



US 20230194217A1

(19) **United States**

(12) **Patent Application Publication**  
**Indelicato et al.**

(10) **Pub. No.: US 2023/0194217 A1**

(43) **Pub. Date: Jun. 22, 2023**

(54) **APPARATUS AND PROCESS FOR DRONE  
LOCATING, INTERDICTION AND  
RECOVERY**

(60) Provisional application No. 63/012,340, filed on Apr.  
20, 2020.

**Publication Classification**

(71) Applicant: **Government of the United States, as  
represented by the Secretary of the  
Air Force, Wright-Patterson AFB, OH  
(US)**

(51) **Int. Cl.**  
**F41H 11/02** (2006.01)  
**G01S 17/66** (2006.01)  
**G01S 17/04** (2006.01)

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(52) **U.S. Cl.**  
CPC ..... **F41H 11/02** (2013.01); **G01S 17/66**  
(2013.01); **G01S 17/04** (2020.01)

(21) Appl. No.: **18/168,151**

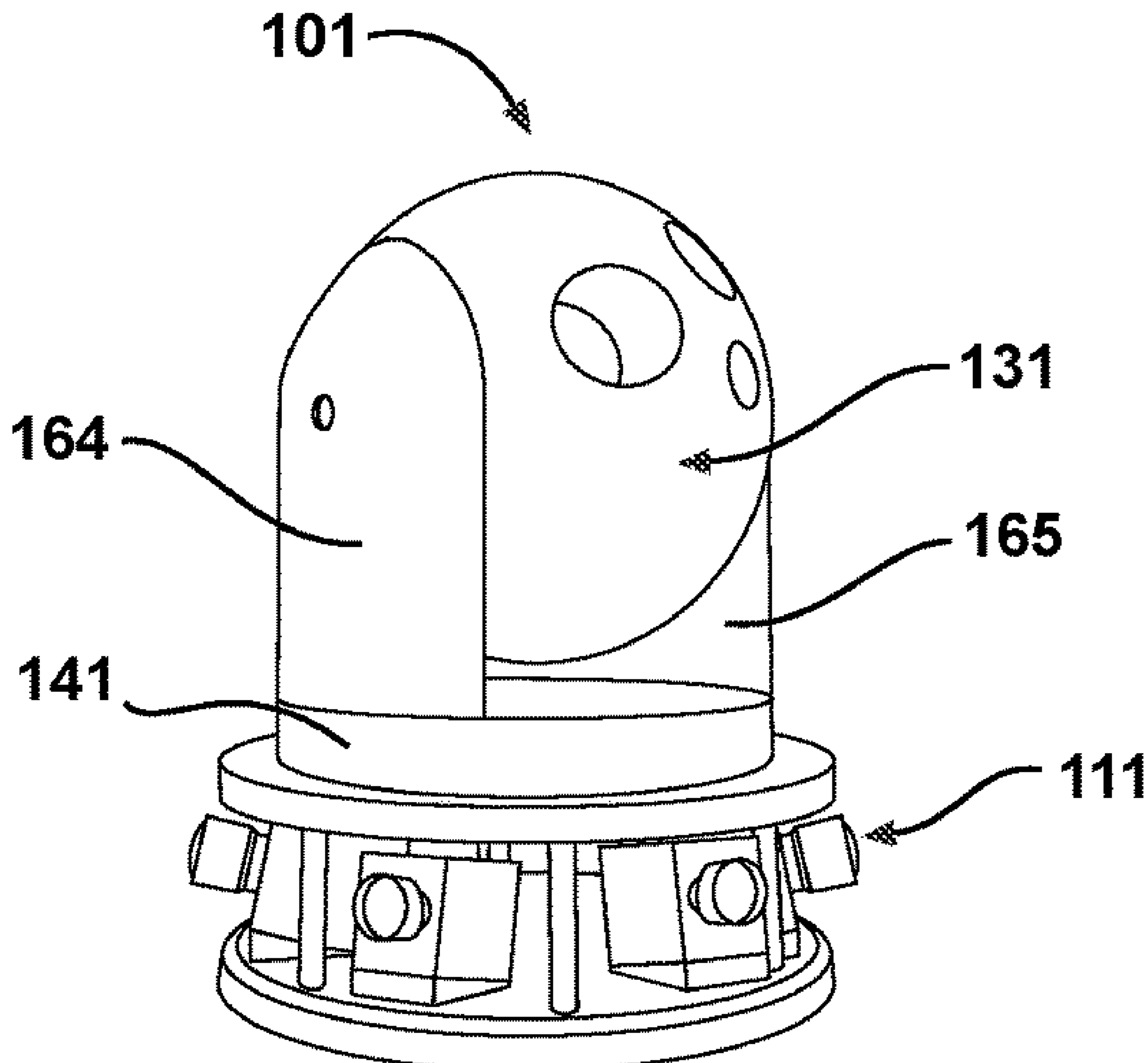
(22) Filed: **Feb. 13, 2023**

**Related U.S. Application Data**

(62) Division of application No. 17/171,340, filed on Feb.  
9, 2021.

(57) **ABSTRACT**

An integrated airspace defense system for identifying and locating a suspicious unmanned aerial vehicle. The system including at least one detection device to monitor the air space and provide a detection information; a computer to process the detection information and identifying the presence of suspicious unmanned aerial vehicles (UAVs) using a sequence of detection algorithms. The integrated airspace defense system identifies and locates the suspicious UAV. In at least one embodiment the integrated airspace defense system is capable of capturing or destroying the suspicious UAV.



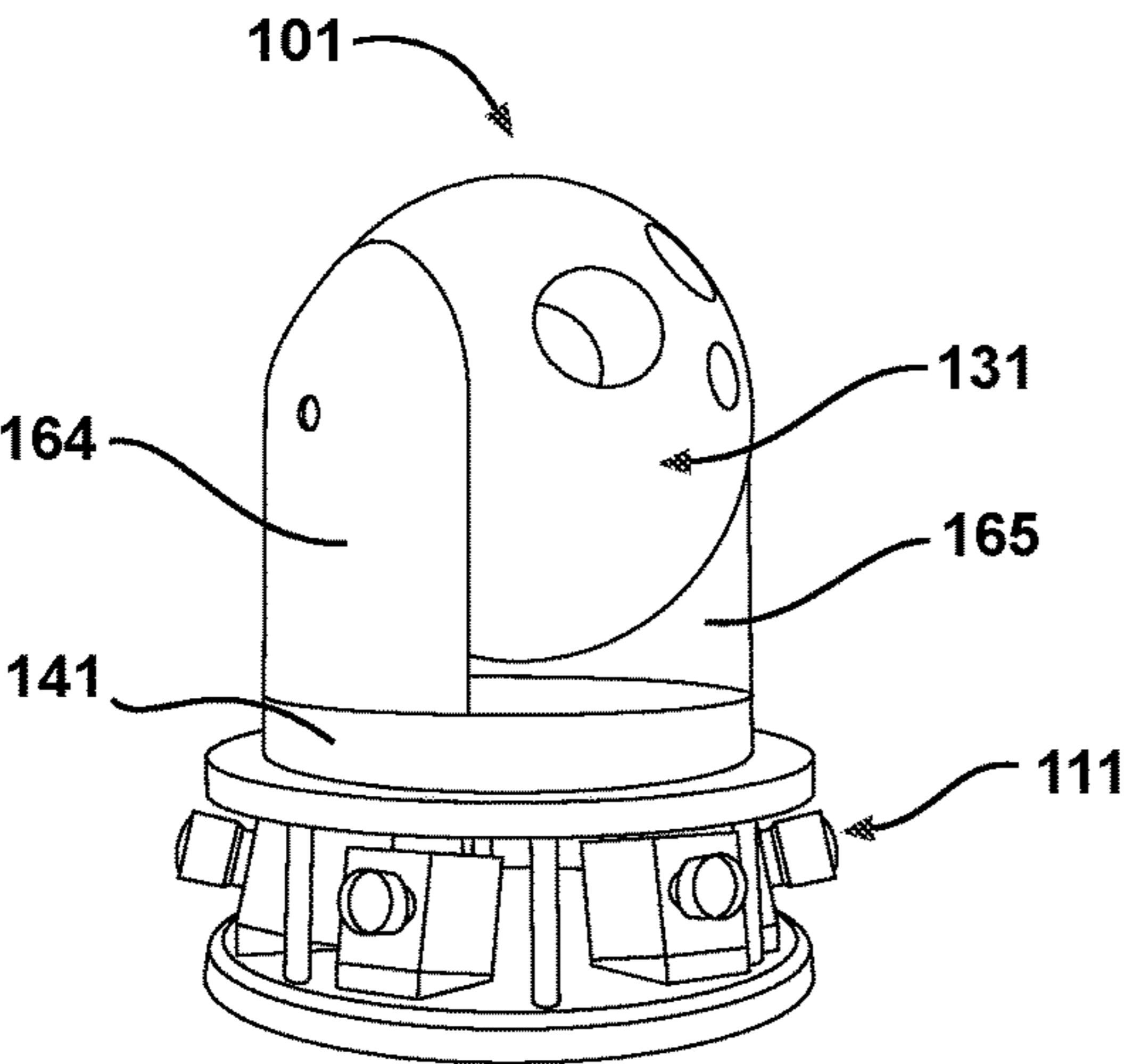


FIG. 1A

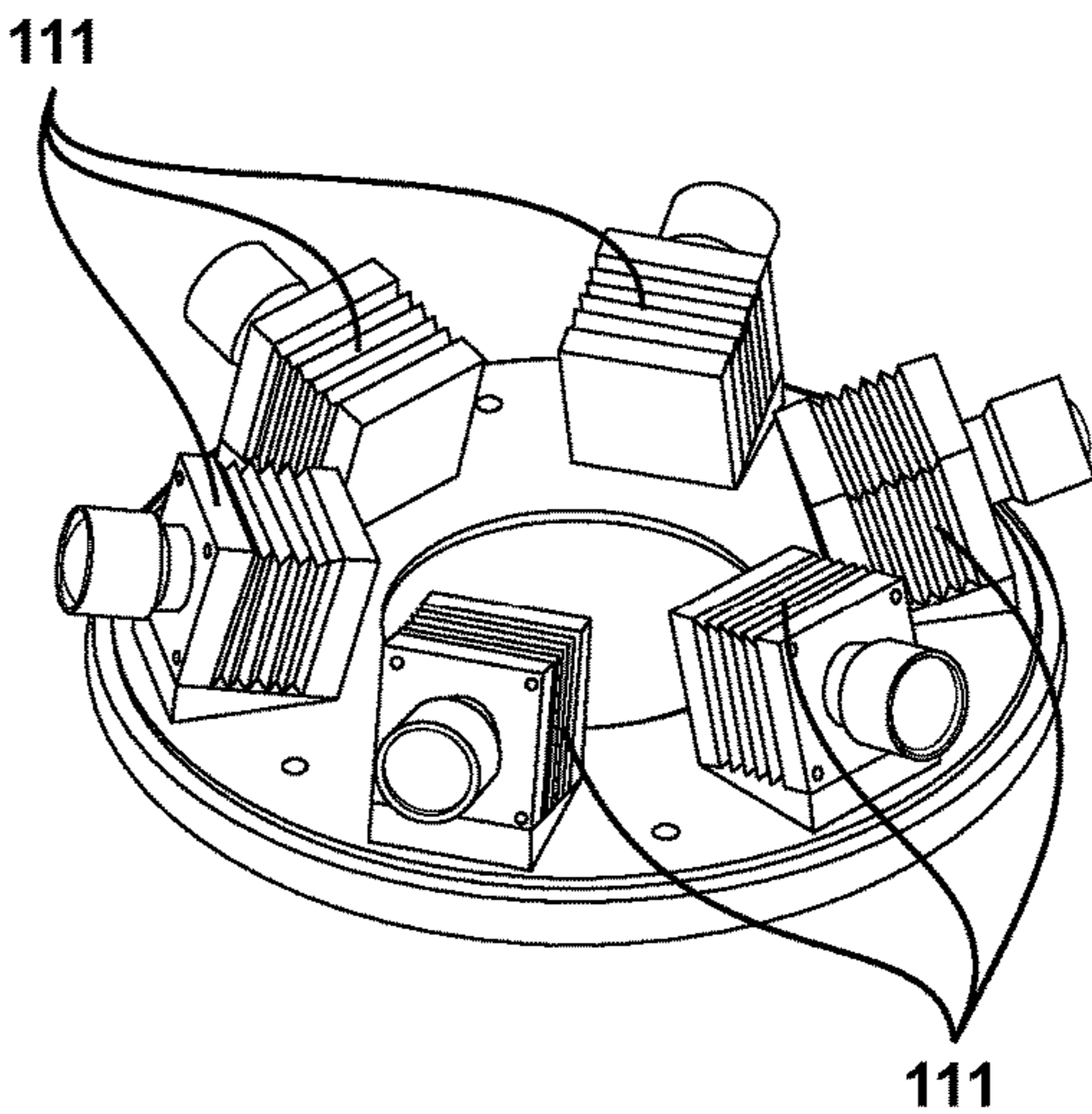


FIG. 1B

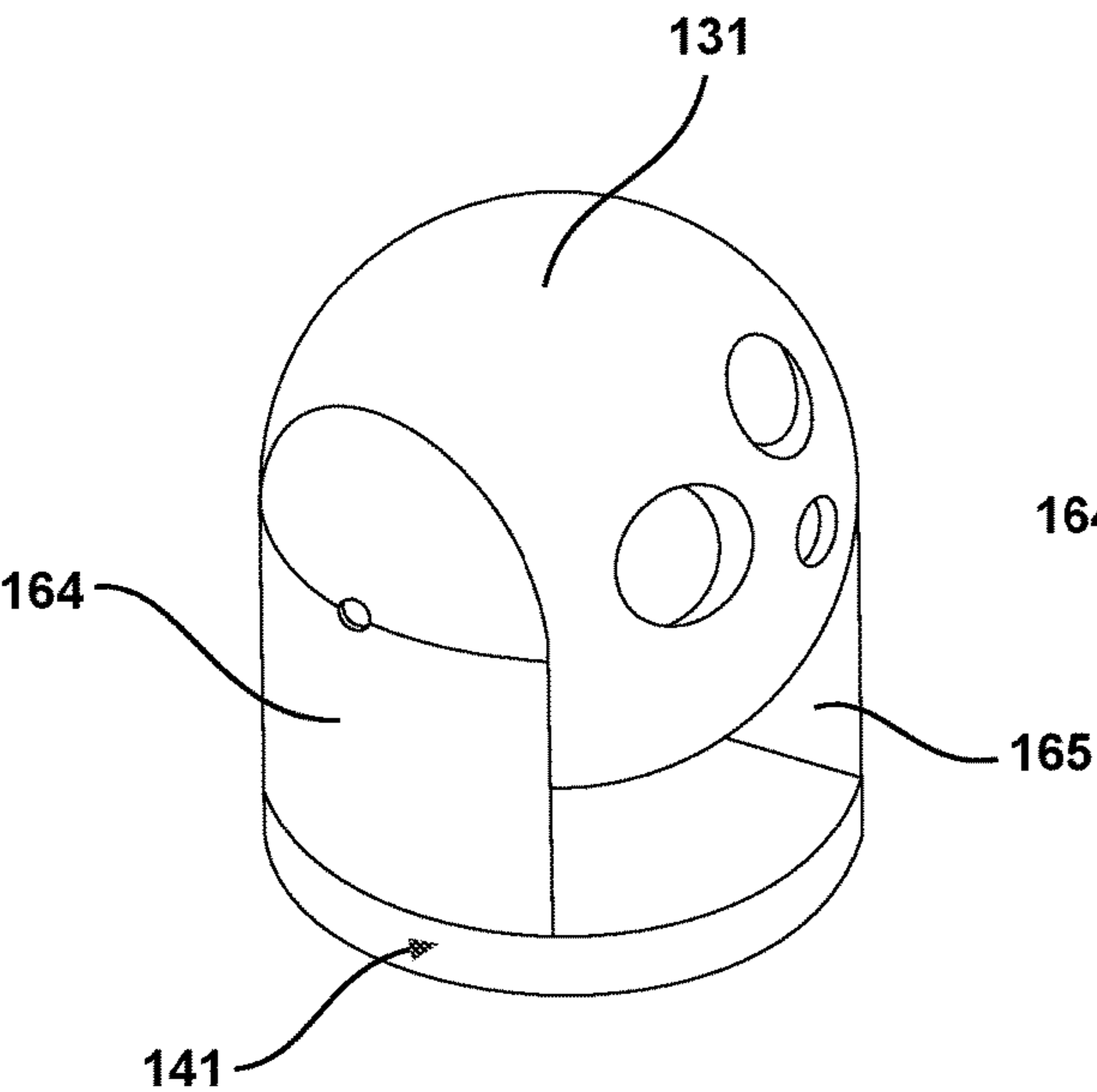


FIG. 1C

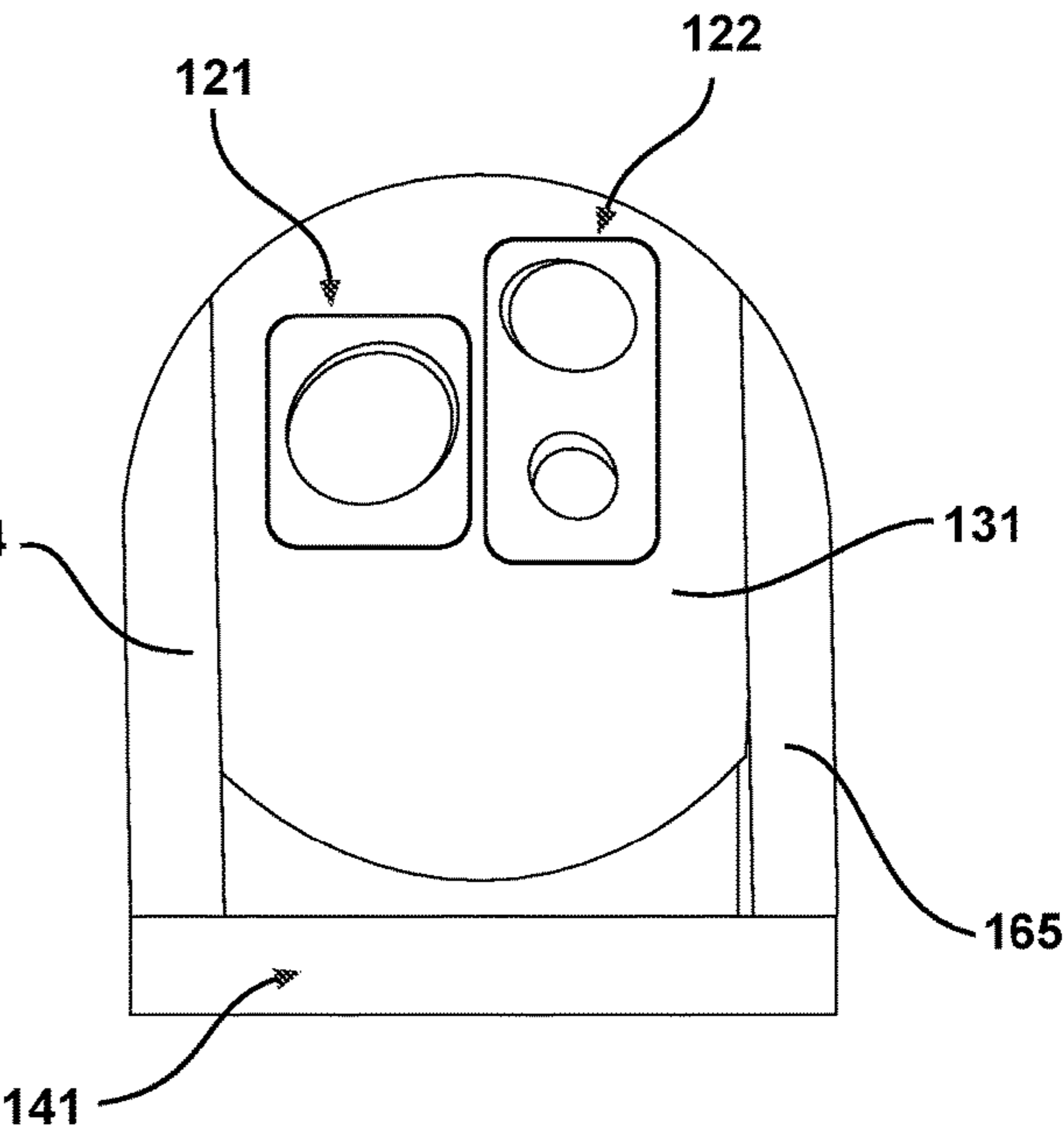


FIG. 1D

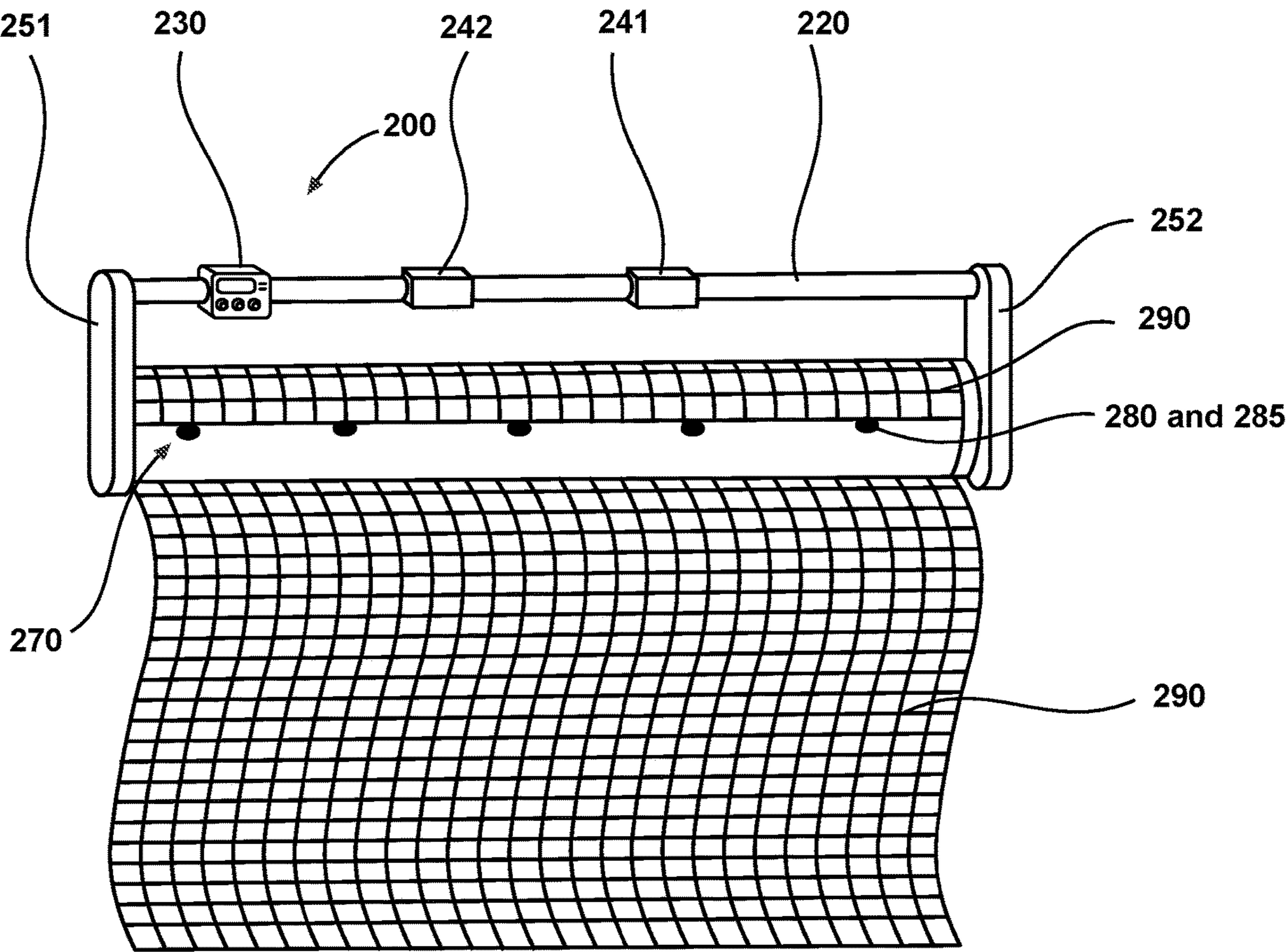


FIG. 2A

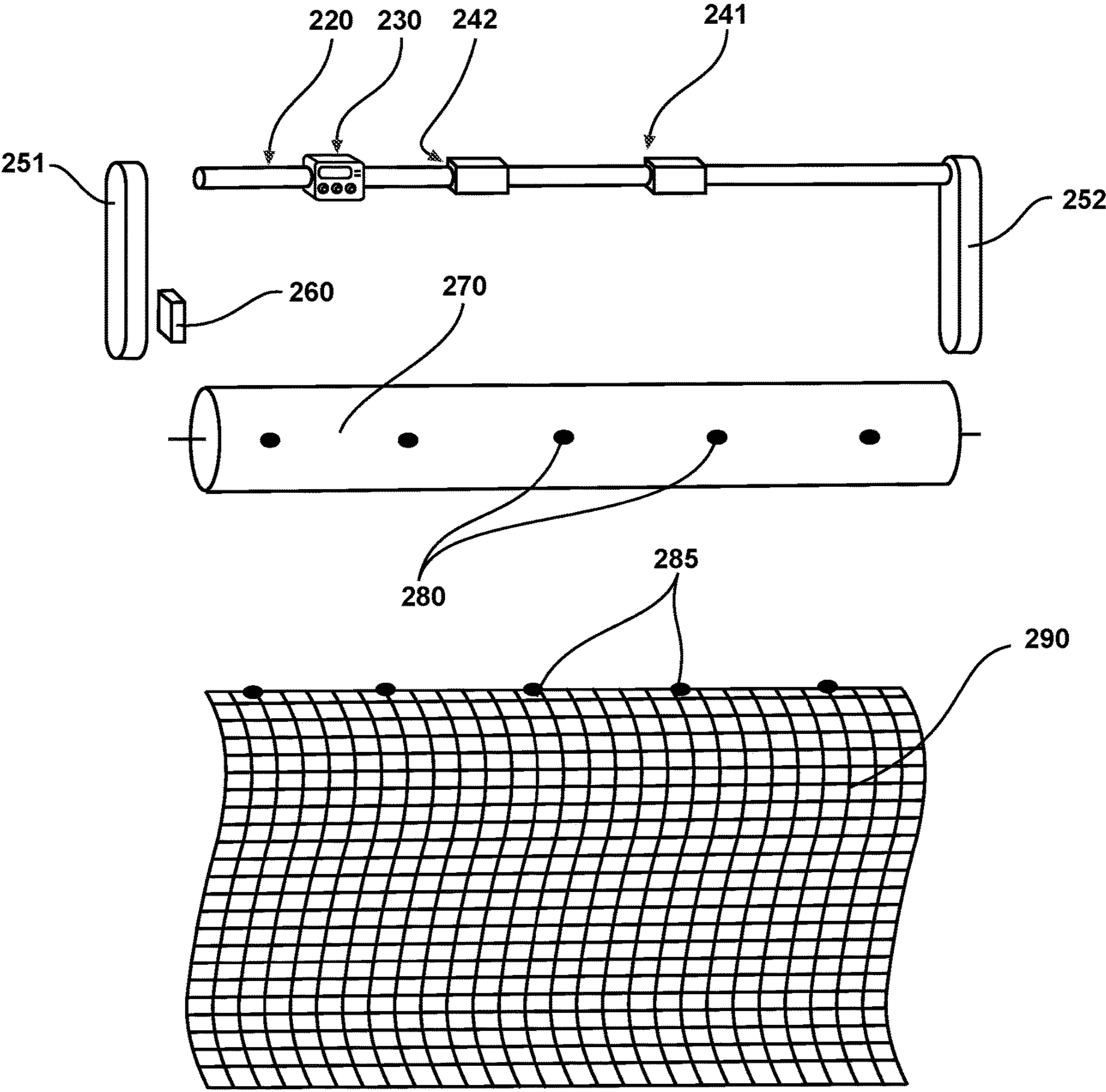


FIG. 2B

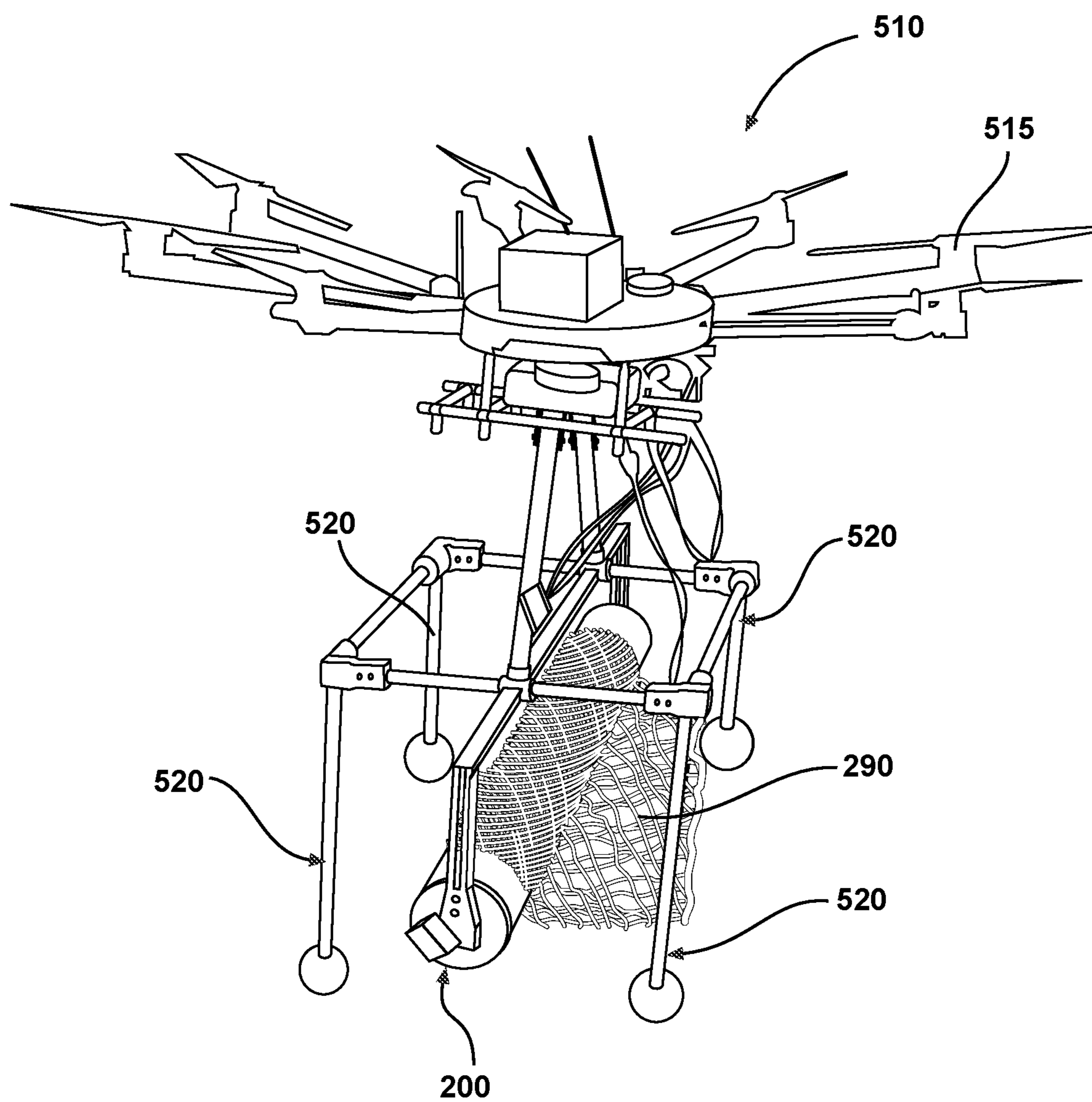


FIG. 2C

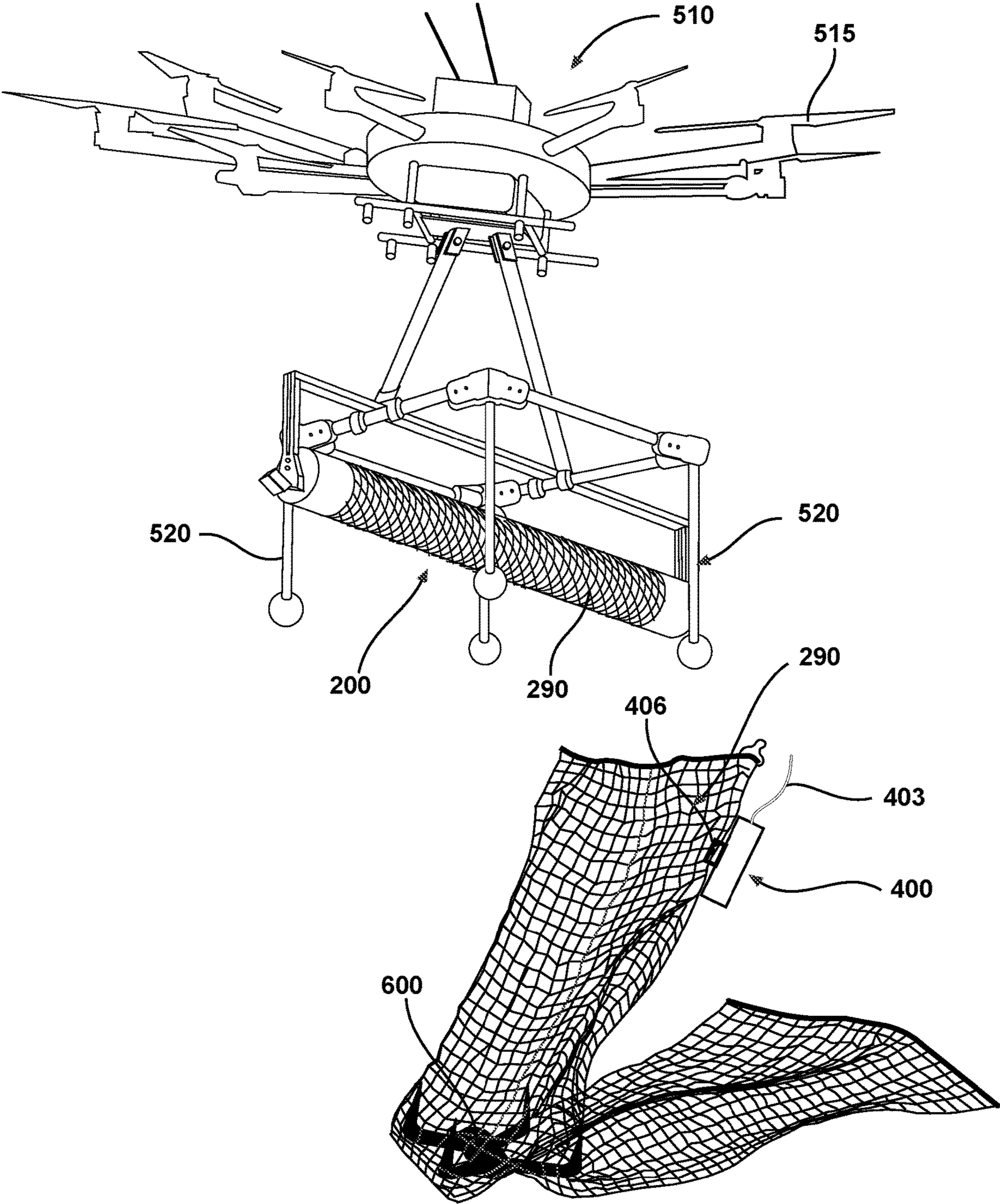


FIG. 2D

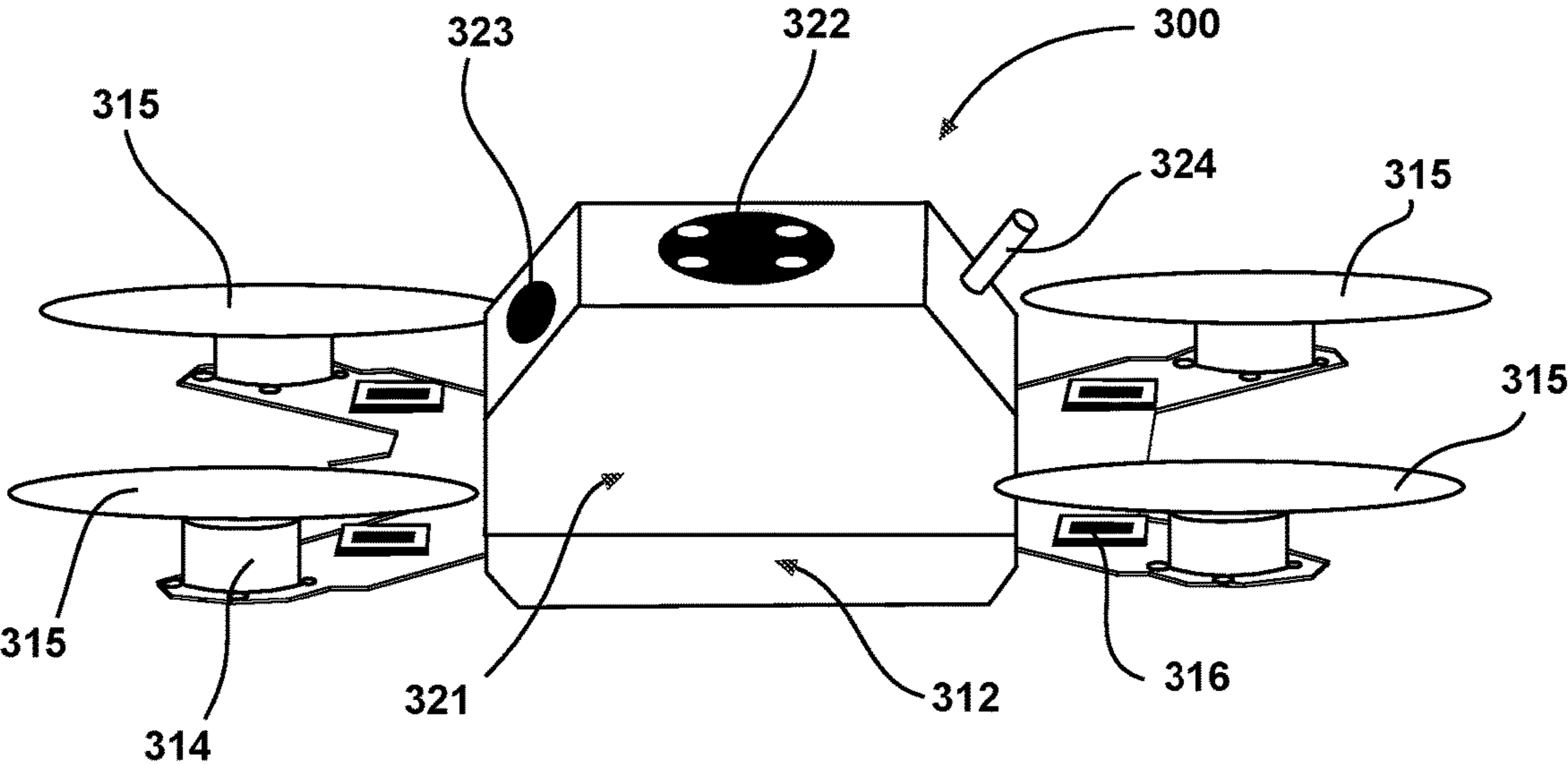


FIG. 3A

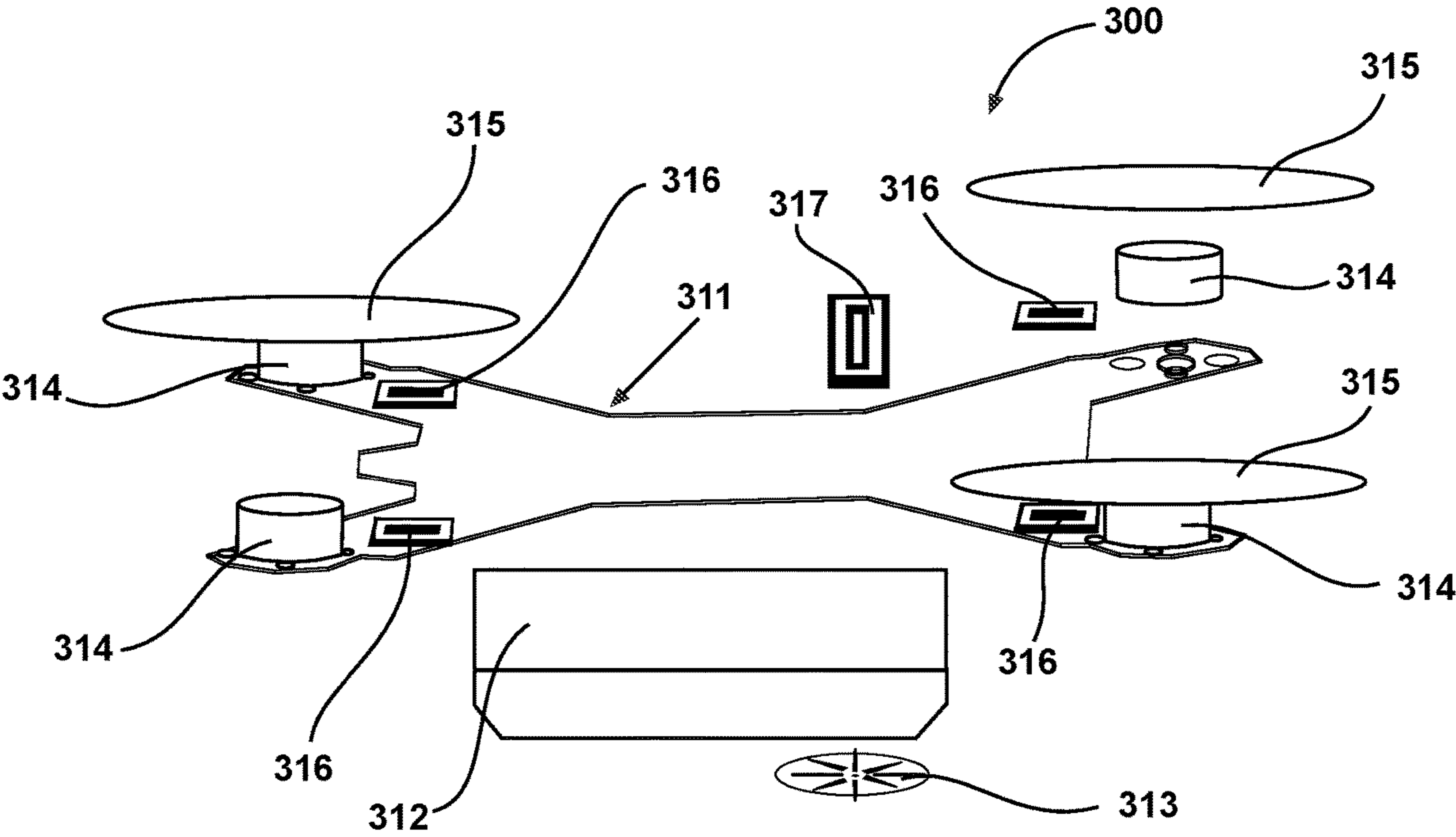


FIG. 3B

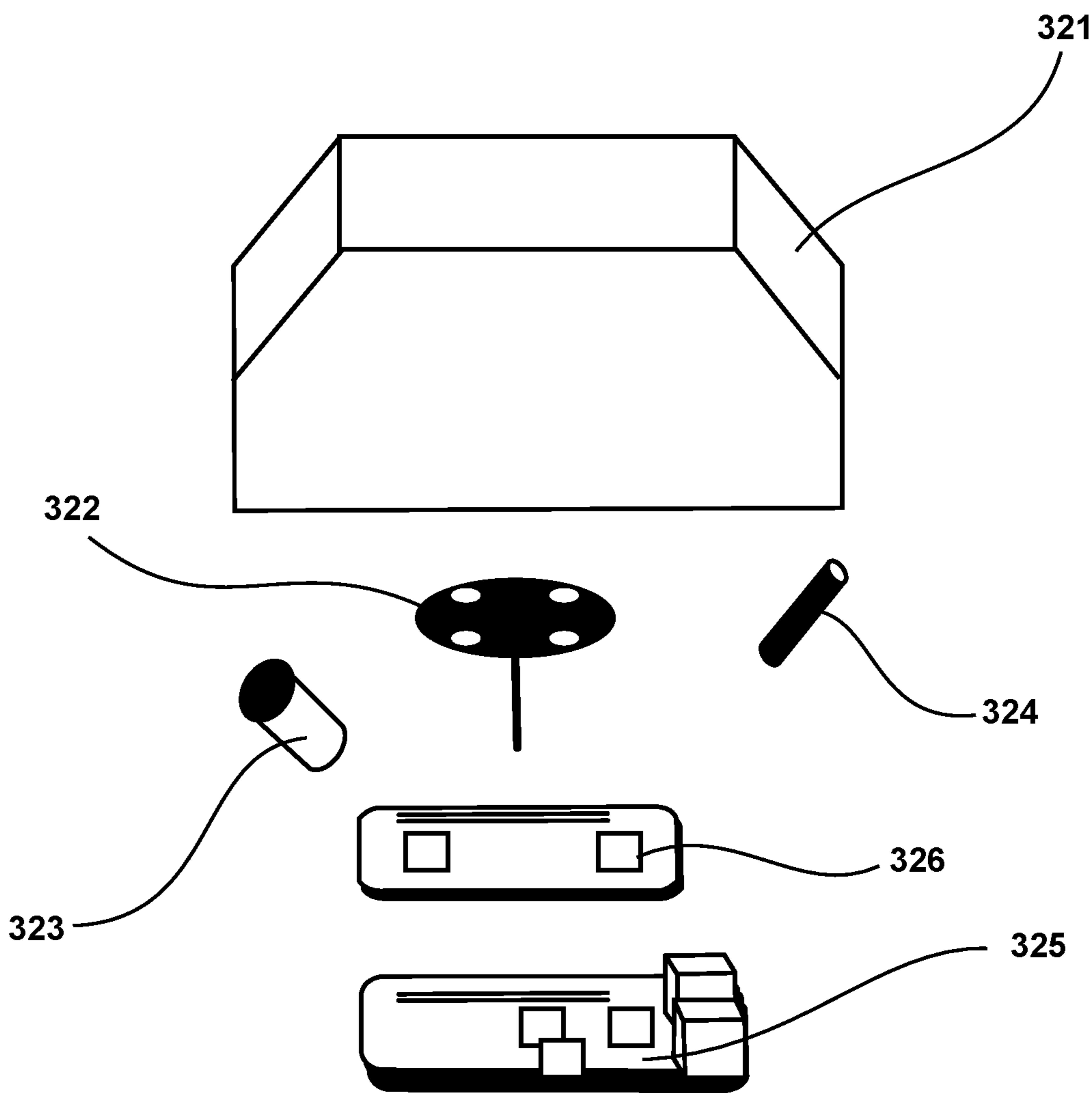


FIG. 3C

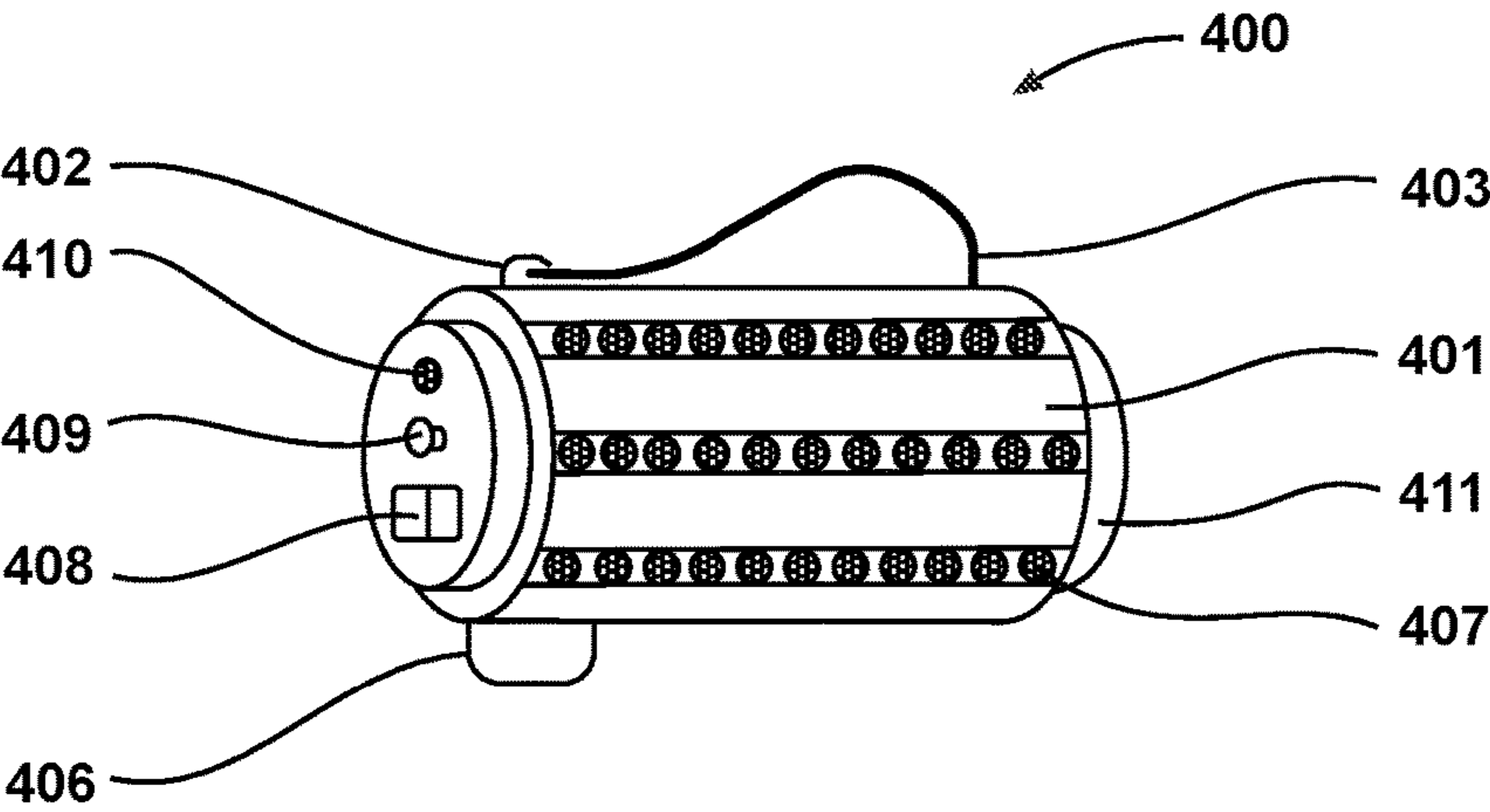


FIG. 4A

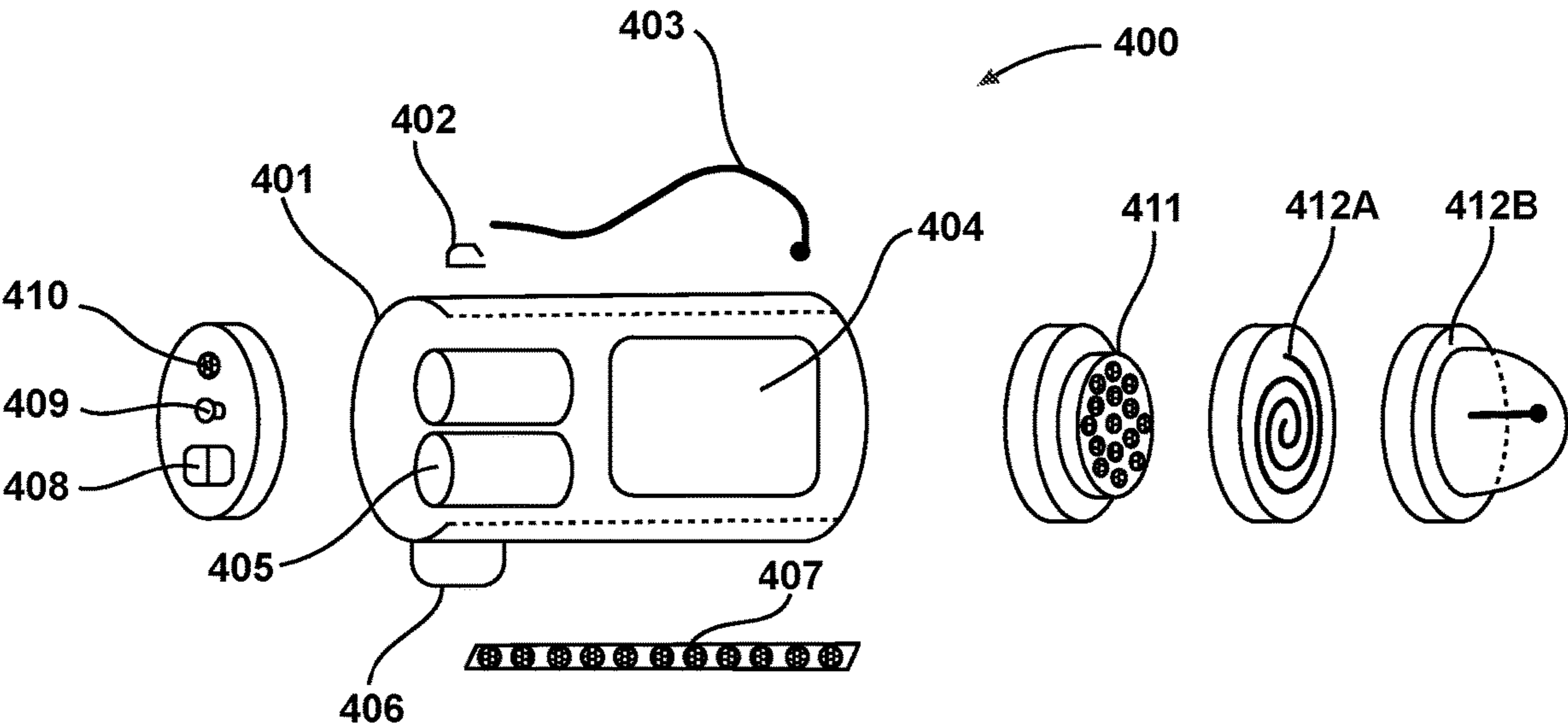


FIG. 4B

# APPARATUS AND PROCESS FOR DRONE LOCATING, INTERDICTION AND RECOVERY

## PRIORITY

[0001] The present application is a divisional of U.S. application Ser. No. 17/171,340 filed 2021 Feb. 9 which in turn claims priority to U.S. Provisional Application Ser. No. 63/012,340, filed 2020 Apr. 20, both of which are expressly incorporated herein by reference.

## RIGHTS OF THE GOVERNMENT

[0002] The invention described herein may be manufactured and used by or for the Government of the United States for all governmental purposes without the payment of any royalty.

## FIELD OF THE DISCLOSURE

[0003] Disclosed is an integrated defensive system to defend an area on land or sea from hostile or unauthorized small Unmanned Aerial Systems (sUAS), and are referred to herein as Unmanned Aerial Vehicles (UAV) or drones, using apparatus and/or process for drone locating, interdiction and recovery. The system includes UAV detection, capture or destruction, and recovery.

## SUMMARY OF THE INVENTION

[0004] The system includes a detection device also known as the “Panotect”, and an interdiction drone also known as the “Stone Drone.” The interdiction drone may be configured with an armored shell. Alternatively a net capture system may be used with a pursuit drone. An accompanying beacon device illustrates a unique aspect of the drone defensive system recovery.

[0005] The disclosed Apparatus and Process for Drone Locating, Interdiction and Recovery may include the integration of the systems disclosed herein including an integrated airspace defense system (IADS) for identifying and locating a suspicious unmanned aerial vehicle, the system including at least one detection device to monitor the air space and provide a detection information and a computer to process the detection information and identifying the presence of suspicious unmanned areal vehicles (UAVs) using a sequence of detection algorithms. The integrated airspace defense system is designed to identify and locate the suspicious UAV. The detection device is at least one wide-field of view camera; the camera connected to a computer controlled pan tilt unit. The pan tilt unit may further including a at least one targeting camera co-aligned to operate with a laser range finder; and wherein the detection information includes at least one image.

[0006] The integrated airspace defense system may interdict and capture the suspicious UAV with a capture UAV and the capture UAV may include a net system assembly having at least one net and a Cross Frame connected to a spindle by a first side panel and a second side panel, such that the spindle may rotate and deploy at least one net upon a command using a power and control connector. The spindle rotation enabled by a rotation servo, the spindle further including an attachment means wherein the at least one net is operably releasable from the spindle; and a first attachment bracket and a second attachment bracket wherein the brackets are separated and operably connected to the capture

UAV and wherein the deployed net entangles the suspicious UAV. The deployed net may then subsequently released from the capture UAV. The attachment means may be magnets. A second net may then be deployed to capture a second suspicious UAV.

[0007] A recovery locator beacon (recovery beacon or beacon) may be attached to the net for locating the entangled suspicious UAV. The recovery beacon may include a protective housing, a spring contact switch, and or a rip-away cord such that when deployed the spring contact electrically connects a connecting circuitry with a power source such that the recovery beacon may be activated. The recovery beacon rip-away cord may include an attachment loop. The recovery beacon may in one embodiment include exterior lights that are powered on when the recovery beacon is activated, in one embodiment using a power switch. The recovery beacon may further include a test button and/or a test indicator light to assist in recovery. The recovery beacon may further include a siren to assist in recovery. The recovery beacon may further include a radio frequency antenna for transmitting a signal that is designed to assist in recovery.

[0008] The integrated airspace defense system (IADS) may in one embodiment incapacitate the suspicious UAV with an interdiction (stone or stone drone) UAV. The interdiction UAV may include a stone frame, at least one battery a wireless charging capability. The battery operably connected to at least one motor to drive at least one propeller using an electronic control unit and a power distribution board, a global positioning system (GPS) antenna, an optical camera capable of autopilot connected through a radio link; and an armored shell. The shell being operably designed to remove from the airspace the suspicious UAV upon contact. In one embodiment the suspicious UAV airspace removal is performed with a kinetic impact of the interdiction UAV with the suspicious UAV.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1A is an illustration of a drone detection device;

[0010] FIG. 1B is an illustration of the drone detection device optical wide field of view cameras;

[0011] FIG. 1C is an illustration of the drone detection device moveable housings including the pan tilt housing and pan base;

[0012] FIG. 1D is an illustration of the drone detection device camera and range finder;

[0013] FIG. 2A is an illustration of the net system assembly;

[0014] FIG. 2B is an exploded illustration of the net system assembly with separated net;

[0015] FIG. 2C is an illustration of a pursuit drone equipped with a net system assembly;

[0016] FIG. 2D is an illustration of a pursuit drone equipped with a net system assembly capturing a drone.

[0017] FIG. 3A is an illustration of the interdiction “stone” drone;

[0018] FIG. 3B is an exploded illustration of the “stone” drone elements;

[0019] FIG. 3C is another exploded illustration of the “stone” drone elements with armored shell;

[0020] FIG. 4A is an illustration of a recovery beacon;

[0021] FIG. 4B is an exploded illustration of a recovery beacon;

**[0022]** It should be understood that the appended drawings are not necessarily to scale, presenting a somewhat simplified representation of various features illustrative of the basic principles of the invention. The specific design features of the sequence of operations as disclosed herein, including, for example, specific dimensions, orientations, locations, and shapes of various illustrated components, will be determined in part by the particular intended application and use environment. Certain features of the illustrated embodiments have been enlarged or distorted relative to others to facilitate visualization and clear understanding. In particular, thin features may be thickened, for example, for clarity or illustration.

#### DETAILED DESCRIPTION OF THE INVENTION

**[0023]** A drone detection system, also known as the “Panotect”, provides Security Forces (SF) and other defense and law enforcement personnel a quick and effective solution for detecting, identifying, and tracking small Unmanned Aerial Systems (sUAS). Small UASs are categorized as class I and II drones (under 55 lbs), and are referred to herein as UAVs or drones. Without a drone detection system in place, there is no method for notifying when these small UAVs fly onto bases or into other secure areas. Currently, of the suggested methods for detecting and identifying the growing threat of hostile UASs, many are impractical for a variety of reasons, including cost of scaling a system or limited detection ranges. This system solves these issues and can be placed around military bases, government installations, or integrated as a component to a wide range of defense networks; multiple systems can be linked together to cover a larger area. This system is also able to be mounted on a mobile platform such as a vehicle for convoy protection.

**[0024]** FIG. 1A shows a drone detection device **101**. An installed drone detection system may include one or more drone detection devices **101** deployed as needed to provide coverage and monitor a protected air space (not shown) from hostile UAVs. The detection device **101** may be stationary or mobile. The drone detection device **101** may include a computer-controlled pan-tilt unit (PTU) housing **131**. The drone detection device **101** may further include one or more of the wide field of view cameras **111**.

**[0025]** FIG. 1B illustrates an embodiment of one arraignment envisioned including and internal ring of wide field of view optical cameras **111**. A computer (not shown) may be connected to the cameras to processes camera images with a sequence of detection algorithms to determine if a hostile UAV is present.

**[0026]** FIG. 1C shows a computer-controlled pan-tilt unit (PTU) housing **131**. The PTU housing **131** includes a palming base **141** that allows the PTU **131** to pan (left and right) and tilting side panels **164** and **165** that allow the PTU **131** to tilt (up and down).

**[0027]** In one embodiment the PTU **131** may include at least one targeting camera **121** that is coaligned with a laser rangefinder **122** as shown in FIG. 1D. The targeting camera **121** may have a narrow field of view or otherwise adapted to operationally function with the laser range finder **122**.

**[0028]** The process of initial detection begins when a target is detected by one or more of the wide field of view cameras **111**. A computer connected to the cameras processes the images with a sequence of detection algorithms to

determine a possible target. Night detections are possible due to the common use of onboard lighting on UAV systems, necessary for the remote piloting and/or navigation of the UAV. Once a possible hostile UAV is detected, its heading and elevation angle are passed to a computer-controlled pan-tilt unit (PTU) **131**. The PTU is equipped with the narrow field-of-view camera **121** that is co-aligned with the laser rangefinder **122**. The imagery from the narrow field-of-view camera **121**, along with a second set of optical detection algorithms, is used to provide fine control to the PTU so that the laser rangefinder can get an accurate range measurement of the hostile UAV. The computer uses the azimuth, elevation, and range of the target to determine its position in a global coordinate frame. The target position, speed, and size are used to differentiate between UAVs and clutter such as birds, clouds, planes, etc. through the combination of passive and active optical detection. After a target is detected, tracked, and characterized as a hostile UAV, the computer transmits the target information to alert defense personnel or automated defensive systems of the target.

**[0029]** The individual components and materials can be swapped out for alternatives, allowing different configurations and upgrades. Combined with an effective UAV engagement solution, this system can protect installations and bases, both permanent and rapidly constructed. This system can also be employed to identify hostile UAVs for convoys and dismounted personnel, important buildings, stadiums, and public spaces. The power for the detection system can either be provided by an electrical battery in the case of a temporary or vehicle-mounted system or connected to mains power as a more permanent solution.

**[0030]** This system uses a passive optical detection cycle followed by active optical tracking. Prior systems used sensors other than optical cameras for primary detection, and optical detection was cited as incapable of reliable and precise detection of UAVs. This system demonstrates optical detection is as capable as and less expensive than alternative detection methods, primarily radar systems.

#### Net & Spindle

**[0031]** Interdiction of hostile small Unmanned Aerial Systems (sUAS) may be performed with a modified or dedicated airborne platform. Small UASs are categorized as class I and II drones (under 55 lbs), and may be referred to herein as Unmanned Aerial Vehicles (UAVs) or drones. One such method for interdiction and capture is with an entangling net, suspended from a spindle system.

**[0032]** As shown in FIG. 2A, a net system assembly **200** may be attached to the defending UAV, below the rotors **515** and above the landing gear **520** (See FIG. 2C). The net system assembly **200** may be used to stop intruding small UAVs by entangling them in a net **290** when flown into their propellers or lifting surfaces. With the use of multiple rolled deployable nets **290**, the net system assembly **200** may engage multiple intruding UAVs.

**[0033]** As shown in FIG. 2A, the net system assembly **200** is supported by a cross frame **220** and connects to its capture UAV through attachment brackets **241** and **242**, and supports the rest of the spindle with side panels **251** and **252**. Power and control are passed through connector **230**, wherein the brackets **241** and **242** are separated and together operably connected to the UAV. The frame **220** and side panel

components **251** and **252** are connected to a spindle **270** by such that a spindle **270** may rotate and release on command a net **290**.

[0034] FIG. 2B shows the spindle **270** attaching to the frame assembly, and rotation may be enabled by a rotational servo **260**. The spindle **270** further includes spindle magnets **280** which attach to the net magnets **285**, wherein the net(s) **290** is operably releasable from the spindle **270**, when driven by the rotational servo **260**.

[0035] The FIG. 2B cross frame **220** and connects to its capture UAV through attachment brackets **241** and **242**, and supports the rest of the spindle with side panels **251** and **252**. Power and control are passed through connector **230**, wherein the brackets **241** and **242** are separated and together operably connected to the UAV. The frame **220** components are connected to a spindle **270** by such that a spindle **270** may rotate and release on command a net **290**.

[0036] In one embodiment the spindle **270** of FIG. 2B may have one or more modes of operation including for example loading and unfurling/entangling. During loading operations, the spindle **270** counter-rotates, and the net magnets **285** attached to the spindle magnets **280** and to subsequent net magnets, loading in succession. The spindle **270** maintains the net(s) **290** in a loaded and rolled up configuration during stand-by and transit flight (See FIG. 2C). When the capture UAV is pursuing a target, the first net **290** is unfurled to its full length by rotating the spindle **270**. Once the target is engaged, the net **290** will detach automatically from the net magnets **285** separating, and then the next net (**290A** FIG. 2D) on the spindle **270** may be unfurled as needed.

[0037] In one embodiment, the net system assembly **200** hangs below the capture UAV (See FIG. 2C) to be above and out of the way of the landing gear, and below and out of the way of the rotors/propellers **515**. The cross frame **220** keeps the main structure sturdy and enables spindle operations and rotations without pinching. The net assembly connects to the capture UAV through attachment brackets **241** and **242**, with power and control through connector **230**. In this manner the net system assembly can be connected and disconnected from the capture UAV for configuration and maintenance (not shown).

[0038] As shown in FIG. 2C capture drone **510** includes capture drone rotors **515** which are mounted above the net system assembly **200** to keep the net **290** away from the capture drone rotors **515**. Landing gear **520** are designed to also keep the net **290** away from the capture drone rotors **515** and off the landing surface, allowing the landing gear to touch down first, level and such that the net remains its distance from the capture drone rotors **515**.

[0039] FIG. 2D illustrates a capture drone **510** with rotors **515** immediately after netting a hostile drone **600** is entangled in a net **290** have a recovery beacon **400** attached by attachment loop **406**, the recovery beacon **400** trailing the rip-away cord **403**. Further illustrated is a second net **290A** ready to deploy from the net system assembly **200** in the pursuit of other hostile drones (not shown).

[0040] The system uses common light-weight materials, the specifics for the frame and net material depend upon the size desired and the speed of engagement. The individual components and materials can be swapped out for alternatives, allowing different configurations and upgrades. The configuration of the capture UAV may use UAV components, including frames, controllers, motors, autopilot systems, additional computer controllers, cameras, and associ-

ated software (none shown). The individual components and materials can be swapped out for alternatives as improvements and upgrades in drone technology allow. Initial configuration of the capture UAV include an airborne platform based upon a modified DJI S1000 using a Pixhawk autopilot, an onboard Raspberry Pi computer to interface with the autopilot and communications, a first person vision (FPV) camera for flight control, and the Drone kit API to create precision guidance system. The capture UAV with net assembly systems can be pre-positioned around an installation for rapid interception of intruding hostile UAVs. Prior UAV interception devices relied on static or single use net systems; this system improves the usage for multiple encounters.

[0041] As shown in FIG. 3A, FIG. 3B and FIG. 3C the capture drone **300** may include a Frame **311**, Batteries **312**, Wireless Charging **313**, one or more motors **314**, one or more propellers **315**, one or more electronic control units **316**, at least one power distribution board **317**, a GPS antenna **322**, an optical camera **323**, a radio link **324**, a microcontroller **325**, and an autopilot **326**, all operably connected as known in the art. The components preferably are of sufficient lifting power to carry the net system and overtake or intercept the target drone. Further, as shown in FIG. 3B and FIG. 3C the capture UAV **300** may be hardened with an armored shell **321** (FIG. 3C) to enable repeat uses of primary systems.

#### Interdiction Drone

[0042] An interdiction drone, also known as the “Stone Drone”, provides Security Forces (SF) and other defense and law enforcement personnel a quick and effective solution to intruding small Unmanned Aerial Systems (sUAS). Small UASs are categorized as class I and II drones (under 55 lbs), and shall be referred to herein as Unmanned Aerial Vehicles (UAVs) or drones. Without a system in place, there is nothing to stop these small drones from coining onto bases or into secure areas, and disrupting operations, gathering intelligence, or delivering hazardous payloads to soft targets. These interdiction drones may be placed around military bases, government installations, or built into convoy operations to provide dismounted soldiers protection in the field. This interdiction drone uses a simple approach, using a kinetic strike to engage a potential or confirmed hostile threat, and eliminating the hazard before there is injury, accident, or casualty.

[0043] FIG. 3A is an illustration of the interdiction drone **300**. FIG. 3B and FIG. 3C are an exploded illustration of a stone drone **300** showing the various components including a frame **311**, preferably optimized for speed, coupled with motors **314** and propellers **315**. The power source is an electrical battery **312**, which uses wireless charging **313** while in the stored, stand-by state. The electricity is distributed through a power distribution board **317**, and each motor is controlled by an associated electronic control unit **316**. These components represent a high-speed drone set up, and can be built using common industry components; high speed operations may be preferred to pursue and overtake potential targets and provide enough kinetic impact force to de-flight the targets. Together these components would enable high speed, quick agility pursuit.

[0044] On top of this frame is an armored shell **321** as illustrated in FIG. 3C, containing the controller and input parts. The central piece is the microcontroller **325**, which

handles all the computation and processing for the drone. Guidance is directed by the GPS antenna **322**, and instructions and directions come in through the radio link antenna **324**, which also transmits images and status updates to the ground station. The microcontroller receives images through the camera **323**, and communicates to the autopilot **326**.

**[0045]** During a standard operation, the interdiction (stone) drone **300** would receive a go signal from the ground station, with the location of the intruding hostile drone to fly to and intercept. Powering up, the drone **300** would lift off and begin flying to the intercept area. Once at a nominal distance, the microcontroller would begin processing images, searching for the intruding target based upon characteristics passed on from the ground station. One key characteristic of the search is the camera **323** facing upward, to detect the hostile drone against the sky background, rather than tracking against ground or horizon clutter. Images and status updates are transmitted back to the ground station, and the interdiction drone can receive further guidance updates while in flight. Once the hostile drone is detected, identified, and tracked, the microcontroller would begin updating the autopilot with directions, in turn guiding the drone into the path and colliding with the intruder. At high speed, this kinetic collision would be enough to damage and de-flight a hostile drone. The armored shell **321** would protect the sensitive components inside, allowing for multiple uses from these parts, but all of the components are selected and priced to enable disposable operations if necessary. The drone can remain in its stand-by housing until needed, receiving necessary electrical power through its charging pad until it is used.

**[0046]** The armored shell **321** may be made of any material known in the art including aluminum, steel, plastic, and fiber composite. The armored shell **321** is preferably strong enough to disable a hostile drone on impact and preferably protect the vital components of the delivery drone **300** (FIG. 3A) from disabling damage while maintaining proper flight characteristics including high speed and maneuverability.

**[0047]** The interdiction drone **300** may have individual components and materials swapped out for alternatives, allowing different configurations and upgrades to be implemented into the defensive shield. The kinetic solution is preferable to other systems and products that either used illegal (RF jamming, Lasers) or overly complicated, and represents the simplest and fastest resolution to an intruding threat. With an accompanying detection device as discussed above and as part of an integrated defensive UAV system, the interdiction drone may protect any and all installations and bases, both permanent and rapidly constructed, as well as convoys and dismounted personnel, from the threat of attacking sUASs/UAVs. This system can also be employed on a much larger commercial scale, protecting important buildings, stadiums, and public spaces.

#### Recovery Beacon

**[0048]** Recovery of downed and netted suspicious (hostile) small Unmanned Aerial Systems (sUAS), also referred to herein as Unmanned Aerial Vehicles (UAVs) and drones, may be assisted by the use of a beacon device. As shown in FIG. 4A, presented in an exploded illustration in FIG. 4B, a recovery beacon **400** provides location and detection of the de-flighted UAVs brought down by the methods and apparatus discussed above. The beacon **400** enables Security Forces (SF) and other responders to quickly and accurately

identify and locate an object, day or night, in all weather conditions and in all environments. The initial use is to locate downed intruding UAVs when captured, such as illustrated above with a releasable net.

**[0049]** As shown in FIG. 4A and exploded illustration FIG. 4B the recovery beacon **400** is built on a protective housing **401**. Inside is a power source **405** and electronic circuitry **404**, connecting the power with a triggering mechanism including a spring contact switch **402**, powering the recovery beacon when a rip cord **403** is pulled away from the spring contact switch **402**. When the rip cord is ripped away it is designed to complete a contact circuit with spring contact switch **402** and activates the recovery beacon **400**.

**[0050]** An arming mechanism may include a recessed power switch **408**, and/or a test button **409** and test light **410** to verify the beacon will activate when deployed.

**[0051]** An alarm system may include a plurality of exterior lights **407**, set up to enable visual location, day and night, no matter what orientation the beacon lands in. The exterior lights **407** may be light emitting diodes (LED), which can be infrared (IR) LEDs if covert recovery is desired. In addition, there are several modules that can be attached, depending upon mission and location needs, including a siren **411** and an RF antenna **412A** and transmitter **412B** (two configurations shown). An opposing attachment loop **406** may be used to secured the recovery beacon **400** to a fall away net **290** (FIG. 2D) to a subsequent fall away net **290A** or other capture device (not shown).

**[0052]** In one embodiment, an attachment loop **406** sticks out from the case **401**, allowing the recovery beacon to be securely connected to a net **290** or other system. To arm the beacon **400**, there may be a recessed power switch **408**. To assist in verifying the arming, if the rip cord **403** is in place with the contact switch **402** (i.e. the beacon is in place but not activated/sounding), the test button **409** and/or test light **410** may be used to verify the beacon will activate when deployed. On the exterior of the beacon, multiple exterior lights **407** are set up to enable visual location, day and night, no matter what configuration the beacon lands in. IOE the exterior lights are light emitting diodes (LED), which can be infrared (IR) LEDs if covert recovery is desired. In addition, there are several modules that can be attached, depending upon mission and location needs, including a siren **411** and an RF antenna and transmitter **412** (two configurations shown).

**[0053]** To use the recovery beacon **200**, batteries **405** may be inserted and the selected locator module (**411** and/or **412**) may be connected. With the power switch **408** off the rip cord **403** is linked to the spring clip **402** through a net **209** or strut (not shown) (ex. the surface the beacon and net will detach from). The opposing attachment loop **406** is secured to the associated fall-away net **409** or other releasing device (not shown). The power switch **408** is turned on, and the beacon **400** can be verified everything is working by pressing test button **409** and checking the test light **410**. The beacon is now armed and ready to be used. In its current stand by configuration, it can remain deployed on the net system until it is used in an engagement. When in use, when a net **290** entangles with an intruding UAV and separates from the net system assembly **200**, the recovery beacon's rip cord **403** will be pulled from the spring clip **402**, completing the electrical circuit. The external lights **407** and locating module **411** or **412** will be exciting, allowing recovery personnel to locate the beacon for recovery.

**[0054]** The recovery beacon **400** was created after feedback from SF personnel and other responders, describing the problems and challenges faced when trying to locate a downed UAV after an intrusion engagement. The recovery beacon may provide several forms of notification, including visual and auditory, enabling both location identification and hazard warning for responders. It is built with common circuitry elements, but the whole package hasn't been put together before nor has a similar device been used in the field for recovery aspects. The beacon can be made with alternative materials and components, enabling flexible configurations, while the same mission effects can be reached. With alternative triggering mechanisms, the beacon can be used in a wider range of scenarios, such as an impact trigger to help recover friendly UASs following a crash, or identifying where friendly resupply packages are located in field.

**[0055]** While the present invention has been illustrated by a description of one or more embodiments thereof and while these embodiments have been described in considerable detail, they are not intended to restrict or in any way limit the scope of the appended claims to such detail. Additional advantages and modifications may readily appear to those skilled in the art. The invention in its broader aspects is therefore not limited to the specific details, representative apparatus and method, and illustrative examples shown and described. Accordingly, departures may be made from such details without departing from the scope of the general inventive concept.

We claim:

1. An integrated airspace defense system for identifying and locating a suspicious unmanned aerial vehicle, the system including:
  - at least one detection device to monitor the air space and provide a detection information;
  - a computer to process the detection information and identifying the presence of suspicious unmanned aerial vehicles (UAVs) using a sequence of detection algorithms;
  - the integrated airspace defense system identifies and locates the suspicious UAV;
  - wherein the integrated airspace defense system incapacitates the suspicious UAV with an interdiction UAV; the interdiction UAV including:
    - a stone frame; at least one battery; a wireless charging capability; the battery operably connected to at least one motor to drive at least one propeller using an electronic control unit and a power distribution board;
    - a global positioning system (GPS) antenna;
    - an optical camera capable of autopilot and connected through a radio link; and
    - an armored shell, the shell operably designed to remove from the airspace the suspicious UAV upon contact.
2. The integrated airspace defense system claim 2 wherein the suspicious UAV airspace removal is performed with a kinetic impact of the interdiction UAV with the suspicious UAV.

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