(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 433 084 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
08.05.2013 Bulletin 2013/19

(21) Application number: **10784603.2**

(22) Date of filing: **18.05.2010**

(51) Int Cl.:
F42B 10/64 *(2006.01)* *F42B 10/14* *(2006.01)*

(86) International application number:
PCT/US2010/035178

(87) International publication number:
WO 2011/019424 (17.02.2011 Gazette 2011/07)

(54) **GUIDED MISSILE**

LENKFLUGKÖRPER

MISSILE GUIDÉ

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR

(30) Priority: **19.05.2009 US 179391 P**

(43) Date of publication of application:
28.03.2012 Bulletin 2012/13

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Printed by Jouve, 75001 PARIS (FR)

Description

FIELD

[0001] A guided missile having a projectile body and aerodynamic surfaces that stabilize, guide, and/or lift the projectile body during various stages of a flight path.

[0002] A prior art example of such a missile is described in US 4,076,187 A, which forms a starting point for independent claims 1 and 12.

BACKGROUND

[0003] Range (*e.g.*, 25 nautical miles), accuracy (*e.g.*, within 10 meters of identified target), and effectiveness (*e.g.*, greater than 99% lethality), are usually considered key performance parameters when designing a guided missile. In other words, these parameters cannot be compromised in the interest of reduced costs, manufacturing reliability, and/or simplified structure. Moreover, these key factors need to be balanced within a missile design to insure that all three are optimized. For example, while range can be prolonged by faster muzzle velocity, the resulting increased setback acceleration can negatively impact crucial instrumentation and thereby shortchange accuracy and/or effectiveness.

[0004] A missile also often inherits other variables that afford little or no liberties during design development. For example, the projectile body usually must have a size/shape to accommodate an intended artillery platform and/or gun barrel (*e.g.*, 155 mm diameter and 1 m length). And if a missile includes a payload (*e.g.*, a warhead), its size, shape, and/or weight are almost always dictated primarily by mission objectives.

SUMMARY

[0005] A missile design is provided that reduces costs, increases reliability, and/or simplifies structure without compromising key performance parameters. Range performance is achieved by enhanced acceleration capability and improved lift-to-drag ratio, not faster muzzle velocities and/or greater launch charges. In this manner, setback acceleration is decreased, whereby the missile's instrumentation can reside in a less reliability-threatening environment. And, thanks to lower launch loads, the missile's structural-strength requirements can be relaxed.

[0006] The missile achieves its enhanced-acceleration feature by combining the functionality of certain aerodynamic surfaces. Specifically, the missile comprises tail fins that perform a stabilizing function during the just-launched stage of the flight path and perform a guiding function during post-ballistic stages of the flight path. And the missile achieves its improved-lift feature by a pair of wings that are deployed from a mid portion of the projectile body. By controlled maneuvering of the wings and the fins, the missile can cruise during an apogee stage, precisely adjust direction during a midcourse trajectory stage, and/or situate itself for a near vertical angle-of-attack during terminal trajectory.

[0007] The missile can be constructed to have a conventional projectile-body shape) and to carry a payload adequate for most mission objectives. For example, the projectile body can have a diameter (*e.g.*, 155 mm) and length (*e.g.*, 1 m) compatible with current and future artillery platforms and/or howitzers. And the missile can provide accurate, first round fire-for-effect capacity.

[0008] According to an aspect of the invention, a missile includes: a projectile body having a fore-aft axis and comprising a nose portion, and a mid portion aft of the nose portion, and a tail portion aft of the mid portion; a bearing coupler within the projectile body allowing at least a part of the tail portion to rotate freely relative to the mid portion about the fore-aft axis; a clutch within the projectile body that engages/disengages to selectively allow/prevent rotation of the at least part of the tail portion; wings, stowed within pockets in the mid portion, that extend to deployed positions outside of the projectile body; fins stored within slots in the at least part of the tail portion, wherein the fins are biased to extend radially outward in roll-stabilizing orientations; and a deflector that deflects the fins from their roll-stabilizing orientations to angularly align their leading edges relative to the aft-fore axis in direction-controlling orientations.

[0009] According to another aspect of the invention, a method of missile flight includes the steps of: launching a missile from a launch unit; deploying fins of the missile with their leading edges in roll-stabilizing orientations; during an initial roll-stabilized flight regime, allowing free rotation of a tail of the missile that includes the fins; after the roll-stabilized flight regime, engaging a clutch of the missile to prevent tail rotation; and deflecting leading edges of the fins using a deflector of the missile.

[0010] These and other features of the missile are fully described and particularly pointed out in the claims. The following description and annexed drawings set forth in detail certain illustrative embodiments, these embodiments being indicative of but a few of the various ways in which the principles may be employed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

Figure 1 is schematic diagram of a mission wherein a missile is launched and then guided to encounter a target.

Figures 2A - 2C are side, top, and aft schematic views of a missile having wings deployed in an aft direction.

Figures 3A - 3C are side, top, and aft schematic views of a missile having wings deployed in a fore direction.

Figure 4 is a schematic diagram of a controller of the missile.

DETAILED DESCRIPTION

[0012] Referring now to the drawings, and initially to Figure 1, a missile 10 is shown in a military setting as it follows a flight path from a launch unit 11 to a target 12. The launch unit 11 can comprise a howitzer 13, or other gun or cannon, having conventional specifications and/or capabilities. For example, muzzle velocity can be 700 - 1000 m/s and the launch acceleration can be 8 - 15K.

[0013] The illustrated flight path includes a just-launched stage (immediately after exit from the howitzer 13) and post-launch stages thereafter. The post-launch stages include a ballistic stage (determined primarily by muzzle velocity and launch angle), an apogee stage (upon reaching a cruise elevation), a mid-course trajectory stage (optimized for target range/arrival), and a terminal trajectory stage (optimized for target impact). Other flight paths are possible and contemplated. For example, if the missile 10 was on a battle-damage-assessment or other information-collecting mission, the flight path may not includes the latter trajectory stages.

[0014] The missile's pursuit of the target 12 can be collaborated by other manned and unmanned units, such as a remote command unit 15, a field intelligence unit 16, and/or a global-positioning-system unit 17.

[0015] Referring now to Figures 2A - 2C and/or Figures 3A - 3C, the missile 10 is shown in more detail. The missile 10 comprises a projectile body 20 having a generally cylindrical shape with a fore-aft axis 21. The projectile body 20 can be shaped/sized to accommodate a conventional launch unit (*e.g.*, launch unit 11). For example, the projectile body 20 can have a diameter of 155 mm and a length of 1 - 3 meters (*e.g.*, 1 m, 1.55 m, 2.25 mm, etc.).

[0016] The projectile body 20 comprises a nose portion 30, a mid portion 40 aft of the nose portion 30, and a tail portion 50 aft of the mid portion 40. The nose portion 30 can comprise a payload chamber 31 occupying most of its interior space. The midportion 40 comprises diametric wing slots 41 and can comprise instrument bays 42 occupying the space around the slots 41.

[0017] The tail portion 50 can comprise a base part 51, a retainer part 52, a bearing coupler 53, and a clutch 54. The base part 51 can be fixedly mounted to the mid portion 40 and the retainer part 52 attached to the base part 51 by the bearing coupler 53. The retainer part 52 includes radial slots 55 (*e.g.*, four) spaced circumferentially around its outer surface.

[0018] The bearing coupler 53 allows the retainer part 52 to rotate freely relatively to the base 51 (and/or the mid portion 40) about the fore-aft axis 21. The clutch 54 can be engaged-disengaged to allow-prevent tail rotation. In an alternative design, the entire tail portion 50 could be coupled to the mid portion 40 by the bearing coupler 53, whereby it would constitute the retainer part 52. In either event, at least part of the tail portion 50 can rotate freely relative to the mid portion 40. The retainer part 52 includes (has in it) the slots 55.

[0019] The missile 10 can comprise a payload 60, contained within the chamber 31 in the nose portion 30. In a military setting, such as illustrated, the payload 60 could comprise a warhead (*e.g.*, destructive munitions). The nose portion 30 and/or the chamber 31 can include other objects or devices, such as communication/guidance gear for actively or passively interacting with remote units 11, 15, 16, and/or 17.

[0020] The missile 10 further comprises wings 70 and fins 80. In Figure 2A and Figure 3A, the wings 70 are shown stowed within the pockets 41 in the mid portion 40 and the fins 80 are shown stored within the slots 55 in the tail portion 50. In Figures 2B - 2C and Figures 3B - 3C, the wings 70 are shown in deployed positions and the fins 80 are shown in released conditions.

[0021] The wings 70 each comprise an airfoil 71 having a leading edge 72. A wing deployer 73 within the mid portion 40 is operative to deploy the wings 70 from their stowed positions (Figure 2A and Figure 3A) to their deployed positions (Figures 2B - 2C and Figures 3B - 3C.) In the stowed position, the wings' leading edges 72 are aligned substantially parallel with the fore-aft axis 21. In the deployed positions, the wings' leading edges 72 extend radially outward from the fore-aft axis 21 in lift-imparting orientations.

[0022] The wings 70 can comprise arms 74 connected to their inboard edges and the wing deployer can comprise a rod 75 to which the distal ends of the arms 74 are pivotally attached. As shown in Figures 2A - 2C, the rod 75 can be located in an aft region of the mid portion 40, and the wings 70 can symmetrically move in the aft direction to deploy from the pockets 71. Alternatively, as shown in Figures 3A - 3C, the rod 75 can be located in a fore region of the mid portion 40, and the wings 70 can symmetrically move in the fore direction to deploy from the pockets 71. In either or any event, the deployed position of the wings 70 can be rigid whereby their leading edges 72 remain at a constant deflection angle relative to the fore-aft axis 21.

[0023] The fins 80 each comprise an airfoil 81 having a leading edge 82. An obturator 83 maintains the fins in their stored condition (Figure 2A and Figure 3A) until muzzle exit and releases them upon muzzle exit for movement to their released conditions (Figures 2B - 2C and Figures 3B - 3C.) The obturator 83 is designed to break, fracture, or otherwise destruct to release the fins 80 during the just-launched stage of the flight path. Preferably, the obturator 83 is located towards the aft end of the tail portion 50, to protect the fins 80 during firing and/or reduce pressure on protective covers (not shown).

[0024] When the fins 80 are in released conditions, their leading edges 82 extend radially outward from the aft-fore axis 21 in roll-stabilizing orientations. A fin deflector 84, within the tail portion 50, is operative to deflect the fins 80 from their roll-stabilizing orientations to angularly align their leading edges 82 relative to the aft-fore axis 81 in direction-controlling orientations.

[0025] The missile 10 can further comprise a controller

90, such as schematically shown in Figure 4. The controller 90 can comprise, for example, an output panel 91 that conveys control signals to the clutch 54, the wing deployer 73, and the fin deflector 84. The illustrated controller 90 also comprises an input panel 92 that receives information from onboard sensors, a GPS receiver 93, a collector 94, a command-unit receiver 95, a command-unit transmitter 96, a processor 97, and memory/storage 98. The controller 90 can be housed within the instrument bay 42 in the mid portion 40 and/or it can be powered by a battery 99 also housed within the instrument bay 42.

[0026] Prior to launch of the missile 10, the wings 70 would be stowed within the mid portion 40, the fins 80 would be stored within the tail portion 50, and the obturator 83 would be intact. As the missile 10 exits the gun muzzle, the obturator 83 would release the fins 80 and they would move to released conditions whereat their leading edges 82 are in roll-stabilizing orientations. The clutch 54 would be disengaged, thereby allowing tail rotation during the ballistic stage of the path flight. The clutch 54 would remain disengaged, the wings 70 would stay in stowed positions, and the fins 80 would maintain roll-stabilizing orientations until the missile 10 reached the apogee stage of the flight path.

[0027] Upon reaching the apogee of the ballistic stage of the flight path, the controller 90 can begin its contribution to the flight path. Specifically, the controller 90 can be programmed to send control signals (via its output panel 91) to the deployer 73 to deploy the wings 70. The wings 70 can be adapted to impart substantial lift to the projectile body 20, with little or no steering or guiding responsibilities. To this end, the tip-to-tip span of the wings 70 can be greater (*e.g.*, 50% greater, 75% greater, 100% greater, 150% greater, and/or 200% greater) than the tail span of the fins 80. And, as indicated above, the wings' leading edge 72 can rigidly remain at a constant angle relative to the fore-aft axis 21.

[0028] During the apogee stage of the flight path, the clutch 54 can be engaged to prevent tail rotation. And the controller 90 can signal the fin deflector 84 to deflect the fins' leading edges 82 in particular direction-determining orientations. Preferably, the fins 80 and/or the deflector 84 are designed to deflect in a multitude of orientations (about a plurality of axes) for optimum guidance of the missile 10.

[0029] As the missile 10 approaches the target 12, and begins the midcourse trajectory stage of the flight path, the wings 70 can remain deployed or be returned to stowage (depending upon descent angle). And the fins 80 can continue to be maneuvered to direct the missile 10 towards the target 12. The wings 70 can be returned to stowed positions (if not already there) during the terminal trajectory stage, to allow a near vertical angle of attack.

[0030] The controller 90 can ascertain the missile's stage in the flight path in a variety of ways. For example, the controller 90 can continuously obtain the missile's current global position (via its GPS receiver 93) and compare this to previously input positions (*e.g.*, input prior to launch). Flight path stages can be ascertained by the altitude of the missile 10 and/or predetermined period of times. If the missile 10 and/or the controller 90 are equipped with target-seeking instrumentation (*e.g.*, the collector 94), visual data concerning the target 12 can be used for this purpose. And/or a remote unit, such as the command unit 15, can receive data from and/or convey instructions to the controller 90 (*e.g.*, via receiver 95 and transmitter 96).

[0031] One may now appreciate that the missile 10 has design that reduces costs, increases reliability, and/or simplifies structure without compromising key performance parameters. With particular reference to the fins 80, they function both as stabilizing components during the ballistic stage of the flight path and later as guiding components during post-ballistic stages of the flight path. This combined functionality removes the need for canards or other separate guiding components. Such a canard-less design, especially with a fore-stored payload, frees up space in the mid portion 40 for the relatively large wings 70 which provide additional lift/acceleration capability and an improved lift-to-drag ratio.

Claims

1. A missile (10) comprising:

a projectile body (20) having a fore-aft axis (21) and comprising a nose portion (30), and a mid portion (40) aft of the nose portion (30), and a tail portion (50) aft of the mid portion (40); a bearing coupler (53) within the projectile body (20) allowing at least a part of the tail portion (50) to rotate freely relative to the mid portion (40) about the fore-aft axis (21);

a clutch (54) within the projectile body (20) that engages/disengages to selectively allow/prevent rotation of the at least part of the tail portion (50);

fins (80) stored within slots (55) in the at least part of the tail portion (50), wherein the fins (80) are biased to extend radially outward in roll-stabilizing orientations;

characterized by :

wings (70), stowed within pockets (41) in the mid portion (40), that extend to deployed positions outside of the projectile body (20); and

a deflector (84) that deflects the fins (80) from their roll-stabilizing orientations to angularly align their leading edges (82) relative to the aft-fore axis (21) in direction-controlling orientations.

2. A missile (10) as set forth in claim 1, further comprising a controller (90);

wherein the controller (90) is programmed to control the clutch (54) to prevent tail rotation upon reaching a fin-guiding stage of the flight path.

3. A missile (10) as set forth in claim 1, further comprising a controller (90); wherein the controller (90) is programmed to control a deployer (73) to deploy the wings (70) upon reaching a wing-deploying stage of the flight path.

4. A missile (10) as set forth in claim 3, wherein the controller (90) is programmed to control the deployer (73) to return the wings (70) to the pockets (41) upon reaching a large angle-of-attack stage of the flight path.

5. A missile (10) as set forth in any of claims 2 to 4, wherein the controller (90) is programmed to control a deflector (84) to deflect the fins (80) in different angular alignments whereat their leading edges (82) are in direction-controlling orientations.

6. A missile (10) as set forth in any of claims 1 to 5, wherein the tip-to-tip span of the wings (70) is greater than the tail span of the fins (80).

7. A missile (10) as set forth in any of claims 1 to 5, wherein the tip-to-tip span of the wings (70) is at least 50% greater than the tail span of the fins (80).

8. A missile (10) as set forth in any of claims 1 to 7, further comprising an obturator (83) on an aft end of the projectile body (20); wherein the obturator (83) protects the fins (80) during launch of the missile (10).

9. A missile (10) as set forth in any of claims 1 to 8, further comprising a deployer (73), within the mid portion (40), that selectively deploys the wings (70) from the pockets (41) to deployed positions.

10. A missile (10) as set forth in claim 9, wherein the deployer (73) includes a rod (75); wherein the wings (70) each include an airfoil (71) and an arm (74) having one end connected to the airfoil (71) and another end pivotally connected to the rod (75); and wherein the wings (70) pivot in an aft direction when moving from the pockets (41) to their deployed positions.

11. A missile (10) as set forth in claim 9, wherein the deployer (73) includes a rod (75); wherein the wings (70) each include an airfoil (71) and an arm (74) having one end connected to the airfoil (71) and another end pivotally connected to the rod (75); and wherein the wings (70) pivot in a fore direction when moving from the pockets (41) to their deployed positions.

12. A method of missile flight, the method comprising:

launching a missile from a launch unit;
deploying fins of the missile with their leading edges in roll-stabilizing orientations;
during an initial roll-stabilized flight regime, allowing free rotation of a tail of the missile that includes the fins;
after the roll-stabilized flight regime, engaging a clutch of the missile to prevent tail rotation relative to a mid portion of the missile; **characterized in** :
deflecting leading edges of the fins using a deflector of the missile.

13. A method as set forth in claim 12, further comprising deploying wings of the missile during flight.

14. A method as set forth in claim 13, wherein the deploying the wings occurs after the beginning of the roll-stabilized flight regime, and before the conclusion of the roll-stabilized flight regime.

15. A method as set forth in claim 13 or claim 14, further comprising, after the deploying the wings, stowing the wings while the missile is still in flight.

Patentansprüche

1. Flugkörper (10), aufweisend:

einen Projektilkörper (20) mit einer Längsachse (21) und mit einem Nasenabschnitt (30) und einem Mittelabschnitt (40) nach dem Nasenabschnitt (30) und einem Heckabschnitt (50) nach dem Mittelabschnitt (40); einen Lagerkoppler (53) in dem Projektilkörper (20), der zumindest einen Teil des Heckabschnitts (50) um die Längsachse (21) frei relativ zum Mittelabschnitt (40) rotieren lässt;
eine Kupplung (54) in dem Projektilkörper (20), die einrückt/ausrückt, um eine Rotation des zumindest einen Teils des Heckabschnitts (50) zu ermöglichen/verhindern;
Finnen (80), die in Schlitzen (55) in dem zumindest einen Teil des Heckabschnitts (50) aufgenommen sind, wobei die Finnen (80) so vorgespannt sind, dass sie sich in rollstabilisierenden Orientierungen radial nach außen erstrecken;
gekennzeichnet durch:

Flügel (70), die in Taschen (41) im Mittelabschnitt (40) verstaut sind, die sich in ausgefahrene Positionen außerhalb des Pro-

jektilkörpers (20) erstrecken; und
eine Ablenkvorrichtung (84), die die Finnen (80) aus ihren rollstabilisierenden Orientierungen ablenkt, um ihre Vorderkanten (82) relativ zur Längsachse (21) in richtungskontrollierenden Orientierungen winkelig auszurichten.

2. Flugkörper (10) nach Anspruch 1,
des Weiteren aufweisend eine Steuerung (90);
wobei die Steuerung (90) zum Steuern der Kupplung (54) programmiert ist, um eine Heckrotation beim Erreichen einer Finnenlenkstufe der Flugbahn zu verhindern.

3. Flugkörper (10) nach Anspruch 1,
des Weiteren aufweisend eine Steuerung (90);
wobei die Steuerung (90) zum Steuern einer Ausfahrvorrichtung (73) programmiert ist, um die Flügel (70) beim Erreichen einer Flügelausfahrstufe der Flugbahn auszufahren.

4. Flugkörper (10) nach Anspruch 3, wobei die Steuerung (90) zum Steuern der Ausfahrvorrichtung (73) programmiert ist, um die Flügel (70) beim Erreichen einer Stufe mit großem Angriffswinkel der Flugbahn zu den Taschen (41) zurückzuführen.

5. Flugkörper (10) nach einem der Ansprüche 2 bis 4, wobei die Steuerung (90) zum Steuern einer Ablenkvorrichtung (84) programmiert ist, um die Finnen (80) in verschiedenen Winkelausrichtungen abzulenken, in welchen ihre Vorderkanten (82) in richtungskontrollierenden Orientierungen sind.

6. Flugkörper (10) nach einem der Ansprüche 1 bis 5, wobei die Spannweite von Spitze zu Spitze der Flügel (70) größer ist als die Heckspannweite der Finnen (80).

7. Flugkörper (10) nach einem der Ansprüche 1 bis 5, wobei die Spannweite von Spitze zu Spitze der Flügel (70) mindestens 50% größer ist als die Heckspannweite der Finnen (80).

8. Flugkörper (10) nach einem der Ansprüche 1 bis 7, des Weiteren aufweisend einen Obturator (83) an einem hinteren Ende des Projektilkörpers (20);
wobei der Obturator (83) die Finnen (80) während des Abschusses des Flugkörpers (10) schützt.

9. Flugkörper (10) nach einem der Ansprüche 1 bis 8, des Weiteren aufweisend eine Ausfahrvorrichtung (73) im Mittelabschnitt (40), die die Flügel (70) selektiv aus den Taschen (41) in ausgefahrene Positionen ausfährt.

10. Flugkörper (10) nach Anspruch 9,
wobei die Ausfahrvorrichtung (73) eine Stange (75) enthält;
wobei die Flügel (70) jeweils eine Tragfläche (71) und einen Arm (74), von dem ein Ende mit der Tragfläche (71) verbunden ist und ein anderes Ende schwenkbar mit der Stange (75) verbunden ist, enthalten; und
wobei die Flügel (70) heckwärts schwenken, wenn sie sich aus den Taschen (41) in ihre ausgefahrenen Positionen bewegen.

11. Flugkörper (10) nach Anspruch 9,
wobei die Ausfahrvorrichtung (73) eine Stange (75) enthält;
wobei die Flügel (70) jeweils eine Tragfläche (71) und einen Arm (74), von dem ein Ende mit der Tragfläche (71) verbunden ist und ein anderes Ende schwenkbar mit der Stange (75) verbunden ist, enthalten; und
wobei die Flügel (70) nach vorne schwenken, wenn sie sich aus den Taschen (41) in ihre ausgefahrenen Positionen bewegen.

12. Verfahren für einen Flugkörperflug, wobei das Verfahren Folgendes aufweist:

Abschießen eines Flugkörpers von einer Abschusseinheit;
Ausfahren von Finnen des Flugkörpers, wobei deren Vorderkanten in rollstabilisierenden Orientierungen sind;
während eines anfänglichen, rollstabilisierten Flugplans, Ermöglichen einer freien Rotation eines Hecks des Flugkörpers, das die Finnen enthält;
nach dem rollstabilisierten Flugplan, Einrücken einer Kupplung des Flugkörpers, um eine Heckrotation relativ zu einem Mittelabschnitt des Flugkörpers zu verhindern;
gekennzeichnet durch:

Ablenken von Vorderkanten der Finnen mit Hilfe einer Ablenkvorrichtung des Flugkörpers.

13. Verfahren nach Anspruch 12, des Weiteren aufweisend das Ausfahren von Flügeln des Flugkörpers während des Fluges.

14. Verfahren nach Anspruch 13, wobei das Ausfahren der Flügel nach dem Beginn des rollstabilisierten Flugplans und vor Beendigung des rollstabilisierten Flugplans vor sich geht.

15. Verfahren nach Anspruch 13 oder Anspruch 14, des Weiteren aufweisend, nach dem Ausfahren der Flügel, das Verstauen der Flügel, während sich der Flugkörper noch im Flug befindet.

Revendications

1. Missile (10) comprenant:

un corps de projectile (20) présentant un axe avant-arrière (21) et comportant une partie de nez (30), et une partie centrale (40) en arrière de la partie de nez (30), et une partie de queue (50) en arrière de la partie centrale (40), un coupleur à roulement (53) à l'intérieur du corps de projectile (20) permettant à au moins une partie de la partie de queue (50) de tourner librement par rapport à la partie centrale (40) autour de l'axe avant-arrière (21);
un embrayage (54) à l'intérieur du corps de projectile (20), qui s'engage/se désengage pour permettre/empêcher de façon sélective la rotation de ladite au moins une partie de la partie de queue (50);
des ailerons (80) rangés à l'intérieur de fentes (55) dans ladite au moins une partie de la partie de queue (50), dans lequel les ailerons (80) sont poussés de façon à s'étendre radialement vers l'extérieur dans des orientations de stabilisation du roulis,

caractérisé par

des ailes (70), rangées dans des poches (41) dans la partie centrale (40), qui s'étendent dans des positions déployées à l'extérieur du corps de projectile (20); et
un déflecteur (84) qui dévie les ailerons (80) de leurs orientations de stabilisation du roulis afin d'aligner angulairement leurs bords d'attaque (82) par rapport à l'axe avant-arrière (21) dans des orientations de commande de direction.

2. Missile (10) selon la revendication 1, comprenant en outre un dispositif de commande (90);
dans lequel le dispositif de commande (90) est programmé de façon à commander l'embrayage (54) pour empêcher la rotation de la queue lorsque l'on atteint un stade de guidage par ailerons de la trajectoire de vol.

3. Missile (10) selon la revendication 1, comprenant en outre un dispositif de commande (90);
dans lequel le dispositif de commande (90) est programmé de façon à commander un système de déploiement (73) pour déployer les ailes (70) lorsque l'on atteint un stade de déploiement des ailes de la trajectoire de vol.

4. Missile (10) selon la revendication 3, dans lequel le dispositif de commande (90) est programmé de façon à commander le système de déploiement (73) pour ramener les ailes (70) dans les poches (41) lorsque l'on atteint un stade de grand angle d'attaque de la trajectoire de vol.

5. Missile (10) selon l'une quelconque des revendications 2 à 4, dans lequel le dispositif de commande (90) est programmé de façon à commander un déflecteur (84) pour dévier les ailerons (80) dans différents alignements angulaires dans lesquels leurs bords d'attaque (82) se trouvent dans des orientations de commande de direction.

6. Missile (10) selon l'une quelconque des revendications 1 à 5, dans lequel l'envergure de bout à bout des ailes (70) est supérieure à l'envergure de queue des ailerons (80).

7. Missile (10) selon l'une quelconque des revendications 1 à 5, dans lequel l'envergure de bout à bout des ailes (70) est supérieure d'au moins 50 % à l'envergure de queue des ailerons (80).

8. Missile (10) selon l'une quelconque des revendications 1 à 7, comprenant en outre un obturateur (83) sur une extrémité arrière du corps de projectile (20); dans lequel l'obturateur (83) protège les ailerons (80) pendant le lancement du missile (10).

9. Missile (10) selon l'une quelconque des revendications 1 à 8, comprenant en outre un système de déploiement (73), à l'intérieur de la partie centrale (40), qui déploie de façon sélective les ailes (70) hors des poches (41) jusqu'à des positions déployées.

10. Missile (10) selon la revendication 9,
dans lequel le système de déploiement (73) comporte une barre (75);
dans lequel les ailes (70) comportent chacune une surface portante (71) et un bras (74) dont une extrémité est connectée à la surface portante (71) et une autre extrémité est connectée de façon pivotante à la barre (75); et
dans lequel les ailes (70) pivotent dans une direction arrière lorsqu'elles se déploient des poches (41) vers leurs positions déployées.

11. Missile (10) selon la revendication 9,
dans lequel le système de déploiement (73) comprend une barre (75);
dans lequel les ailes (70) comportent chacune une surface portante (71) et un bras (74) dont une extrémité est connectée à la surface portante (71) et une autre extrémité est connectée de façon pivotante à la barre (75); et
dans lequel les ailes (70) pivotent dans une direction avant lorsqu'elles se déplacent des poches (41) vers leurs positions déployées.

12. Procédé de vol d'un missile, le procédé comprenant les étapes suivantes:

lancer un missile à partir d'une unité de lancement;
déployer des ailerons du missile avec leurs bords d'attaque dans des orientations de stabilisation du roulis;
pendant un régime initial de vol à roulis stabilisé, permettre la rotation libre d'une queue du missile qui comporte les ailerons;
après le régime de vol à roulis stabilisé, engager un embrayage du missile pour empêcher la rotation de la queue par rapport à une partie centrale du missile;
caractérisé en ce que l'on dévie les bords d'attaque des ailerons en utilisant un déflecteur du missile.

13. Procédé selon la revendication 12, comprenant en outre le déploiement des ailes du missile pendant le vol.

14. Procédé selon la revendication 13, dans lequel le déploiement des ailes est effectué après le commencement du régime de vol à roulis stabilisé, et avant la fin du régime de vol à roulis stabilisé.

15. Procédé selon la revendication 13 ou la revendication 14, comprenant en outre, après le déploiement des ailes, le rangement des ailes alors que le missile est toujours en vol.

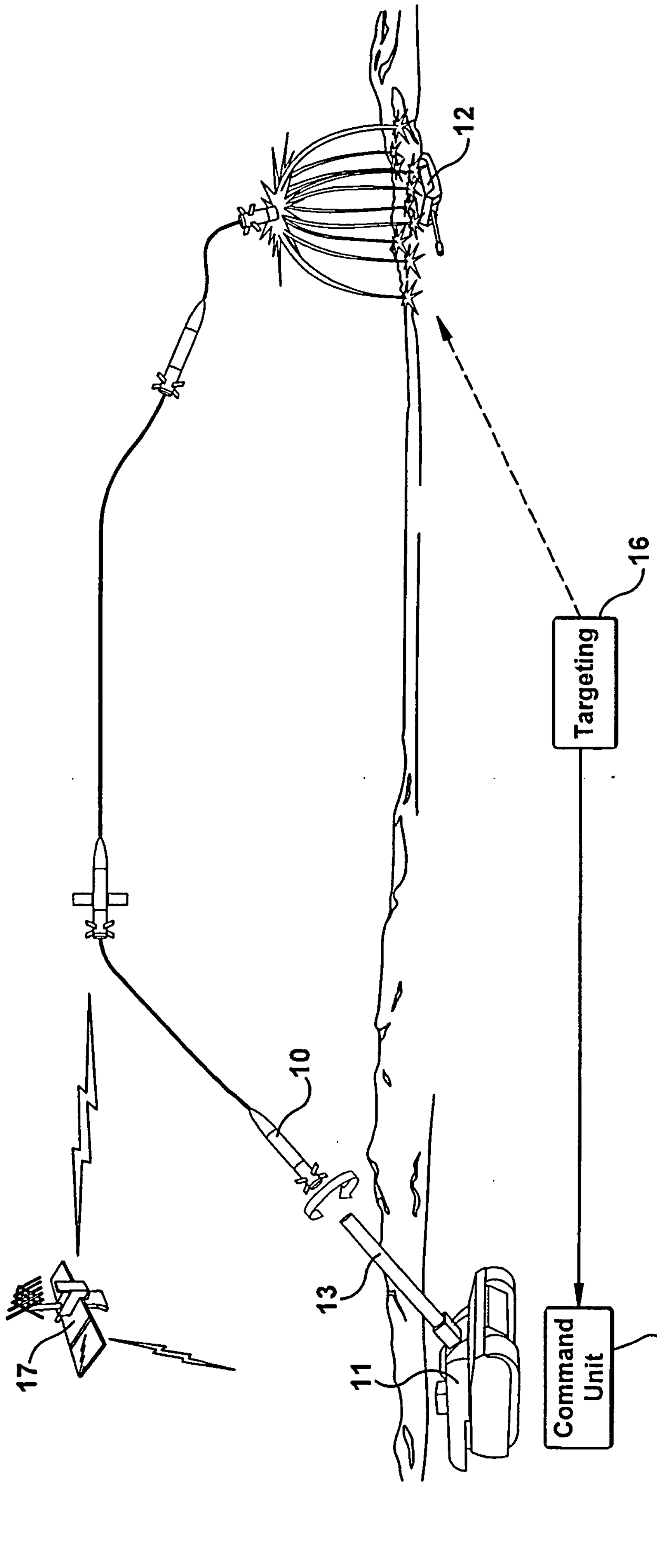


Figure 1

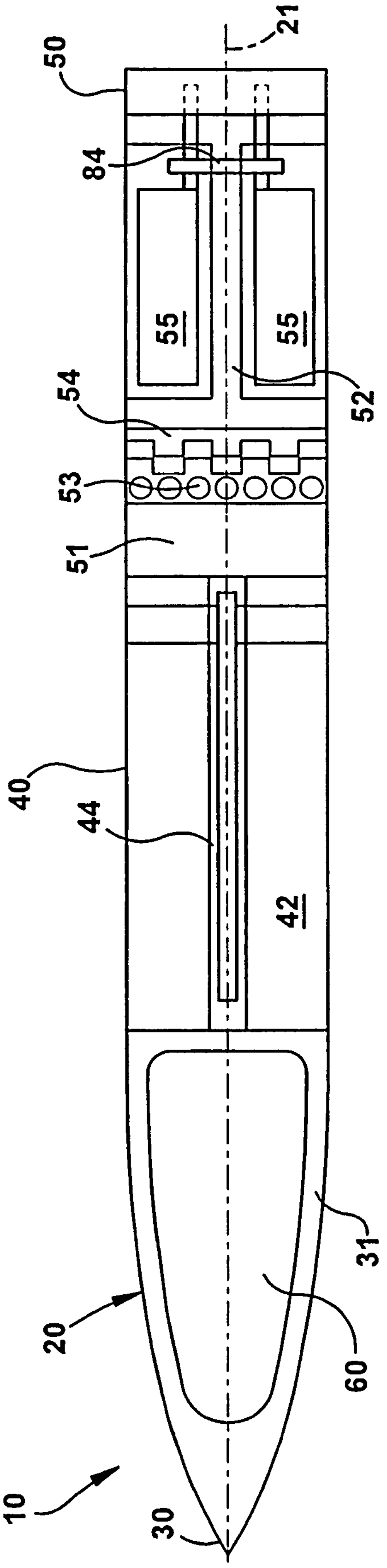
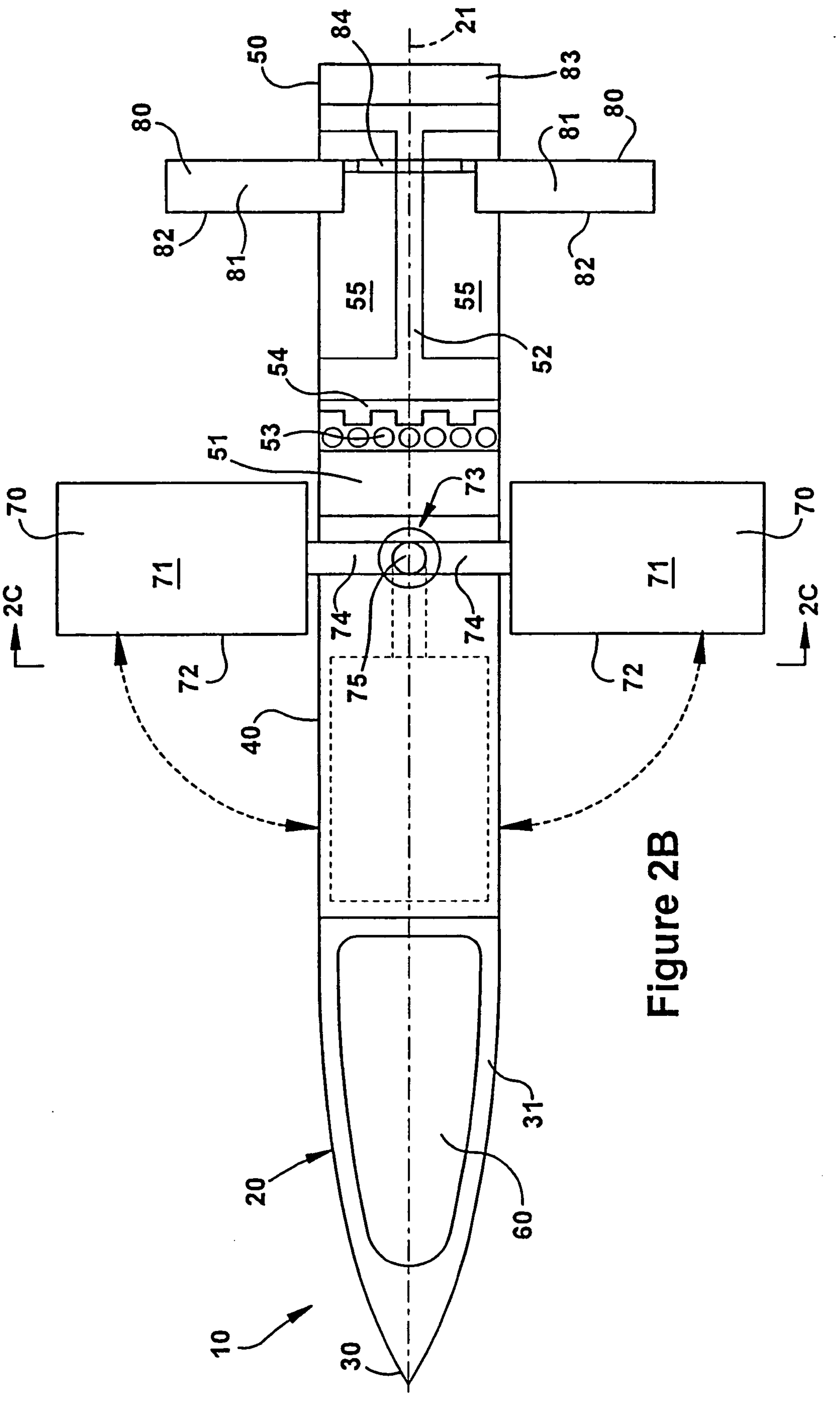


Figure 2A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51
73
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74
75
74
71
70
2C
72
72
2C
40
31
20
60
10
30

Figure 2B

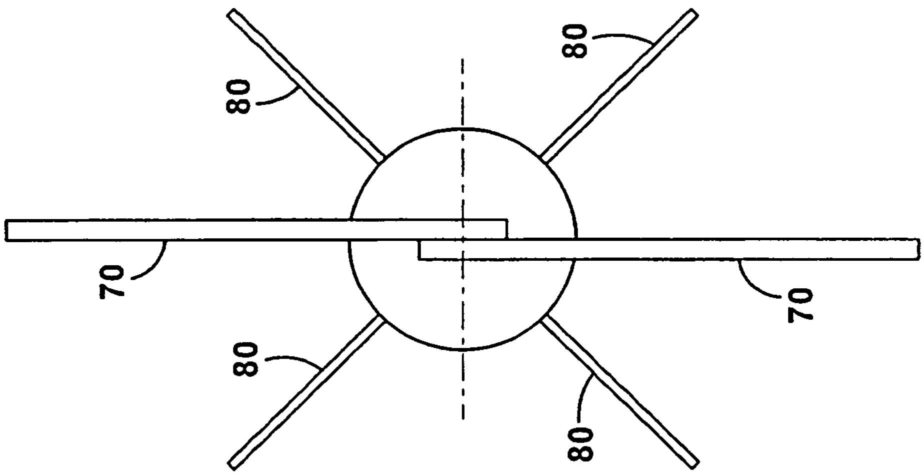


Figure 2C

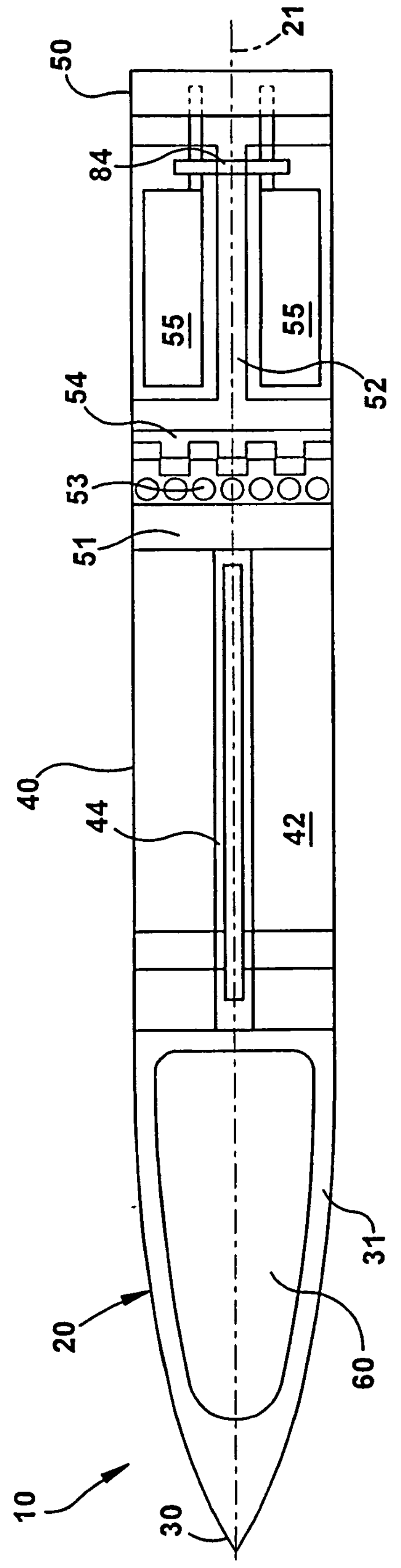
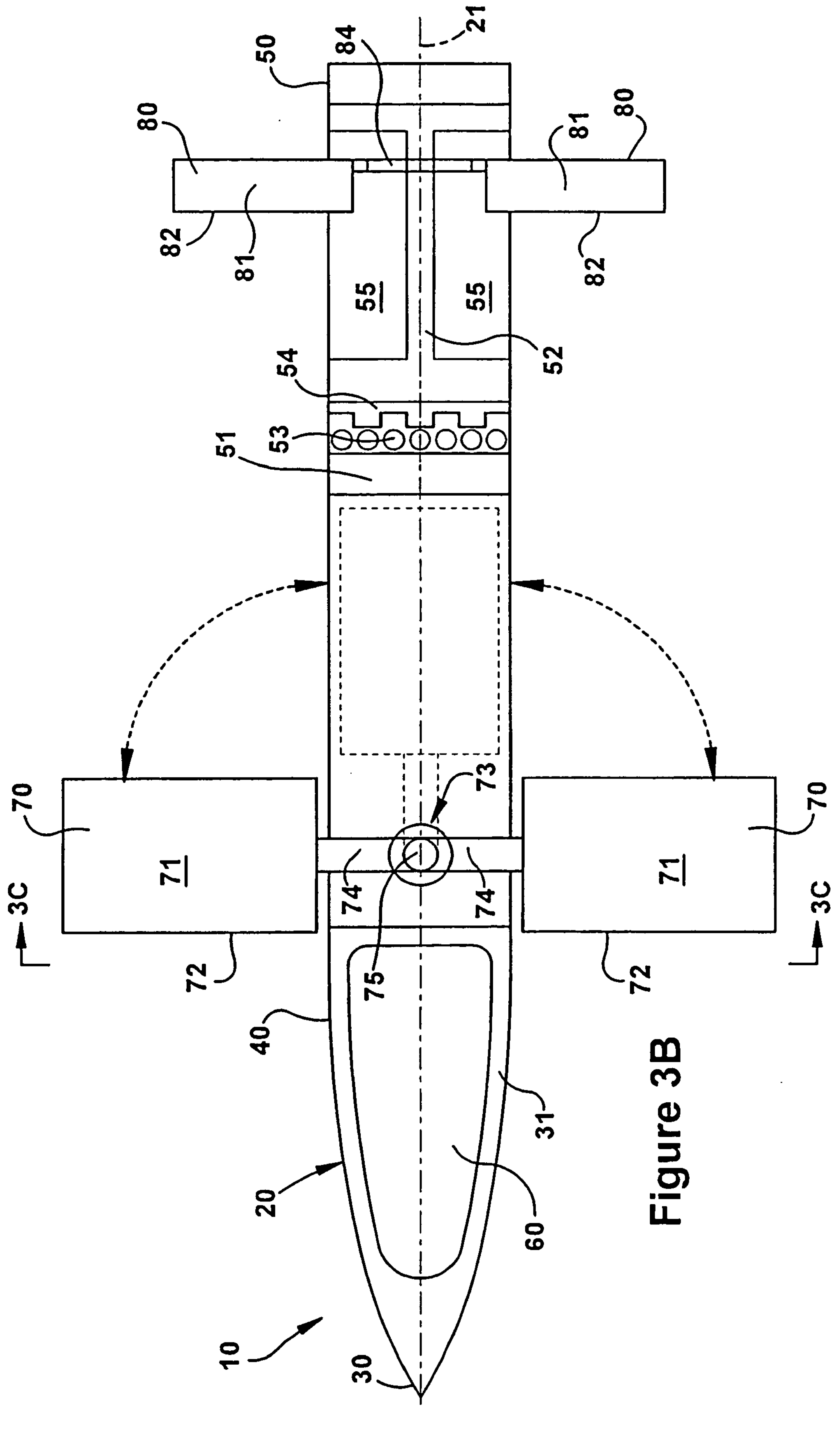


Figure 3A



10
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31
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52
53
54
55
55
60
70
70
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73
74
74
75
80
80
81
81
82
82
84
3C
3C

Figure 3B

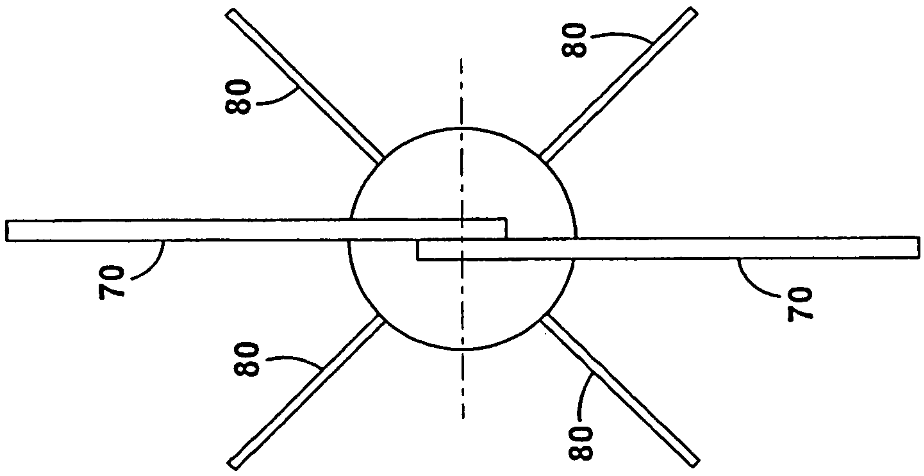
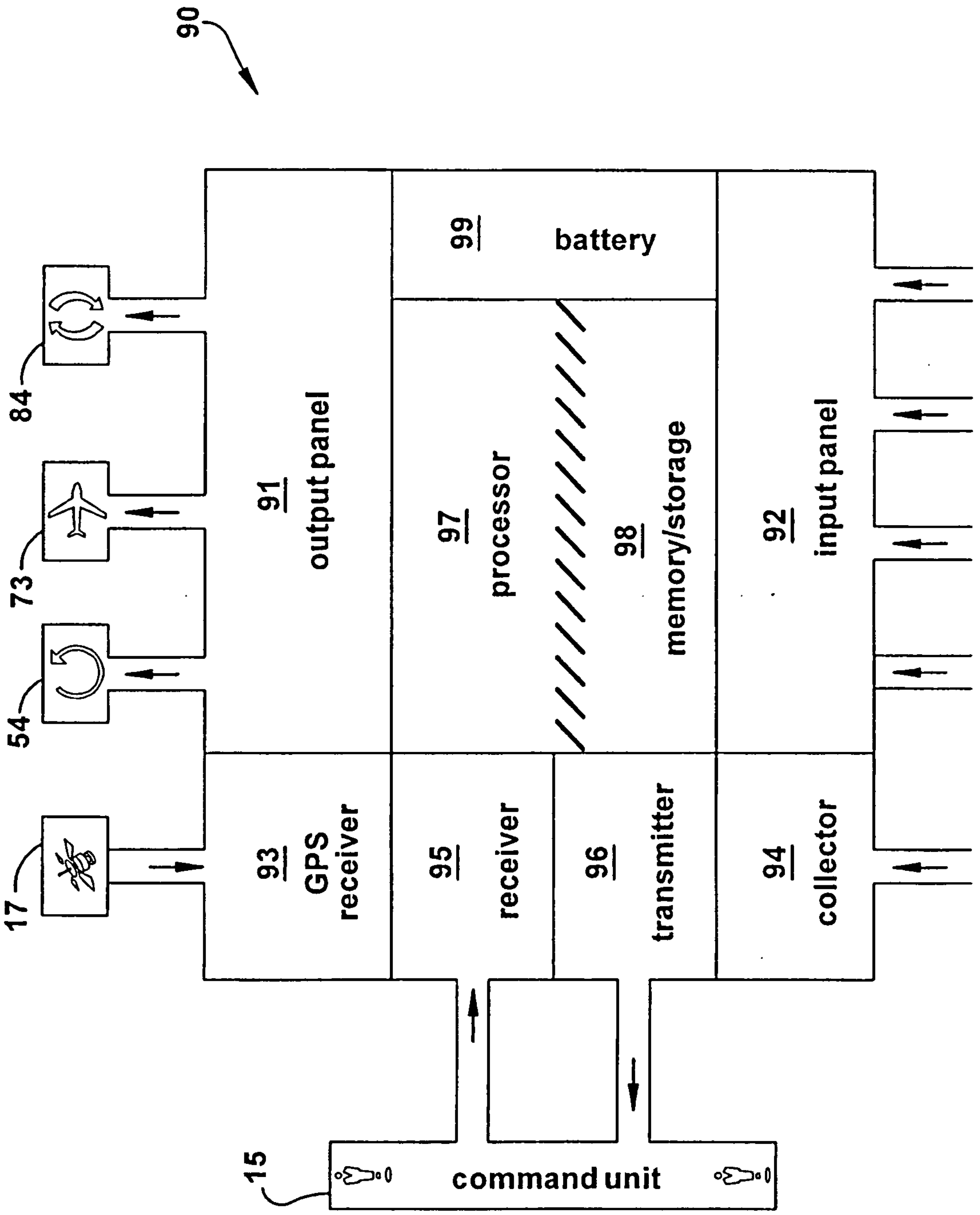


Figure 3C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17
54
73
84
91
output panel
97
processor
98
memory/storage
92
input panel
99
battery
93
GPS
receiver
95
receiver
96
transmitter
94
collector
15
command unit

Figure 4

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 4076187 A **[0002]**