to the present invention is adapted to emit or eject the mist of the inflammable liquid to a position which is at least 0.5 meters away from the apparatus, such as 1 meter away from the apparatus, such as 2 meters away from the apparatus, such as 5 meters away from the apparatus, such as 10 meters away form the apparatus, such as 15 meters away from the apparatus.

[0030] In one embodiment, the controller unit is adapted to control the discharge units position relative to the stand by operating at least one of the one or more actuators.

[0031] In one embodiment, the discharge unit is adapted to generate a mist of the inflammable liquid at a pressure which is below twice an ambient atmospheric pressure in the area of the automatic fire extinguishing apparatus.

[0032] In one embodiment, any droplet of the inflammable liquid in the mist of the inflammable liquid is below 0.1 mm, such as below 0.09 mm, such as below 0.08 mm, such as below 0.07 mm, such as below 0.06 mm, such as below 0.05 mm, such as below 0.04 mm, such as below 0.03 mm, such as below 0.02 mm, such as below 0.01 mm.

[0033] In one embodiment, the controller unit is adapted to operate the discharge unit and or the stand by means of a wired or wireless connection.

[0034] In one embodiment, the apparatus is self-propellable and thus comprises a propelling means for propelling the automatic fire extinguishing apparatus via the controller unit. One example of such a means is wheels, continuous tracks etc. Moreover, the apparatus may comprise a motor for propelling the apparatus. In one embodiment, this motor is an electrical motor. In one embodiment, the motor is a hydraulic motor which uses the pressurized the inflammable liquid to cause the hydraulic motor to rotate.

[0035] The invention according to the first aspect may comprise any combination of features and/or elements of the invention according to the second aspect. As an example the apparatus may be adapted to generate a mist of an inflammable liquid in which the pressure inside the mist is at a predetermined pressure level. The predetermined pressure level may be substantially at the level of the atmospheric pressure in the surroundings of the construction.

[0036] In one embodiment, the automatic fire extinguishing apparatus is adapted to discharge between 0 and 30 liters per minute, such as between 0 and 15 liter per minute.

[0037] The size of the droplets discharged by the automatic fire extinguishing apparatus may be between 0.001 millimetres and 0.1 millimetres, such as between 0.01 and 0.5 millimetres.

[0038] In a SECOND aspect, the present invention relates to a method of extinguishing a fire in a construction which defines an under-pressure inlet at which the fire defines an under-pressure by means of which oxygen is sucked into the fire and an over-pressure outlet through which smoke is expelled during the fire; the method comprising the step of:

- generating at the under-pressure inlet a mist of an inflammable liquid or a substance such that the mist is sucked by into the under-pressure inlet by means of the under-pressure generated by the fire, whereby the fire is smothered.

[0039] The method has the same advantages as the apparatus according to the first aspect of the invention. Additionally, the method may comprise any combination of features and/or elements as the invention according to the first aspect.

[0040] In one embodiment, the step of 'generating at the under-pressure inlet a mist of an inflammable liquid' comprises the step of providing a mist in which any droplet of the inflammable liquid is below 0.1 mm, such as below 0.09 mm, such as below 0.08 mm, such as below 0.07 mm, such as below 0.06 mm, such as below 0.05 mm, such as below 0.04 mm, such as below 0.03 mm, such as below 0.02 mm, such as below 0.01 mm.

[0041] In order to ensure that no drag is created which causes oxygen to be supplied into the fire, the step of 'generating at the under-pressure inlet a mist of an inflammable liquid' comprises the step of generating a mist of an inflammable liquid in which the pressure inside the mist is at a predetermined pressure level. In one embodiment, the predetermined pressure level is substantially at the level of the atmospheric pressure in the surroundings of the construction and/or in the surroundings of the under-pressure inlet.

[0042] In one embodiment, the predetermined pressure level is below twice the pressure in the area of the

under-pressure inlet and/or in the surroundings of the under-pressure inlet (i.e. below two times the pressure), such as below 1.5 times the pressure in the area of the under-pressure inlet, such as below 1.25 times the pressure in the area of the under-pressure inlet, such as below 1.2 times the pressure in the area of the under-pressure inlet, such as below 1.1 times the pressure in the area of the under-pressure inlet, such as below 1.05 times the pressure in the area of the under-pressure inlet.

BRIEF DESCRIPTION OF THE FIGURES

[0043] The invention will now be described in further detail with reference to the figures in which:

Fig. 1 discloses a fire in a construction, and

Fig. 2 discloses an apparatus and a method according to the present invention in use with the aim of extinguishing the fire in the construction.

DETAILED DESCRIPTION OF THE FIGURES

[0044] Fig. 1 discloses a construction 100 defining an under-pressure inlet 102 and an over-pressure outlet 104. A fire 106 is burning in the construction 100, whereby a lower part 108 and an upper part 110 are defined. As the fire 106 needs oxygen in order to continue, the fire 106 creates an under pressure which causes air containing oxygen to be sucked into the under-pressure inlet 102 and towards the fire 106. This is indicated by arrows 112 and 114. Thus, cold air (relative to the temperature of the fire 106 and relative to the temperature in the upper part 110) is sucked into the lower part 108 of the chamber. Moreover, the fire 106 exhausts smoke and gasses - often also combustible gasses - which enters the upper part 110 and exits the construction 100 through the over-pressure outlet 104. This is indicated by arrows 116 and 118. It will be appreciated that as the upper part 110 comprises exhaust smoke from the fire, the temperature in the upper part 110 is significantly higher than in the lower part 108. It will also be appreciated that depending on the size of the under-pressure inlet 102 and the size of the over-pressure outlet 104, the transition 120 between the lower part 108 and the upper part 110 may be positioned at different vertical positions.

[0045] Fig. 2 discloses use of the apparatus and the method according to the present invention and it is noted that reference numbers which are identical with the reference numbers of Fig. 1 refer to identical elements.

[0046] In Fig. 2 an automatic fire extinguishing apparatus 122 is provided at the vicinity of the under-pressure inlet 102. The automatic fire extinguishing apparatus 122 is operated such that a mist 124 of an inflammable liquid is generated. Due to the under-pressure (relative to the atmospheric pressure in the surroundings of the construction 100) at the under-pressure inlet 102, the mist 124 is sucked into under-pressure inlet 102 and further into the lower part 108. This causes oxygen to be expelled from the lower part 108 whereby the fire 106 cannot continue. Thus with the use of limited amounts of liquid, the fire is extinguished.

Claims

1. An automatic fire extinguishing apparatus for extinguishing a fire in a construction which defines an under-pressure inlet at which the fire defines an under-pressure by means of which oxygen is sucked into the fire and an over-pressure outlet through which smoke is expelled during the fire, the apparatus comprising:

- a discharge unit;

  - an discharge compartment adapted to contain a predetermined amount of an inflammable liquid, the discharge compartment comprising:

    - an inlet through which the inflammable liquid is supplied to the discharge compartment,
    - an inlet valve for controlling a flow of the inflammable liquid into the discharge compartment,
    - an outlet trough which the inflammable liquid is ejected,
    - an outlet valve for controlling the flow of the inflammable liquid out of the discharge compartment, and
    - a sensor adapted to determine one or more predetermined thermodynamic conditions in the compartment;

  - wherein the apparatus is adapted to determine by means of the sensor when a predetermined thermodynamic condition is achieved and to open the outlet valve in response thereto such that the inflammable liquid contained in the compartment is discharged through the outlet

- a stand for supporting the discharge unit; and
- a controller unit for remotely controlling one or more parameters of the automatic fire extinguishing apparatus.

2. An automatic fire extinguishing apparatus according to claim 1, wherein the discharge unit is adapted to generate a mist of the inflammable liquid at a pressure which is below twice an ambient atmospheric pressure in the area of the automatic fire extinguishing apparatus.

3. An automatic fire extinguishing apparatus according to claim 2, wherein any droplet of the inflammable liquid in the mist of the inflammable liquid is below 0.1 mm, such as below 0.01 mm.

4. An automatic fire extinguishing apparatus according to any of the preceding claims, the controller unit is adapted to operate the discharge unit and or the stand by means of a wired or wireless connection.

5. An automatic fire extinguishing apparatus according to any of the preceding claims, wherein the stand is adapted to stand on or be inserted into the ground.

6. An automatic fire extinguishing apparatus according to any of the preceding clams, wherein the stand comprises fastening means for fastening the stand to a structure.

7. An automatic fire extinguishing apparatus according to any of the preceding claims, further comprising a propelling means for propelling the automatic fire extinguishing apparatus via the controller unit.

8. A method of extinguishing a fire in a construction which defines an under-pressure inlet at which the fire defines an under-pressure by means of which oxygen is sucked into the fire and an over-pressure outlet through which smoke is expelled during the fire; the method comprising the step of:

    - generating at the under-pressure inlet a mist of an inflammable liquid such that the mist is sucked by into the under-pressure inlet by means of the under-pressure generated by the fire, whereby the fire is smothered.

9. A method according to claim 8, wherein the step of 'generating at the under-pressure inlet a mist of an inflammable liquid' comprises the step of providing a mist in which any droplet of the inflammable liquid is below 0.1 mm, such as below 0.01 mm.

10. A method according to any of claims 8-9, wherein the step of 'generating at the under-pressure inlet a mist of an inflammable liquid' comprises the step of generating a mist of an inflammable liquid in which the pressure inside the mist is at a predetermined pressure level.

11. A method according to any of claims 8-10, wherein the predetermined pressure level is substantially at the level of the atmospheric pressure in the surroundings of the construction.

12. A method according to any of claims 8-11, wherein the predetermined pressure level is below twice the pressure in the area of the under-pressure inlet.

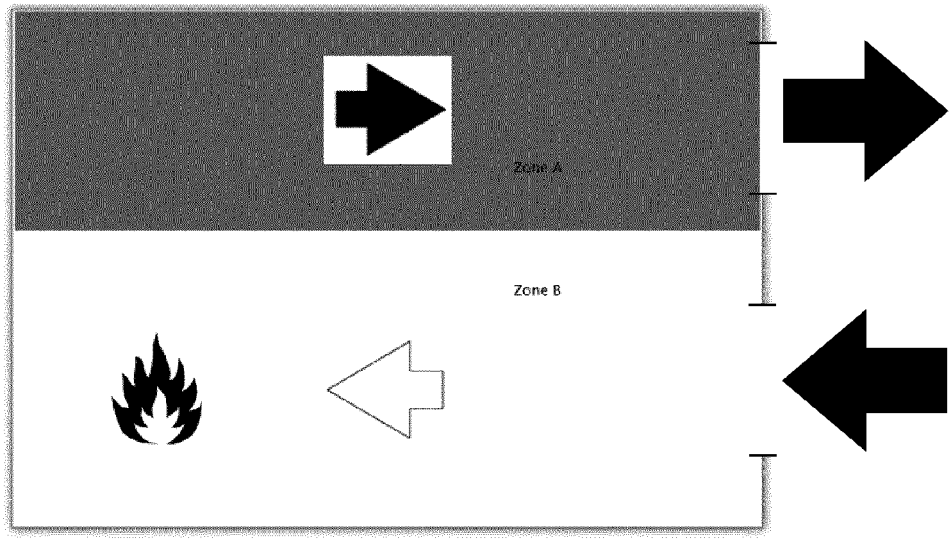

Fig. 1

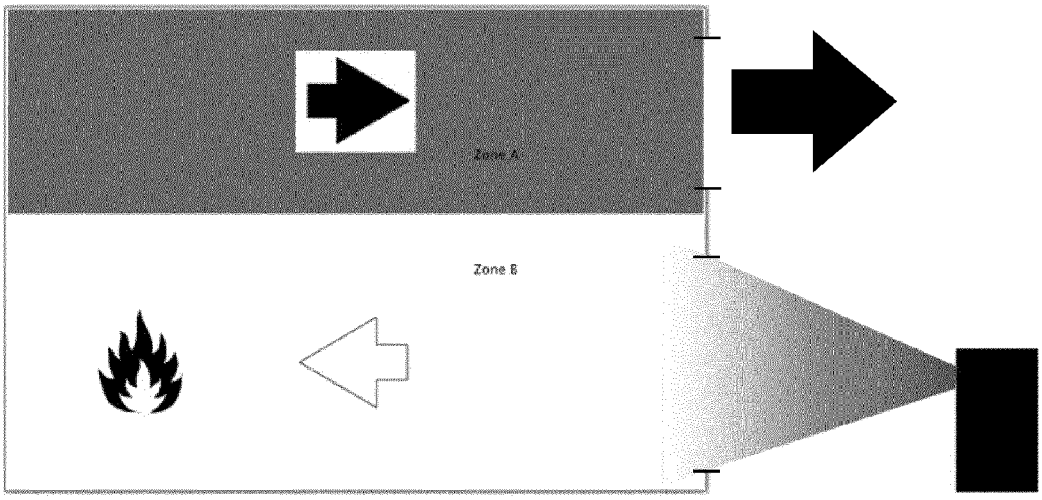

Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 12 15 0087

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	US 4 949 794 A (PETIT KEVIN J [US] ET AL) 21 August 1990 (1990-08-21) * abstract; figures * * column 9, line 27 - line 43 * -----	1-12	INV. A62C31/24 A62C37/36 A62C99/00
X	US 3 583 637 A (MISCOVICH JOHN A) 8 June 1971 (1971-06-08) * abstract; figures * -----	1-12	
A	WO 97/26048 A1 (VIGH ANDREAS [DE]) 24 July 1997 (1997-07-24) * abstract; figures * -----	1-12	
			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	26 June 2012	Vervenne, Koen

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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E : earlier patent document, but published on, or after the filing date
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 12 15 0087

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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26-06-2012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4949794 A	21-08-1990	NONE	
US 3583637 A	08-06-1971	ES 378529 A1	16-06-1972
		GB 1243168 A	18-08-1971
		US 3583637 A	08-06-1971
WO 9726048 A1	24-07-1997	AT 204187 T	15-09-2001
		AU 1441697 A	11-08-1997
		CN 1211196 A	17-03-1999
		DE 19601282 C1	12-06-1997
		EP 0877638 A1	18-11-1998
		ES 2162234 T3	16-12-2001
		HU 9900976 A2	28-07-1999
		WO 9726048 A1	24-07-1997

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