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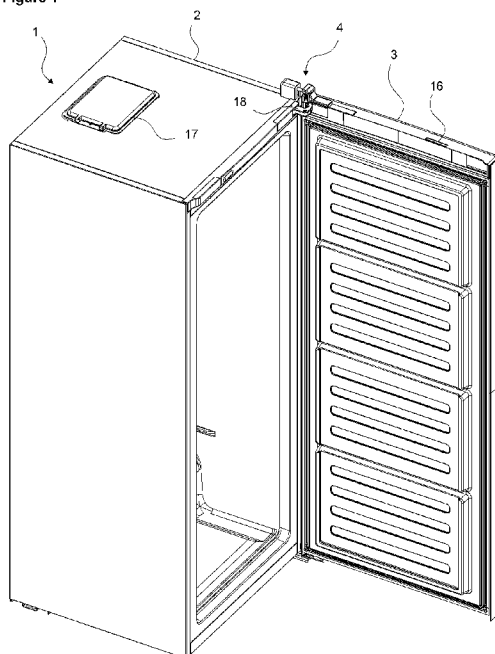
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(54) Title: A COOLING DEVICE COMPRISING A DOOR CLOSING MECHANISM AND THE CONTROL METHOD

Figure 1



(57) Abstract: The present invention relates to a cooling device (1) compris-
ing one or more than body (2) wherein the objects to be cooled are placed
and that have an inlet port (A) enabling the user to access therein; one or
more than door (3) that prevents the heat transfer between the body (2) and
the outer environment when closed, that enables the user to access the interi-
or of the body (2) when opened and that is mounted to one side of the body
(2); at least one hinge (18) that enables the door (3) to open/close and to ro-
tate around the edge of the door (3) is mounted to the body (2); a sensor (16)
that detects if the door (3) is open; a control unit (17), and a door closing
mechanism (4).

Description**A COOLING DEVICE COMPRISING A DOOR CLOSING MECHANISM AND THE CONTROL METHOD**

- [0001] The present invention relates to a cooling device comprising a door closing mechanism and the control method thereof.
- [0002] In cooling devices, in particular in domestic refrigerators, the door being left open adversely affects the cooling efficiency. Therefore, it is important for the cooling efficiency of the cooling devices to enable the door to be properly closed. It is very difficult for users to close the door especially when their hands are full. Since the user can close the door only by pushing the same, the door may close at different speeds. When the said pushing force is less or more, the door may not close properly. Therefore, although the user thinks the door is closed, the door may remain ajar. This situation causes excessive energy consumption and the spoiling of the stored foodstuffs.
- [0003] In the state of the art Japanese Patent Application No. JP3470203, a cooling device is disclosed, comprising doors that are opened or closed by means of bevel gears disposed on the body.
- [0004] The aim of the present invention is the realization of a cooling device wherein the door remaining open is enabled to be automatically closed.
- [0005] The cooling device realized in order to attain the aim of the present invention, explicated in the first claim and the respective claims thereof, comprises a door closing mechanism having two bevel gears that are disposed on the body and the door and that enable the door remaining open to be automatically closed.
- [0006] The two bevel gears directly contact each other on the door and are moved by a motor operated according to the remaining open time of the door, thus enabling the door to move with respect to the body and close on the body. Thus, in cases when the door is forgotten to be closed or the door is not properly closed, the door is prevented from remaining open.
- [0007] The door closing mechanism comprises a cover that protects the motor fixed onto the body and a casing that protects the second shaft fixed onto the body and the first gear and the second gear contacting each other on

the door. While a cavity through which the first shaft passes is arranged on the cover, an L-shaped housing through which the first shaft passes and that enables the casing to move with respect to the first shaft is arranged on the casing. The said housing is arranged on the adjacent walls of the casing that remain parallel to the frame of the body when the door is open and closed. By means of the L-shaped housing, the first shaft extending from the body towards the door is prevented from blocking the movement of the door.

- [0008] In an embodiment of the present invention, the cooling device is controlled according to the remaining open time of the door and the motor is operated according to the remaining open time of the door. In another version of this embodiment, it is detected that the door cannot be closed due to an object between the door and the body, and thus the motor is stopped.
- [0009] By means of the present invention, by detecting that the door is left open or not properly closed by the user, the door is automatically closed.
- [0010] The cooling device and the control method realized in order to attain the aim of the present invention are illustrated in the attached figures, where:
- [0011] Figure 1 – is the general view of a cooling device.
- [0012] Figure 2 – is the exploded view of the motor, the cover, the first shaft and the first gear.
- [0013] Figure 3 – is the exploded view of the motor, the cover, the first shaft and the first gear.
- [0014] Figure 4 – is the top view of the motor, the cover, the first shaft and the first gear.
- [0015] Figure 5 – is the exploded view of the door, the connection member, the casing, the second shaft and the second gear.
- [0016] Figure 6 – is the sideways exploded view of the door, the connection member, the casing, the second shaft and the second gear.
- [0017] Figure 7 – is the detailed cross-sectional view of the door, the connection member, the casing, the second shaft and the second gear together.
- [0018] Figure 8 – is the exploded perspective view of the first shaft, the first gear and the second shaft and the second gear together with the cover and the

casing.

[0019] Figure 9 – is the sideways exploded view of the first shaft, the first gear and the second shaft and the second gear together with the cover and the casing.

[0020] Figure 10 – is the flow chart of the control method of the present invention.

[0021] Figure 11 – is the flow chart of another version of the control method of the present invention.

[0022] The elements illustrated in the figures are numbered as follows:

1. Cooling device
2. Body
3. Door
4. Door closing mechanism
5. First shaft
6. First gear
7. Second shaft
8. Second gear
9. Motor
10. Cover
11. Casing
12. Cavity
13. Housing
14. Connection member
15. Fixing member
16. Sensor
17. Control unit
18. Hinge
19. Magnet

[0023] The cooling device (1) comprises one or more than body (2) wherein the objects to be cooled are placed and that have an inlet port (A) enabling the user to access therein; one or more than door (3) that prevents the heat transfer between the body (2) and the outer environment when closed, that enables the user to access the interior of the body (2) when opened and that is mounted to one side of the body (2); at least one hinge (18) that

enables the door (3) to open/close and to rotate around the edge whereat the door (3) is mounted to the body (2); a sensor (16) that detects if the door (3) is open, and a control unit (17).

[0024] The cooling device (1) of the present invention comprises a door closing mechanism (4) having

[0025] - a motor (9) that is disposed on the body (2) and that is operated by the control unit (17) when the door (3) remains open,

[0026] - a first shaft (5) that is mounted onto the body (2) and that is rotated by the motor (9),

[0027] - a first bevel gear (6) that is fixed to the first shaft (5) so as to rotate around the axis of the first shaft (5),

[0028] - a second shaft (7) that is fixed onto the door (3), and

[0029] - a second bevel gear (8) that is fixed to the second shaft (7) and that enables the door (3) to be rotated around the axis of the second shaft (7) with the triggering of the first gear (6) (Figure 1).

[0030] In the cooling device (1), the first gear (6) and the second gear (8) constantly contact each other independently from the position of the door (3).

[0031] When the door (3) is not closed properly or is left open, the sensor (16) detects that the door (3) is left open and delivers this information to the control unit (17). In this case, the control unit (17) operates the motor (9). When the motor (9) is operated, the first shaft (5) with one end being connected to the motor (9) starts to rotate around its own axis and rotates the first gear (6) that is fixed to the other end thereof. As a result of this movement of the first gear (6), the second gear (8) contacting the first gear (6) starts move and the door (3) together with the second shaft (7) fixed onto the door (3) moves over the hinge (18) whereby the door (3) is mounted to the body (2). As the first gear (6) rotates the second gear (8), the door (3) also moves with respect to the door (2) and closes over the body (2). Thus, when the door (3) of the cooling device (1) is left open or cannot be closed properly, the door (3) is enabled to be completely closed by means of the door closing mechanism (4).

[0032] In an embodiment of the present invention, the first shaft (5) extends in the

horizontal direction and the second shaft (7) in the vertical direction.

- [0033] The door closing mechanism (4) comprises the motor (9) that is fixed onto the ceiling of the body (2) at the edge thereof close to the door (3), a cover (10) that partially encloses the first shaft (5), a cavity (12) on the cover (10), through which the first shaft (5) passes, and fixing members (15) that enable the cover (10) to be fixed onto the body (2). The fixing members (15) on the cover (10) engage with the recesses on the body (2) and enable the cover (10) to be fixed onto the body (2) (Figure 2, Figure 3 and Figure 4).
- [0034] The door closing mechanism (4) furthermore comprises a connection member (14) that is fixed onto the upper surface of the door (3) and that has the first shaft (7) on its end, extending in the vertical direction and a casing (11) that covers the connection member (14), the first gear (6) and the second gear (8). The connection member (14) carrying all the load has a stepped configuration for the reinforcement thereof. The casing (11) comprises an L-shaped housing (13) through which the first shaft (5) and that extends along two adjacent edges - which are the edges parallel to the frame on the body (2) when the door (3) is completely open or closed - in the horizontal direction. Thus, by preventing the first shaft (5) extending from the body (2) towards the door (3) from contacting the edges of the casing (11) during the opening and closing of the door (3), the door (3) is enabled to easily open/close (Figure 5, Figure 6 and Figure 7).
- [0035] The first shaft (5) where to the first gear (6) is mounted passes through the cavity (12) on the cover (10) and through the housing (13) on the casing (11) so as to extend from the body (2) towards the door (3) and the first gear (6) on the first shaft (5) contacts on the door (3) the second gear (8) mounted onto the second shaft (7) extending in the vertical direction on the door (3). In this case, the first and the second gears (6, 8) are enclosed by the casing (11). When the sensor (16) delivers to the control unit (17) the information that the door (3) is left open, the control unit (17) operates the motor (9), and the first shaft (5) and the first gear (6) fixed to the end thereof are rotated in the horizontal axis. This movement enables the second gear (8) contacting the first gear (6), hence the second shaft

(7) fixed thereto and the door (3) to move. When the door (3) moves, the housing (13) on the casing (11) moves with respect to the first shaft (5) passing therethrough (Figure 8 and Figure 9).

[0036] In an embodiment of the present invention, the sensor (16) is a reed switch that is mounted onto the body (2) and that is activated by magnetic field, and a magnet (19) that is mounted onto the door (3). When the door (3) is closed, the magnet (19) triggers the reed switch and the information that the door (3) is closed is delivered to the control unit (17). Since the magnet (19) does not trigger the sensor (16) when the door (3) is open, the reed switch shifts to the active position and the information that the door (3) is open is delivered to the control unit (17).

[0037] The control method executed by the control unit (17) for the control of the cooling device (1) of the present invention explicated above comprises the following steps:

- warning the user for a predetermined time (T2) (300) when a predetermined time (T1) has elapsed (200) when the door (3) is open (100), and
- operating the motor (9) when the predetermined time (T2) elapses (400) and stopping the motor (9) (600) when the door (3) is closed (500).

[0038] In another embodiment of the control method of the cooling device (1), the motor (9) is operated for a predetermined time (T3) (700). If the door (3) is not closed at the end of this time (T3) (800), it is decided that an obstruct is present between the door (3) and the body (2) and the motor (9) is stopped (900) (Figure 11).

[0039] By means of the present invention, in case the door (3) is left open or not properly close, the door (3) is enabled to be automatically closed. Thus, unfavorable situations that may occur due to the door (3) remaining open are prevented.

Claims

1. A cooling device (1) comprising one or more than body (2) wherein the objects to be cooled are placed and that have an inlet port (A) enabling the user to access therein; one or more than door (3) that prevents the heat transfer between the body (2) and the outer environment when closed, that enables the user to access the interior of the body (2) when opened and that is mounted to one side of the body (2); at least one hinge (18) that enables the door (3) to open/close and to rotate around the edge whereat the door (3) is mounted to the body (2); a sensor (16) that detects if the door (3) is open, and a control unit (17), **characterized in that** a door closing mechanism (4) comprising
 - a motor (9) that is disposed on the body (2) and that is operated by the control unit (17) when the door (3) remains open,
 - a first shaft (5) that is mounted onto the body (2) and that is rotated by the motor (9) and a first bevel gear (6) that is fixed to the first shaft (5) so as to rotate around the axis of the first shaft (5), and
 - a second shaft (7) that is fixed onto the door (3) and a second bevel gear (8) that is fixed to the second shaft (7) and that enables the door (3) to be rotated around the axis of the second shaft (7) with the triggering of the first gear (6).
2. A cooling device (1) as in Claim 1, **characterized in that** the first shaft (5) extending in the horizontal direction and the second shaft (7) extending in the vertical direction.
3. A cooling device (1) as in Claim 1, **characterized in that** the door closing mechanism (4) comprising the motor (9) that is fixed onto the ceiling of the body (2), a cover (10) that partially encloses the first shaft (5), a cavity (12) on the cover (10), through which the first shaft (5) passes, and fixing members (15) that enable the cover (10) to be fixed onto the body (2).
4. A cooling device (1) as in Claim 1, **characterized in that** the door closing mechanism (4) comprising a connection member (14) that is fixed onto the upper surface of the door (3) and that has the first shaft (7) on its end, extending in the vertical direction and a casing (11) that covers the connection member (14), the first gear (6) and the second gear (8).
5. A cooling device (1) as in Claim 4, **characterized in that** the casing (11) comprises an L-shaped housing (13) through which the first shaft (5) passes

and that extends along two adjacent edges in the horizontal direction.

6. A cooling device (1) as in Claim 5, **characterized in that** the housing (13) that is arranged on the edge parallel to the frame on the body (2) when the door (3) is completely open or closed.
7. A cooling device (1) as in Claim 1, **characterized in that** the sensor (16) comprising a reed switch that is mounted onto the body (2) and that is activated by magnetic field, and a magnet (19) that is mounted onto the door (3).
8. A control method executed for controlling a cooling device (1), comprising the steps of:
 - warning the user for a predetermined time (T2) (300) when a predetermined time (T1) has elapsed (200) when the door (3) is open (100),
 - operating the motor (9) when the predetermined time (T2) elapses (400) and stopping the motor (9) (600) when the door (3) is closed (500).
9. A control method executed for controlling a cooling device (1), comprising the steps of
 - warning the user for a predetermined time (T2) (300) when a predetermined time (T1) has elapsed (200) when the door (3) is open (100),
 - operating the motor (9) when the predetermined time (T2) elapses (400),
 - operating the motor (9) for a predetermined time (T3) (700),
 - if the door (3) is not closed at the end of this time (T3) (800), deciding that an obstruct is present between the door (3) and the body (2) and stopping the motor (9) (900).

Figure 1

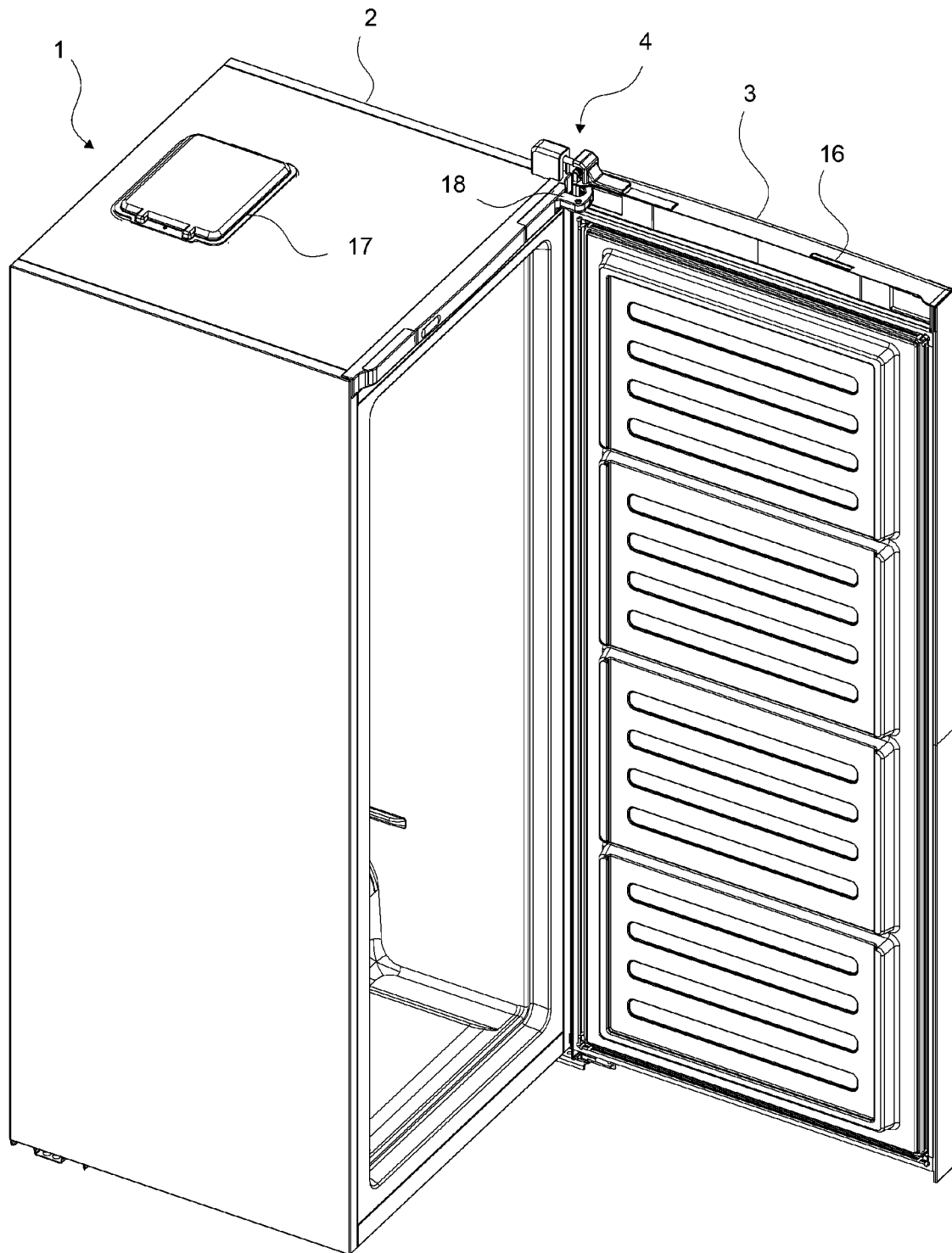


Figure 2

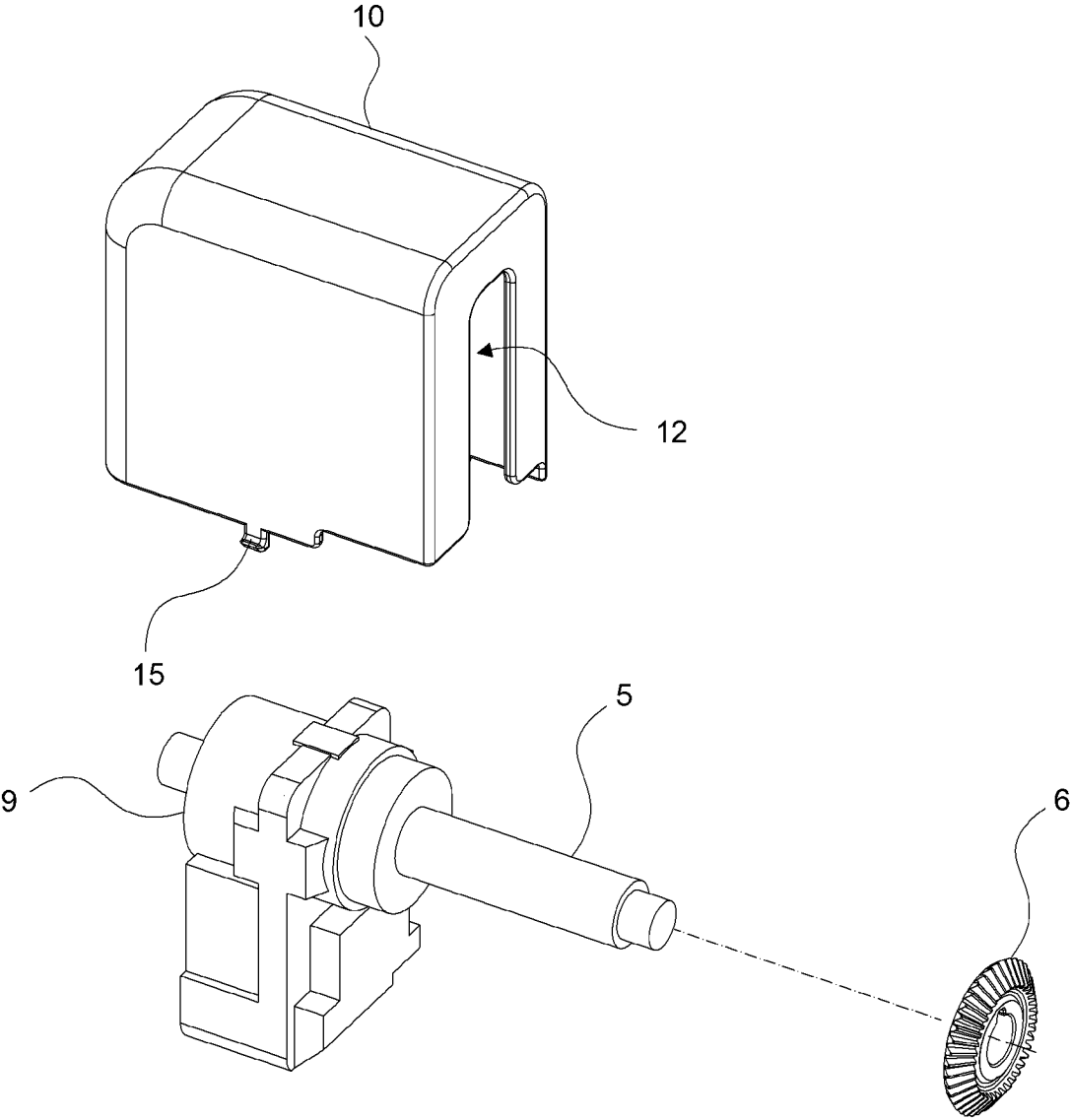


Figure 3

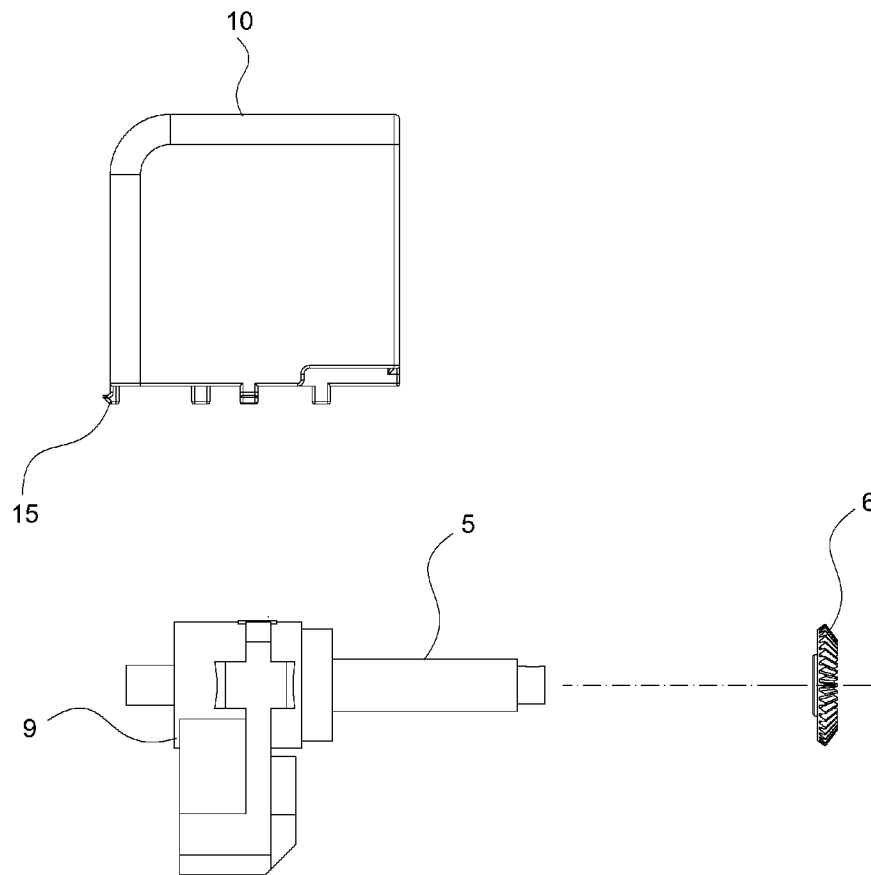


Figure 4

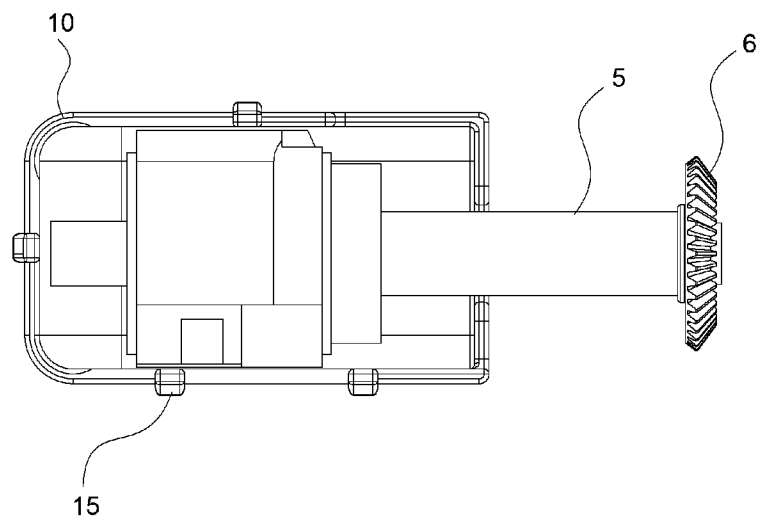


Figure 5

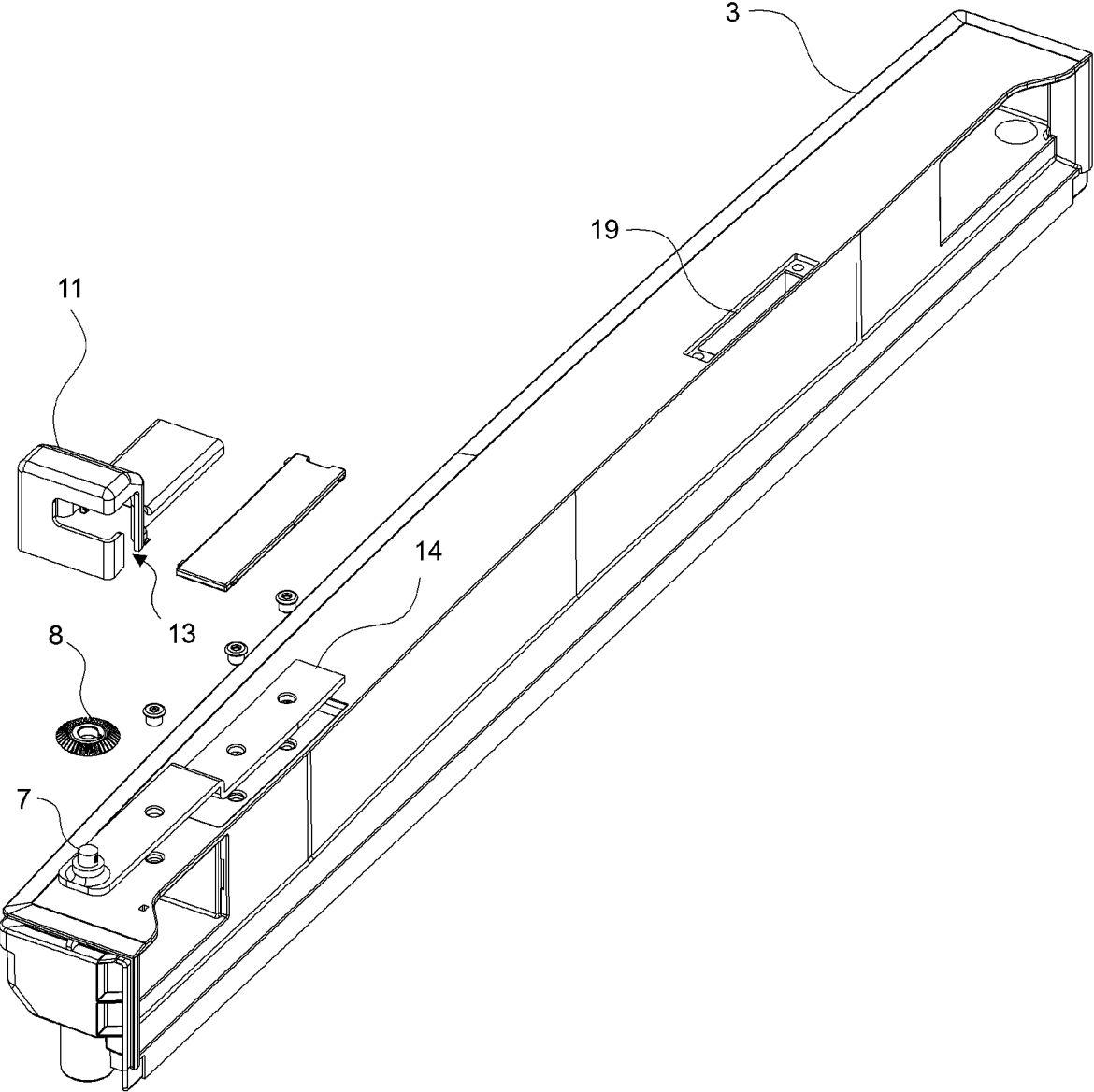


Figure 6

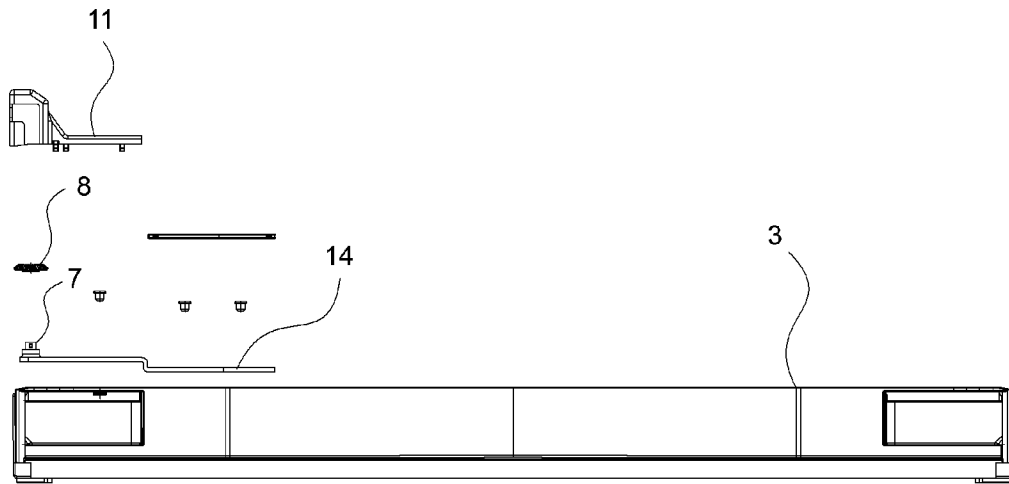


Figure 7

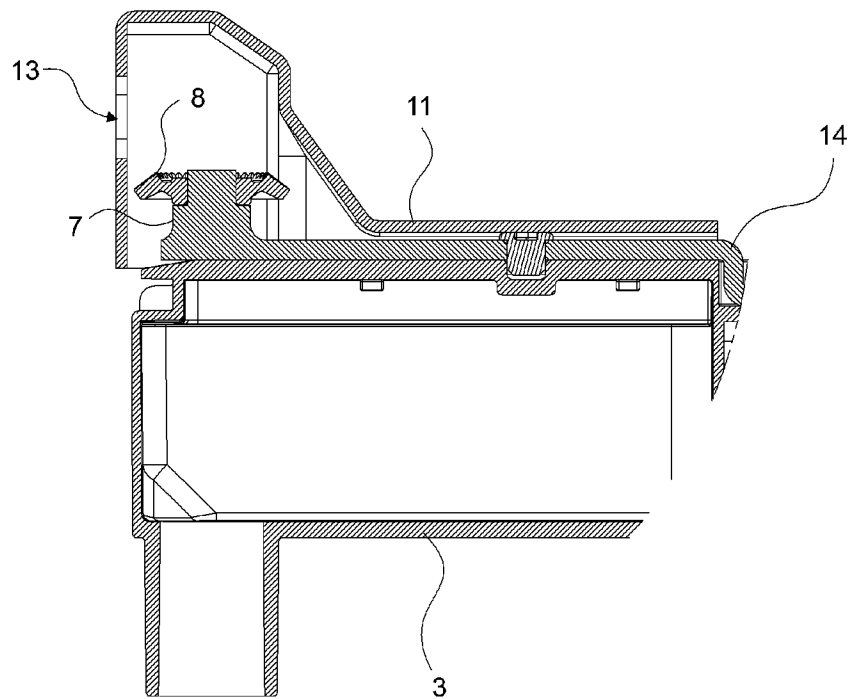


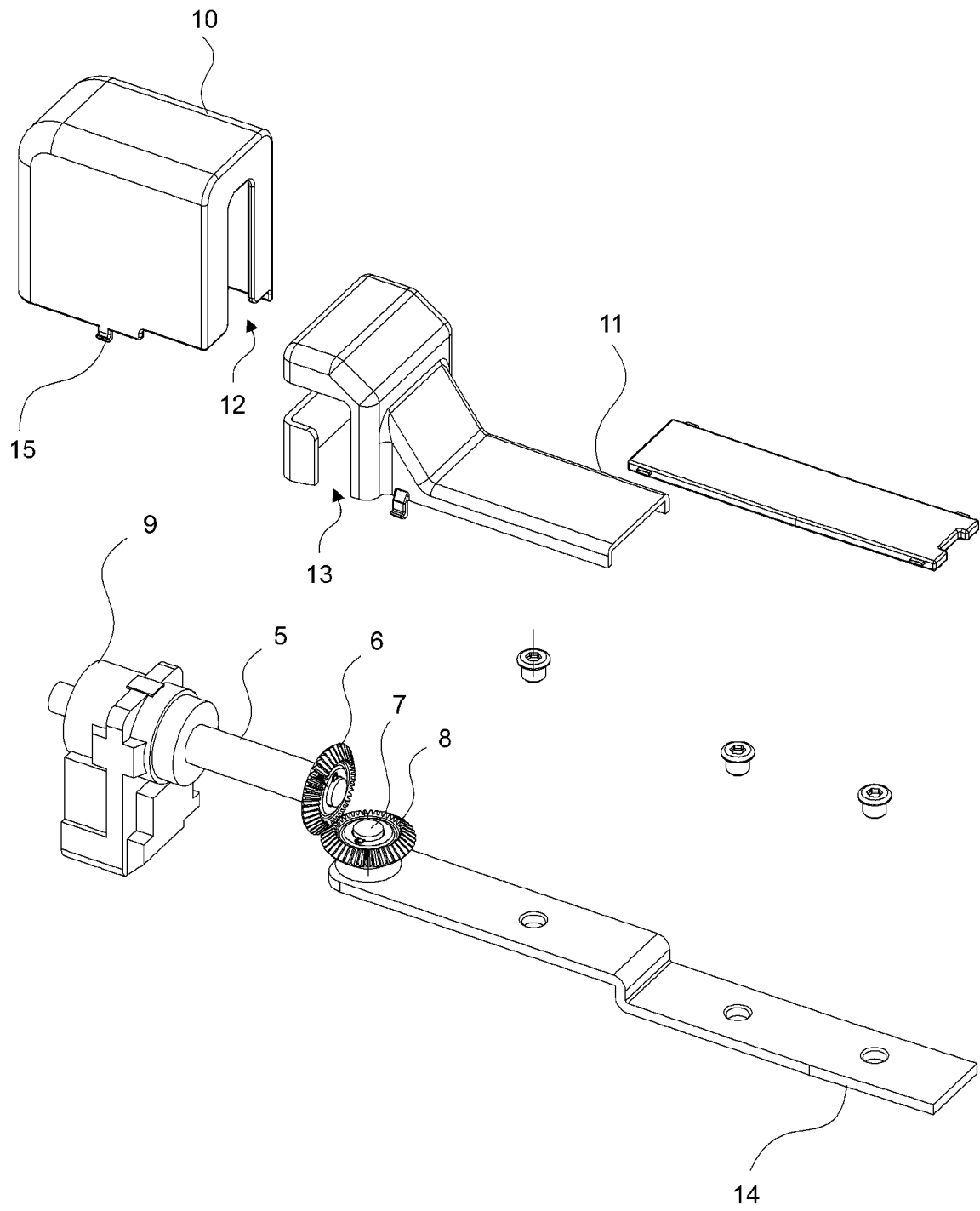
Figure 8

Figure 9

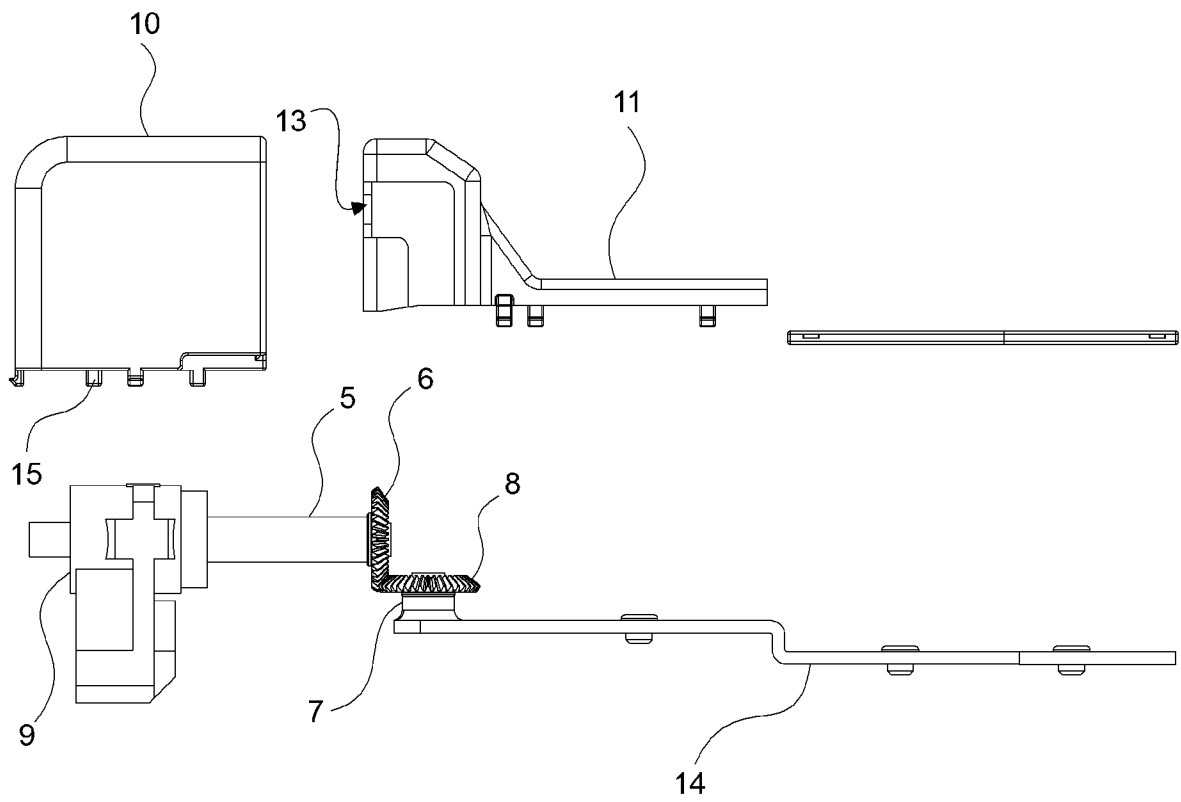


Figure 10

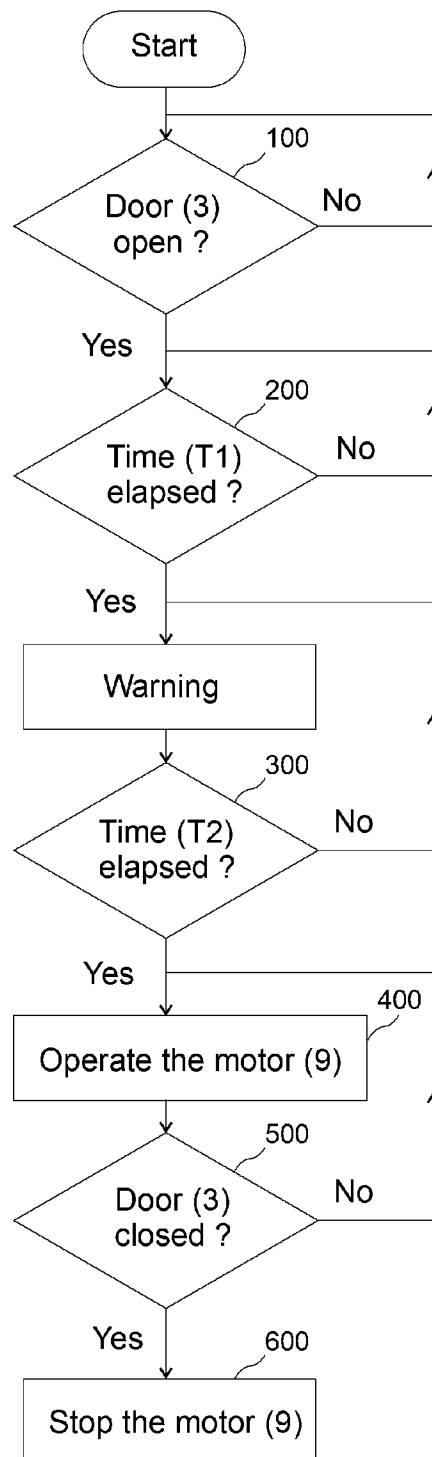
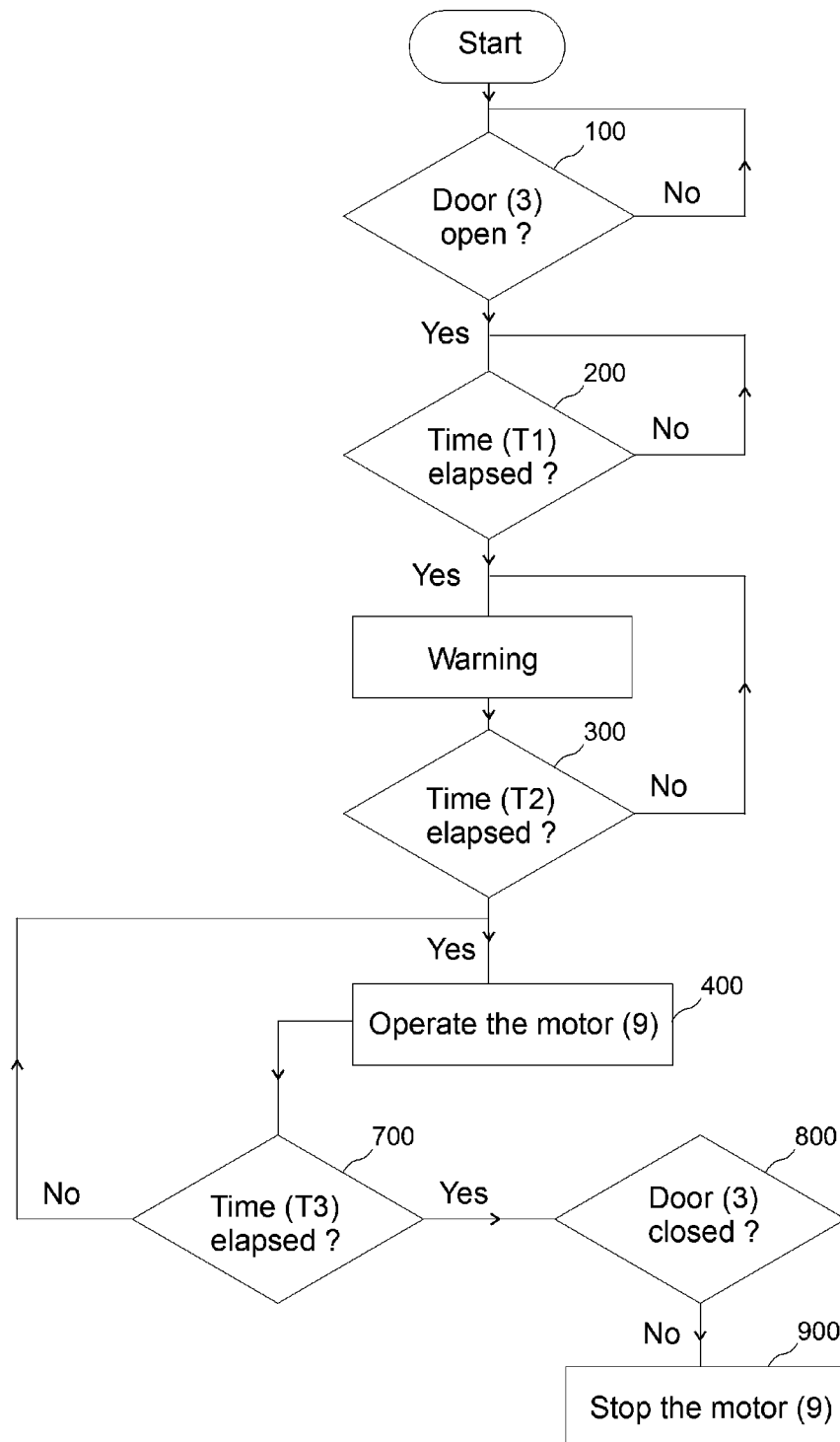


Figure 11



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/064914

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ADD. F25D29/00

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

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Minimum documentation searched (classification system followed by classification symbols)
F25D E05F E05B

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	JP 2008 196743 A (HITACHI APPLIANCES INC) 28 August 2008 (2008-08-28) paragraphs [0090] - [0092] -----	8
X	JP 2004 003774 A (MATSUSHITA REFRIGERATION) 8 January 2004 (2004-01-08) paragraphs [0032] - [0035] -----	8
X	JP 2000 111238 A (NEC GUMMA LTD) 18 April 2000 (2000-04-18) paragraphs [0009], [0010], [0026] -----	8
Y	US 2010/018240 A1 (HECHT JOSEF [DE] ET AL) 28 January 2010 (2010-01-28) paragraphs [0026] - [0031]; figure 2 ----- -/-	1-7



Further documents are listed in the continuation of Box C.



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Date of the actual completion of the international search

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Canköy, Necdet

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/064914

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2011/094160 A1 (HOUSER BLUE [US]) 28 April 2011 (2011-04-28) paragraph [0036]; figure 2 -----	1-7
X	US 2014/265805 A1 (CHAMBERLIN MICHAEL T [US]) 18 September 2014 (2014-09-18) paragraphs [0014] - [0017] -----	9

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2016/064914

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2008196743 A	28-08-2008	CN 101240970 A	13-08-2008
		JP 4247279 B2	02-04-2009
		JP 2008196743 A	28-08-2008
JP 2004003774 A	08-01-2004	NONE	
JP 2000111238 A	18-04-2000	NONE	
US 2010018240 A1	28-01-2010	CN 101223329 A	16-07-2008
		DE 202005011427 U1	23-11-2006
		EP 1904707 A1	02-04-2008
		JP 2009501893 A	22-01-2009
		US 2010018240 A1	28-01-2010
		WO 2007009783 A1	25-01-2007
US 2011094160 A1	28-04-2011	NONE	
US 2014265805 A1	18-09-2014	NONE	