WING DEPLOYMENT AND LOCKING SYSTEM

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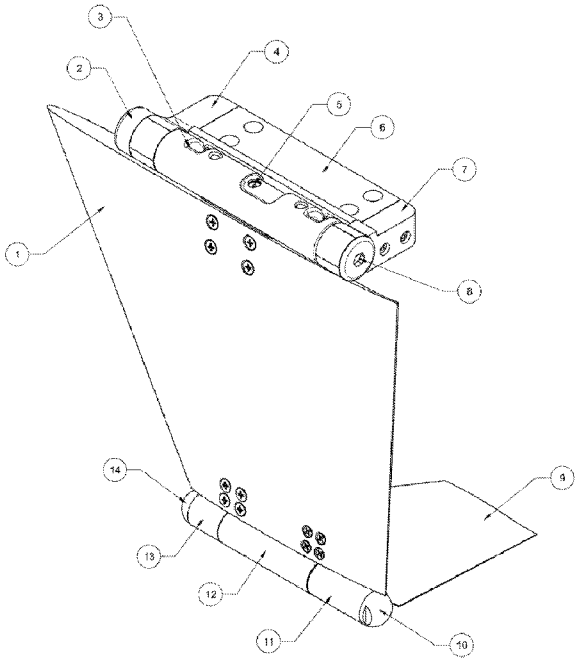
(54) **Title:** WING DEPLOYMENT AND LOCKING SYSTEM

Figure 1



(57) Abstract: The invention is related to a wing deployment and locking system, which enhances the storage efficiency by reducing the volume occupied by the munition through folding the wings onto the munition body in case where the munition is stored inside a special canister in the air platform or the tube of the launching platform prior to firing and which enables reaching a longer range by the aerodynamic advantage obtained as a result of creation of the same or more wing surface area compared to the conventional fixed wing systems, by ensuring wings to be deployed at the time of firing when the munition leaves the tube in which it is stored. The system consists of wing-1 (1) and wing-2 (9), which creates an aerodynamic surface area, and subsystem mechanisms that allow the wings to deployed and remain locked in the deployed state during the flight. The wing-1 subsystem is basically consists of; the machined spring-1 (16), which provides the required drive with high torque production to the system by firing the pyrotechnic bolt (18), hinge-1 (3), which ensures deployment of the wing-1 (1) by making a radial rotation movement through the one-way clutch-1 (15) located at both ends, and lock spring-1 (17) and lock pin-1 (19), which ensures the locking of the system when wing-1 (1) comes to the fully deployed position. The wing-2 subsystem is basically consists of; the machined spring-2 (21), which is in the torsion-state when the system is in its undeployed position, the spring housing (12), which enables the deployment of the wing-2 (9) by making a radial rotation movement through the one-way clutch-2 (20) located at both ends thanks to the high torque provided by the machined spring-2 (21) when the munition is released at the moment of firing, the lock spring-2

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(24) and the lock pin-2 (23) that ensures locking when the wing-2 (9) is in its fully deployed position.

DESCRIPTION

WING DEPLOYMENT AND LOCKING SYSTEM

Technical Field of the Invention

The invention relates to wing deployment and locking system in the fields of defence, aviation and aerospace, providing that wings and winglets, that are used for making an object able to fly and remain securely in the air during flight through generating aerodynamic forces, are in a folded position prior to launch, allowing ease of movement and increasing storage efficiency; and are transformed from the folded position into a fully-deployed and locked position when launched, providing an aerodynamic advantage obtained with an extended surface area.

Prior Art

In cases where munitions are stored inside a special canister in an air platform or inside a tube in a launching platform prior to using them, the development of methods aiming at reducing the volume of munition are worked on so as to simultaneously store more munitions and increase fire power. When the wings are in a fully-deployed position, which causes quite a high increase in the volume covered by the wings overextending the diameter of munition, it may be impossible to place the munition into the target air platform. The fully-deployed position of the wings furthermore leads to a decrease in the number of munitions that can be carried, and which thus cause the fire power and target destruction capability to remain insufficient. The wing deployment mechanisms are used to enable the munition wings/fins to be folded for satisfying the need for the storage of munition in a smaller volume and, when it is launched, to be deployed for getting into flying position. The automatic wing deployment mechanisms in the prior art includes torsion springs and hydraulic actuator mechanisms that are located adjacent to the wings and that allows the wings to be deployed along with firing the munition by making controlled rotational movement until the wings reach a certain wingspan. In the majority of wing deployment systems, wing is opened through its rotation movement around the vertical z-axis extending from the upper part to the lower part of munition. Methods employed in the prior art for locking in the deployed position in order to ensure that the structural integrity is retained and the wings are kept securely in the deployed

position against the presence of aerodynamic and aerothermal loads generated during flight in conjunction with the deployment of wings are generally such that the matching holes in the wing root and in the surface on which the wing is fastened are engaged with each other by spring-loaded ring pin or that a tab attached to the wing root in such a way that it protrudes from the wing root is fitted into a recess formed in the flying object's (such as a missile, rocket etc.) body itself.

The prior art document with the patent number US61 8644B1 discloses a wing deployment and locking system wherein a tapered connection is used. The system includes a wing (400) that is located on a flying object, a base (300) in the shape of an elongated rod on which there are holes allowing the wing to be mounted onto exterior surface of the flying object by screws, arms (303 and 305) protruding from the base, tapered teeth (307 and 309) extending from the side of the arms and being in the form of a tab with a cylindrical hole along an axis parallel to the base, wing bosses (401 and 403) extending from the bottom side of the wing through which the wing and the base are assembled and having a cylindrical cavity along an axis which is identical with the axis of the tapered teeth in the base, tapered slots (405 and 407) that are on the wing bosses and shaped to match with the tapered teeth in the base, a pin (201) that is used for joining the wing and the base by being inserted through the cylindrical holes passing through the same axis of the wing bosses and the tapered teeth, torsion spring (103) which is wound around the pin and located between the wing and the base, and compression spring (101) which is wound around the pin under the torsion spring. When the flying object onto which the system is mounted is launched by being released from the canister inside which the flying object is stored, the wing begins to open by rotating around the pin through the torque applied by the torsion spring. In the last five degrees remaining before the wing is fully open, tapered slots (405, 407) in the wing bosses and tapered teeth (307,309) in the base begin to mesh with each other. Over the last five degrees, compression spring which is wound around the pin under the torsion spring, having sufficient tension, enables the tapered slots and the tapered teeth to be completely mated with each other by translating the wing bosses linearly along the axis through which the pin passes by a predetermined distance. Thus, the wing is locked in the fully open position and this position is retained against aerodynamic loading during flight.

The prior art document with the patent number US4691 880A discloses a wing deployment system powered by a torsion spring. In this system; a foldable wing section (16) hinged to a stationary or fixed wing section (14) mounted on the body of a missile is deployed until it is extended to the same span direction with the fixed wing section by being rotated about hinge (18) in a clockwise direction. The foldable wing section is fully deployed in conjunction with the configuration of torsion springs that rotates a splined shaft (24) to which it is connected by means of a gear train (64) along with the release of the configuration of torsion springs loaded in closing position of the foldable wing section when the wing is deployed. The system is designed to be able to operate to a considerable extent independently of temperature variations and reduce the effects of environmental conditions on the performance by using the configuration of torsion springs in lieu of a pyrotechnic wing actuation system for deploying wings. Furthermore, in the system, there is a lock linkage which enables the foldable wing section to remain folded until its deployment, and which is connected with both the foldable wing section and the fixed wing section by means of lock pins.

The prior art document with the patent number US4884766A relates to a fin deployment system, ensuring that high performance in flight is delivered through reducing aerodynamic drag which hinders the movement of aircraft, and that fin cross section is minimized through mounting of the fin deployment system completely within the flying object for obviating the possibility of being detected by radar by virtue of reducing the radar cross section. A pyrotechnic gas generator that is used in the system as an actuation mechanism for enabling the deployment of the fin in the folded position is connected to a piston (42) and a fin lock mechanism (44) in the folded position. The gas heated by the pyrotechnic gas generator which is ignited electrically or chemically is spread through orifices (50, 52), which not only pushes the piston towards a fin hinge (20) by applying pressure against the base of the piston but also allows the release of the fin by pushing a piston (54) loaded by spring comprised in the lock mechanism in the folded position towards base (60). Grooves (38a) being made on the inner surface of a housing (38) encircling the piston (42) interlock with external splines (66a) on the outer surface of the piston (42), which causes that the piston (42) rotates simultaneously while making a linear movement. Inner splines (66b) on the internal side of the piston (42) slides along straight grooves

on a torque shaft enclosed by the piston, which enables the torque shaft and a clutch (18) which is connected to the torque shaft to make only rotational movement. The rotary movement of the piston is transmitted to the fin hinge through the clutch, which pivots the fin spar (16) upward and fully extends the fin. When the fin is fully extended, along with the release of a spring comprised in the lock mechanism (110) in the deployed position as connected with the fin spar, the locking of the fin in the fully deployed position is carried out by enabling a plunger (112) to be inserted into a recess on an actuator control shaft (24) while at time same time allowing controlled rotation of the fin along the fin's vertical axis. In the system, furthermore, there is a spring-powered retraction mechanism allowing only the controlled rotation of the fin when the fin comes into the fully-deployed position by disconnecting the clutch from the fin hinge.

In the wing deployment and locking system which is the subject matter of the invention, wings are folded onto the body of a munition for increasing storage efficiency in cases where a munition is stored inside a special canister in an air platform or a tube in a launching platform. Thus, thanks to the wing deployment system that is mounted to the bodies of munitions without the necessity of increasing the inside body volume of the munitions in the design of which volume constraints are encountered, the wings, which occupy much less volume through being folded before launch and enable obtaining of the same or more aerodynamic surface area through being fully deployed at the time of launching in comparison with the conventional fixed-wing systems wherein the wings are kept fixed rather than being folded, are utilized. As a result of the munition having less need for space associated with folding the wings of the munition which is enabled to gain the capabilities for achieving a long-range and carrying a heavy warhead along with increasing its wing surface area as much as in the fixed-wing systems, the carriage of more munitions simultaneously inside the canister in the air platform or the tube in the launching platform is made possible, which ensure that more fire power and destruction capability is reached. Unlike the systems in the prior art, in this system, special designed machined spring having higher strength and high torque generation capability is used, in lieu of torsion spring, for enabling the wings to be deployed by radial rotation of the wings about the x-axis. When the wing is fully deployed, with the aim of preventing uncontrolled rotational movement of the wing, the retraction

mechanism powered by spring in the prior art systems is provided, in the present invention, with recesses (hinge-1 recess, spring housing recess) and the protrusions (casing protrusion, front hinge-2 protrusion, rear hinge-2 protrusion) that are formed in the parts of the subsystem to which the wing is connected, and matched with each other when the wing comes to the fully deployed position to prevent the rotational movement of the wing. The locking in the fully deployed state is carried out by spring-powered pins being inserted into a housing or a formed surface on the parts providing rotational movement.

Purpose of the Invention

An object of the invention is to develop a wing deployment and locking system that increases storage efficiency in cases where a munition is stored inside a special canister in an air platform or a tube in a launching platform prior to its launching by reducing the volume occupied by the munition through folding wings onto the body of the munition, and enables to obtain aerodynamic advantage and achieve longer range through the formation of the same or more wing surface area in comparison with the fixed-wing systems by enabling wings to be deployed when launching the munition.

Yet another object of the invention is to develop a wing deployment and locking system that do not require an electrical interface, and that minimizes losses stemming from the spacing between the moving parts.

Descriptions of the Figures

Figure 1: Isometric perspective drawing of the wing deployment and locking system for undeployed state (both wing-1 and wing-2 are undeployed in folded state).

Figure 2: Wing-1 and integrated wing-1 subsystem.

Figure 3: Wing-2 and integrated wing-2 subsystem.

Figure 4: Detailed section drawing of wing-1 subsystem mechanism.

Figure 5: Detailed section drawing of wing-2 subsystem mechanism.

Figure 6: Isometric perspective drawing of wing deployment and locking system for only wing-2 is fully deployed.

Figure 7: Isometric perspective drawing of the wing deployment and locking system in deployed state (Both wing-1 and wing-2 are fully deployed)

Figure 8: Perspective drawings of hinge-1 (3) and casing (6) parts in the wing-1 subsystem.

Figure 9: Exploded perspective drawing of wing-2 subsystem.

Descriptions of the References in the Figures

The references in the figures are listed below with relevant parts/properties:

1: Wing-1

2: Cover- 1

3: Hinge-1

4: Spring retainer

5: Spring Pin-1

6: Casing

7: Bearing housing

8: Cover-2

9: Wing-2

10: Cover-3

11: Rear hinge-2

12: Spring housing

13: Front hinge-2

14: Cover-4

15: One-way clutch-1

16: Machined spring-1

17: Lock spring-1

18: Pyrotechnic bolt

19: Lock pin-1

20: One-way clutch-2

21: Machined spring-2

22: Spring pin-2

23: Lock pin-2

24: Lock spring-2

25: Hinge-1 recess

26: Casing protrusion

27: Spring housing recess

28: Front hinge-2 protrusion

29: Rear hinge-2 protrusion

30: Lock pin housing

Disclosure of the Invention

Figure 1 shows the undeployed position of the wing deployment and locking system. By means of this position, where the wings are positioned to be folded over the munition body, the volume that the wings overflow from the munition body is reduced and storage efficiency is provided when the munition is stored on the air platform or in the tube of the launching platform.

Figure 2 shows the wing-1 (1) and the subsystem integrated into wing-1 (1) and Figure 3 shows the wing-2 (9) and the subsystem integrated into wing-2 (9). Wing-1 and wing-2 subsystems perform deployed state locking to allow the munition to deploy its wings under aerodynamic loads at the moment of firing and to remain in its deployed position for the duration of the flight.

Figure 4 shows a detailed section drawing of the wing-1 subsystem mechanism. Specially designed pre-stressed machined spring-1 (16) that provides the drive on the system to deploy the wing-1 (1), which is fixed to the hinge-1 (3) with the spring pin-1 (5) on one side and fixed to the spring retainer (4) on the other side. Hinge-1 (3) is mounted radially in the spring holder (4) and bearing housing (7), which allows it to make only radial movement on the wing-1 (3) by means of one-way clutch-1 (15) at both ends. By means of the bearings, Hinge-1 (3), which provides wing-1 (3) to

deploy completely by rotating radially, is also limited to the casing (6) part with radial direction to the spring retainer (4) and the bearing housing (7). The pyrotechnic bolt (18), which connects the casing (6) and the hinge-1 (3), keeps machined spring-1 (16) in the torsion-state and Hinge-1 (3) in a locked state while the system is initially in undeployed state. When the wing-1 (1) is in fully deployed position in casing (6), there are lock spring-1 (17) and lock pin-1 (19) that perform the locking process to keep it in fully deployed position during the flight duration. In order to ensure the integrity of the wing-1 subsystem, cover-1 (2) and cover-2 (8) are placed at the ends of the hinge-1 (3) as shown in Figure 1.

Figure 5 shows a detailed section drawing of the wing-2 subsystem mechanism. Specially designed pre-tensioned machined spring-2 (21) that provides the drive on the system to deploy the wing-2 (9), on one side fixed to the spring housing (12) with the spring pin-2 (22), on the other side fixed to the front hinge-2 (13). The spring housing (12) is bearing radially to the front hinge-2 (13) and rear hinge-2 (11), which allows it to make radial-only movement on two sides of the wing-2 (9) via the one-way clutch-2 (20). As the spring housing (12) rotates radially by the bearings, as a result of the fully deploying of the wing-2 (9), the lock spring-2 (24) and lock pin-2 (23) performs deployed state locking inside the rear hinge-2 (11) to protect this deployed position during flight. Cover-3 (10) shown in Figure 1 is used to hold the lock spring-2 (24) stuck in the rear hinge-2 (11) and also cover-4 (14) in the end part of the front hinge-2 (13) is used to provide the system with all its need.

Figure 6 shows a perspective drawing for deployed position of only wing-2 (9) in the deploying and locking system. Undeployed state of wing 2 (9) shown in Figure 1 becomes deployed as shown in Figure 6 with the fire of munition as a result of releasing of the machined spring-2 (21), which is initially in the torsion-state, in the wing-2 subsystem mechanism shown in Figure 5. In the spring-driven system, by means of the bearings the spring pin-2 (22) and the spring housing (12) which is connected to each other rotates radially with the rotation movement of the machined spring-2 (21) so that it is provided to deploy the wing-2 (9). When wing-2 (9) is in its fully deployed position, spring housing recess (27) on the spring housing (12) knocks into the front hinge-2 protrusion (28) and rear hinge-2 protrusion (29) on the hinge-2 as shown in Figure 9. Thus, the rotation movement of the spring housing (12) is prevented and the wing-2 (9) does not advance further than the fully deployed

position. At the same time, lock spring-2 (24), which is located inside the rear hinge-2 (11) and is compressed by cover-3 (10), becomes released and pushes the lock pin-2 (23) in the undeployed state of the wing-2 (9). Deployed position locking process is realized with locating housing on the lock pin-2 (23) to the formed surface on the machined spring-2 (21).

With the fire of the pyrotechnic bolt (18) which is located in the wing-1 (1) subsystem mechanism and is used as the undeployed state locking system of wing-1 , hinge-1 (3) and machined spring-1 (16) which are in the locked state at the beginning are released when wing-2 (9) takes fully deployed position shown in Figure 6. Wing-1 (1) is fully deployed with the fire of the pirotechnic bolt (18) and then with the rotational movement of machined spring-1 (16), which drives the system, spring pin-1 (5) and hinge-1 (3) by the means of the bearing shown in Figure 7. When the wing-1 (1) comes to the fully deployed position, the hinge-1 recess (25) with the formed surface on the hinge-1 (3) hits the casing protrusion (26) on the casing (6) shown in Figure 8. Thus, the rotation movement of the hinge-1 (3) is prevented and the wing-1 (1) does not advance further than the fully deployed position. In addition, when the wing-1 (1) comes to the fully deployed position, 2 lock pins-1 (19) in the casing (6) connected to the hinge-1 (3) by means of the pyrotechnic bolt (18) are pushed by 2 lock springs-1 (17) and 2 lock pins-1 (19) slides into slots on the hinge-1 (3) and locking operation is carried out to ensure that the wing-1 (1) remains in its fully deployed position during the flight.

The one-way clutch-1 (15) and one-way clutch-2 (20) in the wing-1 subsystem mechanism and wing-2 subsystem mechanism that are shown respectively in Figure 4 and Figure 5 have the ability to meet the aerodynamic loads that may come in the opposite direction to the system and to prevent the return movement of the system.

In addition, as shown in Figure 8 and Figure 9 in the system, connection interfaces with holes for bolt coupling are available on the spring housing (12), front hinge-2 (13) and rear hinge-2 (11) to connect between the wings and their subsystems by mounting hinge-1 (3) to wing-1 (1), by mounting spring housing (12) to wing-2 (9), by mounting front hinge-2 (13) and rear hinge-2 (11) to hinge-1 (3).

Industrial Application of the Invention

The wing deployment and locking system, which is the subject matter of the invention, can be used in all flying objects where the wing and winglet systems are used to enable the object to fly and remain on air while being subjected to the aerodynamic forces by generating a lifting force, and guide the object by providing it with maneuverability. However, especially in the defense industry where volume limitation is required, it is preferred to be used in cases where the volume requirement is to be reduced by folding the wings onto the munition body before firing, when the munition used is stored inside a canister in an air platform or a tube of the launching platform, thus increasing the firepower by carrying more munitions simultaneously and achieving a longer range along with providing aerodynamic advantages through creating more surface area in a lower volume compared to a fixed wing.

CLAIMS

1. A wing deployment and locking system comprising,

- a wing-1 (1) and a wing-2 (9), forming aerodynamic surface,
- a hinge-1 (3) having one-way clutch-1 (15) at each end through which the hinge-1 can make only radial motion on the wing-1 (1) by radially bearing through a spring retainer (4) and a bearing house (7),
- a pre-stressed machined spring-1 (16) that is fixed to the hinge-1 (3) by means of a spring pin-1 (5) on one side and the spring retainer (4) on the other,
- at least two lock spring-1 (17) and at least two lock pin-1 (19), that are positioned inside a casing (6),
- at least two lock pin housing (30) positioned on the hinge-1 (3) such that at least two lock pin-1 (19) located inside the casing (6) can slide separately into when the wing-1 (1) is in the fully deployed position,
- an actuator mechanism that enable the machined spring-1 (16), which is torsionally loaded when the wing-1 (1) is in the undeployed state, to be released, which allows the hinge-1 (3) to be rotated,
- at least two casing protrusion (26) located on the casing (6),
- at least two hinge-1 recess (25) having a formed surface, which is positioned on the hinge-1 (3) so as to match separately with at least two casing protrusion (26) located on the casing when the wing-1 (1) is in the fully deployed position,
- a spring housing (12) having one-way clutch-2 (20) at each end through which the spring housing can make only radial motion on the wing-2 (9) by radially bearing through a front hinge-2 (13) and a rear hinge-2 (11),
- a pre-stressed machined spring-2 (21) that is fixed to the spring house (12) by means of a spring pin-2 (22) on one side and front hinge-2 (13) on the other,

- at least one lock spring-2 (24) and at least one lock pin-2 (23), that are located inside the rear hinge-2 (11),

- a cover-3 (10) that holds the lock spring-2 (24) in the compressed position,

- a rear hinge-2 protrusion (29) located on the rear hinge-2 (11) and a front hinge-2 protrusion (28) located on the front hinge-2 (13),

- a spring housing recess (27) having a formed surface, which is positioned at both end of the spring housing (12) so as to match separately with the front hinge-2 protrusion (28) and the rear hinge-2 protrusion (29) when the wing-2 (9) is in the fully deployed position.

2. The wing deployment and locking system according to claim 1 preferably comprising a pyrotechnic bolt (18) as an actuator mechanism enabling the machined spring-1 (16) to switch from the torsion-state to the released state.

3. The wing deployment and locking system according to claim 2 wherein the pyrotechnic bolt (18) is positioned to link together the hinge-1 (3) and the casing (6).

4. The wing deployment and locking system according to claim 1 further comprising connecting interfaces for mounting the front hinge-2 (13) and rear hinge-2 (11) to the wing-1 , and the wing-1 (1) to the hinge-1 (3) by means of bolts.

5. The wing deployment and locking system according to claim 1 further comprising a cover-1 (2) and a cover-2 (8) that are positioned to cover both ends of the hinge-1 (3), and a cover-4 (14) positioned at one end of the front hinge-2 (13).

6. A method for opening the wing-1 (1) of the wing deployment and locking system according to claim 1 comprising the steps:

- firing the pyrotechnic bolt (18) which keeps the hinge-1 (3) in a locked position so as to prevent its rotation, and the machined spring-1 (16) in the torsion-state,

- releasing the machined spring-1 (16) and the hinge-1 (3) by firing the pyrotechnic bolt (18),

- enabling the deployment of the wing-1 (1) by rotating the hinge-1 (3), to which the released machined spring-1 (16) is fixed by means of the spring pin-1 (5), to allow for making only radial motion over the wing-1 (1) by means of bearings

- knocking of the at least two casing protrusion (26) on the casing (6) separately into the at least two hinge-1 recess (25) having a formed surface on the hinge-1 (3) which is rotated when the wing-1 comes to the fully deployed position, which results in the hinge-1 (3) being prevented from making radial motion, and thus the wing-1 (3) being prevented from being rotated further from its fully deployed position.

7. A method for opening the wing-2 (9) of the wing deployment and locking system according to claim 1 comprising the steps:

- releasing the machined spring-2 (21) which is in the torsion-state when the wing-2 (9) is in the undeployed state,

- enabling the deployment of the wing-2 (9) by rotating the spring housing (12), to which the released machined spring-2 (21) is connected by means of the spring pin-2 (22), to allow for making only radial motion over the wing-2 (9) by means of bearings

- knocking of the front hinge-2 protrusion (28) and the rear hinge-2 protrusion (29) into the spring housing recess (27) having a formed surface at both end of the spring housing (12) which is rotated when the wing-2 comes to the fully deployed position, which results in the spring housing (12) being prevented from making radial motion, and thus the wing-2 (9) being prevented from being rotated further from its fully deployed position.

8. A method for deployed state locking of the wing-1 (1) of the wing deployment and locking system according to claim 1 wherein the at least two lock pin-1 (19) being pushed by the at least two lock spring-1 (17), that are located inside the casing (6), are inserted into the at least two lock pin housing (30) located on the hinge-1 (3) to ensure the locking when the wing-1 (1) comes to the fully deployed position.

9. A method for deployed state locking of the wing-2 (9) of the wing deployment and locking system according to claim 1 wherein a slot on the at least one lock pin-2 (23) being pushed by the at least one lock spring-2 (24), that are located inside the rear hinge-2 (11), is matched up with a formed surface on the machined spring-2 (21) to ensure the locking when the wing-2 (9) comes to the fully deployed position.

Figure 1

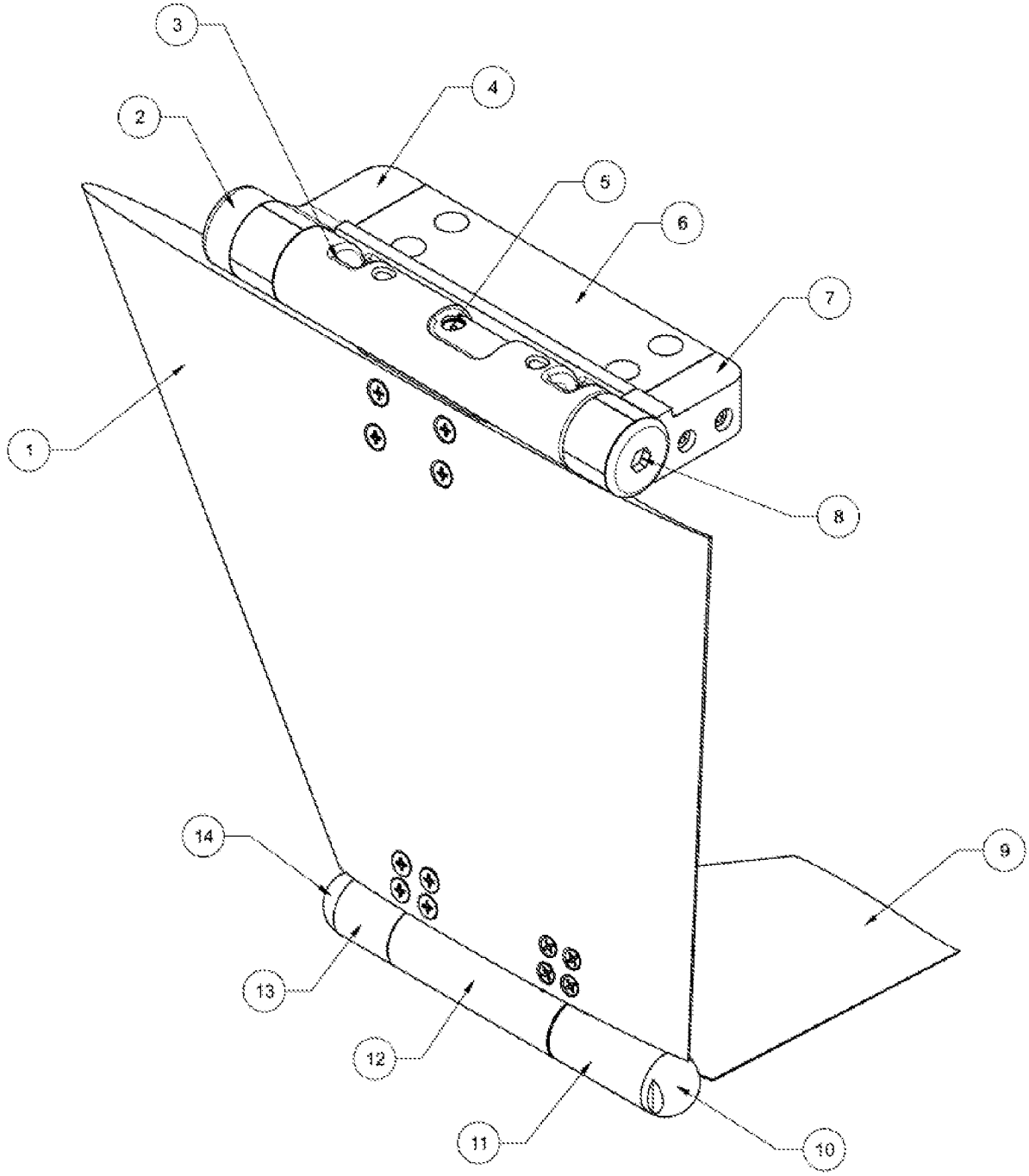


Figure 2

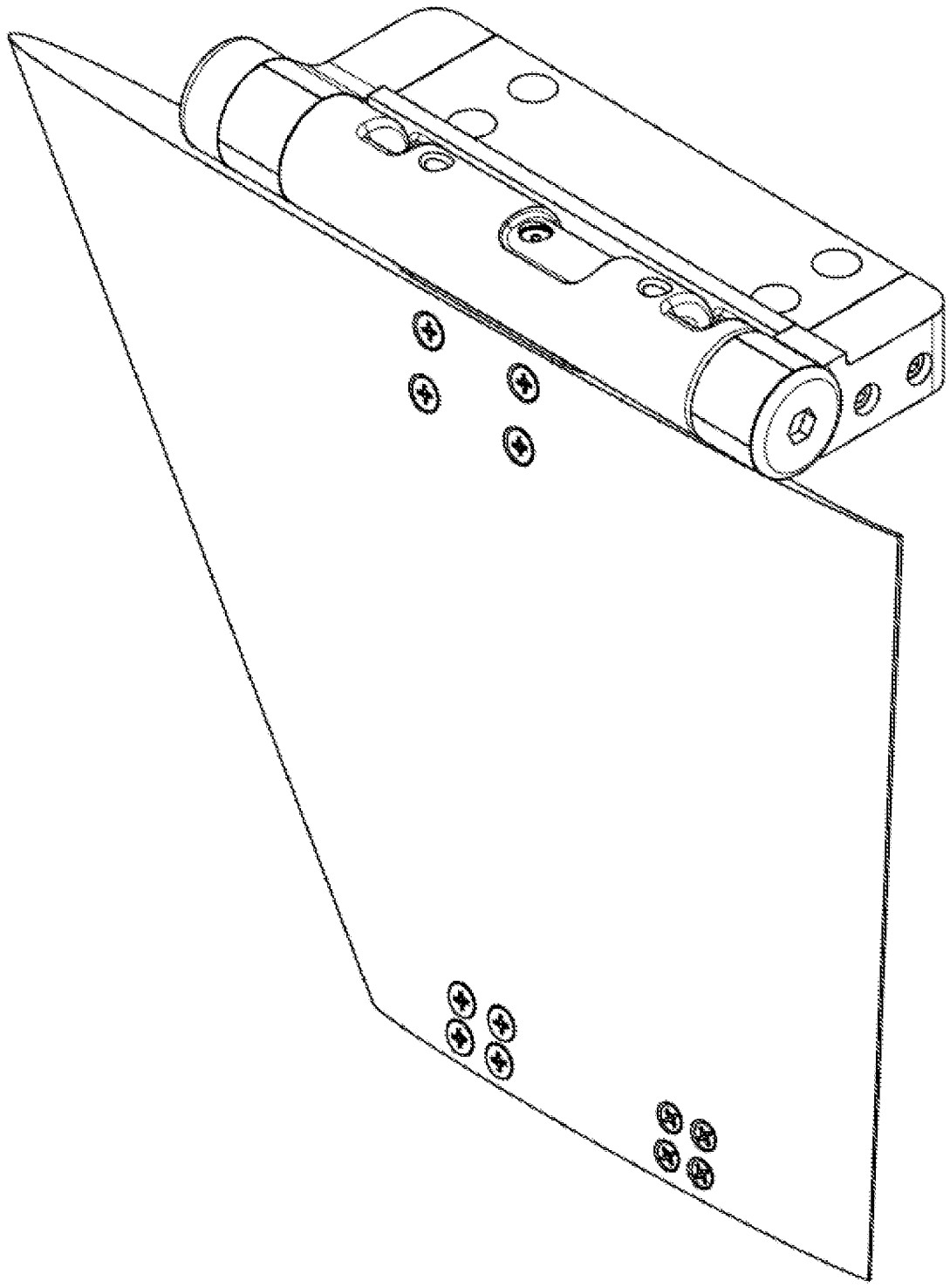


Figure 3

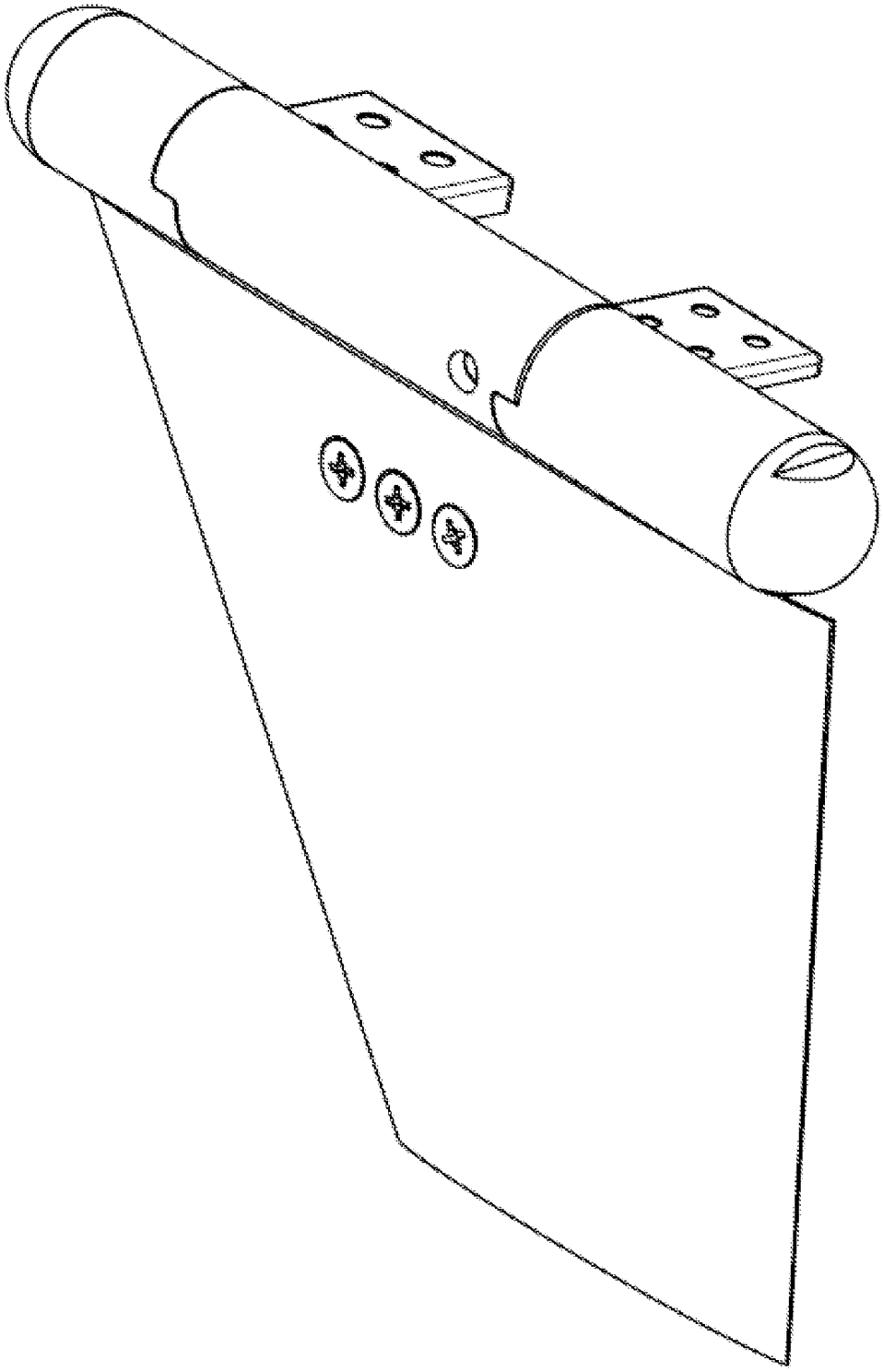


Figure 4

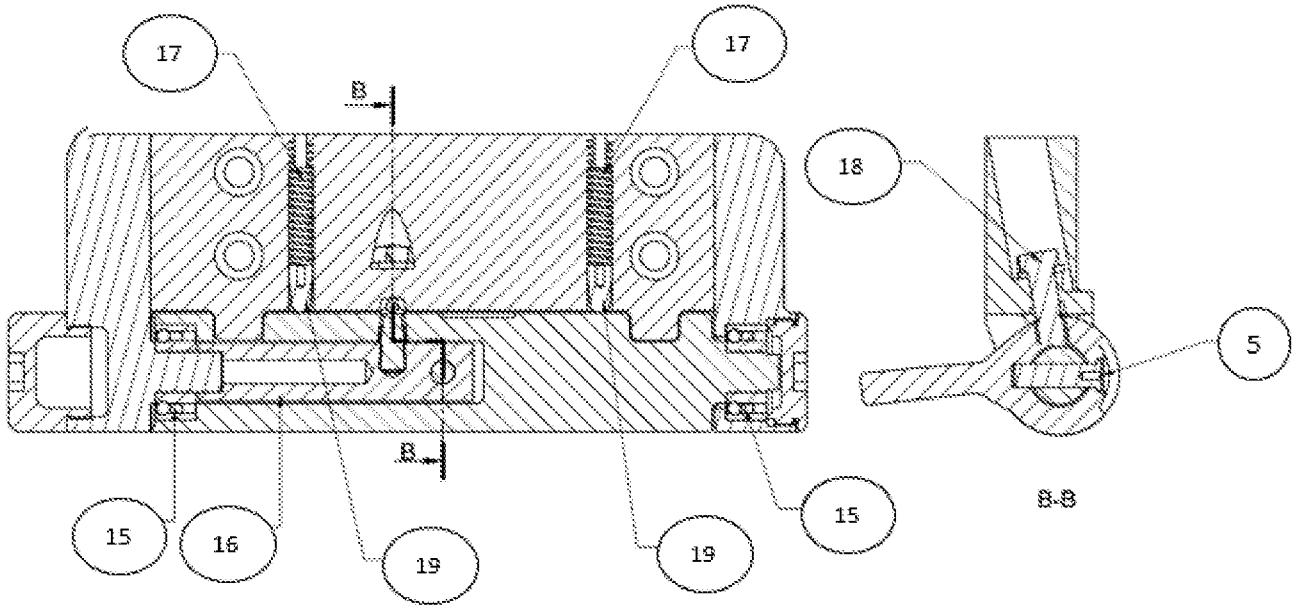


Figure 5

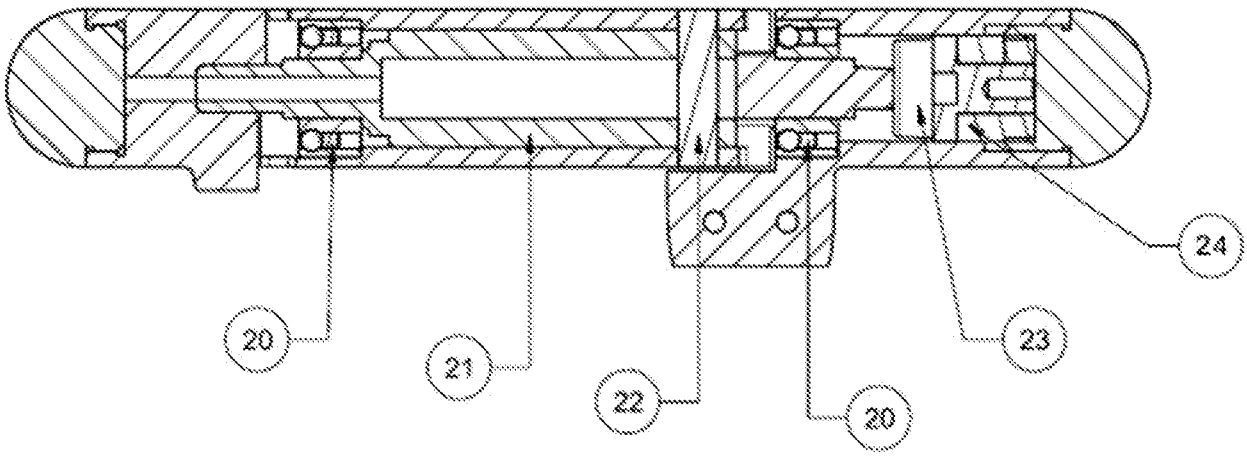


Figure 6

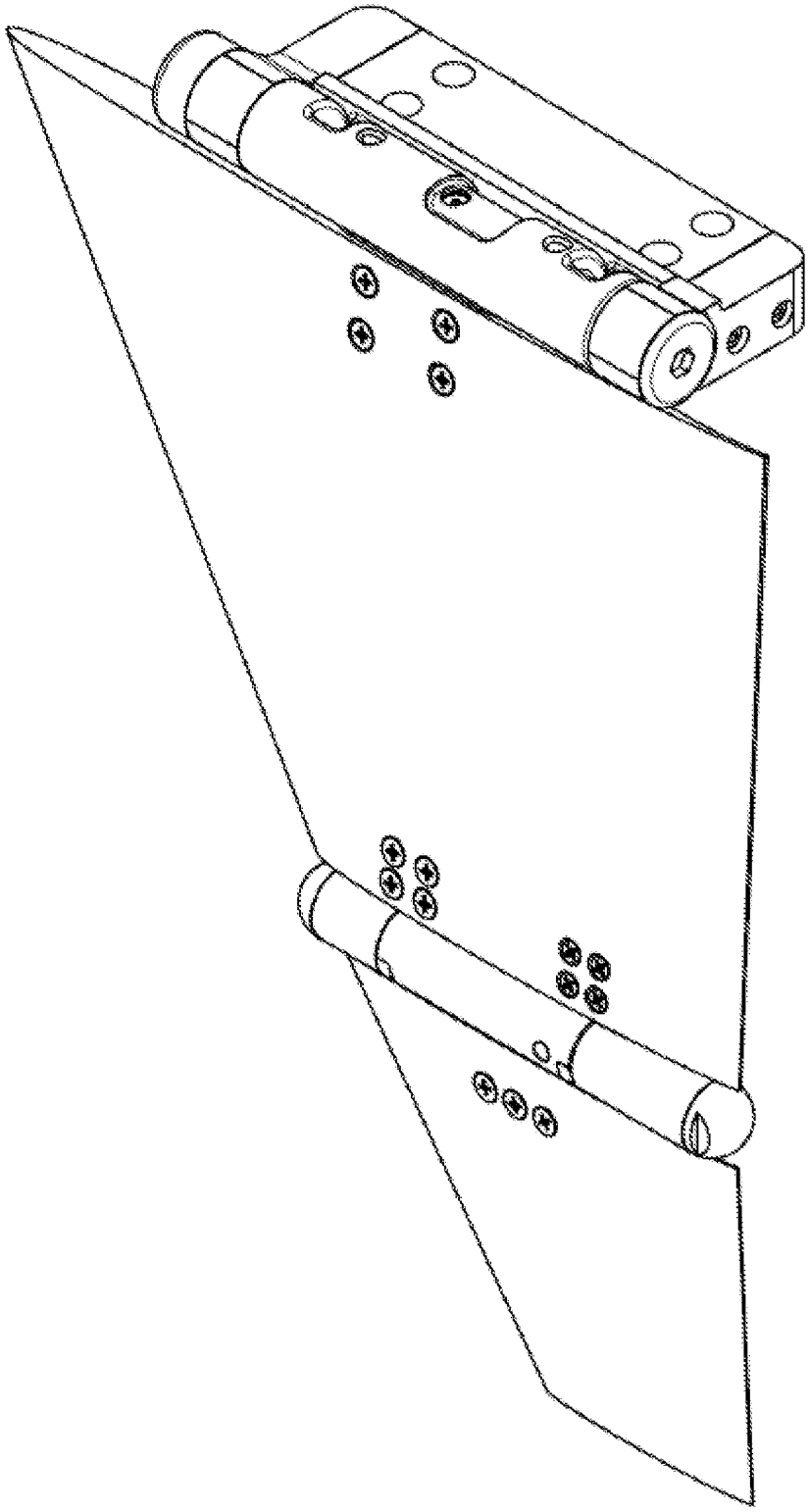


Figure 7

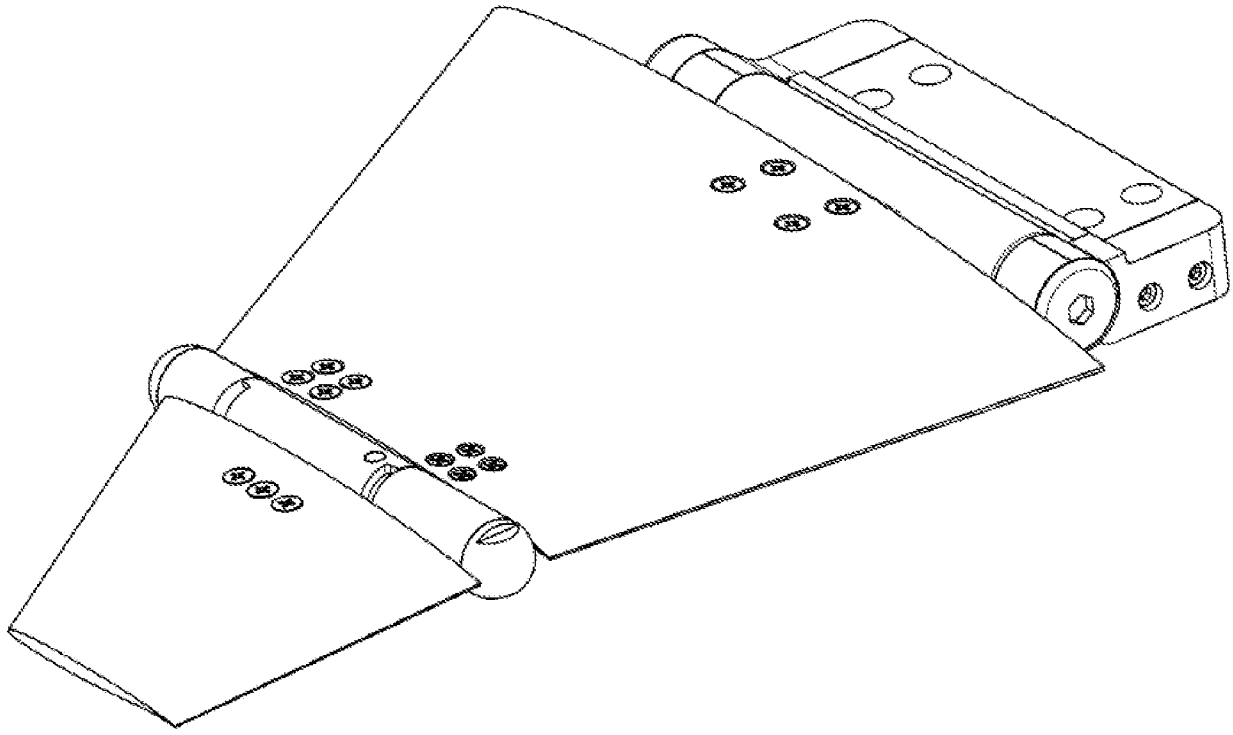


Figure 8

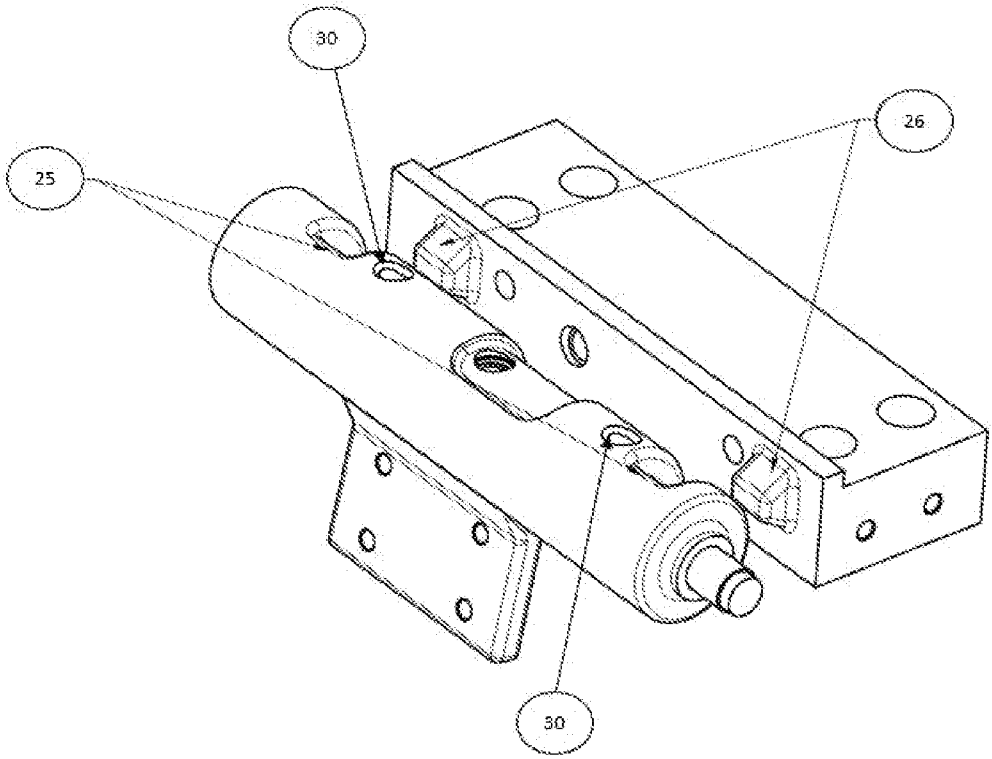
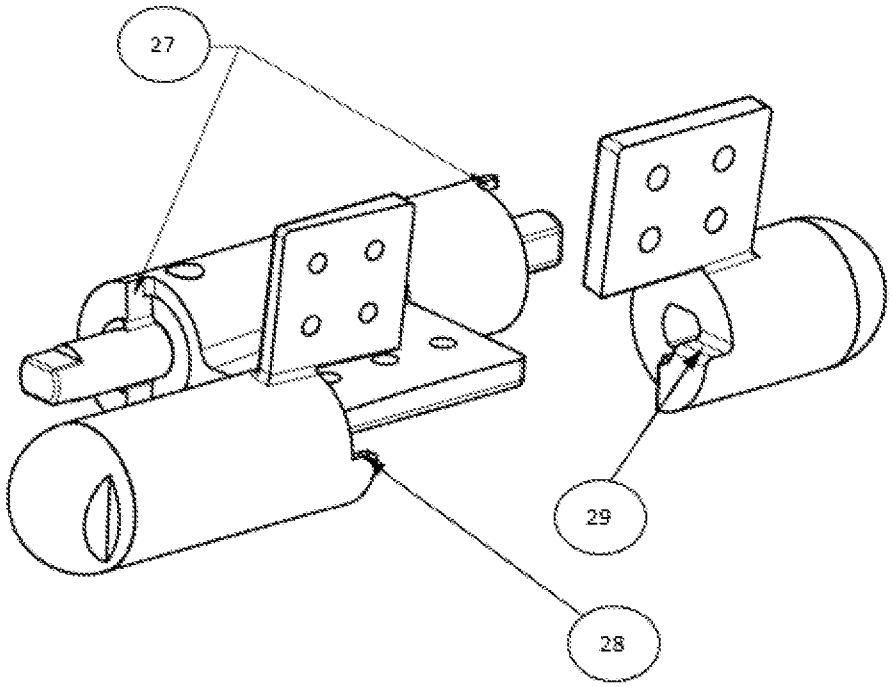


Figure 9



INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2020/051709

A. CLASSIFICATION OF SUBJECT MATTER
INV. F42B10/16
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F42B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 26 49 643 A1 (MESSERSCHMITT BOELKOW BLOHM) 15 June 1978 (1978-06-15) figures page 5, paragraph 3 - page 6, last paragraph	1-9
A	FR 929 040 A (ROBERT ROGER-AIME; MATGE PIERRE [FR]) 15 December 1947 (1947-12-15) figures 7-9 page 2, lines 43-85	1-9
A	KR 101 833 682 B1 (AGENCY DEFENSE DEV [KR]) 2 March 2018 (2018-03-02) figures 1-6,10 paragraphs [0074] - [0083] paragraphs [0106] - [0111]	1

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|X| See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
15 May 2020	28/05/2020

Name and mailing address of the ISA/	Authorized officer
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International application No
PCT/IB2020/051709

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 3 421 925 A1 (MBDA FRANCE [FR]) 2 January 2019 (2019-01-02) abstract; figures paragraphs [0032] - [0034] paragraphs [0037] - [0054] -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		FR 3068094 A1	28-12-2018
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