

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 267.001 PCT	FOR FURTHER ACTION		See Form PCT/IPEA/416
International application No. PCT/US2019/032041	International filing date (day/month/year) 13 May 2019 (13.05.2019)	Priority date (day/month/year) 17 May 2018 (17.05.2018)	
International Patent Classification (IPC) or both national classification and IPC IPC: A01M 21/04; G06K 9/00, 9/62; H01S 3/00 CPC: A01M 21/046; G06K 9/00657, 9/62; H01S 3/00			
Applicant MORGAN PERRY			

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:

- a. ☒ (sent to the applicant and to the International Bureau) a total of 22 sheets, as follows:
- ☒ sheets of the description, claims and/or drawings which have been amended and/or sheets containing rectifications authorized by this Authority, unless those sheets were superseded or cancelled, and any accompanying letters (see Rules 46.5, 66.8, 70.16, 91.2, and Section 607 of the Administrative Instructions).
- ☐ sheets containing rectifications, where the decision was made by this Authority not to take them into account because they were not authorized by or notified to this Authority at the time when this Authority began to draw up this report, and any accompanying letters (Rules 66.4bis, 70.2(e), 70.16 and 91.2).
- ☐ superseded sheets and any accompanying letters, where this Authority either considers that the superseding sheets contain an amendment that goes beyond the disclosure in the international application as filed, or the superseding sheets were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in item 4 of Box No. I and the Supplemental Box (see Rule 70.16(b)).
- b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____ containing a sequence listing, in the form of an Annex C/ST.25 text file, as indicated in the Supplemental Box Relating to Sequence Listing (see paragraph 3ter of Annex C of the Administrative Instructions).

4. This report contains indications relating to the following items:

- ☒ Box No. I Basis of the report
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand 05 December 2019 (05.12.2019)	Date of completion of this report 11 April 2020 (11.04.2020)
Name and mailing address of the IPEA/US COMMISSIONER FOR PATENTS MAIL STOP PCT, ATTN: IPEA/US P.O. BOX 1450 ALEXANDRIA, VA 22313-1450, UNITED STATES OF AMERICA Facsimile No. (571)273-8300	Authorized officer PETER POON Telephone No. 571-272-6891

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Box No. I Basis of the report

1. With regard to the **language**, this report is based on:

- ☒ the international application in the language in which it was filed.
- ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of:
- ☐ international search (Rules 12.3(a) and 23.1(b))
- ☐ publication of the international application (Rule 12.4(a))
- ☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a) and (b))

2. With regard to the **elements** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

- ☐ the international application as originally filed/furnished, or
- ☒ the description:
pages 1-14 as originally filed/furnished.
pages* _____ received by this Authority on _____
pages* _____ received by this Authority on _____
- ☒ the claims:
Nos. _____ as originally filed/furnished.
Nos.* _____ as amended (together with any statement) under Article 19
Nos.* 1-33 received by this Authority on 05 December 2019 (05.12.2019)
- ☒ the drawings:
pages _____ as originally filed/furnished.
pages* 1/3-3/3 received by this Authority on 05 December 2019 (05.12.2019)
- ☐ a sequence listing - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since either they are considered to go beyond the disclosure as filed, or they were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in the Supplemental Box (Rules 70.2(c) and (c-bis)):

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____

5. ☐ This report has been established:

- ☐ taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rules 66.1(d-bis) and 70.2(e)).
- ☐ without taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rules 66.4bis and 70.2(e)).

6. With regard to top-up searches (Rules 66.1ter and 70.2(f)):

- ☐ A top-up search was carried out by this Authority on _____
- ☐ Additional relevant documents have been discovered during the top-up search.
- ☒ No top-up search was carried out by this Authority because it would serve no useful purpose.

7. ☐ Supplementary international search report(s) from Authority(ies) _____ has/have been received and taken into account in establishing this report (Rule 45bis.8(b) and (c)).

* If item 4 applies, some or all of those sheets may be marked "superseded."

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Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement		
1. Statement			
Novelty (N)	Claims	1-33	YES
	Claims		NO
Inventive step (IS)	Claims		YES
	Claims	1-33	NO
Industrial applicability (IA)	Claims	1-33	YES
	Claims		NO
2. Citations and explanations (Rule 70.7)			
----- NEW CITATIONS -----			
US 2016/0205917 A1 (CHAN ET AL) 21 July 2016 (21.07.2016) , all			
US 9,609,858 B2 (STOWE ET AL) 19 March 2015 (19.03.2015) , all			
US 9,565,848 B2 (STOWE ET AL) 19 March 2015 (19.03.2015) , all			
----- EXPLANATION -----			
Claims 1-3, 5-24 and 27-33 lack an inventive step under PCT Article 33(3) as being obvious over Stowe et al. (U.S. Patent No. 9,609,858) in view of Billman (U.S. Patent Application Publication No. 2016/0325127). For claim 1, Stowe et al. discloses a system for targeting and damaging but not incinerating a growing plant or crop, while avoiding adverse impact on people, animals, vehicles, structures, other crops, or the environment, even those potentially or likely among and/or adjacent to the target plant or crop (Col. 1, lines 36-38), the system comprising: a laser operable to generate a beam of energy sufficient to damage a plant when the plant is exposed to the beam (Col. 1, lines 36-38 and Col. 8, lines 52-55); a controller operable to determine whether a target of the laser is a plant to be damaged, and in response to the determination (Col. 1, lines 34-36: image processor): prevent the laser's energy beam from reaching the target, if the target is not a plant to be damaged, and cause the laser's energy beam to reach the target, if the target is a plant to be damaged (Col. 7, lines 43-61); and an aircraft operable to position the laser and the controller airborne (Col. 10, lines 63-65). Stowe et al. fails to show the laser is located at least 350 meters away and the aircraft is operable to position the laser and the controller airborne at least 350 meters away from the plant. However, Billman teaches a system for targeting and damaging a growing plant (abstract), the system comprising: a laser operable to generate a beam of energy sufficient to damage a plant when the plant is exposed to the beam ([0069-0071]) located at least 350 meters away ([0038]); and an aircraft (as shown in Figs. 3A-4D) operable to position the laser and the controller airborne at least 350 meters away from the plant ([0038]). It would have been obvious to one having ordinary skill in the art to provide the system of Stowe et al. with the distance as specified by Billman to eliminate the need to be positioned on the ground in order to perform the recited functions of the system. For claim 2, Stowe et al. as modified by Billman disclose the system of claim 1 wherein the beam of energy is sufficient to critically damage the plant when the plant is exposed to the beam (Stowe et al. Col. 1, lines 36-38). For claim 3, Stowe et al. as modified by Billman disclose the system of claim 1 wherein the aircraft is an airplane (Billman [0079, 0082, 0085]). For claims 5-7, Stowe et al. as modified by Billman disclose the system of claim 1 wherein the laser includes an optical component operable to shape the beam of energy generated by the laser, wherein the laser includes an optical component operable to focus in a single dimension the beam of energy generated			

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by the laser, and wherein the laser includes an optical component operable to shape the beam of energy generated by the laser, and to modify the shape of the beam (Stowe et al. Col. 9, lines 25-43).

For claims 8-11, Stowe et al. as modified by Billman disclose the system of claim 1 wherein the controller includes a sensor operable to sense the shape of the laser's target, and circuitry for comparing the shape of the target sensed by the sensor with a shape of a known object (Stowe et al. Col. 8, lines 34-64), wherein the controller includes an infrared sensor and circuitry for comparing data of the laser's target generated by the infrared sensor with data that represents a known object (Stowe et al. Col. 6, lines 44-57), wherein the controller includes a hyperspectral sensor and circuitry for identifying and distinguishing a growing plant or crop from other plants or crops and comparing data of the laser's target generated by the hyperspectral sensor with data that represents a known object (Stowe et al. Col. 8, lines 43-64), wherein the controller includes a multispectral sensor and circuitry for comparing identifying and distinguishing a growing plant or crop from other plants or crops and data of the laser's target generated by the multispectral sensor with data that represents a known object (Stowe et al. Col. 8, lines 43-64).

For claim 12, Stowe et al. fails to show the controller includes a global positioning sensor and circuitry for comparing data of the laser's target generated by the global positioning sensor with data that represents a known location. Billman teaches the system comprising: a controller that includes a global positioning sensor and circuitry for comparing data of the laser's target generated by the global positioning sensor with data that represents a known location ([0075]). It would have been obvious to one having ordinary skill in the art to have modified the system of Stowe et al. to include the controller having a global positioning sensor as taught by Billman for the advantage of accurately identifying the location of unwanted plants and weeds to be damaged using the system.

For claim 13, Stowe et al. as modified by Billman disclose the system of claim 1 wherein: the laser is operable to generate a beam of energy sufficient to damage a plant that is located 5,000 meters away, and the aircraft is operable to position the laser and controller airborne 5,000 meters away from the plant (Billman teaches it is known that aircraft having a laser are operable to position the laser and controller airborne 5,000 meters away from the plant, [0050]).

For claim 14, Stowe et al. discloses a method for distinguishing a growing plant or crop from others and targeting and damaging but not incinerating it, while avoiding adverse impact on people, animals, vehicles, structures, other crops, or the environment, even those potentially or likely among and/or adjacent to the target plant or crop (Col. 1, lines 36-38), the method comprising: positioning a laser away from an area of growing plants (Col. 1, lines 36-38 and Col. 8, lines 52-55); identifying a target, within the area, to be exposed to a beam of energy generated by the laser; determining, with a controller of the system, whether the target is a plant to be damaged (Col. 1, lines 34-36: image processor); if the target is a plant to be damaged, then generating, with the system's laser, a beam of energy such that the target is exposed to an amount of energy sufficient to damage the plant; and if the target is not a plant to be damaged, then preventing, with the system's controller, the laser's beam of energy from reaching the target (Col. 7, lines 43-61).

Stowe et al. fails to show positioning the laser is located at least 350 meters away. However, Billman teaches a method for targeting and damaging a growing plant (abstract), the method comprising: positioning a laser of a system at least 350 meters away from an area of growing plants ([0038]). It would have been obvious to one having ordinary skill in the art to provide the method of Stowe et al. with the distance as specified by Billman to eliminate the need to be positioned on the ground in order to perform the recited functions of the system.

For claim 15, Stowe et al. as modified by Billman disclose the method of claim 14 wherein positioning the laser includes flying an aircraft (Stowe et al. Col. 10, lines 63-65) that the laser is mounted in, at least 350 meters away from the area of growing plants (Billman [0038]).

For claim 16, Stowe et al. discloses identifying a target includes identifying the target before aiming the laser at the target (Col. 8, lines 31-43: "digital comparison", "stored image information"), but fail to explicitly show the method of claim 14 wherein identifying a target includes identifying the target at least one hour before aiming the laser at the target. However, it would have been obvious to one having ordinary skill in the art to identify the target at least one hour before aiming the laser at the target for the advantage of verifying the data and unwanted plant to be damaged. *KSR International Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1739, 1740, 82 USPQ2d 1385, 1395, 1396 (2007).

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For claim 17-18, Stowe et al. as modified by Billman disclose the method of claim 14 wherein identifying a target includes sensing the target with a hyperspectral sensor, identifying and distinguishing a growing plant or crop from other plants or crops (Stowe et al. Col. 8, lines 43-64), and wherein identifying a target includes sensing the target with a multispectral sensor, identifying and distinguishing a growing plant or crop from other plants or crops (Stowe et al. Col. 8, lines 43-64).

For claim 19, Stowe et al. as modified by Billman disclose the method of claim 14 wherein determining whether the target is a plant to be damaged includes determining this immediately before aiming the laser at the target (Stowe et al. Col. 15, lines 27-31).

For claims 20-22, Stowe et al. as modified by Billman disclose the method of claim 14 wherein determining whether the target is a plant to be damaged includes sensing the target with a hyperspectral sensor (Stowe et al. Col. 8, lines 43-64), wherein determining whether the target is a plant to be damaged includes sensing the target with a multispectral sensor (Stowe et al. Col. 8, lines 43-64), wherein determining whether the target is a plant to be damaged includes sensing the target with an infrared sensor (Stowe et al. Col. 6, lines 44-57).

For claim 23, Stowe et al. as modified by Billman disclose the method of claim 14 wherein determining whether the target is a plant to be damaged includes sensing the shape of the target (Stowe et al. Col. 8, lines 34-64).

For claim 24, Stowe et al. as modified by Billman disclose the method of claim 14 wherein generating, with the system's laser, a beam of energy includes aiming, with the system's controller, the laser at the target (Stowe et al. Col. 15, lines 29-30).

For claim 25, Stowe et al. fails to specifically show wherein preventing the laser's beam of energy from reaching the target includes preventing the laser from generating the beam of energy while the laser is aimed at the target. However, Billman teaches a method for targeting and damaging a growing plant (abstract), the method comprising: preventing the laser's beam of energy from reaching the target includes preventing the laser from generating the beam of energy while the laser is aimed at the target ([0085]: "approval to begin", "joy stick operation"). It would have been obvious to one having ordinary skill in the art to have modified the method of Stowe et al. to include the preventing step as taught by Billman for the advantage of preventing the misfiring or accidental actuation of the laser.

For claim 27, Stowe et al. as modified by Billman disclose the method of claim 14 wherein: positioning a laser of a system includes positioning the laser 5,000 meters away from an area of growing plants, and generating, with the system's laser, a beam of energy includes generating a beam of energy sufficient to damage a plant that is located 5,000 meters away (Billman teaches it is known that aircraft having a laser are operable to position the laser and controller airborne 5,000 meters away from the plant, [0050]).

For claims 28-29, Stowe et al. fails to show wherein the system is protected against hostile human action associated with the target, such as small arms fire, by distance and armoring, and wherein the system is protected against most conventional ground-based weaponry associated with the target by distance and armoring. However, Billman teaches the system comprising: the aircraft (as shown in Figs. 3A-4D) is protected against hostile human action associated with the target, such as small arms fire, by distance and armoring (Stowe et al. Col. 10, lines 63-65: aircraft; Billman Fig. 4A and [0080]: armor 96), and wherein the system is protected against most conventional ground-based weaponry associated with the target by distance and armoring (Stowe et al. Col. 10, lines 63-65: aircraft; Billman Fig. 4A and [0080]: armor 96). It would have been obvious to one having ordinary skill in the art to provide the system of Stowe et al. with the armor as specified by Billman to protect the aircraft from environmental factors and hostile human action.

For claim 30, Stowe et al. as modified by Billman disclose the system of claim 1 wherein operation of the system does not require ground access to or near the target before, during, or after use of the system (Stowe et al. Col. 10, lines 63-65: aircraft).

For claims 31-32, Stowe et al. fails to show the method of claim 14 wherein the system is operated at a distance and with armoring to protect it against hostile human action associated with the target such as small arms fire, and wherein the system is operated at a distance and with armoring to protect it against most conventional ground-based weaponry associated with the target. However, Billman teaches the method comprising: the system mounted in an aircraft (as shown in Figs. 3A-4D), wherein the system is operated at a distance and with armoring to protect it against hostile human action associated with the

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	target such as small arms fire(Stowe et al. Col. 10, lines 63-65: aircraft; Billman Fig. 4A and [0080]: armor 96), and wherein the system is operated at a distance and with armoring to protect it against most conventional ground-based weaponry associated with the target (Stowe et al. Col. 10, lines 63-65: aircraft; Billman Fig. 4A and [0080]: armor 96). It would have been obvious to one having ordinary skill in the art to provide the method of Stowe et al. with the armor as specified by Billman to protect the aircraft from environmental factors and hostile human action. For claim 33, Stowe et al. as modified by Billman disclose the smethod of claim 14 wherein system operations does not require ground access to or near the target before, during, or after use of the system (Stowe et al. Col. 10, lines 63-65: aircraft). Claim 4 lacks an inventive step under PCT Article 33(3) as being obvious over the prior art as applied in claim 1 and further in view of Spiegel (U.S. Patent No. 7,506,815). For claim 4, Stowe et al. as modified by Billman fail to show wherein the laser is operable to generate a beam of light having a wavelength of 532 nanometers. However, Spiegel teaches a system comprising: a laser beam (Fig. 1 and Col. 3, lines 61-62: 13), wherein the laser is operable to generate a beam of light having a wavelength of 532 nanometer (Col. 6, lines 7-11). It would have been obvious to one having ordinary skill in the art to provide the system of Stowe et al. and Billman to include the wavelength of light for the laser as taught by Spiegel for the advantage of providing a highly visible laser beam during system execution at a distance of at least 350 meters away. Claim 26 lacks an inventive step under PCT Article 33(3) as being obvious over the prior art as applied in claim 1 and further in view of Pugh, Jr. (U.S. Patent No. 3,619,037). For claim 26, Stowe et al. as modified by Billman fail to show wherein preventing the laser's beam of energy from reaching the target includes blocking the laser's beam of energy while the laser is aimed at the target. However, Pugh, Jr. teaches a method comprising: preventing the laser's beam of energy from reaching the target includes blocking the laser's beam of energy while the laser is aimed at the target (abstract; Col. 2, lines 34-43). It would have been obvious to on ehaving ordinary skill in the art to have modified the method of Stowe et al. and Billman to include blocking the laser's beam as taught by Pugh, Jr. for the advnatage of preventing the misfiring or accidental actuation of the laser.

5 December 2019

International Searching Authority/US
 Mail Stop PCT, Attn: ISA/US
 Commissioner for Patents
 P.O. Box 1450
 Alexandria, VA 22313-1450

RE: PCT/US19/32041, Chapter II Demand and Article 34 Amendments

Dear Commissioner,

We are in receipt of the 24 July 2019 Written Opinion (WO) of the ISA for the above-cited PCT patent application. We respond here with a Chapter II Demand (attached to this letter) and Article 34 Amendments (also attached to this letter). More specifically, the Applicant has amended the claims and the drawings, and has included: 1) a set of Replacement Sheets for the claims and the drawing that contain the claims and drawings as amended, and 2) a set of Marked-up Sheets for the claims and drawings that show as underlined and strike-through text the changes from the original filed claims and drawings to the claims and drawings as amended here. These amendments serve to clarify and emphasize how our claims are novel and include inventive steps from the documents the ISA cites in the WO, in particular distinguishing our claims from that of Billman (US 2016/0325127 A1), which is the primary source of denial within the WO.

Amended Claims, Bases, & Statements

Claim amendments, bases and statements are as follows:

Claim 1 is **amended** to 1) clarify our intent that “damaging” not describe utter destruction of a plant or crop such as incineration, and 2) that the technology’s effect is specific to a plant or crop as distinct from people, animals, vehicles, structures, other crops and the environment more broadly.

- Basis: Original claims 8-11, 17-18, and 20-23, as well as paragraphs 13, 18 and 23 – 25, provide technical basis for each of these amended refinements, as thermal imaging, LiDAR, and hyperspectral/multispectral capabilities identified in these claims are required for lasing only a target plant or crop and not people, animals, vehicles, structures, other crops and the environment more broadly.
- Statement: Billman's and our technology on each involve an aircraft, a laser, a thermal imaging sensor, and a vegetative substrate; that is as far as the similarity goes. Our modified claims now emphasize our specific componentry, design, and ability to:

- damage but not incinerate its target;
- avoid adverse effect on the environment;
- avoid injury to people or animals, even those in and around the target area;
- avoid damage to vehicles or structures, even those in and around the target area; and
- avoid damage to non-target plants and crops, even those around the target area.

Billman's invention (along with all others cited) neither contemplates nor is capable of doing ANY of the above (while still being useful), much less all of the above. Comparatively, Billman's invention is a high-tech but crude instrument of destruction, i.e., it applies enough energy to dry brush to start open fires and is generally targeted in real-time by people making decisions of where to apply that energy (e.g., using Billman's "joy stick", paragraphs 0075, 0076, 0085, and 0087 and figures 5A-E). Our technology, as claimed, is a highly specific instrument that ONLY targets a specific crop such as opium poppies and not other surrounding crops, and includes integrated, automated componentry and logic to avoid creating fire hazards, avoid creating human and animal hazards, avoid damaging property such as vehicles and structures, and avoid collateral environmental damage. To analogize, Billman invented a sledge hammer and we invented a nut cracker. Sure, both may include wood and metal, both include forms of fulcrums and levers, both can be used on organic substrates, and both can "damage" the shell of a nut; but if you try to use the sledge hammer to deshell a walnut, you will obliterate the nut, scatter debris throughout your living room, and have no useful result to show for your efforts. Billman's "sledge hammer" has no specificity nor constraints designed into it: it is a flying laser that can set fire to stuff. Our "nutcracker" is specifically designed to fit specific nuts and perform a highly constrained task on the nuts alone, a task that Billman's sledgehammer cannot accomplish and was never conceived of accomplishing.

If we – who are the most knowledgeable and most skilled in the art of our technology on the planet – were given possession of Billman's fully operating invention and unlimited time to adapt it, we still would not be able to restructure/reconstruct/redesign/reapply Billman to operate as ours does. Specifically, we would not be able to 1) identify opium fields versus other fields, 2) limit lasing to only opium poppy fields, 3) avoid setting open fires, 4) avoid lasing people and animals, 5) avoid lasing vehicles and structures, and 6) expect to avoid significant adverse environmental impacts. In short, we would not have a functional product by numerous measures. Given this, it is untenable that Billman precludes our technology as claimed on any relevant measure: novelty, inventive step, or industrial applicability.

[Statement word count: 487 of 500 allowed.]

Claims 2-8 are **unchanged**.

Claim 9 is **amended** as suggested in the WO.

- Basis: The basis is in the original claim itself as filed.
 - Statement: We agree with the WO's suggested removal of the definite article.
- [Statement word count: 11 of 500 allowed.]

Claim 10 is **amended**, in part as suggested in the WO.

- Basis: The basis is in the original claim itself as filed.
 - Statement: This claim amendment is designed simply to clarify the use of hyperspectral technology. Further, we agree with the WO's suggested removal of the definite article.
- [Statement word count: 29 of 500 allowed.]

Claim 11 is **amended**, in part as suggested in the WO.

- Basis: The basis is in the original claim itself as filed.

- Statement: This claim amendment is designed simply to clarify the use of multispectral technology. Further, we agree with the WO's suggested removal of the definite article.
[Statement word count: 29 of 500 allowed.]

Claim 12 is **amended** as suggested in the WO.

- Basis: The basis is in the original claim itself as filed.
- Statement: We agree with the WO's suggested removal of the definite article.
[Statement word count: 11 of 500 allowed.]

Claim 13 is **unchanged**.

Claim 14 is **amended** to 1) clarify our intent that "damaging" not describe utter destruction of a plant or crop such as incineration, and 2) that the effect is specific to a plant or crop as distinct from people, animals, vehicles, structures, other crops and the environment more broadly.

- Basis: Original claims 8-11, 17-18, and 20-23, as well as paragraphs 13, 18 and 23 – 25, provide technical basis for each of these amended refinements, as thermal imaging, LiDAR, and hyperspectral/multispectral capabilities identified in these claims are required for lasing only a target plant or crop and not people, animals, vehicles, structures, other crops and the environment more broadly.
- Statement: With this amendment, we clarify novelty not only over Billman, but also over Spiegel, Palo Alto Research Center, Inc., Coffey, and Pugh. To summarize, using the standard that our claim must not be "anticipated by the prior art" (PCT Article 33[2]):
 - Billman: fails to anticipate distinguishing between types of plants, being able to lase only one type of plant, avoiding setting open fires, incorporating safety systems to avoid lasing people or animals, incorporating safety systems to avoid lasing vehicles or structures, avoiding adverse environmental impacts, and avoiding or coping with hostile ground-based human actors.
 - Spiegel: fails to anticipate being able to damage a plant or crop, distinguishing between types of plants, being able to lase only one type of plant, incorporating safety systems to avoid lasing people or animals, incorporating safety systems to avoid lasing vehicles or structures, and avoiding or coping with hostile ground-based human actors.
 - Palo Alto Research Center, Inc.: fails to anticipate distinguishing between types of plants from a distance, being able to lase only one type of plant from a distance, design to sense and avoid lasing people or animals, design to sense and avoid lasing vehicles or structures, and avoiding or coping with hostile ground-based human actors.
 - Coffey: fails to anticipate being designed to or able to damage a plant or more specifically large crops of widely distributed plants, distinguishing between types of plants, being able to lase only one type of plant, incorporating safety systems to avoid lasing people or animals, and incorporating safety systems to avoid lasing vehicles or structures.
 - Pugh: fails to anticipate being able to damage a plant or crop, distinguishing between types of plants, being able to lase only one type of plant, avoiding setting open fires, incorporating safety systems to avoid lasing people or animals, incorporating safety systems to avoid lasing vehicles or structures, avoiding adverse environmental impacts, and avoiding or coping with hostile ground-based human actors.

We clarify our claim's significant inventive steps from all prior inventions cited in the WO (Billman, Spiegel, Palo Alto Research Center, Inc., Coffey, Pugh), taken together. Using the standard that our claim must not be "obvious to a person skilled in the art" (PCT Article 33), our claim still retains not merely one inventive step, but at least the four following new, inventive steps:

- 1) integrating technology to distinguish plants from humans, animals, vehicles and structures;
- 2) integrating sensors and logic to lase only specific plants while assuring avoiding humans, animals, vehicles and structures;
- 3) design and features to lase non-military targets on the ground along with design and features to mitigate effects of hostile ground-based human actors; and
- 4) design and features for lasing a widely distributed vegetative target from a long distance off site.

Even considered together, the cited prior art does not do nor approach doing any one of these four things, much less all of them.

[Statement word count: 480 of 500 allowed.]

Claims 15 and 16 are **unchanged**.

Claim 17 is **amended**.

- Basis: The basis is in the original claim itself as filed.
- Statement: This claim amendment is designed simply to clarify the use of hyperspectral technology.
[Statement word count: 17 of 500 allowed.]

Claim 18 is **amended**.

- Basis: The basis is in the original claim itself as filed.
- Statement: This claim amendment is designed simply to clarify the use of multispectral technology.
[Statement word count: 17 of 500 allowed.]

Claims 19-27 are **unchanged**.

Three new claims that depend from claim 1 are **added** as claims 28-30, and three new claims that depend from claim 14 are **added** as claims 31 – 33.

- Bases: The bases for these can be found in the original application paragraphs 4, 6, 13, 14, 15, 16, 18, and 19 as filed, and the second claim within U.S. Provisional Patent Application 62/673,040 filed 17 May 2018 and incorporated in the international application by reference in paragraph 1, wherein extensive discussion of protection against hostile actors and ground fire and the lack of need for site ground access are described.
- Statement: While hostile action against is discussed at length in the original application as filed, WO objections suggest that our design components in this regard should be clarified, better distinguishing our claims from others such as those of Billman and Palo Alto Research Center, Inc., which contemplate no such eventuality, requirement, or operating environment.

While we believe we initially made these aspects of our claims clear (per the numerous bases cited above), we make these changes in particular because we find a misunderstanding of our technology

represented in the WO, Box No. V, 2 Citations and explanations, Supplemental Box, "As per claim 16" paragraph, last four lines: "additionally, if the application is covert such as for destroying illegal crops such as coca or poppies, it may be desirable that targets can be established in advance so that a military or police operation can be executed most effectively and safely to reduce potential casualties or undesirable collateral property damage."

This WO comment/discussion, rather than demonstrating the similarity of Billman and our claims, actually highlights distinct differences. Central to the design, features and function of our claims is that on-site use of military or police troops is explicitly not required for our technology to be effective and safe. Our technology is novel, incorporates significant steps beyond the state of the art, and has enormous industrial applicability precisely because it overcomes these limitations inherent in any such attempted application of Billman or other prior art, limitations that have to date caused the worldwide war on drugs to be widely regarded as a failure.

[Statement word count: 265 of 500 allowed.]

Other Items/Issues

Below we address a few detailed, specific items from the WO.

Box No. V, 1. Statement: this indicates none of our claims contain an inventive step.

Response: Based on the subsequent explanations in the WO provided by the ISA, we believe this listing may be a mistake and not reflective of the considered assessment of the ISA. In Box VIII and Supplemental Boxes, the ISA opines that only Claims 4, 8-11, 13, 16, 17-23, and 26-27 lack an inventive step, indicating that 1-3, 5-7, 12, 14-15, and 24-25 were likely regarded as including an inventive step but were not noted as such in the Box V, 1 listing.

Box No. V, 2 Citations and explanations, "As per claim 6" paragraph:

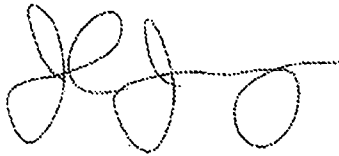
Response: Based on our reading of Billman, in particular paragraphs 0073 and 0082 cited, we believe this is a mistaken understanding of the laser focusing described in Billman. In Billman, paragraph 0073 thrice cites the beam's "diameter" and another time cites its "spot" size; all of these descriptions indicate a typical planar focusing of a beam into a circular cross-section, the far-and-away most common cross-sectional shape for industrial application lasers. Paragraph 0082 provides nothing that suggests any other type of beam focusing. In our claim 6, we specifically claim our system with single-dimension beam focusing. In our case, we would focus the beam in a vertical direction, resulting in a horizontal line beam at target. Nothing in Billman suggests this unusual type of focusing. This is a non-trivial difference. Such a line beam provides three non-obvious, novel benefits: 1) it allows for extreme cost, bulk and weight reductions (up to 95%!) in the lensing necessary to be carried on the aircraft, and bulk and weight considerations are always critical in aviation applications; 2) it allows the beam fluence at target to be many orders of magnitude lower than a spot beam of similar height and laser power, resulting in reductions in corresponding hazards presented to people, animals, and the

environment, and 3) it is significantly more efficient than a spot beam in disrupting the metabolic processes of the plant substrate, as evidenced by Lepeschkin (cited in U.S. Provisional Patent Application 62/673,040 filed 17 May 2018, page 3).

Box No. VII, Certain defects in the international application:

Response: We have corrected the figures to include consecutive numbering with Arabic numerals and attached the corrections here.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'John Janeway', with a stylized, cursive script.

John Janeway, USPTO # 45,796
Janeway Patent Law PLLC
Suite 506
2208 NW Market Street
Seattle WA 98107

What is claimed is:

1. A system for targeting and damaging but not incinerating a growing plant or crop, while avoiding adverse impact on people, animals, vehicles, structures, other crops, or the environment, even those potentially or likely among and/or adjacent to the target plant or crop, the system comprising:
 - a laser operable to generate a beam of energy sufficient to damage a plant when the plant is exposed to the beam and located at least 350 meters away;
 - a controller operable to determine whether a target of the laser is a plant to be damaged, and in response to the determination:
 - prevent the laser's energy beam from reaching the target, if the target is not a plant to be damaged, and
 - cause the laser's energy beam to reach the target, if the target is a plant to be damaged; and
 - an aircraft operable to position the laser and the controller airborne at least 350 meters away from the plant.
2. The system of claim 1 wherein the beam of energy is sufficient to critically damage the plant when the plant is exposed to the beam.
3. The system of claim 1 wherein the aircraft is an airplane.
4. The system of claim 1 wherein the laser is operable to generate a beam of light having a wavelength of 532 nanometers.
5. The system of claim 1 wherein the laser includes an optical component operable to shape the beam of energy generated by the laser.
6. The system of claim 1 wherein the laser includes an optical component operable to focus in a single dimension the beam of energy generated by the laser.

7. The system of claim 1 wherein the laser includes an optical component operable to shape the beam of energy generated by the laser, and to modify the shape of the beam.
8. The system of claim 1 wherein the controller includes a sensor operable to sense the shape of the laser's target, and circuitry for comparing the shape of the target sensed by the sensor with a shape of a known object.
9. The system of claim 1 wherein the controller includes an infrared sensor and circuitry for comparing ~~the~~ data of the laser's target generated by the infrared sensor with data that represents a known object.
10. The system of claim 1 wherein the controller includes a hyperspectral sensor and circuitry ~~for identifying and distinguishing a growing plant or crop from other plants or crops and~~ comparing the data of the laser's target generated by the hyperspectral sensor with data that represents a known object.
11. The system of claim 1 wherein the controller includes a multispectral sensor and circuitry for comparing ~~identifying and distinguishing a growing plant or crop from other plants or crops and~~ the data of the laser's target generated by the multispectral sensor with data that represents a known object.
12. The system of claim 1 wherein the controller includes a global positioning sensor and circuitry for comparing ~~the~~ data of the laser's target generated by the global positioning sensor with data that represents a known location.
13. The system of claim 1 wherein:
 - the laser is operable to generate a beam of energy sufficient to damage a plant that is located 5,000 meters away, and
 - the aircraft is operable to position the laser and controller airborne 5,000 meters away from the plant.
14. A method for ~~distinguishing a growing plant or crop from others and targeting and damaging but not incinerating its growing plant, while avoiding adverse impact on people, animals, vehicles, structures, other crops, or the~~

environment, even those potentially or likely among and/or adjacent to the target plant or crop, the method comprising:

positioning a laser of a system at least 350 meters away from an area of growing plants;

identifying a target, within the area, to be exposed to a beam of energy generated by the laser;

determining, with a controller of the system, whether the target is a plant to be damaged;

if the target is a plant to be damaged, then generating, with the system's laser, a beam of energy such that the target is exposed to an amount of energy sufficient to damage the plant; and

if the target is not a plant to be damaged, then preventing, with the system's controller, the laser's beam of energy from reaching the target.

15. The method of claim 14 wherein positioning the laser includes flying an aircraft that the laser is mounted in, at least 350 meters away from the area of growing plants.
16. The method of claim 14 wherein identifying a target includes identifying the target at least one hour before aiming the laser at the target.
17. The method of claim 14 wherein identifying a target includes sensing the target with a hyperspectral sensor, identifying and distinguishing a growing plant or crop from other plants or crops.
18. The method of claim 14 wherein identifying a target includes sensing the target with a multispectral sensor, identifying and distinguishing a growing plant or crop from other plants or crops.
19. The method of claim 14 wherein determining whether the target is a plant to be damaged includes determining this immediately before aiming the laser at the target.

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20. The method of claim 14 wherein determining whether the target is a plant to be damaged includes sensing the target with a hyperspectral sensor.
21. The method of claim 14 wherein determining whether the target is a plant to be damaged includes sensing the target with a multispectral sensor.
22. The method of claim 14 wherein determining whether the target is a plant to be damaged includes sensing the target with an infrared sensor.
23. The method of claim 14 wherein determining whether the target is a plant to be damaged includes sensing the shape of the target.
24. The method of claim 14 wherein generating, with the system's laser, a beam of energy includes aiming, with the system's controller, the laser at the target.
25. The method of claim 14 wherein preventing the laser's beam of energy from reaching the target includes preventing the laser from generating the beam of energy while the laser is aimed at the target.
26. The method of claim 14 wherein preventing the laser's beam of energy from reaching the target includes blocking the laser's beam of energy while the laser is aimed at the target.
27. The method of claim 14 wherein:
 - positioning a laser of a system includes positioning the laser 5,000 meters away from an area of growing plants, and
 - generating, with the system's laser, a beam of energy includes generating a beam of energy sufficient to damage a plant that is located 5,000 meters away.
28. The system of claim 1 wherein the system is protected against hostile human action associated with the target, such as small arms fire, by distance and armoring.
29. The system of claim 1 wherein the system is protected against most conventional ground-based weaponry associated with the target by distance and armoring.

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30. The system of claim 1 wherein operation of the system does not require ground access to or near the target before, during, or after use of the system.
31. The method of claim 14 wherein the system is operated at a distance and with armoring to protect it against hostile human action associated with the target such as small arms fire.
32. The method of claim 14 wherein the system is operated at a distance and with armoring to protect it against most conventional ground-based weaponry associated with the target.
33. The method of claim 14 wherein system operations does not require ground access to or near the target before, during, or after use of the system.

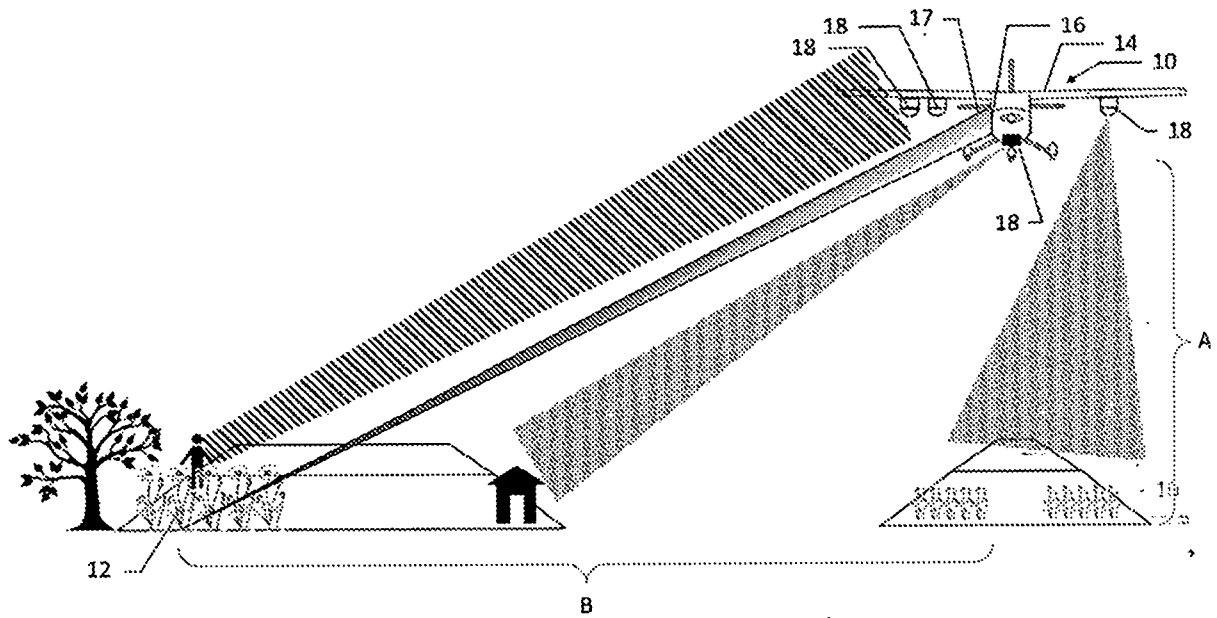
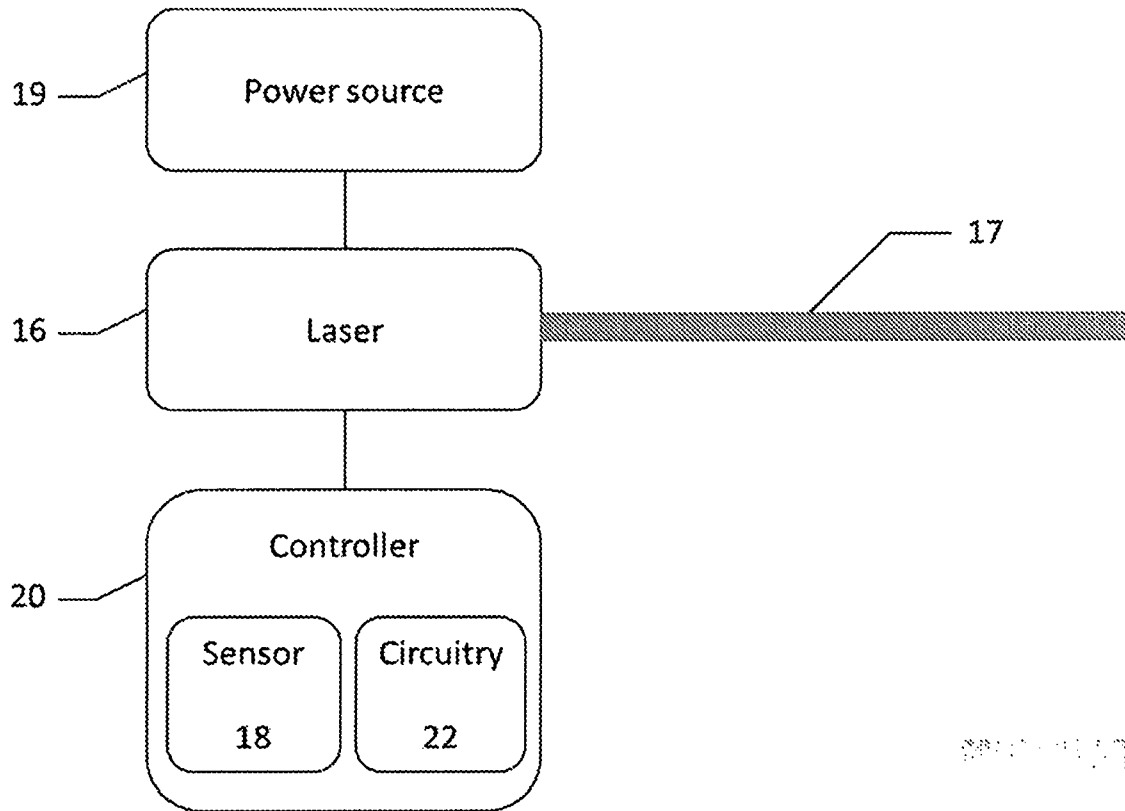


FIG. 1

2/3FIG. 2

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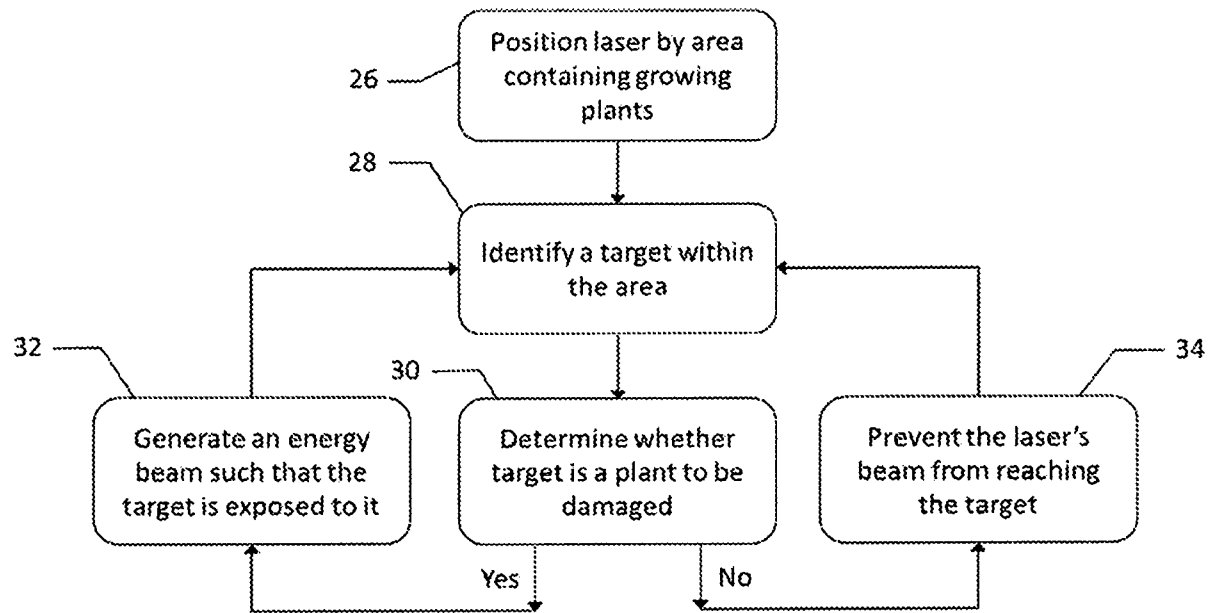


FIG. 3

PCT/US19/32041 Replacement Sheet

What is claimed is:

1. A system for targeting and damaging but not incinerating a growing plant or crop, while avoiding adverse impact on people, animals, vehicles, structures, other crops, or the environment, even those potentially or likely among and/or adjacent to the target plant or crop, the system comprising:
 - a laser operable to generate a beam of energy sufficient to damage a plant when the plant is exposed to the beam and located at least 350 meters away;
 - a controller operable to determine whether a target of the laser is a plant to be damaged, and in response to the determination:
 - prevent the laser's energy beam from reaching the target, if the target is not a plant to be damaged, and
 - cause the laser's energy beam to reach the target, if the target is a plant to be damaged; and
 - an aircraft operable to position the laser and the controller airborne at least 350 meters away from the plant.
2. The system of claim 1 wherein the beam of energy is sufficient to critically damage the plant when the plant is exposed to the beam.
3. The system of claim 1 wherein the aircraft is an airplane.
4. The system of claim 1 wherein the laser is operable to generate a beam of light having a wavelength of 532 nanometers.
5. The system of claim 1 wherein the laser includes an optical component operable to shape the beam of energy generated by the laser.
6. The system of claim 1 wherein the laser includes an optical component operable to focus in a single dimension the beam of energy generated by the laser.

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7. The system of claim 1 wherein the laser includes an optical component operable to shape the beam of energy generated by the laser, and to modify the shape of the beam.
8. The system of claim 1 wherein the controller includes a sensor operable to sense the shape of the laser's target, and circuitry for comparing the shape of the target sensed by the sensor with a shape of a known object.
9. The system of claim 1 wherein the controller includes an infrared sensor and circuitry for comparing data of the laser's target generated by the infrared sensor with data that represents a known object.
10. The system of claim 1 wherein the controller includes a hyperspectral sensor and circuitry for identifying and distinguishing a growing plant or crop from other plants or crops and comparing data of the laser's target generated by the hyperspectral sensor with data that represents a known object.
11. The system of claim 1 wherein the controller includes a multispectral sensor and circuitry for identifying and distinguishing a growing plant or crop from other plants or crops and data of the laser's target generated by the multispectral sensor with data that represents a known object.
12. The system of claim 1 wherein the controller includes a global positioning sensor and circuitry for comparing data of the laser's target generated by the global positioning sensor with data that represents a known location.
13. The system of claim 1 wherein:
 - the laser is operable to generate a beam of energy sufficient to damage a plant that is located 5,000 meters away, and
 - the aircraft is operable to position the laser and controller airborne 5,000 meters away from the plant.
14. A method for distinguishing a growing plant or crop from others and targeting and damaging but not incinerating it, while avoiding adverse impact on people, animals, vehicles, structures, other crops, or the environment, even

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those potentially or likely among and/or adjacent to the target plant or crop,
the method comprising:

positioning a laser of a system at least 350 meters away from an area of
growing plants;

identifying a target, within the area, to be exposed to a beam of energy
generated by the laser;

determining, with a controller of the system, whether the target is a plant to
be damaged;

if the target is a plant to be damaged, then generating, with the system's
laser, a beam of energy such that the target is exposed to an amount
of energy sufficient to damage the plant; and

if the target is not a plant to be damaged, then preventing, with the
system's controller, the laser's beam of energy from reaching the
target.

15. The method of claim 14 wherein positioning the laser includes flying an aircraft that the laser is mounted in, at least 350 meters away from the area of growing plants.
16. The method of claim 14 wherein identifying a target includes identifying the target at least one hour before aiming the laser at the target.
17. The method of claim 14 wherein identifying a target includes sensing the target with a hyperspectral sensor, identifying and distinguishing a growing plant or crop from other plants or crops.
18. The method of claim 14 wherein identifying a target includes sensing the target with a multispectral sensor, identifying and distinguishing a growing plant or crop from other plants or crops.
19. The method of claim 14 wherein determining whether the target is a plant to be damaged includes determining this immediately before aiming the laser at the target.

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20. The method of claim 14 wherein determining whether the target is a plant to be damaged includes sensing the target with a hyperspectral sensor.
21. The method of claim 14 wherein determining whether the target is a plant to be damaged includes sensing the target with a multispectral sensor.
22. The method of claim 14 wherein determining whether the target is a plant to be damaged includes sensing the target with an infrared sensor.
23. The method of claim 14 wherein determining whether the target is a plant to be damaged includes sensing the shape of the target.
24. The method of claim 14 wherein generating, with the system's laser, a beam of energy includes aiming, with the system's controller, the laser at the target.
25. The method of claim 14 wherein preventing the laser's beam of energy from reaching the target includes preventing the laser from generating the beam of energy while the laser is aimed at the target.
26. The method of claim 14 wherein preventing the laser's beam of energy from reaching the target includes blocking the laser's beam of energy while the laser is aimed at the target.
27. The method of claim 14 wherein:
 - positioning a laser of a system includes positioning the laser 5,000 meters away from an area of growing plants, and
 - generating, with the system's laser, a beam of energy includes generating a beam of energy sufficient to damage a plant that is located 5,000 meters away.
28. The system of claim 1 wherein the system is protected against hostile human action associated with the target, such as small arms fire, by distance and armoring.
29. The system of claim 1 wherein the system is protected against most conventional ground-based weaponry associated with the target by distance and armoring.

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30. The system of claim 1 wherein operation of the system does not require ground access to or near the target before, during, or after use of the system.
31. The method of claim 14 wherein the system is operated at a distance and with armoring to protect it against hostile human action associated with the target such as small arms fire.
32. The method of claim 14 wherein the system is operated at a distance and with armoring to protect it against most conventional ground-based weaponry associated with the target.
33. The method of claim 14 wherein system operations does not require ground access to or near the target before, during, or after use of the system.

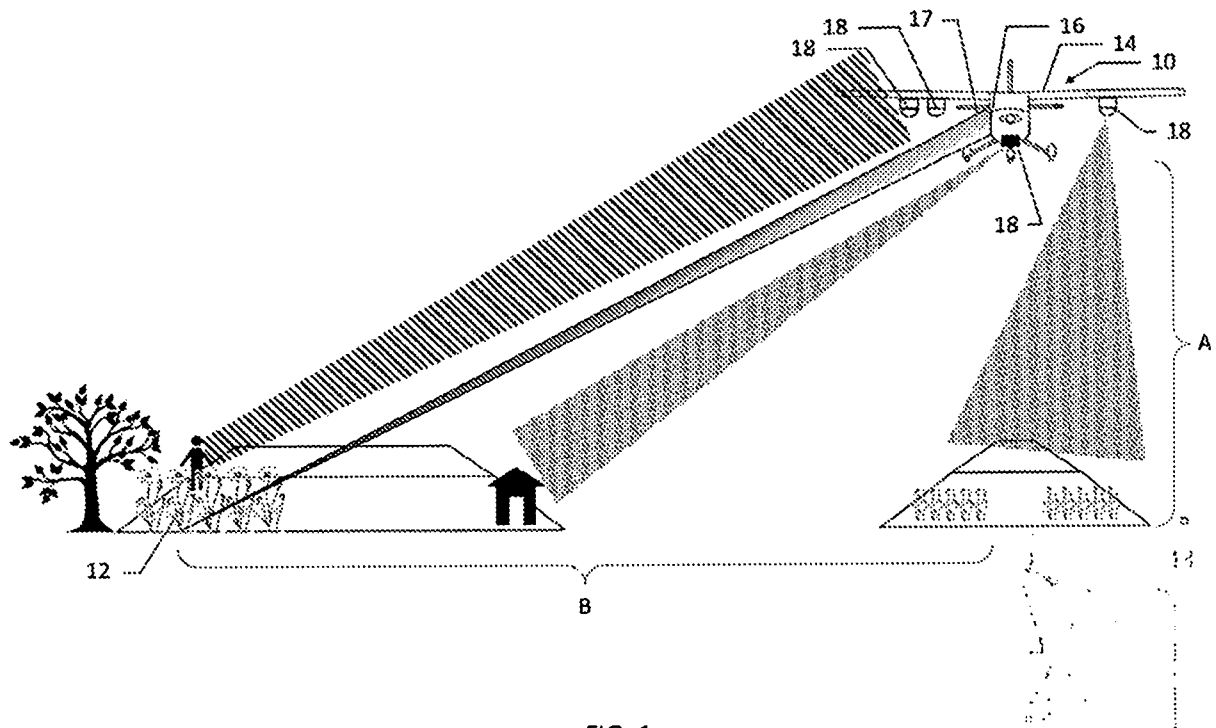


FIG. 1

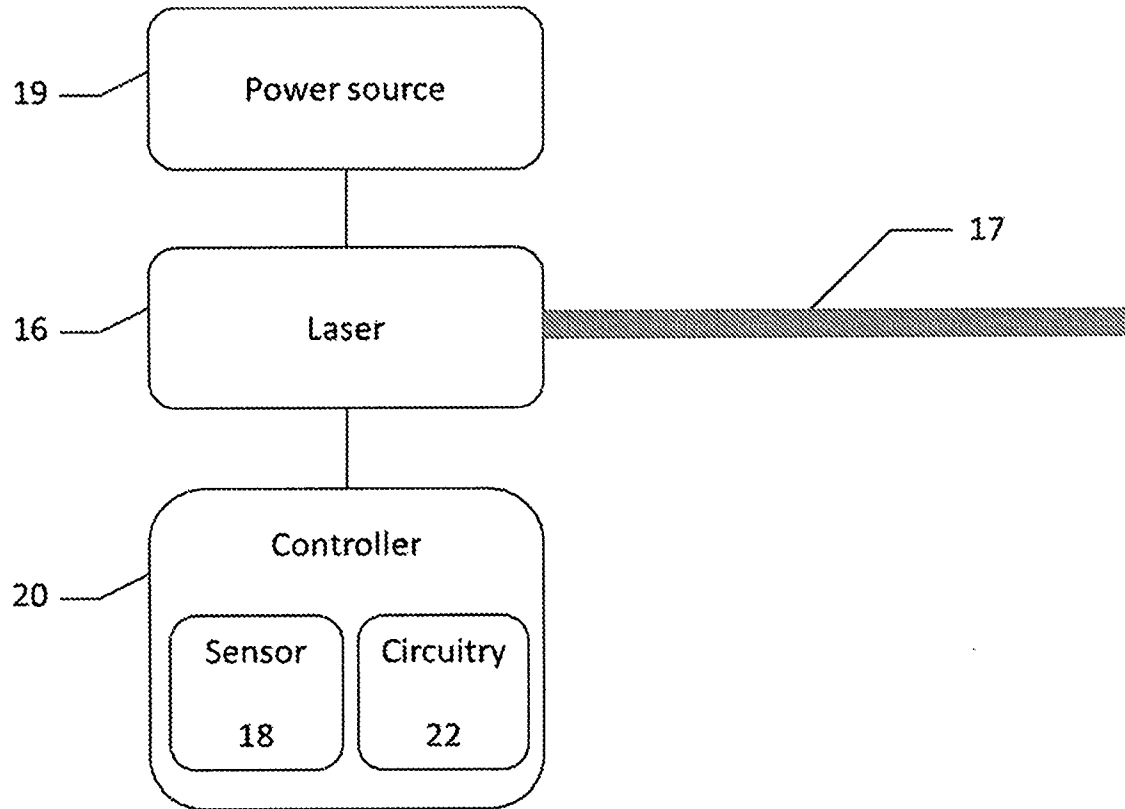


FIG. 2

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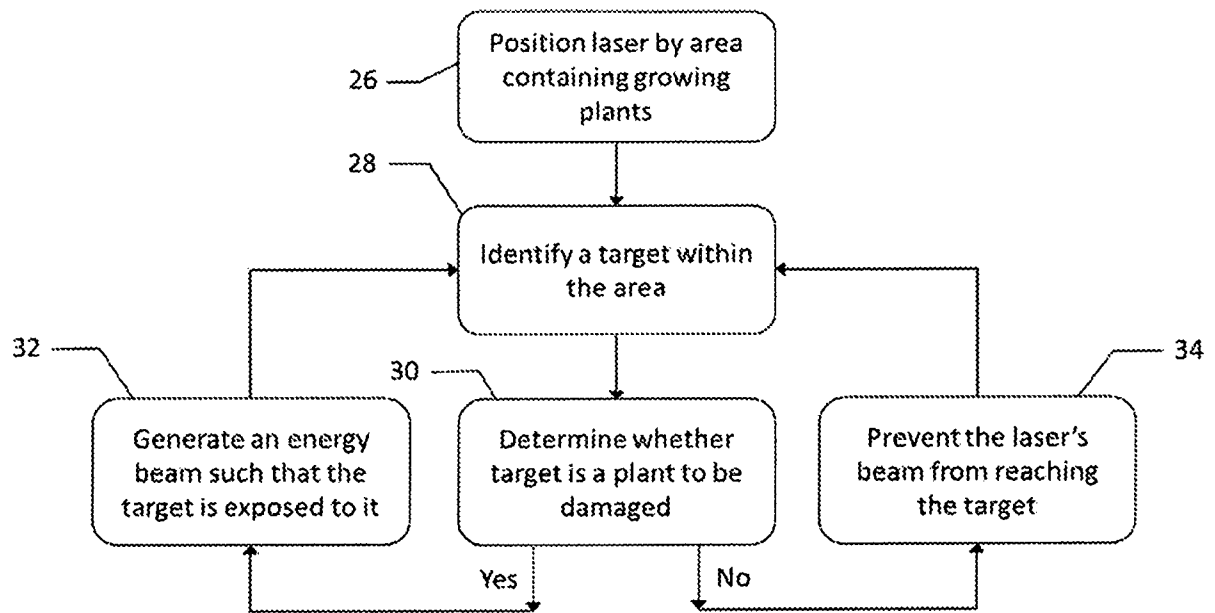


FIG. 3