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- (54) Title:** COOLING WATER VALVE

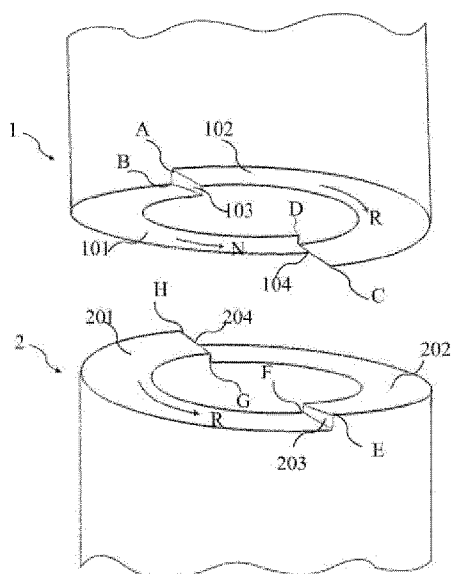


Fig. 1

- (57) Abstract:** The present patent application discloses a cooling water valve, comprising an upper valve core (1) and a lower valve core (2) that are connected to each other in a height direction; the upper end face of the lower valve core comprises a first lower slope (201) and a second lower slope (202) that are connected in a circumferential direction, the first lower slope and the second lower slope respectively showing a descending trend in a forward direction; the lower end face of the upper valve core comprises a first upper slope (101) and a second upper slope (102) that are connected in a circumferential direction, the first upper slope and the second upper slope respectively showing an ascending trend in a forward direction; the first lower slope fits the first upper slope, the second lower slope fits the second upper slope, and the upper valve core is rotatable in a forward or a reverse direction; when the upper valve core rotates in the forward direction, the lower valve core rotates synchronously with the upper valve core; when the upper valve core rotates in the reverse direction, the lower valve core does not rotate synchronously with the upper valve core. The present patent application allows a reduction of the total volume of the valve core to save space while providing diverse functional modes.

Description

Title of the Invention

Cooling water valve

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Technical Field

The present patent application relates to the field of new-energy vehicle technology, in particular to a cooling water valve.

10 **Background Art**

With a cooling water valve in a new-energy vehicle in the current market, the gear is driven by an actuator to drive the valve core, thereby switching between functions; however, since there is a demand for water valves with increasingly diverse functional modes, how to increase the functional modes of water valves has become a difficult problem; most cooling water valves in the current market
15 comprise a single actuator and a single valve core, so complex functions may often be fulfilled only by increasing the sizes or number of valve cores; with a few cooling water valves, the number of actuators is increased to add diverse functional modes, but such a product is expensive because it comprises two actuators, which cannot
20 satisfy consumers.

Summary of the Patent Application

An objective of the present patent application is to solve the problem of a cooling water valve with a single valve core having limited functional modes. The present
25 utility model provides a cooling water valve that allows a reduction of the total volume of the valve core to save space while providing diverse functional modes.

To solve the above technical problem, an embodiment of the present patent application discloses a cooling water valve, comprising an upper valve core and a

lower valve core that are connected to each other in a height direction; the upper end face of the lower valve core comprises a first lower slope and a second lower slope that are connected in a circumferential direction, the first lower slope and the second lower slope respectively showing a descending trend in a forward direction;

5 the lower end face of the upper valve core comprises a first upper slope and a second upper slope that are connected in a circumferential direction, the first upper slope and the second upper slope respectively showing an ascending trend in a forward direction; the first lower slope fits the first upper slope, the second lower slope fits the second upper slope, and the upper valve core is rotatable in a forward

10 or a reverse direction; when the upper valve core rotates in the forward direction, the lower valve core rotates synchronously with the upper valve core; when the upper valve core rotates in the reverse direction, the lower valve core does not rotate synchronously with the upper valve core.

15 According to the above technical solution, when the upper valve core rotates in a forward direction, the lower valve core is driven by the upper valve core to rotate synchronously therewith, in which case the upper and lower valve cores rotate synchronously to jointly adjust their positions, which means that the upper and lower valve cores rotate to different angles, corresponding to different pipelines,

20 thereby achieving the goal of controlling the coolant flow path to control the working temperatures of the batteries, air conditioner, and other components in the new-energy vehicle; when the upper valve core rotates in a reverse direction, the lower valve core will not be driven by the upper valve core to rotate, in which case the lower valve core does not move, while the upper valve core rotates alone to

25 adjusts its position, which means that the upper valve core rotates to different angles, also corresponding to different pipelines, thereby achieving the goal of controlling the coolant flow path to control the working temperatures of the batteries, air conditioner, and other components in the new-energy vehicle. In other words, the upper and lower valve cores may be driven synchronously or asynchronously,

30 so this solution makes it possible to unlock more functional modes compared with a conventional multilayer valve core that allows synchronous rotation only. In another aspect, this solution requires only a single actuator for driving, making it more

convenient to control cost.

According to another specific embodiment of the present patent application, the length of the first lower slope and that of the second lower slope in the height

5 direction gradually decrease in a forward direction, the lowest point of the first lower slope is adjacent to the highest point of the second lower slope, and the lowest point of the first lower slope is lower than the highest point of the second lower slope; the lowest point of the second lower slope is adjacent to the highest point of the first lower slope, and the lowest point of the second lower slope is lower than
10 the highest point of the first lower slope; the length of the first upper slope and that of the second upper slope in the height direction gradually increase in a forward direction, the highest point of the first upper slope is adjacent to the lowest point of the second upper slope, and the highest point of the first upper slope is higher than the lowest point of the second upper slope; the highest point of the second upper
15 slope is adjacent to the lowest point of the first upper slope, and the highest point of the second upper slope is higher than the lowest point of the first upper slope.

According to another specific embodiment of the present patent application, the height difference between the lowest point of the first lower slope and the highest

20 point of the second lower slope forms a first stop surface extending in the height direction, the height difference between the highest point of the first lower slope and the lowest point of the second lower slope forms a second stop surface extending in the height direction, the height difference between the highest point of the first upper slope and the lowest point of the second upper slope forms a third stop
25 surface extending in the height direction, and the height difference between the lowest point of the first upper slope and the highest point of the second upper slope forms a fourth stop surface extending in the height direction, the first stop surface abutting the third stop surface, and the second stop surface abutting the fourth stop surface.

According to another specific embodiment of the present patent application, the first lower slope, the second lower slope, the first upper slope, and the second upper slope are all in the shape of a semicircular ring.

5 Brief Description of the Drawings

Fig. 1 is an exploded view of the upper and lower valve cores in an embodiment of the present patent application;

Fig. 2 is a schematic diagram of the connection between the upper and lower valve cores in an embodiment of the present patent application.

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The reference signs are: 1. upper valve core; 101. first upper slope; 102. second upper slope; 103. third stop surface; 104. fourth stop surface; 2. lower valve core; 201. first lower slope; 202. second lower slope; 203. first stop surface; 204. second stop surface; A. lowest point of the second upper slope; B. highest point of the first upper slope; C. highest point of the second upper slope; D. lowest point of the first upper slope; E. highest point of the second lower slope; F. lowest point of the first lower slope; G. lowest point of the second lower slope; H. highest point of the first lower slope.

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20 Specific Embodiments

Ways of implementing the present patent application are explained below by way of specific embodiments, and those of ordinary skill in the art will be able to easily understand other advantages and effects of the present patent application from the content disclosed herein. Although the description of the present patent application will be presented in conjunction with preferred embodiments, this does not mean that the features of the present patent application are limited to these embodiments. On the contrary, the purpose of presenting the patent application in conjunction with embodiments is to cover other choices or modifications that might be derived on the basis of the claims of the present patent application. In order to provide in-depth understanding of the present patent application, the description below will include many specific details. The present patent application may also be implemented

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without these details. Additionally, to avoid confusing or obfuscating the key points of the present patent application, some specific details will be omitted in the description. It must be explained that where no conflict arises, embodiments in the present patent application may be combined, and features in embodiments may be combined.

It should be noted that in this description, similar labels and letters denote similar terms in the drawings below; therefore, if a term is defined in one drawing, there is no need to further define and explain it in subsequent drawings.

In the description of the present embodiment, it must be explained that directional or positional relationships indicated by the terms “upper”, “lower”, “inner” and “bottom”, etc. are based on directional or positional relationships shown in the drawings, or are directional or positional relationships in usual placement of the present patent application product when in use, and are merely intended to facilitate description of the present patent application and simplify description; they do not indicate or imply that the apparatus or element referred to must have a specific direction and be constructed and operated in a specific direction, and therefore cannot be interpreted as restrictions on the present patent application.

The terms “first”, “second”, etc. merely serve a distinguishing purpose in description, and must not be interpreted as indicating or implying relative importance.

In the description of the present embodiment, it must also be explained that unless otherwise clearly specified and defined, the terms “disposed”, “connected together” and “connected” should be interpreted in a broad sense, e.g. they may indicate a fixed connection, or a detachable connection, or an integral connection; they may indicate a mechanical connection, or an electrical connection; they may indicate a direct connection, or an indirect connection via an intermediate medium, or internal communication between two elements. Those of ordinary skill in the art can interpret the specific meaning of the above-mentioned terms in the present embodiment according to the particular circumstances.

To clarify the object, technical solution and advantages of the present patent application, embodiments of the present patent application are described in further detail below with reference to the drawings.

5 Referring to Fig. 1 and Fig. 2, the present application provides a cooling water valve comprising an upper valve core 1 and a lower valve core 2 that are connected to each other in a height direction (as indicated by the direction Z in Fig. 1); the upper end face of the lower valve core 2 comprises a first lower slope 201 and a second lower slope 202 that are connected in a circumferential direction, wherein the first
10 lower slope 201 and the second lower slope 202 respectively show a descending trend in a forward direction (as indicated by the direction R in Fig. 1), which means that the first lower slope 201 and the second lower slope 202 form the upper end face of the lower valve core 2. The lower end face of the upper valve core 1 comprises a first upper slope 101 and a second upper slope 102 that are connected
15 in a circumferential direction, the first upper slope 101 and the second upper slope 102 respectively showing an ascending trend in a forward direction; the first lower slope 201 fits the first upper slope 101, the second lower slope 202 fits the second upper slope 102, and the upper valve core 1 is rotatable in a forward or a reverse direction (as indicated by the direction N in Fig. 1); when the upper valve core 1
20 rotates in the forward direction, the lower valve core 2 rotates synchronously with the upper valve core 1; when the upper valve core 1 rotates in a reverse direction, the lower valve core 2 does not rotate synchronously with the upper valve core 1. For example, the cooling water valve further comprises an actuator (not shown in a drawing).

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According to the above technical solution, referring to Fig. 1 and Fig. 2, the actuator drives the gear, thus driving the upper valve core 1 to rotate in the forward direction (as indicated by the direction R in Fig. 1), while the lower valve core 2 is driven by the upper valve core 1 to rotate synchronously therewith, in which case the upper
30 valve core 1 and the lower valve core 2 rotate synchronously to jointly adjust their positions, which means that the upper valve core 1 and the lower valve core 2 rotate to different angles, corresponding to different pipelines, thus forming different coolant flow circuits to achieve the purpose of controlling the coolant flow paths,

further controlling the working temperatures of the batteries, air conditioner, and other components in the new-energy vehicle; driven by the actuator, the upper valve core 1 rotates in the reverse direction (as indicated by the direction N in Fig. 1), while the lower valve core 2 is not driven by the upper valve core 1 to rotate, in

5 which case the lower valve core 2 does not move, and the upper valve core 1 rotates alone to adjust its position, which means that the upper valve core 1 rotates to different angles, also corresponding to different pipelines, so different pipelines corresponding to the upper valve core 1 are in communication with the pipelines of the lower valve core 2 that are in this state, thus forming different
10 coolant flow circuits, in order to control the coolant flow paths and further control the working temperatures of the batteries, air conditioner, and other components in the new-energy vehicle. In other words, the upper valve core 1 and the lower valve core 2 may be driven synchronously or asynchronously, so this solution makes it possible to unlock more functional modes, compared with a conventional multilayer
15 valve core that allows synchronous rotation only. In another aspect, this solution requires only a single actuator for driving, making it more convenient to control cost.

In some possible implementations, referring to Fig. 1, the length of the first lower
20 slope 201 and that of the second lower slope 202 gradually decrease in the height direction (as indicated by the Z direction in Fig. 1) in a forward direction (as indicated by the R direction in Fig. 1), with the lowest point F of the first lower slope adjacent to the highest point E of the second lower slope, and the lowest point F of the first lower slope is lower than the highest point E of the second lower slope; the
25 lowest point G of the second lower slope is adjacent to the highest point H of the first lower slope, and the lowest point G of the second lower slope is lower than the highest point H of the first lower slope, which means that the intersection of the first lower slope 201 and the second lower slope 202 is in a stepped shape, or, in other words, in a forward direction, the upper end face of the lower valve core 2
30 comprises two upward steps arranged at intervals.

The length of the first upper slope 101 and that of the second upper slope 102 in the height direction gradually increase in the forward direction, which means that

the lower end face of the upper valve core 1 gradually decreases in the forward direction, or, in other words, the lower end face of the upper valve core 1 gradually approaches the upper end face of the lower valve core 2 in the forward direction. The highest point B of the first upper slope is adjacent to the lowest point A of the second upper slope, and the highest point B of the first upper slope is higher than the lowest point A of the second upper slope; the highest point C of the second upper slope is adjacent to the lowest point D of the first upper slope, and the highest point C of the second upper slope is higher than the lowest point D of the first upper slope, which means that the intersection of the first upper slope 101 and the second upper slope 102 is in a stepped shape, or, in other words, in a forward direction, the lower end face of the upper valve core 1 comprises two downward steps arranged at intervals.

In some possible implementations, referring to Fig. 1, the height difference between the lowest point F of the first lower slope and the highest point E of the second lower slope forms a first stop surface 203 extending in the height direction (as indicated by the direction Z in Fig. 1), the height difference between the highest point H of the first lower slope and the lowest point G of the second lower slope forms a second stop surface 204 extending in the height direction, the height difference between the highest point B of the first upper slope and the lowest point A of the second upper slope forms a third stop surface 103 extending in the height direction, and the height difference between the lowest point D of the first upper slope and the highest point C of the second upper slope forms a fourth stop surface 104 extending in the height direction. In other words, the two sides of the first stop surface 203 in the height direction are located at the lowest point F of the first lower slope and the highest point E of the second lower slope, respectively, the two sides of the second stop surface 204 in the height direction are located at the highest point H of the first lower slope and the lowest point G of the second lower slope, respectively, the two sides of the third stop surface 103 in the height direction are located at the highest point B of the first upper slope and the lowest point A of the second upper slope, respectively, and the two sides of the fourth stop surface 104 in the height direction are located at the lowest point D of the first upper slope and the lowest point C of the second upper slope, respectively. The first stop surface

203 abuts the third stop surface 103, while the second stop surface 204 abuts the fourth stop surface 104. For example, the first stop surface 203, the second stop surface 204, the third stop surface 103, and the fourth stop surface 104 are all rectangular and of the same size.

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According to the above technical solution, referring to Fig. 1 and Fig. 2, the upper valve core 1 is driven by an actuator to rotate in a forward direction (as indicated by the direction R in Fig. 1), while the first stop surface 203 abuts the third stop surface 103, and the second stop surface 204 abuts the fourth stop surface 104, in which case the driving force obtained by the upper valve core 1 can push the first stop surface 203 through the third stop surface 103, and can push the second stop surface 204 through the fourth stop surface 104, thereby allowing synchronous rotation of the upper valve core 1 and the lower valve core 2 to adjust their positions; driven by the actuator, the upper valve core 1 rotates in the reverse direction (as indicated by the direction N in Fig. 1), meaning that the third stop surface 103 and the fourth stop surface 104 also slide in the reverse direction, so the third stop surface 103 separates from the first stop surface 203, and the fourth stop surface 104 also separates from the second stop surface 204, in which case the lower valve core 2, not driven, is nonrotatable, namely motionless, so the asynchronous rotation of the upper valve core 1 and the lower valve core 2 is achieved, which means that the upper valve core 1 rotates alone to adjust the position. In summary, compared with a conventional valve having a single valve core available on the current market, this solution can better provide diverse functional modes while having a smaller total volume to save space.

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In some possible embodiments, referring to Fig. 1, the first lower slope 201, the second lower slope 202, the first upper slope 101, and the second upper slope 102 are all in the shape of a semicircular ring. For example, the first lower slope 201 and the second lower slope 202 each occupy half of the upper end face of the lower valve core 2, while the first upper slope 101 and the second upper slope 102 each occupy half of the lower end face of the upper valve core 1, wherein this design can produce a balancing effect so that the upper valve core 1, when rotating in a forward direction, may better drive the lower valve core 2 to rotate, and then they

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jointly adjust their positions to allow control of the coolant flow path.

Although the present patent application has been illustrated and described by referring to some preferred embodiments thereof, those of ordinary skill in the art
5 should understand that the above content is a more detailed explanation of the present patent application given in conjunction with specific embodiments, and it cannot be determined that specific implementation of the present patent application is limited to these explanations. Those of ordinary skill in the art can make various changes thereto in form and detail, including making some simple deductions or
10 substitutions, without deviating from the spirit and scope of the present patent application.

Claims

1. A cooling water valve, wherein it comprises an upper valve core and a lower valve core that are connected to each other in a height direction, wherein

5 the upper end face of the lower valve core comprises a first lower slope and a second lower slope that are connected in a circumferential direction, the first lower slope and the second lower slope respectively showing a descending trend in a forward direction;

the lower end face of the upper valve core comprises a first upper slope and a
10 second upper slope that are connected in a circumferential direction, the first upper slope and the second upper slope respectively showing an ascending trend in a forward direction;

the first lower slope fits the first upper slope, the second lower slope fits the second upper slope, and the upper valve core is rotatable in a forward or a reverse
15 direction;

when the upper valve core rotates in the forward direction, the lower valve core rotates synchronously with the upper valve core;

when the upper valve core rotates in the reverse direction, the lower valve core does not rotate synchronously with the upper valve core.

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2. The cooling water valve as claimed in claim 1, wherein the length of the first lower slope and that of the second lower slope in the height direction gradually decrease in a forward direction, the lowest point of the first lower slope is adjacent to the highest point of the second lower slope, and the lowest point of the first lower
25 slope is lower than the highest point of the second lower slope; the lowest point of the second lower slope is adjacent to the highest point of the first lower slope, and the lowest point of the second lower slope is lower than the highest point of the first lower slope; the length of the first upper slope and that of the second upper slope in the height direction gradually increase in a forward direction, the highest point of
30 the first upper slope is adjacent to the lowest point of the second upper slope, and

the highest point of the first upper slope is higher than the lowest point of the second upper slope; the highest point of the second upper slope is adjacent to the lowest point of the first upper slope, and the highest point of the second upper slope is higher than the lowest point of the first upper slope.

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3. The cooling water valve as claimed in claim 2, wherein the height difference between the lowest point of the first lower slope and the highest point of the second lower slope forms a first stop surface extending in the height direction, the height difference between the highest point of the first lower slope and the lowest point of the second lower slope forms a second stop surface extending in the height direction, the height difference between the highest point of the first upper slope and the lowest point of the second upper slope forms a third stop surface extending in the height direction, and the height difference between the lowest point of the first upper slope and the highest point of the second upper slope forms a fourth stop surface extending in the height direction, the first stop surface abutting the third stop surface, and the second stop surface abutting the fourth stop surface.

4. The cooling water valve as claimed in claim 1, wherein the first lower slope, the second lower slope, the first upper slope, and the second upper slope are all in the shape of a semicircular ring.

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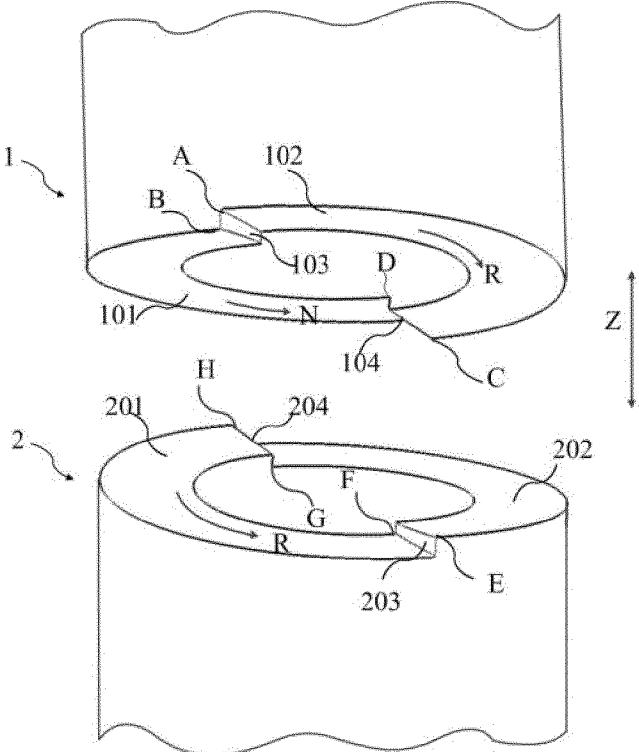


Fig. 1

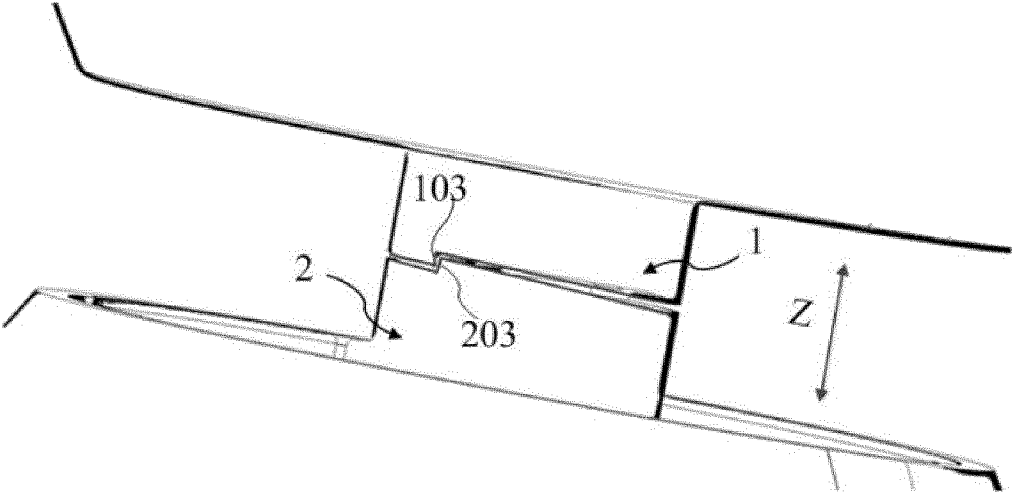


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No

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A. CLASSIFICATION OF SUBJECT MATTER INV. F16K11/085 F16K11/16 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) F16K		
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, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 201 561 183 U (YU GUOZHONG) 25 August 2010 (2010-08-25) figure 1	1 - 4
A	----- CN 113 251 179 A (MIANYANG FULIN SEIKO CO LTD) 13 August 2021 (2021-08-13) figures 1,3 -----	1 - 4
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
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Date of the actual completion of the international search 30 May 2024		Date of mailing of the international search report 13/06/2024
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer París López, Rosa

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
CN 201561183 U	25-08-2010	NONE	

CN 113251179 A	13-08-2021	NONE	
