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(54) Title: A FASTENER MECHANISM

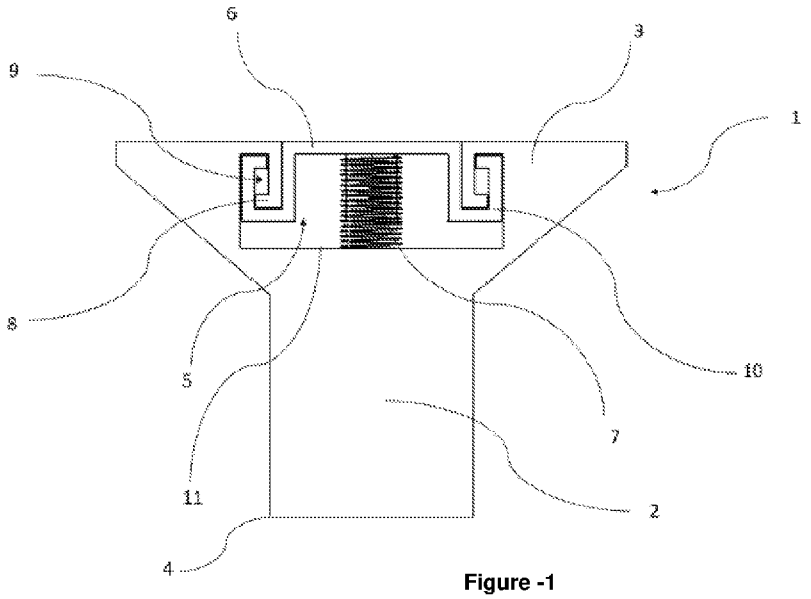

Figure -1

(57) Abstract: The present invention relates to a fastener (2) that enables at least two structural parts (Y) to be connected to each other; at least one head (3) located on the fastener (2) and contacting at least one of the structural parts (Y) in the connected state; at least one handle (4) extending outward from the head (3) and contacting two structural parts (Y) when connected; at least one opening (5) located on the head (3) for placing the fastening apparatus (A) in the fastener; at least one plug (6) located in the opening (5) in a movable manner; at least one spring (7) on the fastener (2), which is compressed upon a force applied to the plug (6), or released when the applied force is removed, thereby triggering the plug (6) to move in the opening (5); a first position (I) in which the spring (7) is compressed by the contact of the fastening apparatus (A) with the plug (6); a second position (II) in which the spring (7) is released by removing the fastening apparatus (A) from the opening (5).

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A FASTENER MECHANISM

This invention relates to a fastener with Low Radar Cross Section Area, which is used in platforms utilized in production.

The technology developed to reduce Radar Cross Section (RCA) is currently used in sea, land and air platforms. One of the most important parameters of reducing the Radar Cross Section (RCA) on platforms is to eliminate or minimize the impedance discontinuities of a surface. One of the most important reasons for impedance discontinuities on surfaces is the fasteners used on platforms. A number of fasteners used on platform surfaces negatively affect the low Radar Cross Section (RCA) profile. The main reasons for this are the impedance discontinuities created by the screwing hole at the head of the fastener, and the multiple electromagnetic scattering centers formed by the cavity effect caused by the screwing hole at the head of the fastener. To achieve this, the most common uses are flake and paste applications. With the use of these methods, eliminating impedance discontinuities and cavity-induced multiple reflection points comes to the forefront. However, existing methods create disadvantages in terms of application times, energy consumed, labor costs and maintenance costs.

US5074730A, which is included in the known-state of the art, discloses a fastener comprising a bolt with an enlarged head at one end and a nose at the other end. Said patent document discloses a spring mechanism, in which the spring is compressed to provide an up and down movement of an interface in the fastener.

Thanks to a fastener mechanism according to the present invention, a system that eliminates surface discontinuities and cavity-induced multiple reflection points is obtained.

Another object of the present invention is to achieve a weight gain by reducing the use of additional materials and modifying the fastener structure, thanks to the binder mechanism.

Another object of the present invention is to achieve surface continuity on aerodynamic surfaces of the platforms.

The fastener mechanism realized to achieve the object of the present invention, which is defined in the first claim and other claims dependent thereon, comprises a fastener connecting structural parts or allowing them to contact each other that are used in production or as a product; a plug acting as an interface and contacting a fastening apparatus or a user-preferred tool, e.g. a screwdriver, inserted into a head portion of the fastener, so as to move into the fastener. The plug can move in the fastener when the spring in contact with the plug is compressed or released. As the spring is compressed, the plug moves to a first position (I) and becomes screwable. If the fastening apparatus does not contact, the spring is released, so that the plug is moved upwards towards a second position (II).

The fastener mechanism according to the invention comprises an extension on the fastener, which allows the plug to remain in the second position (II) when it reaches the aerodynamic surface of the fastener or the upper surface of the coupling hole. This extension can be provided at the fastener as a single piece with the fastener, in an area of the fastening apparatus, or can be attached to the fastener later. The extension can serve as a stopper so that the plug remains or stays in the fastener following removal of the fastening apparatus from the fastener.

In an embodiment of the invention, the fastener mechanism enables protrusions of the plug to be placed in a space created by the extensions on the side walls of the fastener.

In an embodiment of the invention, the fastener mechanism comprises a system in which the plug can be removed and inserted into the fastener such that protrusions of the plug push the opposite extensions of the fastener.

In an embodiment of the invention, the fastener mechanism provides a monolithic surface by completely covering the hole for mounting the fastener. Surface continuity is provided on the platform where it is installed by blocking or filling the fastener opening with the plug.

In an embodiment of the invention, the fastener mechanism comprises a fastener base to prevent downward movement of the plug through the fastener. When the plug contacts this base, it can hit and stop.

In an embodiment of the invention, the fastener mechanism comprises a spring to move the plug; or a flexible material that allows the movement of the plug. The spring enables the movement of the plug by not directly contacting the fastening apparatus.

In an embodiment of the invention, the fastener mechanism comprises a mechanism in which the spring that enables the movement of the plug is positioned between the plug and the base.

In an embodiment of the invention, the fastener mechanism enables the fastener to be removably attached to the platforms via apparatus.

In an embodiment of the invention, the fastener mechanism can be produced by additive manufacturing or by means of traditional assembly.

In an embodiment of the invention, the fastener mechanism can be form-compatible with the fastener apparatus.

Radar visibility can be adjusted by coating a radar absorbing material or a conductive material on the fastener.

The fastener mechanism realized to achieve the object of the present invention is illustrated in the attached drawings, in which:

Figure 1 is a cross-sectional view of the fastener mechanism.
Figure 2 is a perspective view of the fastener mechanism in the first position (I).
Figure 3 is a perspective view of the fastener mechanism in the second position (II).

All the parts illustrated in figures are individually assigned a reference numeral and the corresponding terms of these numbers are listed below:

1. Fastener Mechanism
2. Fastener
3. Head
4. Handle
5. Opening
6. Plug
7. Spring
8. Extension
9. Space
10. Protrusion
11. Base

(Y) Structural Part
(A) Fastening Apparatus
(D) Hole
(I) First Position
(II) Second Position

The fastener mechanism (1) comprises a fastener (2) that enables at least two structural parts (Y) to be connected to each other; at least one head (3) located on the fastener (2) and contacting at least one of the structural parts (Y) in the connected state; at least one handle (4) extending outward from the head (3) and contacting two structural parts (Y) when connected; at least one opening (5) located on the head (3) for placing the fastening apparatus (A) in the fastener; at least one plug (6) located in the opening (5) in a movable manner; at least one spring (7) on the fastener (2), which is compressed upon a force applied to the plug (6), or released when the applied force is removed, thereby triggering the plug (6) to move in the opening (5); a first position (I) in which the spring (7) is compressed by the contact of the fastening apparatus (A) with the plug (6); a second position (II) in which the spring (7) is released by removing the fastening apparatus (A) from the opening (5).

The fastener mechanism (1) according to the invention comprises at least one extension (8) located integrally with the head (3), extending from the head (3) towards the opening (5), and at least partially contacting the plug (6) to fix the plug (6) in the second position (II).

The fastener mechanism (1) comprises fasteners (2) used to connect or attach structural parts (Y) used on platforms to each other. The fastening apparatus (A) contacts the head (3) on the fastener (2) and the opening (5) on the head (3), so that the plug (6) located movably in the opening (5) and the spring (7) contacting the plug (6) are compressed. In this way, the plug (6) can move to the first position (I) and allow the handle (4) part of the fastener (2) to be inserted into the structural part (Y). When the contact of the fastening apparatus (A) with the plug (6) decreases, the spring (7) is released, thus the plug (6) almost completely closes the opening (5) and moves to the second position (II). In order to avoid removal of the plug (6) from the fastener (2) or to fix it in the second position (II), an extension (8) is provided on the fastener (2) aligned with the head (3).

In an embodiment of the invention, the fastener mechanism (1) comprises at least one space (9) formed on a wall of the opening (5) by means of the extension (8) in the head (3); at least one protrusion (10) which is located on the plug (6) placed inside the space (9). A space (9) is created on the wall of the opening (5) by means of the extension (8) inside the head (3) part of the plug (6). The protrusions (10) of the plug (6) can be placed in this space (9).

In an embodiment of the invention, the fastener mechanism (1) comprises at least two flexible extensions (8) located opposite each other within the opening (5) for the removable attachment of the plug (6); at least two flexible protrusions (10) located opposite to the extensions (8), in a form-compatible manner with the extensions (8). The contact of the extension (8) and protrusions (10) enables them to guide each other, thereby controlling the movement of the plug within the fastener.

In an embodiment of the invention, the fastener mechanism (1) comprises at least one hole (D) on the structural part (Y); the fastener (2) which almost completely covers the hole (D) in a form-compatible manner with the hole (D) and provides surface continuity on the structural part (Y).

In an embodiment of the invention, the fastener mechanism (1) comprises a base (11) located on the opening (5) and preventing the plug from moving from the first position (I)

in a direction of the handle (4). The base (11) enables the plug (6) to move in a controlled manner in the pushing direction and to stop at a point predetermined by the user.

In an embodiment of the invention, the fastener mechanism (1) comprises the spring (7) located between the plug (6) and the base (11). The spring (7) contacts the plug (6) to enable the movement of the plug (6) within the fastener (2).

In an embodiment of the invention, the fastener mechanism (1) comprises the plug (6) that almost completely covers the head opening in the second position (II). Therefore, it eliminates the surface discontinuity created by the hole (D) in the structural part (Y), and provides a monolithic surface on the surface to which it is attached.

In an embodiment of the invention, the fastener mechanism (1) comprises the fastener (2) removably attached to the structural part (Y). Depending on the user's preference, the fastener (2) can be removably attached to the structural part (Y) by pushing and/or rotating.

In an embodiment of the invention, the fastener mechanism (1) comprises the fastener (2) produced by additive manufacturing.

In an embodiment of the invention, the fastener mechanism (1) comprises the opening (5) that is form-compatible with the fastening apparatus (A). Thus, the fastener (2) can be easily placed on the structural part (Y).

In an embodiment of the invention, the fastener mechanism (1) comprises the head (3) which is coated with a radar absorbing material or a conductive material and located almost completely aligned with the aerodynamic surface of the structural part (Y). An upper part of the fastener (2) on the aerodynamic surface that is connected to the structural part (Y) can be covered with a radar absorbing material or a conductive material according to the user's preference. Therefore, radar visibility can be adjusted to a desired level.

In an embodiment of the invention, the fastener mechanism (1) comprises the fastener (2) suitable for use in a space or air vehicle.

CLAIMS

1. A fastener mechanism (1) comprising a fastener (2) that enables at least two structural parts (Y) to be connected to each other; at least one head (3) located on the fastener (2) and contacting at least one of the structural parts (Y) in the connected state; at least one handle (4) extending outward from the head (3) and contacting two structural parts (Y) when connected; at least one opening (5) located on the head (3) for placing the fastening apparatus (A) in the fastener; at least one plug (6) located in the opening (5) in a movable manner; at least one spring (7) on the fastener (2), which is compressed upon a force applied to the plug (6), or released when the applied force is removed, thereby triggering the plug (6) to move in the opening (5); a first position (I) in which the spring (7) is compressed by the contact of the fastening apparatus (A) with the plug (6); a second position (II) in which the spring (7) is released by removing the fastening apparatus (A) from the opening (5), **characterized by** at least one extension (8) located integrally with the head (3), extending from the head (3) towards the opening (5), and at least partially contacting the plug (6) to fix the plug (6) in the second position (II).

2. A fastener mechanism (1) according to claim 1, **characterized by** at least one space (9) formed on a wall of the opening (5) by means of the extension (8) in the head (3); at least one protrusion (10) which is located on the plug (6) placed inside the space (9).

3. A fastener mechanism (1) according to any of the above claims, **characterized by** at least two flexible extensions (8) located opposite each other within the opening (5) for the removable attachment of the plug (6); at least two flexible protrusions (10) located opposite to the extensions (8), in a form-compatible manner with the extensions (8).

4. A fastener mechanism (1) according to any of the above claims, **characterized by** at least one hole (D) on the structural part (Y); the fastener (2) which almost completely covers the hole (D) in a form-compatible manner with the hole (D) and provides surface continuity on the structural part (Y).

5. A fastener mechanism (1) according to any of the above claims, **characterized by** at least one base (11) located on the opening (5) and acting as a stopper for the movement of the plug (6) from the first position (I) in a direction of the handle (4).

6. A fastener mechanism (1) according to claim 5, **characterized by** the spring (7) located between the plug (6) and the base (11).

7. A fastener mechanism (1) according to any of the above claims, **characterized by** the plug (6) that almost completely covers the opening (5) in the second position (II).

8. A fastener mechanism (1) according to any of the above claims, **characterized by** the fastener (2) removably attached to the structural part (Y).

9. A fastener mechanism (1) according to any of the above claims, **characterized by** the fastener (2) produced by additive manufacturing.

10. A fastener mechanism (1) according to any of the above claims, **characterized by** the opening (5) that is form-compatible with the fastening apparatus (A).

11. A fastener mechanism (1) **characterized by** the head (3) which is coated with a radar absorbing material or a conductive material and located almost completely aligned with the aerodynamic surface of the structural part (Y).

12. A fastener mechanism (1) according to any of the above claims, **characterized by** the fastener (2) suitable for use in a space or air vehicle.

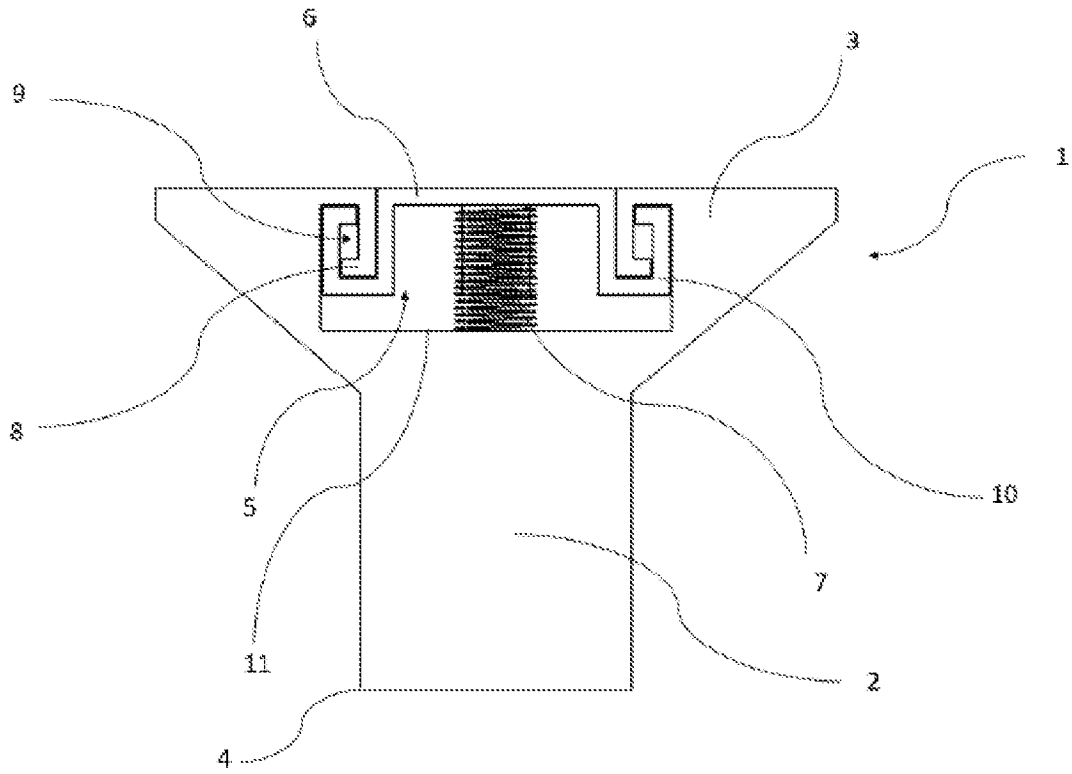

Figure -1

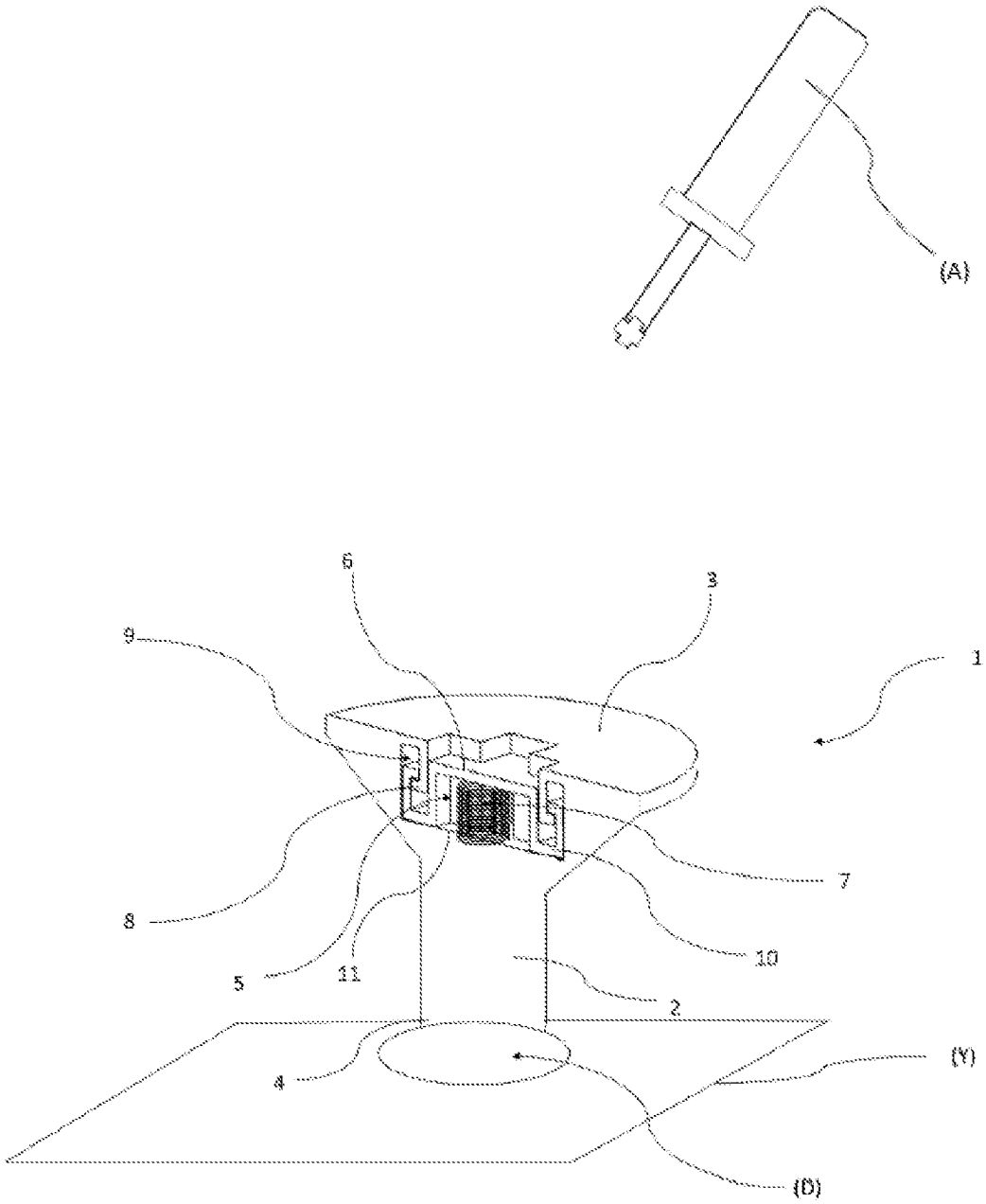

Figure – 2

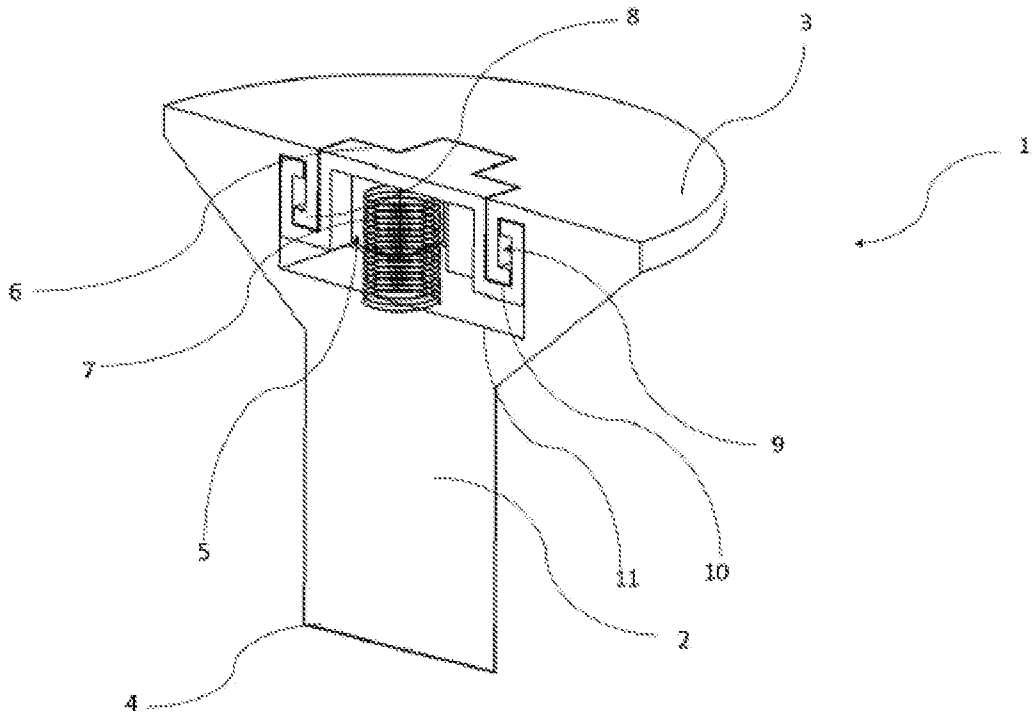

Figure – 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/TR2023/051263

A. CLASSIFICATION OF SUBJECT MATTER
INV. F16B23/00 F16B37/14
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)
F16B B64C B64D

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.
X	CN 109 458 388 A (GUIZHOU HANGTAI PREC MANUFACTURING CO LTD) 12 March 2019 (2019-03-12) the whole document	1-10,12
X	US 4 822 227 A (DURAN JOHN A [US]) 18 April 1989 (1989-04-18) the whole document	1-10,12
X	JP H05 164121 A (MITSUBISHI HEAVY IND LTD) 29 June 1993 (1993-06-29) figures 1-4 paragraphs [0006] - [0009]	11,12
X	US 4 681 497 A (BERECZ IMRE [US]) 21 July 1987 (1987-07-21) the whole document	11,12

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance;; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance;; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 February 2024	27/02/2024

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Schandel, Yannick

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INTERNATIONAL SEARCH REPORT

International application No
PCT/TR2023/051263

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2007 126119 A (MITSUBISHI HEAVY IND LTD) 24 May 2007 (2007-05-24) the whole document	11,12

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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