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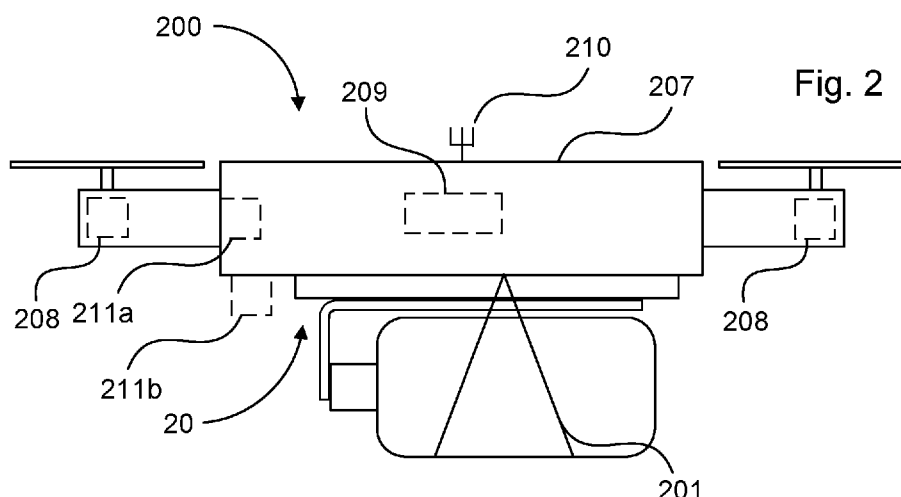
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(54) Title: PORTABLE CLOSE AIR SUPPORT SYSTEM AND PAYLOAD CARRIER



(57) Abstract: The present disclosure relates to a portable close air support system (200) and a payload carrier (20) for use in the system. The portable close air support system comprises a remote control station, an unmanned aerial system, UAS, and a payload carrier attached to the UAS. The payload carrier comprises payload holding means (201) configured to secure a payload to the payload carrier; and a payload release mechanism configured to release the payload from the payload holding means whilst in airborne position to release the payload from the payload holding means. The payload carrier further comprises a payload activation mechanism configured to separate an active part of the payload from a safety arrangement of the payload. The payload activation and the payload release mechanisms are configured for correlated triggering from the remote control station. The carrier release mechanism is arranged to release the payload holding means from the separated active part of the payload.

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PORTABLE CLOSE AIR SUPPORT SYSTEM AND PAYLOAD CARRIER

TECHNICAL FIELD

The present disclosure relates to devices and systems for portable close air support. In particular the disclosure relates to a payload carrier and a portable close air support system comprising the payload carrier.

BACKGROUND

In a military application, soldiers often find themselves fighting in rough or urban terrain, with distances to the enemy being relatively short (within shooting distance). During combat, efficient targeting and coordination of resources is critical, both with respect to time and implementation. Supplies, such as ammunition and medical supplies, may need to be distributed to nearby parties during a fire fight. Furthermore, there is a need to improve the ability to effectively strike at an enemy with available weapons from close range. Safety is also of primary importance in combat situations. In particular, the use of cover when under fire is often critical to survival, and there is a need in the art for solutions which enable soldiers to remain in cover while effectively enabling the distribution of supplies and effectively striking the enemy.

Non-military applications comprise support for public safety authorities, e.g., police or fire fighters that find themselves under attack. During such circumstances, access to portable close air support will provide the ability to quickly neutralize the attackers, e.g., by activating a smoke grenade or a tear gas grenade in hazardous zones.

SUMMARY

An object of the present disclosure is to provide devices and systems which seek to mitigate, alleviate, or eliminate one or more of the above-identified deficiencies and disadvantages in the art, singly or in any combination and to provide portable close air support.

According to a first aspect of the disclosure, this object is achieved by a portable close air support system comprising a remote control station, an unmanned aerial system, UAS, and a payload carrier attached to the UAS. The payload carrier comprises payload holding means configured to secure a payload to the payload carrier; and a payload release mechanism

configured to release the payload from the payload holding means whilst in airborne position to release the payload from the payload holding means. The payload carrier further comprises a payload activation mechanism configured to separate an active part of the payload from a safety arrangement of the payload. The payload activation and the payload release mechanisms are configured for correlated triggering from the remote control station. The carrier release mechanism is arranged to release the payload holding means from the separated active part of the payload.

The disclosed portable close air support system benefits from the ever on-going development and cost reductions in the area of simple unmanned aerial systems, commonly presented as drones. With a platform provided by existing lightweight and inexpensive unmanned aerial systems, a portable close air support system is provided that is simple in design while offering high flexibility in use. The functional design of the payload carrier focusses on providing a reliable and inexpensive payload carrier, both during operational use and with respect to wear and tear in sometimes harsh environments.

In some embodiments, the payload is a grenade and the safety arrangement is a safety pin of the grenade. Thus, the payload carrier may be mounted on an unmanned aerial system, UAS, to provide portable close air support and the payload activation mechanism enables the payload carrier to safely carry a grenade and only release the safety arrangement, i.e., the safety pin, when releasing the grenade at a target location, such as directly above an enemy. This has the advantage that a soldier no longer has to throw grenades, but can instead stay in cover and use the close air support system to deliver the grenade to a precise target location that may be out of reach for a thrown grenade.

According to a second aspect of the disclosure, this object is achieved by a payload carrier arranged to be attached to an unmanned aerial system, UAS. The payload carrier comprises payload holding means configured to secure a payload to the payload carrier and a payload release mechanism configured to release the payload holding means from the payload whilst in airborne position to release the payload from the payload carrier. The payload carrier further comprises a payload activation mechanism configured to separate an active part of the payload from a safety arrangement of the payload. The payload activation and the payload release mechanisms are configured for correlated, remote triggering. The payload

release mechanism is arranged to release the payload holding means from the separated active part of the payload.

In some embodiments, the payload activation mechanism comprises a spring and an articulated link arrangement comprising interconnected first and second link members. A first joint connects the first link member to a mounting bracket of the payload carrier and a second joint connects the second link member to the spring. The payload activation mechanism is configured to be attached to a safety arrangement of a payload and to separate an active part of the payload from the safety arrangement by displacing an intermediary joint interconnecting the first and second link members in response to the remote triggering.

In some embodiments, the intermediary joint is arranged to be displaced by releasing the spring to reduce an angle of articulation between the first and second link members.

In some embodiments, the payload comprises at least one electric actuator that is arranged to be remotely activated to trigger the payload activation mechanism.

The disclosed payload carrier facilitates the use of UAVs as described above in relation to the portable close air support system, and thus has all the associated technical effects and advantages.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing will be apparent from the following more particular description of the example embodiments, as illustrated in the accompanying drawings in which like reference characters refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the example embodiments.

Figure 1 illustrates a use case scenario for the close air support system;

Figure 2 illustrates a schematic functional block diagram for the close air support system;

Figure 3

- a. provides a top (or bottom) view of a payload carrier;
- b. provides a side view of a payload carrier;

Figure 4

- a. illustrate aspects of a payload carrier;
- b. illustrate aspects of a payload carrier;

Figure 5 a-c illustrate various states of payload release from a payload carrier; and

Figure 6 a-c illustrate aspects of payload release and payload activation mechanisms.

DETAILED DESCRIPTION

Aspects of the present disclosure will be described more fully hereinafter with reference to the accompanying drawings. The devices and method disclosed herein can, however, be realized in many different forms and should not be construed as being limited to the aspects set forth herein. Like numbers in the drawings refer to like elements throughout.

The terminology used herein is for the purpose of describing particular aspects of the disclosure only, and is not intended to limit the invention. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise.

Unmanned aerial systems, UASs, are regularly deployed in warfare as scouts and, for large UASs, also as carriers of advanced missile systems. However, for the regular foot soldier, there are currently few, if any, readily available systems for practical use in, for instance, a combat situation. The typical soldier faces challenges that are completely different than those of today's drone pilots. The latter typically sits in an office far away from any combat and remotely pilots large UASs for monitoring wide areas and potentially striking a target with a missile carried by the UAS.

The present disclosure relates to a portable close air support system suitable for use by soldiers in the field. The system comprises a remote control station, a UAS and payload carrier having a payload release mechanism which is configured to release the payload. In a preferred embodiment, the payload carrier is configured to safely carry and deliver standard thrown ordnance, such as hand thrown grenades, and to safely bring it back again if not used.

Figure 1 presents a scenario where an operator 120 of the system disclosed herein, present in a first zone, is under attack from a no go zone. In a military scenario, the operator 120

may be a soldier under attack by an enemy combatant 121. In a civilian scenario, the operator 120 may be a police officer under attack by a civilian 122. In order to protect himself, the operator 120 hides behind an obstacle 123, e.g., behind a police car in the civilian scenario. In the prior art, the operator would have to at least partially expose himself by coming up from behind the obstacle 123 in order to take action against the attacker 121, 122. One of the main aims of the present disclosure is to provide a means which enables the operator 120 to take effective action against the attacker without exposing himself. The means is preferably light enough to be carried around by the operator 120 at all times, while at the same time provide a reliable and robust system which can be deployed at a moment's notice. Returning to the scenario in order to see how the system disclosed herein may be used; the operator 120 guides an unmanned aerial system, UAS, 100 using a wireless remote control 110 configured to transmit control signals to the UAS 100. The UAS 100 is equipped with a forward looking camera and a downward looking camera. The cameras feed images to the wireless remote control 110, which enable the operator 120 to remain in cover as he navigates the UAS 100. The UAS is navigated into the no go zone. With the help of the downward looking camera, the UAS is navigated to a position essentially above the attacker 121, 122. As has been described in the background section above, in scenarios like these it may be desirable to drop a grenade on the attacker. In the military scenario, the grenade may be an explosive, while in the civilian scenario the grenade may be a smoke or teargas grenade. To ensure that the operator does not have to break cover to deliver an activated grenade to the position of attacker, the UAS 100 comprises a payload carrier for carrying a payload, such as a grenade, and a payload release mechanism. The payload carrier comprises payload holding means that enables carrying of the payload, e.g., the grenade, in a safe and controlled manner until the payload release mechanism is activated to release the payload from the payload carrier, thereby dropping the payload from the UAS. The payload carrier also comprises a payload activation mechanism that allows activation of the payload, e.g., the grenade, in response to activation of the payload release mechanism. Thus, the payload release mechanism may be triggered while at the same time triggering the payload activation mechanism which activates the grenade. When the UAS is in the position essentially above the attacker, the operator 120 triggers the payload release mechanism (by transmitting a control signal using the wireless remote control 110), thereby releasing and activating the grenade via the wireless remote control 110.

Figure 2 illustrates a portable close air support system 200 according to the present disclosure. In its most general form, the portable close air support system comprises a remote control station, an unmanned aerial system, UAS, 207 and a payload carrier 20 attached to the UAS 207. The payload carrier comprises payload holding means 201 configured to secure a payload, e.g., a grenade, to the payload carrier 20 and a payload release mechanism configured to release the payload holding means from the payload whilst in airborne operation to thereby release the payload from the payload carrier 20. The payload carrier further comprises a payload activation mechanism configured to separate a safety arrangement, e.g., a safety pin, of the payload from an active part of the payload. The payload activation mechanism and the payload release mechanisms are configured for correlated triggering from the remote control station. The carrier release mechanism is arranged to release the payload holding means from the separated active part of the payload

According to an aspect of the disclosure, the payload is a grenade. There are many types of hand thrown grenades; smoke, teargas, stun, and fragmentation are examples of available types. Such grenades are configured with a body containing a charge that is triggered by a fuse. Cylindrical, round, oval and pineapple shapes are common. The fuse may be triggered by a striker held down by a striker lever or lug. During storage and transportation, the lug is secured by a safety pin. When the grenade is brought into operational use, the lug is held down by the operator while the safety pin is removed. When the grenade is thrown the lug is released; thereby releasing the striker to ignite the fuse.

The payload carrier 20 is arranged under the UAS 207 (with respect to a standard orientation of the UAS during operational use). The UAS 207 is preferably a rotary-wing UAS comprising one or more electric motors 208. According to some aspects, the UAS is a quadcopter. Rotary-wing UASs are adapted to perform Vertical Take-off and Landing, VTOL, and they are able to hover and perform agile manoeuvring. Vertical take-off and landing offers greater flexibility in start and end points compared to UASs requiring a runway, such as airplanes. The VTOL-aspect implies that the unmanned aerial system 207 has the ability to move in an essentially vertical direction. This ability is an advantage in that it enables arranging the UAS 207 to propel itself essentially vertically to clear an obstacle, e.g. a shelter behind which an

operator is taking cover. This is further advantageous for operating the UAS 207 in terrain with varying altitude and/or obstacles, such as trees and/or buildings.

When attached to the UAS 207, the payload carrier 20 can be navigated to a well-defined destination from the remote control station. The UAS optionally comprises a forward looking and/or a downward looking camera 211a, 211b. The forward looking camera 211a enables improved manoeuvrability and allows the operator to remain in cover during operational use of the system. The downward looking camera assists an operator in determining when the UAS has reached an appropriate position for releasing its payload. Either camera may be configured to operate during poor sight conditions, e.g. light amplification, seeing infrared light or seeing through smoke. Processing circuitry 209 and a communications interface 210 of the UAS enables control of the system from the remote control station, preferably a handheld remote control station. The payload carrier may be configured to receive control signals directly from the wireless remote control or indirectly through a communication link to the UAS. The payload release mechanism and payload activation mechanism of the payload carrier are configured to be remotely activated, either directly in response to a command from the remote control station or indirectly whereby remote triggering of the payload activation mechanism brings about triggering also of the payload release mechanism.

Turning to Figures 3a and b top (or bottom) and side views of a payload carrier 30 according to the present disclosure are illustrated. The payload carrier is adapted for attachment to an unmanned aerial system, UAS. The payload carrier 30 comprises payload holding means 301 configured to secure a payload 300, e.g., a grenade, to the payload carrier and a payload release mechanism arranged to release the payload holding means from the payload whilst in airborne position to release the payload from the payload carrier. The payload carrier 30 comprises a payload activation mechanism configured to separate a safety arrangement 303, e.g., a safety pin, of the payload from an active part. The payload activation mechanism and the payload release mechanism are configured for correlated, remote triggering. The carrier release mechanism is arranged to release the holding means 301 from the separated active part of the payload from the payload carrier.

Figures 3a-b conceptually illustrate how the payload carrier 30 may safely carry standard thrown ordnance in the form of a payload 300, i.e., a grenade, and safely bring it back again if not used. The grenade 300 is secured to the payload carrier 30 by payload holding means 301, e.g., by means of an elastic cord, or any other similar type of field adapted, easy to use holding means. According to an aspect of the disclosure, the grenade 300 is arranged such that a lug of the grenade 302 is sandwiched between a surface of the payload carrier 30 and the body of the grenade 300.. The payload activation mechanism of the payload carrier 30, i.e., a mechanism operating on the safety pin, is operatively connected to the safety pin 303, e.g., to a ring of the safety pin 303. When triggered, the payload activation mechanism of the payload carrier 30 is configured to be displaced to pull out the safety pin 303. The payload carrier 30 is further configured to release the attachment of the grenade 300 provided by the holding means 301 using the payload release mechanism. When the safety pin has been removed by the payload activation mechanism, the grenade 300 is released by activating the payload release mechanism to release the payload holding means from the remaining active part of the payload 300, i.e., the part remaining after separation of the safety arrangement. The payload will be separate from the payload carrier by means of gravity. Turning to the disclosed scenario of a grenade, as the payload 300 is separated from the payload carrier, the lug 302 is free to fall off, thereby releasing the striker to ignite the fuse of the grenade. If the grenade is not used, e.g. during a UAS mission, the payload activation mechanism will not be triggered, the safety arrangement 303 will be maintained and the payload may be returned securely.

Figures 4a and 4b illustrate a payload carrier 40 according to the present disclosure. Figures 4a and b respectively illustrate the payload carrier in a loaded state (illustrated without the representation of the payload) and in an unloaded state. The payload carrier 40 comprises fastening means, i.e., a mounting bracket 41, configured to attach the payload carrier to a surface, e.g., to a ground facing surface of an unmanned aerial system, UAS. In addition to being fastened to the UAS, the mounting bracket also serves as a platform for the components of the payload carrier 40, i.e., the payload activation mechanism 42 and the payload release mechanism 43. In some embodiments, the payload carrier 40 comprises at least one electric actuator that is arranged to be remotely activated to trigger the payload activation mechanism.

In the payload carrier embodiment of Figures 4a and b, the payload activation mechanism 42 comprises a spring 46, e.g., a coil spring or a gas spring, and an articulated link arrangement 47 comprising interconnected first and second link members 47d, 47e. A first pivoted joint 47a connects the first link member 47d to the mounting bracket 41 of the payload carrier. A second pivoted joint 47b connects the second link member 47e to the spring. The payload activation mechanism 42 is configured to be attached to a safety arrangement of a payload and to separate an active part of the payload from the safety arrangement by displacing an intermediary pivoted joint 47c interconnecting the first and second link members 47d, 47e in response to the remote triggering. The intermediary pivoted joint 47c is arranged to be displaced by releasing the spring 46 to reduce an angle of articulation between the first and second link members 47d, 47e.

In a preferred embodiment the mounting bracket 41 is separable into a first and a second part, wherein the first part is arranged to receive the second part via a snap-on mechanism so that the two parts can be quickly joined or separated; thereby reducing the turnaround time for loading the UAS. Different payloads can be preloaded into the payload carrying part of the mounting bracket so that an empty second part of a returning UAS quickly can be replaced with another preloaded second part via the snap on mechanism.

It is advantageous if the payload carrier 40 is as simple as possible in its design. This serves several purposes. First, it has to be reliable, both during operational use and with respect to wear and tear in sometimes harsh environments. Second, it has to be light enough to be carried without undue burden to the operator. Third, few and simple components typically implies inexpensive manufacturing.

The payload carrier comprises a mounting bracket 41, a payload activation mechanism 42 and a payload release mechanism 43. The payload activation mechanism 42 and the payload release mechanism 43 are configured for activation in sequence, i.e., for correlated, remote triggering, to ensure that the payload activation mechanism 42 is initiated prior to release of the payload through the payload release mechanism 43.

The payload release mechanism 43 comprises a pivoted lever 44a linked to a release pin 44b. The payload carrier 40 may also comprise a safety mechanism 45 to prevent inadvertent initiation of the payload activation mechanism 42. According to aspects of the disclosure, the safety mechanism comprises a lever 45a and spring 45b. The lever 45a is connected to the mounting bracket 41 and abuts a link arm 42a of the payload activation mechanism 42.

In the unfolded state of the articulated link arrangement, disclosed in Figure 4a, the articulated link arrangement 42 is configured to compress the spring 46, e.g., a coil spring as illustrated or a gas spring. As mentioned, the unfolded state represents the loaded state for the carrier device.

The articulated link arrangement 42 comprises three pivoted joints 47a, 47b, 47c. A first pivoted joint 47a is attached to the mounting bracket 41 and fixates an upper point of the first link member 47d with respect to the mounting bracket 41. A second pivoted joint 47b of the second link member 47e is attached to the main spring 46. The force applied on the second link member 47e by the spring 46 thereby acts on the second link member 47b mainly via the second pivoted joint 47b. An intermediary pivoted joint 47c joins the first link member 47d and the second link member 42e and is arranged between the first and second pivoted joints 47a, 47b. The intermediary pivoted joint is the joint that determines the angle of articulation between the link members. When the spring is released, the angle of articulation is reduced so that the link members are in a direction of one another; thereby transitioning from an unfolded state to a folded state. When the payload activation mechanism 42 is in the unfolded state, as disclosed in Figure 4a, the intermediary pivoted joint 47c is preferably configured to have an offset d with respect to a line L passing through the first and second pivoted joints 47a, 47b.

By connecting the first and second link member so that an intermediary pivoted joint 47c of the connection is at a position that has a slight offset to the line L , the articulated link arrangement 42 will fold in a given direction. The first link member 47d is preferably L-shaped, having a first portion comprising said first and intermediary pivoted joints, and a second portion with an extremity that is free to rotate around the first pivoted joint when transitioning from the unfolded state to the folded state.

In some embodiments, a wire or cord, e.g., an elastic cord (not shown) serves as holding means to secure the payload to the payload carrier. The payload release mechanism is configured to release the holding means, e.g., the elastic cord, following activation of the payload activation mechanism. According to some aspects, the payload release mechanism 43 comprises a pivoted lever 44a linked to a release pin 44b. When the carrier device is in a loaded state, the release pin secures the elastic cord in a position whereby the payload is safely maintained within the mounting bracket. The payload release mechanism is configured to release the elastic cord in response to pressure applied by payload activation mechanism when moving from the unfolded to the folded state, e.g., applied by said extremity of the upper link member 42a on the pivoted lever 44a. The payload release mechanism 43 acting on an elastic cord further contributes to the robust and simplistic design of the payload carrier, with all the associated advantages.

The safety mechanism 45 is arranged to, in a fold-preventing state, prevent the articulated link arrangement 42 from going from the unfolded state to the folded state.

When securing payload in the carrier device, i.e., to a carrier device having an articulated link arrangement in a folded state, a force F is applied to the protruding articulated link arrangement 42 to cock the payload activation mechanism, see Fig. 4b. The force F changes the state of the articulated link arrangement 42 from a folded state (Fig. 4b) to an unfolded state (Fig. 4a). The main spring 4 is compressed by the force F to hold stored energy. The articulated link arrangement 42 automatically enters safety mode when cocked as the safety mechanism 45 blocks the movement, see Fig. 4a.

Figures 5a-c illustrate a payload carrier 50 according to the present disclosure at various states of payload release.

To release the payload the safety mechanism 55 is first actuated by a first force F_1 which release the articulated link arrangement block. A payload in the form of a grenade has been illustrated with dashed lines in order to improve the understanding of the payload carrier construction and operation. The payload is of course not to be considered as part of the payload carrier. With the dropping mechanism in an "Armed" mode a second force F_2 pushes the articulated link arrangement to collapse, thereby releasing the stored energy from the main spring 53. In a preferred embodiment, the payload carrier 50 comprises at

least one electric actuator arranged to provide at least one of the first and second forces F1, F2. According to some aspects, the safety mechanism 55 and/or the articulated link arrangement 52 are arranged to receive the first and/or second force from an external source. According to a further aspect, the external source is an unmanned aerial system, UAS. If the payload carrier 50 is supposed to provide at least one of the first and second forces F1, F2, it needs to be provided with the control signals which makes this happen. Thus, in some embodiments the control module 50 further comprises a signalling interface arranged to receive control signals. According to some aspects, the signalling interface is arranged to receive control signals from a UAS. In this case, the signalling interface may be wireless or a physical link between the UAS and the payload carrier 50. According to some other aspects, the signalling interface is arranged to receive control signals wirelessly from a remote control. Combinations are also possible, where the remote control acts as the primary controller and, if direct connection between the remote control and the payload carrier is lost, the UAS takes over the signalling of control signals. Since the UAS is typically also controlled by the remote control, this provides redundancy in case of malfunction or poor signalling conditions. The safety pin of the payload is attached to an attachment position p on the articulated link arrangement 52 and configured to pull the pin as the main spring extends 53. The attachment position p is preferably configured to enable attachment of the ring of the safety pin to the attachment position. According to some aspects, the attachment position p comprises a cylindrical portion configured to enable arranging the ring around the cylindrical portion. The articulated link arrangement mechanism is configured to engage with the payload release mechanism when the majority of the grenade safety pin is protracted, see Fig. 5b. According to some aspects, the payload release mechanism comprises a pin assembly. The pin assembly may comprise a pivot element configured to adjust the arrangement of a pin by pivoting in response to a force applied via engagement of the articulated link arrangement mechanism with the pivot element. The payload release mechanism is configured to release an elastic cord holding the payload in response to the engagement of the articulated link arrangement mechanism, see Fig. 5c.

Figures 6a-c illustrate an alternative configuration of a payload activation mechanism and a payload release mechanism according to the present disclosure. As an alternative to a mechanical coil spring, a gas generator can be used instead. An example of gas generator is

the blank cartridge for starting guns or nailers. The mechanism consists of a main piston 605 configured to remove the safety arrangement from the active part of the payload, as previously discussed with reference to Figures 3 and 4, and a secondary piston 606 configured to operate the payload release mechanism. The cartridge is loaded into the main barrel at position p1. The safety pin is attached to the main piston 605 at position p2. When the gas generator is activated the gas pushes the main piston out, thereby pulling the safety pin. When the main piston 605 reaches its end position, it opens a valve, allowing the gas to escape into a secondary barrel, see Fig. 6b. The gas pushes the secondary piston 606 out, see Fig. 6c, to release the payload. The safety mechanism is configured to blocking a gas generator striker, like on a hand gun.

CLAIMS

1. A portable close air support system (100, 200) comprising a remote control station, an unmanned aerial system, UAS, (207), and a payload carrier (20, 30, 40, 50) attached to the unmanned aerial system (207), wherein the payload carrier (20, 30, 40, 50) comprises payload holding means (201, 301) configured to secure a payload to the payload carrier (20, 30, 40, 50); and a payload release mechanism (46) configured to release the payload holding means whilst in airborne position to release the payload from the payload carrier, **characterized in**, that the payload carrier (20, 30, 40, 50) comprises a payload activation mechanism configured to separate a safety arrangement from an active part of the payload, that the payload activation and the payload release mechanisms are configured for correlated triggering from the remote control station, and that the carrier release mechanism is arranged to release holding means from the separated active part of the payload.
2. The portable close air support system (100, 200) according to claim 1, wherein the unmanned aerial system (207) is a rotary-wing unmanned aerial system (207).
3. The portable close air support system (100, 200) according to claim 1 or 2, wherein the payload is a grenade and the safety arrangement is a safety pin of the grenade.
4. The portable close air support system (100, 200) according to any of claims 1 to 3, wherein the remote control station is hand-held.
5. A payload carrier (20, 30, 40, 50) arranged to be attached to an unmanned aerial system (207), the payload carrier (20, 30, 40, 50) comprising payload holding means (201, 301, 501) configured to secure a payload to the payload carrier; and a payload release mechanism (46) configured to release the payload holding means whilst in airborne position to release the payload from the payload carrier, **characterized in** that the payload carrier (20, 30, 40, 50) comprises a payload activation mechanism configured to separate a safety arrangement from an active part of the payload, that the payload activation and the payload release mechanisms are configured for correlated, remote triggering, and that the carrier

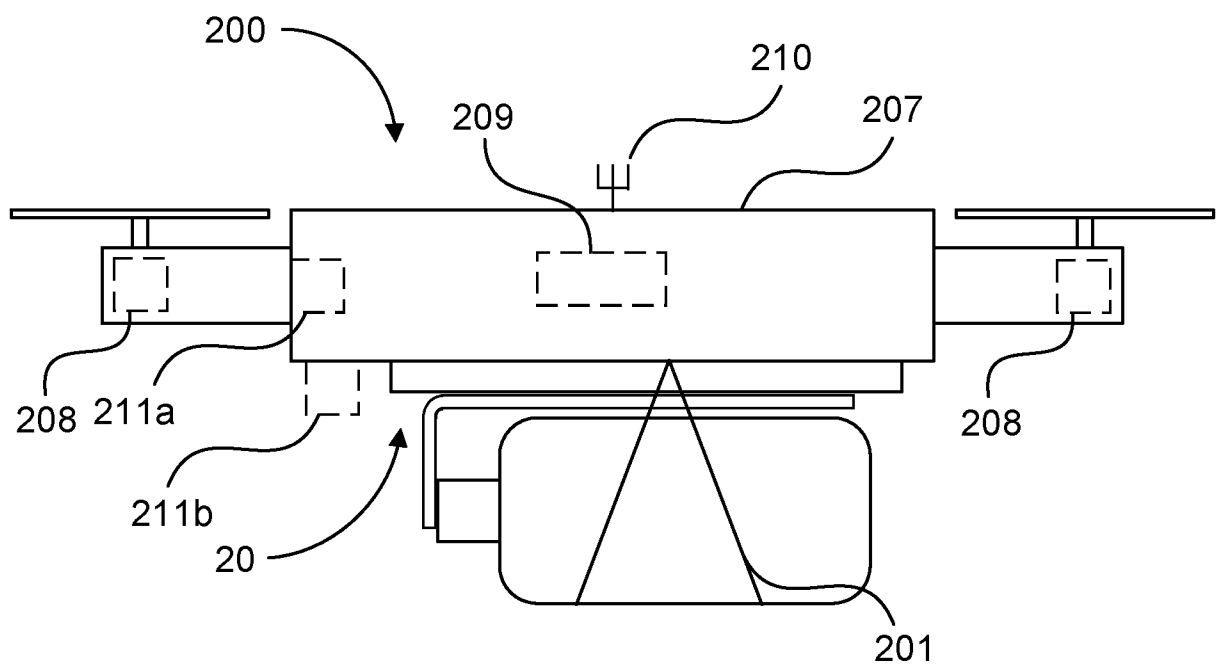
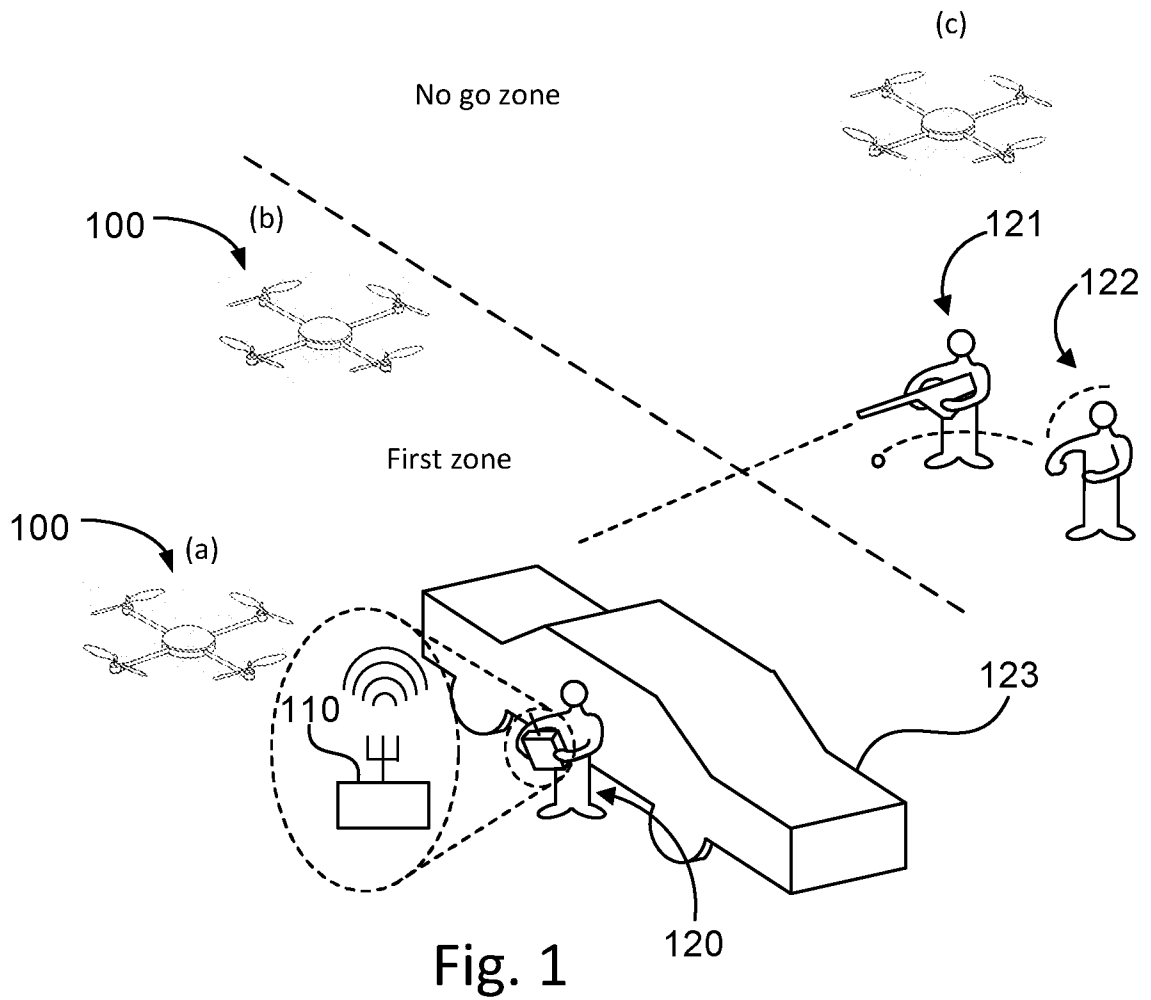
release mechanism is arranged to release holding means from the separated active part of the payload.

6. The payload carrier (20, 30, 40, 50) of claim 5, wherein the payload activation mechanism comprises a spring (46, 53) and an articulated link arrangement (47, 52) comprising interconnected first and second link members (47d, e), a first pivoted joint (47a) connecting the first link member (47d) to a mounting bracket (41) of the payload carrier and a second pivoted joint connecting the second link member (47e) to the spring (46), wherein the payload activation mechanism (42) is configured to be attached to a safety arrangement of a payload and to separate the safety arrangement from an active part of the payload, in response to the remote triggering, by displacing an intermediary joint (47c) interconnecting the first and second link members (47d, e).

7. The payload carrier (20, 30, 40, 50) of claim 6, wherein the intermediary joint (47c) is arranged to be displaced by releasing the spring (46) to reduce an angle of articulation between the first and second link members (47d, e).

8. The payload carrier (20, 30, 40, 50) according to any of claims 5 to 7, wherein the payload carrier (20, 30, 40, 50) comprises at least one electric motor that is arranged to be remotely activated to trigger the payload activation mechanism (42).

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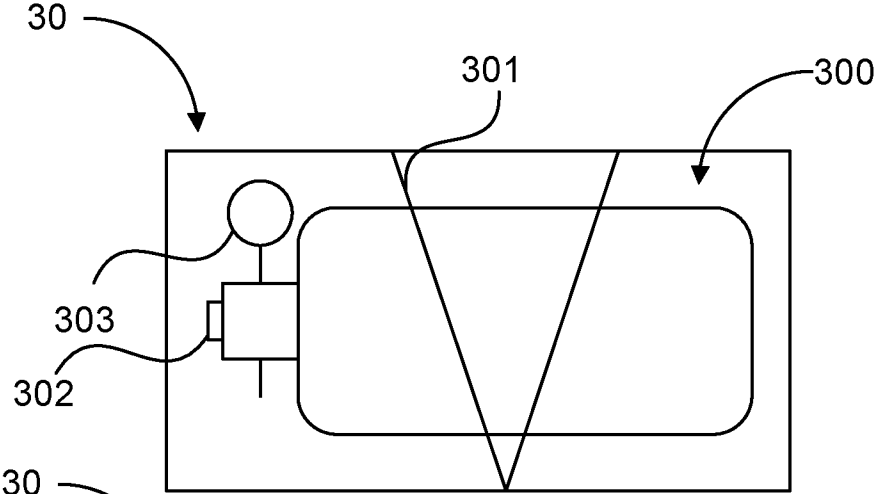


Fig. 3a

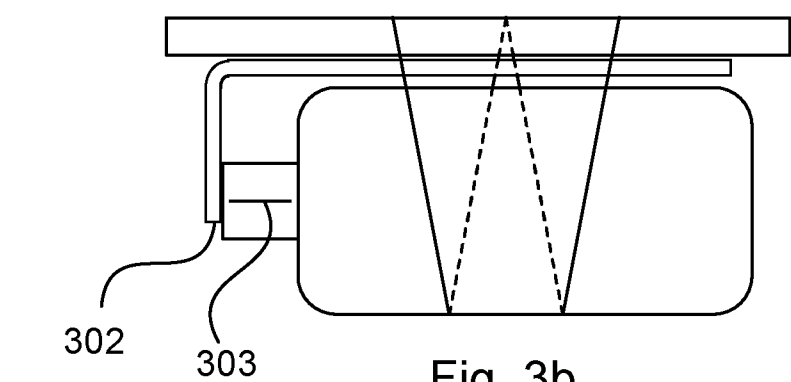


Fig. 3b

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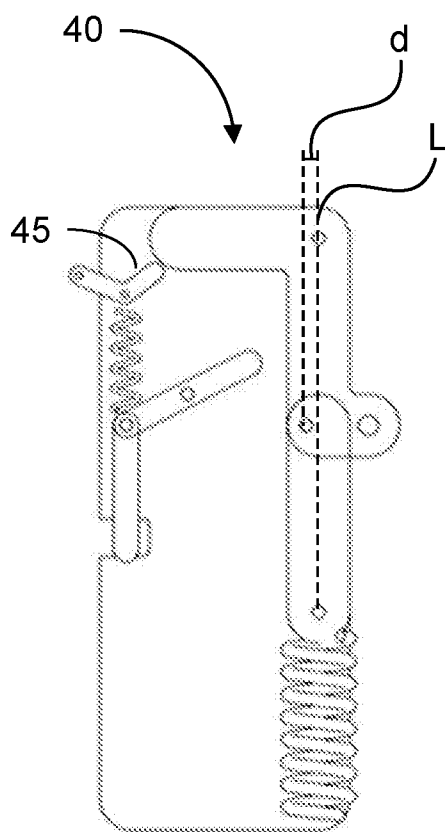


Fig. 4a

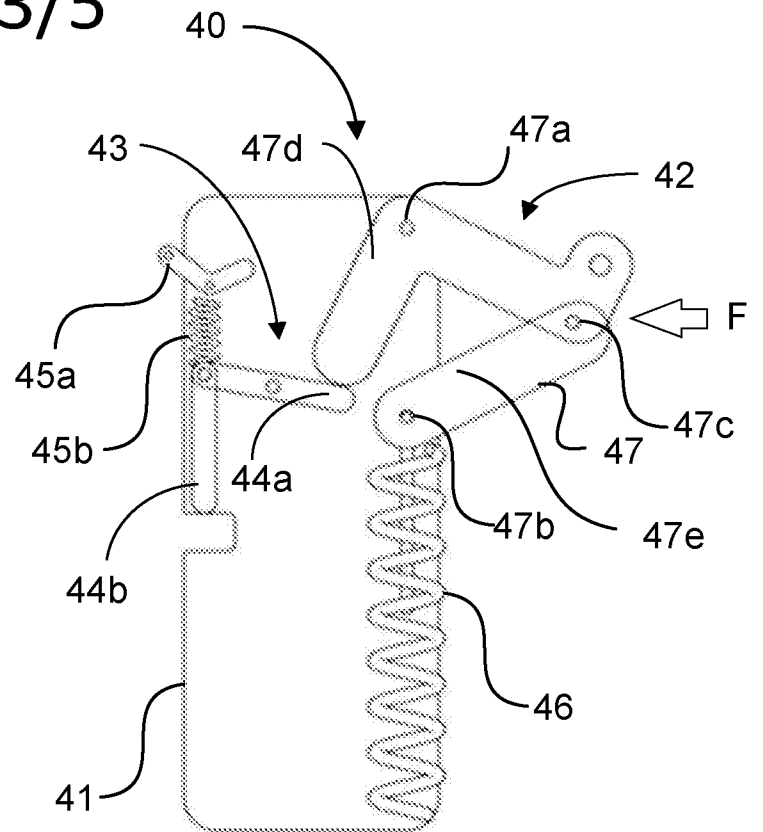


Fig. 4b

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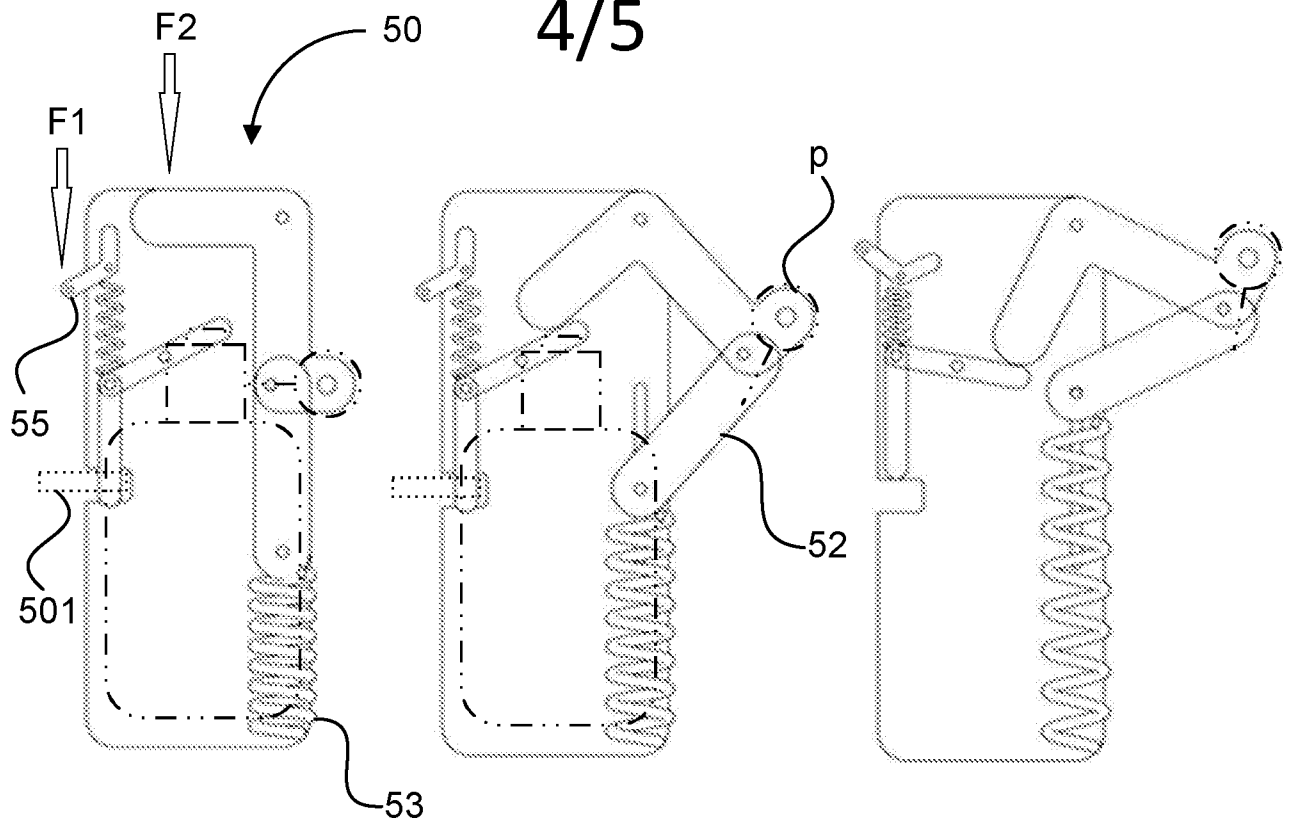


Fig. 5a

Fig. 5b

Fig. 5c

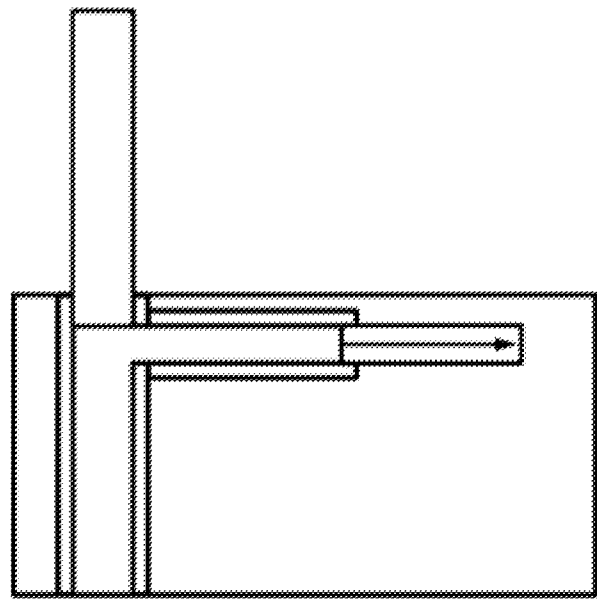


Fig. 6c

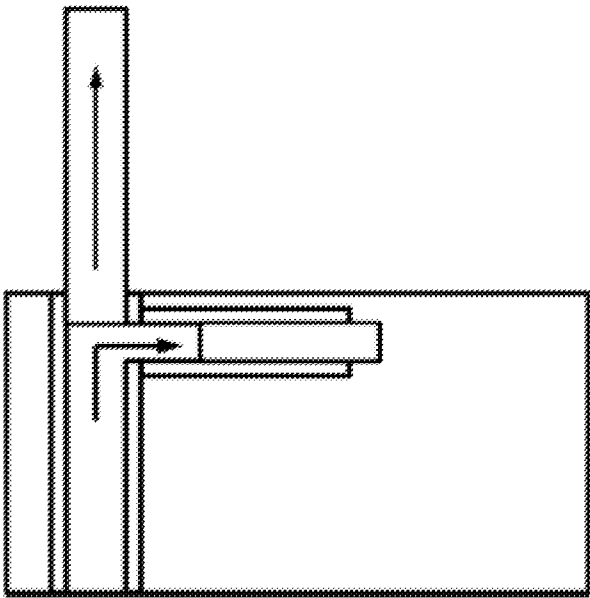


Fig. 6b

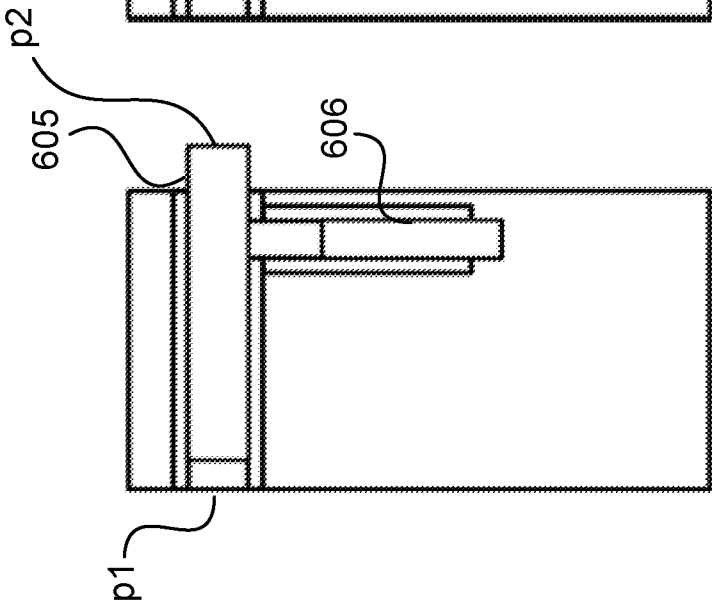


Fig. 6a

INTERNATIONAL SEARCH REPORT

International application No
PCT/SE2017/050952

A. CLASSIFICATION OF SUBJECT MATTER				
INV.	F41G3/16	B64C39/02	B64D1/04	F42C14/02
	F41G3/22	F41G9/00	F42B25/00	F42C15/20
	F41F5/00	F41G9/02		F42C15/44
				F42C15/42
According to International Patent Classification (IPC) or to both national classification and IPC				
B. FIELDS SEARCHED				
Minimum documentation searched (classification system followed by classification symbols)				
F41G B64C B64D F42C F42B F41F F41H				
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched				
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)				
EPO-Internal, WPI Data				
C. DOCUMENTS CONSIDERED TO BE RELEVANT				
Category*	Citation of document, with indication, where appropriate, of the relevant passages			Relevant to claim No.
X	WO 2015/029007 A1 (GABBAY RONEN IZIDOR [IL]) 5 March 2015 (2015-03-05) page 18, line 2 - line 4; figure 9C page 10 - page 13; figures 1-4 -----			1-5
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☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.				
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family				
Date of the actual completion of the international search			Date of mailing of the international search report	
21 December 2017			05/01/2018	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016			Authorized officer Kaleve, Abraham	

INTERNATIONAL SEARCH REPORT

International application No
PCT/SE2017/050952

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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A	US 8 651 347 B1 (MOLCHO HAIM [IL] ET AL) 18 February 2014 (2014-02-18) column 4, line 33 - column 7, line 2; figures 1-4 -----	1-8

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