

Acknowledgement of receipt

We hereby acknowledge receipt of the form for entry into the European phase (EPO as designated or elected Office) as follows:

Submission number	15524791	
PCT application number	PCT/KR2024/020822	
EP application number	24908156.3	
Date of receipt	16 July 2026	
Receiving Office	European Patent Office, The Hague	
Your reference	AL2719 EP	
Applicant		
Country		
Documents submitted	package-data.xml application-body.xml AMSPECEPO-1.pdf \AMSPECEPO-2.pdf (3 p.) SPECTRANEPO-2.pdf \SPECTRANEPO-2.pdf (4 p.) SPECTRANEPO-4.pdf \SPECTRANEPO-4.pdf (22 p.)	ep-euro-pct.xml epf1200.pdf (5 p.) SPECTRANEPO-1.pdf \SPECTRANEPO-3.pdf (15 p.) SPECTRANEPO-3.pdf \SPECTRANEPO-1.pdf (1 p.) CLMS-HWA.pdfAL2719 EP Amended claims marked.pdf (3 p.)
Submitted by	CN=secure.epoline.org	
Method of submission	Online	
Date and time receipt generated	16 July 2026, 14:54 (CEST)	
Message Digest	DF:CA:51:7A:47:E2:84:ED:FB:57:96:A8:D2:9F:CB:23:6F:30:16:59	

/European Patent Office/



Entry into the European phase (EPO as designated or elected Office)

To the European Patent Office

European application number	EP24908156.3
PCT application number	PCT/KR2024/020822
PCT publication number	WO2025135874
Applicant's or representative's reference	AL2719 EP
International Filing Date	20.12.2024
International Searching Authority (ISA)	KR
International Preliminary Examining Authority (IPEA)	not applicable

1. Applicant

Indications concerning the applicant(s) are contained in the international publication or were recorded by the International Bureau after the international publication.
Changes which have not yet been recorded by the International Bureau are set out here:
The/Each applicant requests a reduction of fees under Rule 7a(1) EPC and is a natural person or entity under Rule 7a(2) EPC.
The/Each applicant requests a reduction of fees under Rule 7a(3) EPC and is a micro-entity under Rule 7a(3) EPC.

☒☐☐☐

2. Representative

Representative 1

Representative or association of representatives to be listed in the Register of European Patents and to whom communications are to be notified

Name: VOSSIUS & PARTNER
Department: Patentanwälte Rechtsanwälte mbB
Association No.: 31
Address of place of business: Siebertstrasse 3
81675 München
Germany
Telephone: +49-89-41304-0

3. Authorisation

Representative 1

An individual authorisation is attached.

For employees (Art. 133(3)EPC) only

A general authorisation has been registered under No:

A general authorisation has been filed, but not yet registered.

The authorisation filed with the EPO as PCT receiving Office expressly includes the European phase.

☐☐☐☐

4. Request for examination

Examination of the application under Art. 94 EPC is hereby requested. The examination fee is being (has been, will be) paid.

Request for examination in an admissible non-EPO language:

☒☐

5. Copies

Additional copies of the documents cited in the supplementary European search report are requested.

Number of additional sets of copies

☐

6. Documents intended for proceedings before the EPO

Number of claims on entry into the European phase:

6.1 Proceedings before the EPO as designated Office (PCT I) are to be based on the following documents

the application documents published by the International Bureau, together with any drawings in colour or greyscale on condition that they were filed in that form and are available to the EPO; where the publication includes a set of claims amended under Article 19 PCT, the latter replaces the originally filed claims

15

☐

unless replaced by the amendments attached. comments on the written opinion established by the EPO as the International Searching Authority and/or observations or, where applicable, on the explanations given in the Supplementary International Search Report established by the EPO as the Supplementary International Searching Authority (Rule 45bis.7(e) PCT) <i>Where necessary, further details should be attached as "Other documents"</i>	☒ ☐
6.2 Proceedings before the EPO as elected Office (PCT II) are to be based on the following documents: the documents on which the international preliminary examination report is based, including any annexes unless replaced by the amendments attached. comments on the international preliminary examination report established by the EPO as the International Preliminary Examining Authority and/or observations are enclosed. <i>Where necessary, further details should be attached as "Other documents"</i> If the EPO as International Preliminary Examining Authority has been supplied with test reports, these may be used as the basis of proceedings before the EPO.	☐ ☐ ☐ ☐ ☐
6.3 A copy of the results of the search carried out by the authority with which the previous application(s) whose priority is claimed was (were) filed is attached (R. 141(1) EPC).	☐
7. Translations Translations in one of the official languages of the EPO (English, French, German) are attached as crossed below: <i>* In proceedings before the EPO as designated or elected Office (PCT I + II):</i> 7.1 Translation of the international application (description, claims, any text in the drawings) as originally filed, of the abstract as published and of any indication under Rule 13bis.3 and 13bis.4 PCT regarding biological material 7.2 Translation of the priority application(s) (to be filed only at the EPO's request, Rule 53(3) EPC) 7.3 It is hereby declared that the international application as originally filed is a complete translation of the previous application (Rule 53(3) EPC) <i>* In addition, in proceedings before the EPO as designated Office (PCT I):</i> 7.4 Translation of amended claims and any statement under Art. 19 PCT, if the claims as amended are to form the basis for the proceedings before the EPO (see Section 6). <i>* In addition, in proceedings before the EPO as elected Office (PCT II):</i> 7.5 Translation of any annexes to the international preliminary examination report	☒ ☒ ☐ ☐ ☐ ☐ ☐
8. Biological material The invention uses and/or relates to biological material deposited under Rule 31 EPC. The particulars referred to in Rule 31(1)(c) EPC (if not yet known, the depositary institution and the identification reference(s) [number, symbols, etc.] of the depositor) are given in the international publication or in the translation submitted in Section 7 on: page(s) / line(s) The receipt(s) of deposit issued by the depositary institution is (are) enclosed. will be filed later. Waiver of the right to an undertaking from the requester pursuant to Rule 33(2) EPC attached.	☐ ☐ ☐ ☐ ☐
9. Nucleotide and amino acid sequences The international application discloses nucleotide and/or amino acid sequences. 9.1 The sequence listing was filed under Rule 5.2(a) PCT, or furnished to the EPO as ISA under Rule 13ter. 1(a) PCT, or is otherwise available to the EPO, in a computer-readable format complying with the WIPO Standard applicable at the international date of filing. 9.2 The sequence listing is attached in a computer-readable format complying with the WIPO Standard applicable at the international date of filing (Rule 163(3) EPC).	☐ ☐ ☐

16. Fees

		Factor/ reduction applied	Fee schedule	Amount to be paid
16-1	002 Fee for a European search	1	1 595.00	1 595.00
16-2	005e Designation fee - For all contracting States designated for applications filed on/after 01.04.2009	1	720.00	720.00
16-3	006 Examination fee for other applications	1	2 010.00	2 010.00
16-4	020 Filing fee - entry EP phase - online	1	135.00	135.00
16-5	520 Additional filing fee for the 36th and each subsequent page - entry into EP phase	4	17.00	68.00
Total:			EUR	4 528.00

17. Annotations**18. Signature(s) of applicant(s) or representative**

Place: Munich
Date: 15 July 2026
Signed by: /Rainer Viktor/
Association: VOSSIUS & PARTNER
Representative name: Rainer Viktor
Capacity: Representative
Function of person signing: Representative

Table for section 6 of Form 1200.3

In accordance with the Notice from the European Patent Office dated 26 January 2009 concerning the 2009 fee structure (OJ EPO 2009, 118, and Guidelines for Examination in the EPO, April 2009, A-III, 13.2), the amount of the additional fee (Art. 2, item 1a, Rules relating to Fees) for the pages of this European patent application is calculated as follows:

Documents intended for proceedings before the EPO (R. 159 (1) (b) EPC) and for calculating the additional fee (Art. 2, item 1a, RFees):

		Page(s) from ... to ...	Number of pages
Description:	International application as published	1 to 17	17
	Translation of international application as published		
Claims:	Translation of international application as published		
	Amendments filed on entry into European phase	16 to 18	3
Drawings:	International application as published	1/18 to 18/18	18
	Translation of international application as published		
Abstract:	Default count: one page		1
Total number of pages			39
Fee-exempt pages (Art. 2, item 1a, RFees)			-35
Number of pages to be paid for			4
			(x 17 EUR per page)
Total amount payable		EUR	68

Invention Title REFRIGERATOR

Technical Field

[01] The present specification relates to a refrigerator.

Background Art

5 [02] Generally, a refrigerator is a home appliance that allows food to be stored at a low temperature in an internal storage space shielded by a door.

[03] The storage space is surrounded by an insulating wall, so that the inside of the storage space is maintained at a temperature lower than an outdoor temperature. Depending on a temperature range of the storage space, the storage space may be referred to as a refrigerating chamber or a freezing chamber.

10 [04] In order to put an object into the storage space or take the object out of the storage space, a user opens the door. Generally, the door is rotatably provided at a cabinet, and a gasket is provided between the door and the cabinet. Therefore, in a state in which the door is closed, the gasket is in contact between the door and the cabinet, so that cold air in the storage space can be prevented from leaking. As the adhesion force of the gasket increases, a cold air leakage prevention effect can be increased.

[05] In order to increase the adhesion force of the gasket, the gasket may be formed of a rubber magnet, and a magnet may be
15 provided inside the gasket. However, when the adhesion force of such a gasket increases, a large force is required accordingly when opening the door.

[06] Therefore, recently, a refrigerator in which an auto opening function of a door is implemented has been provided. As a related prior art document, Chinese Utility Registration No. 208324468 exists.

Disclosure

20 **Technical Problem**

[07] An embodiment provides a refrigerator in which an opening angle of a door is increased when the door is automatically opened.

[08] Alternatively or additionally, an embodiment provides a refrigerator in which a door is not only automatically opened but also can be automatically closed.

[09] Alternatively or additionally, an embodiment provides a refrigerator in which a door is not only automatically opened but also
25 a manual opening is possible by a user.

[10] Alternatively or additionally, an embodiment provides a refrigerator in which damage to a driver for auto opening is prevented during a manual opening of a door.

Technical Solution

[11] A refrigerator according to one aspect may include a cabinet having a storage space; a door that opens and closes the storage
30 space; and a door opening and closing device to open the door.

[12] The door opening and closing device may include a driver that generates power, and a power transmission portion that transmits the power of the driver.

[13] The door opening and closing device may include a first operating portion that operates by receiving the power of the driver. The door opening and closing device may further include a second operating portion that operates by receiving the power of the driver and is disposed at a position spaced apart from a rotation center of the door.

[14] When the driver operates for an auto opening of the door, the first operating portion may start to operate, and the second operating portion may start to operate after the first operating portion starts to operate.

[15] The door opening and closing device may further include a first transmission unit to transmit the power of the driver to the first operating portion during an auto opening process of the door. The door opening and closing device may further include a second transmission unit to transmit the power of the driver to the second operating portion.

[16] The first operating portion may include a rack gear connected to the first transmission unit.

[17] The first operating portion may include a first member including the rack gear. The first operating portion may further include a second member rotatably connected to the first member and in contact with a rear surface of the door.

[18] The second operating portion may include a body extending from the cabinet toward the door. The second operating portion may further include a first coupling portion located at one side of the body and coupled to the door. The second operating portion may further include a second coupling portion located at another side of the body and coupled to the second transmission unit.

[19] In an auto opening process of the door, the first transmission unit may block transmission of the power while the first operating portion is operated.

[20] The door opening and closing device may further include an elastic body providing an elastic force to the first operating portion or the first transmission unit so that the first operating portion returns to an initial position in a state in which the transmission of the power is blocked.

[21] In a period of an auto opening process of the door, the first operating portion and the second operating portion may move together in a door opening direction.

[22] In the auto opening process of the door, the first operating portion may move from an initial position to an end position, and the second operating portion may move from an initial position to a door opening position.

[23] Before the second operating portion moves to the door opening position, the first operating portion may move to the end position and then return to the initial position again.

[24] In an auto closing process of the door, in a state in which the first operating portion is stopped at the end position, the second operating portion may move from the door opening position to the initial position.

[25] In a manual opening process of the door, the second transmission unit may block a rotational force of the door from being transmitted to the driver.

[26] In the auto opening process of the door, the second transmission unit may receive the power of the driver from the first transmission unit.

[27] The first transmission unit may include a first transmission gear having a moving portion. The first transmission unit may further include a second transmission gear having a slot in which the moving portion is accommodated and connected to the first operating portion.

[28] In a state in which the moving portion is located in the slot, the first transmission gear and the second transmission gear may interlock with each other.

[29] In a state in which the moving portion is disengaged from the slot, the first transmission gear and the second transmission gear may not interlock with each other.

5 [30] In the auto opening process of the door, the first operating portion may move from an initial position to an end position. When the first operating portion moves to the end position, the moving portion may be disengaged from the slot.

[31] The second transmission gear may include a recess communicating with the slot, and an inclined surface in contact with the moving portion as a surface forming the recess.

10 [32] In the auto closing process of the door, when the second transmission gear rotates in another direction, the moving portion may be moved from the recess into the slot along the inclined surface.

[33] The second transmission unit may include a first transmission portion, and a second transmission portion connectable to or disconnectable from the first transmission portion. The second transmission unit may further include a third transmission portion connected to the second transmission portion and the second operating portion.

15 [34] The first transmission portion may include a first portion in which gear teeth are absent, and a second portion in which gear teeth are present.

[35] In a state in which the door is closed, the first transmission portion may be located at a disconnected position where the first portion is aligned with the second transmission portion. In the auto opening process of the door, when the first transmission portion is rotated by a predetermined angle, the second portion may be connected to the second transmission portion.

[36] At the disconnected position of the first transmission portion, the door is manually openable.

20 [37] In the manual opening process of the door, the second operating portion is movable to the door opening position by the rotational force of the door.

[38] A refrigerator according to another aspect may include a cabinet having a storage space; a door that opens and closes the storage space; and a door opening and closing device to open the door, wherein the door opening and closing device may include a driver that generates power, and an operating portion that operates by receiving the power of the driver and is disposed at a position spaced apart from a rotation center of the door; a first transmission portion to transmit the power of the driver; and a second transmission portion connectable to or disconnectable from the first transmission portion.

25 [39] In a state in which the door is closed, the first transmission portion may be located at a disconnected position where the first transmission portion is disconnected to the second transmission portion. When the driver operates for an auto opening of the door, the first transmission portion may move to a connected position to be connected to the second transmission portion in the auto opening process of the door.

30

Advantageous Effects

[40] According to an embodiment, there is an advantage in that an opening angle of a door is increased when the door is automatically opened.

[41] According to an embodiment, there is an advantage in that a door is not only automatically opened but also can be automatically closed.

[42] According to an embodiment, there is an advantage in that a door is not only automatically opened but also a manual opening is possible by a user.

5 [43] According to an embodiment, there is an advantage in that damage to a driver for auto opening is prevented and operation noise is reduced during a manual opening of a door.

Description of Drawings

[44] FIG. 1 is a perspective view showing a portion of a configuration of a refrigerator according to an embodiment.

[45] FIG. 2 is a plan view of a refrigerator according to the embodiment.

10 [46] FIG. 3 is an enlarged view showing a state in which a door opening and closing device is installed on the refrigerator according to the embodiment.

[47] FIG. 4 is a view showing a portion of a configuration of a power transmission portion in a door opening and closing device according to the embodiment.

[48] FIG. 5 is a cross-sectional view of a first transmission gear for transmitting power to a first operating portion.

15 [49] (a) of FIG. 6 is a perspective view of a second transmission gear, and (b) of FIG. 6 is a side view of a second transmission gear.

[50] FIGS. 7 to 14 are views showing a process in which a door is automatically opened.

[51] FIGS. 15 to 18 are views showing a process in which a door is automatically closed.

20 [52] FIG. 19 is a view showing a process in which a moving portion of a first transmission gear moves into a slot of a second transmission gear in a process in which a door is automatically closed.

[53] FIG. 20 is a control block diagram of a refrigerator according to the embodiment.

[54] FIGS. 21 and 22 are views showing a process in which a door is manually opened.

Mode for Invention

25 [55] Hereinafter, some embodiments of the present disclosure will be described in detail with reference to the accompanying drawings. It should be noted that when components in the drawings are designated by reference numerals, the same components have the same reference numerals as far as possible even though the components are illustrated in different drawings. Further, in description of embodiments of the present disclosure, when it is determined that detailed descriptions of well-known configurations or functions disturb understanding of the embodiments of the present disclosure, the detailed descriptions will be omitted.

30 [56] Also, in the description of the embodiments of the present disclosure, the terms such as first, second, A, B, (a) and (b) may be used. Each of the terms is merely used to distinguish the corresponding component from other components, and does not delimit an essence, an order or a sequence of the corresponding component. It should be understood that when one component is “connected”, “coupled”, “joined” to another component, the former may be directly connected, coupled, or joined to the latter or may be “connected”, “coupled”, or “joined” to the latter with a third component interposed therebetween.

[57] In the present specification, it may be interpreted that at least one of component A and component B includes component A, component B, or component A+B.

[58] In addition, it may be interpreted that at least one of component A or component B includes component A, component B, or component A+B.

5 [59] In the present specification, a front surface of the second door is a surface forming a front appearance of the door, and a rear surface is a surface facing the first door. A front surface of the first door is a surface forming a front appearance of the first door and facing the rear surface of the second door. The rear surface of the first door is a surface facing a cabinet or a storage space.

[60] FIG. 1 is a perspective view showing a portion of a configuration of a refrigerator according to an embodiment, and FIG. 2 is a plan view of a refrigerator according to the embodiment.

10 [61] Referring to FIGS. 1 and 2, a refrigerator 1 according to the embodiment may include a cabinet 10 to form a storage space 12, and a door 20 that opens and closes the storage space 12.

[62] The storage space 12 may include a refrigerating chamber as an example. Alternatively, the storage space 12 may include a freezing chamber as an example. Alternatively, although not shown, the storage space 12 may further include an additional storage space.

15 [63] The door 20 may be a refrigerating chamber door or a freezing chamber door. The door 20 may include a first door 21 for opening and closing a portion of the storage space 12. The door 20 may include a second door 22 for opening and closing another portion of the storage space 12. Alternatively, a single door 21 may open and close a single storage space 12, or may simultaneously open and close a plurality of storage spaces 12.

[64] The door 20 may be formed of a single door, or may include a main door 23 and a sub door 24.

20 [65] FIG. 2 illustrates an example in which the first door 21 of the door 20 is formed of a main door 23 (or an inner door) and a sub door 24 (or an outer door), but is not limited thereto.

[66] The main door 23 may open and close the storage space 12, and the sub door 24 may be rotatable with respect to the main door 23. The sub door 24 may be rotatably connected to the main door 23 or may be rotatably connected to the cabinet 10.

25 [67] The refrigerator of the embodiment may further include a door opening and closing device 100 to open the door 20. When the door 20 includes a plurality of doors 21 and 22, the door opening and closing device 100 may open a part or all of the plurality of doors 21 and 22.

[68] FIG. 2 illustrates an example in which the door opening and closing device 100 opens the first door 21 among the doors 20.

[69] In the case of the embodiment, the door 20 may be automatically opened by the door opening and closing device 100. In addition, the door 20 may be manually opened by a user.

30 [70] The door opening and closing device 100 may be installed on an upper surface of the cabinet 10 as an example, but may be installed on a lower surface thereof. A portion of the door opening and closing device 100 may be connected to an upper side (or a lower side) of the door 20.

[71] When the door 20 includes the main door 23 and the sub door 24, a portion of the door opening and closing device 100 may be connected to an upper side of the main door 23. That is, when the door opening and closing device 100 operates, the main door 23 may be automatically opened.

[72] A gasket (40 in FIG. 3) for limiting cold air leakage of the storage space 12 may be provided between the door 20 and the cabinet 10. As an example, the gasket 40 may be coupled to the door 20. A magnet may be provided inside the gasket 40. A state in which the gasket 40 is in contact with the cabinet 10 may be maintained by the magnet.

[73] Hereinafter, the door opening and closing device 100 of the embodiment will be described in detail.

[74] FIG. 3 is an enlarged view showing a state in which a door opening and closing device is installed on a refrigerator according to the embodiment, FIG. 4 is a view showing a portion of a configuration of a power transmission portion in a door opening and closing device according to the embodiment, and FIG. 5 is a cross-sectional view of a first transmission gear for transmitting power to a first operating portion. (a) of FIG. 6 is a perspective view of a second transmission gear, and (b) of FIG. 6 is a side view of a second transmission gear.

[75] Referring to FIGS. 2 to 6, the main door 23 may be rotatably connected to the cabinet 10 by a first hinge bracket 31. An upper surface of the main door 23 may include a recess 23a depressed downward. The first hinge bracket 31 may be connected to the recess 23a.

[76] The sub door 24 may be rotatably connected to the main door 23 by a second hinge bracket 32.

[77] A door opening and closing device 100 of the embodiment may include a driver 110. The driver 110 may include a bidirectionally rotatable motor as an example.

[78] The door opening and closing device 100 may further include a power transmission portion 120 to transmit the power of the driver 110.

[79] The door opening and closing device 100 may further include a first operating portion 170 (or a door opening portion) that operates by receiving power from the power transmission portion 120. The door opening and closing device 100 may further include a second operating portion 180 (or a door opening portion) that operates by receiving power from the power transmission portion 120. In an auto opening process of the door 20, the first operating portion 170 and the second operating portion 180 may operate sequentially. The second operating portion 180 serves as a door closing portion that allows the door to be closed in an auto closing process of the door.

[80] The door opening and closing device 100 may further include a first transmission unit that transmits power to the first operating portion 170. The door opening and closing device 100 may further include a second transmission unit that transmits power to the second operating portion 180.

[81] The power transmission portion 120 may include a plurality of gears. The door opening and closing device 100 may include a frame 101. The plurality of gears may be rotatably supported by the frame 101. The frame 101 may cover at least a portion of components constituting the door opening and closing device 100.

[82] As an example, the plurality of gears may include first to fifth gears 121, 122, 123, 124, and 125 connected to each other. However, it should be noted that a number of the plurality of gears is not limited in the embodiment. In addition, it should be noted that a shape of the plurality of gears is not limited.

[83] The first gear 121 may be connected to a shaft of the driver 110. The second gear 122 and the third gear 123 may be reduction gears. The fourth gear 124 and the fifth gear 125 may be idle gears. At least one of the second to fourth gears may be a two-stage gear having portions with different diameters.

[84] A last gear among the plurality of gears may be connected to the first transmission unit. As an example, the fifth gear 125 may be connected to the first transmission unit.

[85] The first transmission unit may transmit power to the first operating portion 170 in a period of the auto opening process of the door 20. As an example, the first transmission unit may transmit power to the first operating portion 170 in an initial period of the auto opening process. The first transmission unit may block the power transmission to the first operating portion 170 in another period of the auto opening process. That is, the first transmission unit may block the transmission of the power while the first operating portion 170 is operated.

[86] The first transmission unit may include a first transmission gear 130. The first transmission gear 130 may engaged with a last gear among the plurality of gears.

[87] The first transmission gear 130 may include a moving portion 135. The moving portion 135 may be movably provided at a position spaced apart from a rotation center of the first transmission gear 130. The moving portion 135 may move in a direction parallel to a rotation center line of the first transmission gear 130.

[88] The first transmission gear 130 may include a first portion 131 in which the moving portion 135 is accommodated. The first transmission gear 130 may include a second portion 132 as an opening through which the moving portion 135 passes. A diameter of the first portion 131 may be greater than a diameter of the second portion 132.

[89] The first transmission gear 130 may further include a third portion 133 as an opening for insertion of the moving portion 135. The first portion 131 may be located between the second portion 132 and the third portion 133. A diameter of the third portion 133 may be equal to or greater than the diameter of the first portion 131.

[90] The first transmission gear 130 may further include a cover portion 137 to cover the third portion 133. A diameter of the cover portion 137 may be equal to or less than the third portion 133. A portion of the cover portion 137 may be inserted into the first portion 131. The cover portion 137 may restrict the moving portion 135 from being separated toward the third portion 133 in the first transmission gear 130.

[91] A portion of the moving portion 135 protruding outwards of the first transmission gear 130 may include a rounded surface. The rounded surface may be in contact with the second transmission gear 140.

[92] The moving portion 135 may be formed in a cylindrical shape as an example. Based on the drawings, an upper surface of the moving portion 135 may include a rounded surface.

[93] The moving portion 135 may further include an extension portion 135a extending outwards. A portion of the moving portion 135 may pass through the second portion 132 to protrude outwards of the first transmission gear 130. The extension portion 135a

may be caught on a stepped portion formed by a difference in diameter between the first portion 131 and the second portion 132. The extension portion 135a may be moved within the first portion 131.

[94] Upward movement of the moving portion 135 may be restricted by the extension portion 135a. Downward movement of the extension portion 135a may be restricted by the cover portion 137 or an elastic member 138 to be described later.

5 [95] The first transmission gear 130 may further include an elastic member 138 providing an elastic force to the moving portion 135. The elastic member 138 may elastically support the moving portion 135. The elastic member 138 may be a coil spring as an example.

[96] A groove 135b in which a portion of the elastic member 138 is accommodated may be formed in the moving portion 135. Another side of the elastic member 138 may be supported by the cover portion 137.

10 [97] When an external force is removed after the moving portion 135 is moved downward by the external force, the moving portion 135 may be moved upward by the elastic force of the elastic member 138.

[98] The second transmission gear 140 may be provided with gear teeth 141 on a portion of a circumferential surface thereof. Another portion of the second transmission gear 140 where the gear teeth 141 are not provided may be provided with a slot 142 in which the moving portion 135 is accommodated. The slot 142 may pass through the second transmission gear 140 in a direction
15 parallel to a rotation center line of the second transmission gear 140. Alternatively, the slot 142 may be depressed from the circumferential surface toward a rotation center of the second transmission gear 140.

[99] The moving portion 135 may be selectively accommodated in the slot 142. In a state in which the moving portion 135 is accommodated in the slot 142, a rotational force of the first transmission gear 130 may be transmitted to the second transmission gear 140. On the other hand, in a state in which the moving portion 135 is disengaged from the slot 142, the rotational force of the
20 first transmission gear 130 is not transmitted to the second transmission gear 140.

[100] In the present embodiment, a state in which the moving portion 135 is accommodated in the slot 142 may be referred to as a connected state of the first transmission gear 130 and the second transmission gear 140. In the connected state of the first transmission gear 130 and the second transmission gear 140, the first transmission gear 130 and the second transmission gear 140 may interlock with each other.

25 [101] A state in which the moving portion 135 is disengaged from the slot 142 may be referred to as a disconnected state of the first transmission gear 130 and the second transmission gear 140. In the disconnected state of the first transmission gear 130 and the second transmission gear 140, the first transmission gear 130 and the second transmission gear 140 may not interlock with each other.

[102] The second transmission gear 140 may further include a recess 143 provided at one side of the slot 142. The recess 143 may
30 communicate with the slot 142.

[103] The recess 143 may provide a path or space through which the moving portion 135 located outside the slot 142 can be inserted into the slot 142. One surface of the second transmission gear 140 forming the recess 143 may include an inclined surface 144. The inclined surface 144 may be inclined such that a depression depth of the recess 143 upward from a bottom surface decreases toward the slot 142. The moving portion 135 may come into contact with the inclined surface 144.

[104] The second transmission gear 140 may be connected to an elastic body 149. For the opening of the door 20, the second transmission gear 140 may be rotated in the other direction. In a process in which the second transmission gear 140 is rotated in the other direction, when the moving portion 135 is disengaged from the slot 142, the elastic body 149 may provide an elastic force so that the second transmission gear 140 returns to an initial position in one direction.

5 [105] The elastic body 149 may be a torsion spring as an example, but it should be noted that a type of spring is not limited. The second transmission gear 140 may be provided with a coupling portion 146 to which the elastic body 149 is coupled.

[106] As another example, it is also possible for the elastic body 149 to provide an elastic force to the first operating portion 170. In this case as well, when the moving portion 135 is disengaged from the slot 142, the elastic body 149 may provide an elastic force so that the first operating portion 170 returns to an initial position. In a process in which the first operating portion 170 returns to the initial position, the second transmission gear 140 may return to the initial position in one direction.

[107] In the present embodiment, the first transmission unit serves as a clutch that transmits power or blocks power transmission to the first operating portion 170 during the auto opening process of the door 20, and thus may be named a first clutch unit.

[108] The first operating portion 170 may be engaged with the second transmission gear 140. The first operating portion 170 may be formed of a single member or a plurality of members.

15 [109] As an example, the first operating portion 170 may include a first member 171 engaged with the second transmission gear 140, and a second member 176 rotatably connected to the first member 171.

[110] The first member 171 may include a rack gear 172. When the second transmission gear 140 rotates, the first member 171 may move linearly. The door opening and closing device 100 may further include a guide portion 104 that guides a movement of the first member 171. The guide portion 104 may be formed integrally with the frame 101 or may be coupled to the frame 101.

20 [111] The second member 176 may be rotatably connected to the first member 171 by a shaft 174. The second member 176 may be in contact with the door 20 during the auto opening process of the door. A portion of the second member 176 may include a portion whose width or thickness increases in a direction away from the shaft 174.

[112] The second transmission unit may include a first transmission portion 150. The first transmission portion 150 may be connected to the first transmission gear 130.

25 [113] The first transmission portion 150 may include a first portion 150a and a second portion 150b distinguished by presence or absence of gear teeth on a circumferential surface thereof.

[114] Gear teeth are absent on a circumferential surface of the first portion 150a. Gear teeth 152 are present on a circumferential surface of the second portion 150b. That is, the first transmission portion 150 may be a partial gear. The second portion 150b may be engaged with the first transmission gear 130.

30 [115] The second transmission unit may further include a second transmission portion 154. The second transmission portion 154 may be connected to the first transmission portion 150 in the auto opening process of the door 20. On the other hand, in the manual opening process of the door, it may be spaced apart from the first transmission portion 150.

[116] In a state in which the door 20 is closed, the first portion 150a may be located to face or correspond to the second transmission portion 154. When the driver 110 operates, the first transmission portion 150 is rotated, and when a predetermined time elapses

after the driver 110 starts to operate or the first transmission portion 150 is rotated by a predetermined angle, the second portion 150b is connected to the second transmission portion 154 so that the second transmission portion 154 can be rotated.

[117] A state in which the second portion 150b is connected to the second transmission portion 154 may be referred to as a connected state of the first transmission portion 150 and the second transmission portion 154. A state in which the second portion 150b is not connected to the second transmission portion 154 may be referred to as a disconnected state of the first transmission portion 150 and the second transmission portion 154. A position of the first transmission portion 150 in the disconnected state may be referred to as a disconnected position. In the auto opening process of the door 20, the first transmission portion 150 may move to a connected position so that the first transmission portion 150 and the second transmission portion 154 can be connected.

[118] The second transmission unit may further include a third transmission portion 160. The third transmission portion 160 may be connected to the second transmission portion 154. The third transmission portion 160 may be connected to the second operating portion 180. The third transmission portion 160 may transmit a rotational force of the second transmission portion 154 to the second operating portion 180.

[119] The third transmission portion 160 may include a body 161 formed in a sector shape as an example. Gear teeth 163 may be formed on one surface of the body 161.

[120] A coupling portion 162 to which a shaft 107 providing a rotation center is connected may be provided on another surface of the body 161. The shaft 107 may be provided on the first hinge bracket 31, or may be provided on a member 106 separate from the first hinge bracket 31. At least a portion of the third transmission portion 160 may overlap with the first hinge bracket 31 in a vertical direction.

[121] The third transmission portion 160 may further include a coupling portion 165 to which the second operating portion 180 is connected. The second operating portion 180 may be rotatably connected to the third transmission portion 160 at a position spaced apart from the rotation center of the third transmission portion 160.

[122] The third transmission portion 160 may include one or more holes. The one or more holes can improve strength of the third transmission portion 160. Weight of the third transmission portion 160 can be reduced by the one or more holes.

[123] When a plurality of holes are formed in the third transmission portion 160, it is also possible to be used for detecting a position of the third transmission portion 160 by a position detection sensor.

[124] The second operating portion 180 may include a body 181. The body 181 may extend from the cabinet 10 toward the door 20.

[125] The second operating portion 180 may include a first coupling portion 182 provided at one side of the body 181. The first coupling portion 182 may be rotatably connected to a shaft 33 provided on the door 20 (for example, a main door). Alternatively, it is also possible for the first coupling portion 182 to have a shaft. The first coupling portion 182 may be located in a recess 23a of the main door 23. The shaft 33 may be provided on the first hinge bracket 31, or may be provided on a separate member spaced apart from or coupled to the first hinge bracket 31.

[126] The body 181 may be formed in a linear shape, or may be formed in a shape bent at least once. In a state in which the door 20 is closed, the first coupling portion 182 may be located near a rotation center C1 of the door 20 (or a rotation center of the main

door). As an example, in a state in which the door 20 is closed, the first coupling portion 182 may be located closer to the cabinet 10 or a gasket 40 than the rotation center C1 of the door 20.

[127] The second operating portion 180 may include a second coupling portion 183 provided at another side of the body 181. The second coupling portion 183 may be connected to the third transmission portion 160.

5 [128] Depending on a shape of the first transmission portion 150, the second transmission unit serves as a clutch that transmits the power of the driver 110 to the second operating portion 180 in an auto opening and closing process of the door 20, and blocks a moving force of the second operating portion 180 from being transmitted to the driver 110 in a manual opening and closing process of the door 20. Therefore, the second transmission unit may be named a second clutch unit.

[129] Hereinafter, a process in which the door is opened and closed will be described.

10 [130] FIGS. 7 to 14 are views showing a process in which a door is automatically opened, and FIGS. 15 to 18 are views showing a process in which a door is automatically closed. FIG. 19 is a view showing a process in which a moving portion of a first transmission gear moves into a slot of a second transmission gear in a process in which a door is automatically closed. FIG. 20 is a control block diagram of a refrigerator according to the embodiment.

[131] Referring to FIGS. 3 to 20, a refrigerator of the present embodiment may further include a controller 200. The controller 200
15 may be installed on or spaced apart from an object for control. The controller 200 may be located inside or outside the object for control.

[132] As an example, the controller 200 may be provided on the cabinet 10 or provided on the door 20.

[133] The controller 200 can control the driver 110. The controller 200 may be located outside the driver 110. It is possible for the controller 200 to control the driver 110 alone, and it is also possible to control other components other than the driver 110 in the
20 refrigerator.

[134] The refrigerator 1 may further include an input portion 210. The input portion 210 may input a door opening command for opening the door 20.

[135] The input portion 210 may include a touch sensor that detects a user's touch on a front surface of the door 20, or may include a knock sensor that detects a plurality of knocks applied to the front surface of the door 20. Alternatively, the input portion 210
25 may include a capacitance sensor, a sensor for detecting vibration, or a sensor for detecting sound waves. Alternatively, the input portion 210 may include a mechanical button or a touch screen through which a user's command can be input. Since the input portion 210 can input a command by a user or detect a user's command, the input portion 210 may also be referred to as an input detection portion.

[136] The input portion 210 may be provided on the cabinet 10 or provided on the door 20.

30 [137] The refrigerator 1 may further include a sensor portion 220. The sensor portion 220 can detect opening and closing of the door 20. The sensor portion 220 may be provided on the cabinet 10 or provided on the door 20.

[138] An operation of the driver 110 for the auto opening of the door 20 may be performed in a state in which the door 20 is closed. That is, when the auto opening command of the door 20 is input in a state in which closing of the door 20 is detected by the sensor portion 220, the driver 110 can operate.

[139] In a state in which the door 20 is closed, the first operating portion 170 and the second operating portion 180 may be located at initial positions.

[140] At the initial position of the first operating portion 170, the first operating portion 170 may be spaced apart from a rear surface of the door 20. A first transmission gear 130 may be located between the first operating portion 170 and the second operating portion 180. The second operating portion 180 may be located closer to the rotation center C1 of the door 20 than the first operating portion 170.

[141] At the initial position of the second operating portion 180, the second coupling portion 183 may be located farther from a front surface of the cabinet 10 than the first operating portion 170. The driver 110 may be located farther from the front surface of the cabinet 10 than the second coupling portion 183.

[142] [Auto Opening and Closing Process of Door]

[143] In a state in which the door 20 is closed, a door opening command may be input from the input portion 210. Then, the controller 200 can control the driver 110 for the auto opening of the door 20.

[144] Referring to FIG. 7, the controller 200 may rotate the motor in a forward direction as an example. When the motor rotates in the forward direction, power of the motor can be transmitted to the first operating portion 170 through a power transmission portion 220 and the first transmission unit.

[145] At an initial position of the first transmission portion 150, the first transmission portion 150 and the second transmission portion 154 are in a disconnected state. Therefore, even if the first transmission unit operates and the first transmission portion 150 rotates, the second transmission portion 154 maintains a stopped state.

[146] In a state in which the second transmission portion 154 is stopped, the third transmission portion 160 and the second operating portion 180 also maintain a stopped state.

[147] For an operation of the first operating portion 170, the first transmission gear 130 is rotated in one direction (clockwise direction in the drawing), and the second transmission gear 140 can be rotated in the other direction (counterclockwise direction in the drawing). When the second transmission gear 140 rotates in the other direction, the first operating portion 170 moves in a first direction (for example, a front-rear direction) (a door opening direction) from the initial position toward an end position.

[148] As shown in FIG. 8, when the first operating portion 170 moves in the first direction, the first operating portion 170 is in contact with the rear surface of the door 20. In a state in which the first operating portion 170 is in contact with the rear surface of the door 20, the second operating portion 180 maintains the stopped state.

[149] As shown in FIG. 9, when the first operating portion 170 additionally moves in the first direction, the first operating portion 170 pushes the door 20 so that the door 20 is automatically rotated in an opening direction. Accordingly, at least a portion of the gasket 40 begins to be spaced apart from the cabinet 10.

[150] As shown in FIG. 10, when the first operating portion 170 additionally moves in the first direction, the door 20 is further rotated in the opening direction so that the gasket 40 is completely separated from the cabinet 10.

[151] In the present embodiment, the first operating portion 170 operates so that the gasket 40 is separated from the cabinet 10 at an initial stage of the auto opening of the door 20.

[152] The second operating portion 180 may not operate until the first operating portion 170 operates and the gasket 40 is completely separated from the cabinet 10. Alternatively, the second operating portion 180 may operate after a portion of the gasket 40 is separated from the cabinet 10. In any case, the second operating portion 180 may operate after the first operating portion 170 operates and a set time elapses or the first operating portion 170 moves a set distance.

5 [153] Referring to FIG. 11, even after a portion of the gasket 40 is separated from the cabinet 10, the first operating portion 170 may move additionally in the first direction. In a state such as FIG. 11, the first transmission portion 150 engages with the second transmission portion 154 so that the second transmission portion 154 can be rotated.

[154] When the auto opening of the door 20 is started and the first transmission portion 150 is rotated by a predetermined angle or more, the second portion 150b engages with the second transmission portion 154 so that a rotational force of the first transmission
10 portion 150 can be transmitted to the second transmission portion 154. When the second transmission portion 154 is rotated, the third transmission portion 160 is also rotated so that the second operating portion 180 moves in a door opening direction. After the second operating portion 180 starts to operate, an opening angle of the door 20 can be increased.

[155] The second operating portion 180 may move from an initial position to a door opening position in the door opening direction. The second operating portion 180 may move from the door opening position to the initial position in a door closing direction.

15 [156] In a process in which the second operating portion 180 moves in the door opening direction, the door 20 is spaced apart from the first operating portion 170. In a state in which the first operating portion 170 and the door 20 are spaced apart from each other, the first operating portion 170 no longer applies force to the door 20.

[157] As shown in FIGS. 11 and 12, in a period of the auto opening process of the door 20, the first operating portion 170 may operate together with the second operating portion 180. That is, the first operating portion 170 moves in a first direction toward an
20 end position, and the second operating portion 180 may move to the door opening position.

[158] In the auto opening process of the door 20, the first transmission gear 130 can be rotated only in the one direction. As shown in FIG. 12, in a state in which the moving portion 135 of the first transmission gear 130 is accommodated in the slot 142 of the second transmission gear 140, when the first transmission gear 130 rotates in one direction, the second transmission gear 140 rotates in the other direction.

25 [159] While the second transmission gear 140 rotates in the other direction, the first operating portion 170 moves in the first direction.

[160] Referring to FIG. 13, during a rotation of the first transmission gear 130 in one direction, the moving portion 135 may be disengaged from the slot 142 of the second transmission gear 140. A position of the first operating portion 170 at a time point when the moving portion 135 is disengaged from the slot 142 of the second transmission gear 140 may be the end position.

30 [161] When the moving portion 135 is disengaged from the slot 142 of the second transmission gear 140, the rotational force of the first transmission gear 130 is not transmitted to the second transmission gear 140. That is, a connection between the first transmission gear 130 and the second transmission gear 140 may be released.

[162] Accordingly, the second transmission gear 140 is rotated in one direction by an elastic force of the elastic body 149 to return to the initial position.

[163] In a process in which the second transmission gear 140 rotates in one direction, the first operating portion 170 moves in a second direction from the end position to the initial position.

[164] Referring to FIG. 14, when the second operating portion 180 continuously moves in the door opening direction to move to the door opening position, the opening angle of the door 20 becomes maximum. In the present embodiment, the maximum opening angle of the door 20 may be greater than 90 degrees.

[165] When the maximum opening angle of the door 20 is 90 degrees or more, there is an advantage in that a user can easily access the storage space 12 without the user manually opening the door 20 additionally.

[166] In a process in which the second operating portion 180 moves from the initial position to the door opening position, the second operating portion 180 may maintain a state located adjacent to the first hinge bracket 31. As an example, when a body 181 of the second operating portion 180 is formed in a bent shape and is formed in a shape similar to a bent shape of the first hinge bracket 31, movement of the second operating portion 180 is possible in a state in which the body 181 of the second operating portion 180 is close to the first hinge bracket 31.

[167] Alternatively, in a state in which the second operating portion 180 moves to the door opening position, at least a portion of the second operating portion 180 may overlap with the first hinge bracket 31 in a vertical direction. Accordingly, there is an advantage in that external exposure of the second operating portion 180 is reduced in a state in which the door is opened. As an example, when the body 181 of the second operating portion 180 is formed in a bent shape, a vertical overlap amount between the second operating portion 180 and the first hinge bracket 31 can become maximum in a state in which the second operating portion 180 moves to the door opening position.

[168] If a hinge cover covering the first hinge bracket 31 is added, the second operating portion 180 can be moved within the hinge cover. In this case, there is an advantage in that external exposure of the second operating portion 180 can be minimized.

[169] On the other hand, after the auto opening of the door 20 is completed, the motor may be rotated in a reverse direction for an auto closing of the door 20.

[170] As an example, when a closing command of the door 20 is detected or recognized, such as when a set time elapses after the door 20 is opened, a user is not detected after the door 20 is opened, or a separate door closing command is input, the controller 200 can control the motor to rotate in the reverse direction.

[171] When the motor rotates in the reverse direction, power of the motor is transmitted to the second transmission unit so that the second operating portion 180 can move from the door opening position to the initial position in a door closing direction.

[172] Since the connection between the first transmission gear 130 and the second transmission gear 140 is released in a process in which the door 20 is opened, the first operating portion 170 and the second transmission gear 140 maintain a stopped state in a process in which the motor rotates in the reverse direction.

[173] Referring to FIGS. 16 to 19, in the process in which the motor rotates in the reverse direction, the first transmission gear 130 rotates in the other direction.

[174] In a process in which the first transmission gear 130 rotates in the other direction, the moving portion 135 may be aligned with the recess 143 as shown in (a) of FIG. 19. When the first transmission gear 130 additionally rotates in the other direction, the

moving portion 135 is into contact with the inclined surface 144 within the recess 143. Referring to (b) and (c) of FIG. 19, in the process of rotation of the first transmission gear 130 in the other direction, the moving portion 135 is pressed by the inclined surface 144 to move downward. When the moving portion 135 moves downward, the elastic member 148 may contract. Thereafter, referring to (d) of FIG. 19, when the moving portion 135 is aligned with the slot 142, the elastic member 148 is extended so that the moving portion 135 is inserted into the slot 142 by an elastic force of the elastic member 148. The motor may be stopped at a time point when the moving portion 135 is inserted into the slot 142 or after the moving portion 135 is inserted into the slot 142.

[175] According to the present embodiment, at an initial stage of auto opening of a door, power of a motor is transmitted to a first operating portion to be used for separation of a gasket, and after a separation process or separation of the gasket, it is used as an opening force of the door. Therefore, there is an advantage in that the gasket of the door can be easily separated at the initial stage of door opening.

[176] In addition, in the case of the present embodiment, since a door is not only automatically opened but also automatically closed, there is an advantage in that user convenience is improved.

[177] [Manual Opening Process of Door]

[178] FIGS. 21 and 22 are views showing a process in which a door is manually opened.

[179] Referring to FIGS. 21 and 22, a user can manually open the door 20 in a state in which the door 20 is closed.

[180] As described above, in a state in which the door 20 is closed, since the first transmission portion 150 and the second transmission portion 154 are in a disconnected state, rotation of the first transmission portion 150 is restricted even if the second transmission portion 154 rotates. In the disconnected state of the first transmission portion 150 and the second transmission portion 154, the first transmission portion 150 may be located at a disconnected position.

[181] When a user holds a handle of the door 20 and pulls the door 20, the door can rotate. When the door 20 rotates in an opening direction, the second operating portion 180 connected to the door 20 moves together with the door 20. In a manual opening process of the door 20, the second operating portion 180 is movable to a door opening position by a rotational force of the door 20.

[182] When the second operating portion 180 moves together with the door 20, the third transmission portion 160 connected to the second operating portion 180 rotates. When the third transmission portion 160 rotates, the second transmission portion 154 also rotates. However, since the first transmission portion 150 is located at the disconnected position, the first transmission portion 150 does not rotate even if the second transmission portion 154 rotates. Therefore, in the manual opening process of the door 20, the manual rotational force of the door 20 is not transmitted to the first transmission portion 150. Since the rotational force of the door 20 is not transmitted to the driver 110 either, a load can be prevented from acting on the driver 110. In addition, in the manual opening process of the door 20, since the rotational force of the door 20 is not transmitted to the first transmission unit and the power transmission portion 120 either, generation of noise due to rotation of gears can be prevented.

[183] Even in a process in which a user closes the door 20, the second transmission portion 154 rotates, but the first transmission portion 150 can maintain a stopped state.

[184] On the other hand, considering weight of a door or strength of magnetic force of a magnet, it is also possible to omit the first transmission unit and the first operating portion.

CLAIMS

[Claim 1]

A refrigerator, comprising:

a cabinet having a storage space;

a door that opens and closes the storage space; and

a door opening and closing device configured to open the door,

wherein the door opening and closing device comprises:

a driver that generates power;

a power transmission portion that transmits the power of the driver;

a first operating portion that operates by receiving the power of the driver; and

a second operating portion that operates by receiving the power of the driver and is disposed at a position spaced apart from a rotation center of the door,

wherein when the driver operates for an auto opening of the door, the first operating portion starts to operate, and the second operating portion starts to operate after the first operating portion starts to operate.

[Claim 2]

The refrigerator of claim 1,

wherein the door opening and closing device further comprises:

a first transmission unit configured to transmit the power of the driver to the first operating portion during an auto opening process of the door; and

a second transmission unit configured to transmit the power of the driver to the second operating portion.

[Claim 3]

The refrigerator of claim 2,

wherein the first operating portion comprises a rack gear connected to the first transmission unit.

[Claim 4]

The refrigerator of claim 3,

wherein the first operating portion comprises:

a first member including the rack gear; and

a second member rotatably connected to the first member and in contact with a rear surface of the door.

[Claim 5]

The refrigerator of claim 2,

wherein the second operating portion comprises:

a body extending from the cabinet toward the door;

a first coupling portion located at one side of the body and coupled to the door; and

a second coupling portion located at another side of the body and coupled to the second transmission unit.

[Claim 6]

The refrigerator of claim 2,

wherein in the auto opening process of the door, the first transmission unit blocks transmission of the power while the first operating portion is operated.

5 [Claim 7]

The refrigerator of claim 6,

wherein the door opening and closing device further comprises an elastic body providing an elastic force to the first operating portion or the first transmission unit so that the first operating portion returns to an initial position in a state in which the transmission of the power is blocked.

10 [Claim 8]

The refrigerator of claim 1,

wherein in a period of an auto opening process of the door, the first operating portion and the second operating portion move together in a door opening direction.

[Claim 9]

15 The refrigerator of claim 1,

wherein in an auto opening process of the door, the first operating portion moves from an initial position to an end position, and the second operating portion moves from an initial position to a door opening position,

wherein before the second operating portion moves to the door opening position, the first operating portion returns to the initial position again after being moved to the end position.

20 [Claim 10]

The refrigerator of claim 9,

wherein in the auto closing process of the door, the second operating portion moves from the door opening position to the initial position in a state in which the first operating portion is stopped at the end position.

[Claim 11]

25 The refrigerator of claim 2,

wherein in a manual opening process of the door, the second transmission unit blocks a rotational force of the door from being transmitted to the driver.

[Claim 12]

The refrigerator of claim 2,

30 wherein in the auto opening process of the door, the second transmission unit receives the power of the driver from the first transmission unit.

[Claim 13]

The refrigerator of claim 2,

wherein the first transmission unit comprises:

a first transmission gear having a moving portion; and

a second transmission gear having a slot in which the moving portion is accommodated and connected to the first operating portion,

wherein when the first transmission gear is rotated in one direction in a state in which the moving portion is located in the slot, the second transmission gear is rotated together,

wherein when the first transmission gear is rotated in the one direction in a state in which the moving portion is disengaged from the slot, the second transmission gear is not rotated.

[Claim 14]

The refrigerator of claim 13,

wherein in the auto opening process of the door, the first operating portion moves from an initial position to an end position,

wherein when the first operating portion moves to the end position, the moving portion is disengaged from the slot.

[Claim 15]

The refrigerator of claim 13,

wherein the second transmission gear comprises a recess communicating with the slot, and an inclined surface in contact with the moving portion as a surface forming the recess,

wherein in an auto closing process of the door, when the second transmission gear rotates in another direction, the moving portion is moved from the recess into the slot along the inclined surface.

[Claim 16]

The refrigerator of claim 2,

wherein the second transmission unit comprises:

a first transmission portion;

a second transmission portion connectable to or disconnectable from the first transmission portion; and

a third transmission portion connected to the second transmission portion and the second operating portion.

[Claim 17]

The refrigerator of claim 16,

wherein the first transmission portion comprises a first portion in which gear teeth are absent, and a second portion in which gear teeth are present,

wherein in a state in which the door is closed, the first transmission portion is located at a disconnected position where the first portion is aligned with the second transmission portion,

wherein in the auto opening process of the door, when the first transmission portion is rotated by a predetermined angle, the second portion is connected to the second transmission portion.

[Claim 18]

The refrigerator of claim 17,

wherein at the disconnected position of the first transmission portion, the door is manually openable.

[Claim 19]

The refrigerator of claim 18,

wherein in a manual opening process of the door, the second operating portion is movable to the door opening position

5 by the rotational force of the door.

[Claim 20]

A refrigerator, comprising:

a cabinet having a storage space;

a door that opens and closes the storage space; and

10 a door opening and closing device configured to open the door,

wherein the door opening and closing device comprises:

a driver that generates power;

an operating portion that operates by receiving the power of the driver and is disposed at a position spaced apart from a
rotation center of the door;

15 a first transmission portion configured to transmit the power of the driver; and

a second transmission portion connectable to or disconnectable from the first transmission portion,

wherein in a state in which the door is closed, the first transmission portion is located at a disconnected position where
the first transmission portion is disconnected to the second transmission portion,

20 wherein when the driver operates for an auto opening of the door, the first transmission portion moves to a connected
position to be connected to the second transmission portion in an auto opening process of the door.

ABSTRACT

The refrigerator according to an embodiment includes: a cabinet having a storage chamber; a door for opening and closing the storage chamber; and a door opening and closing device for opening the door, wherein the door opening and closing device includes: a driving unit for generating power; a power transmission unit for transmitting power from the driving unit; a first operation unit operated by receiving power from the driving unit; and a second operation unit operated by receiving power from the driving unit and disposed at a position spaced apart from the center of rotation of the door, and when the driving unit operates to automatically open the door, the first operation unit starts to operate, and after the first operation unit starts to operate, the second operation unit starts to operate.

FIG. 1

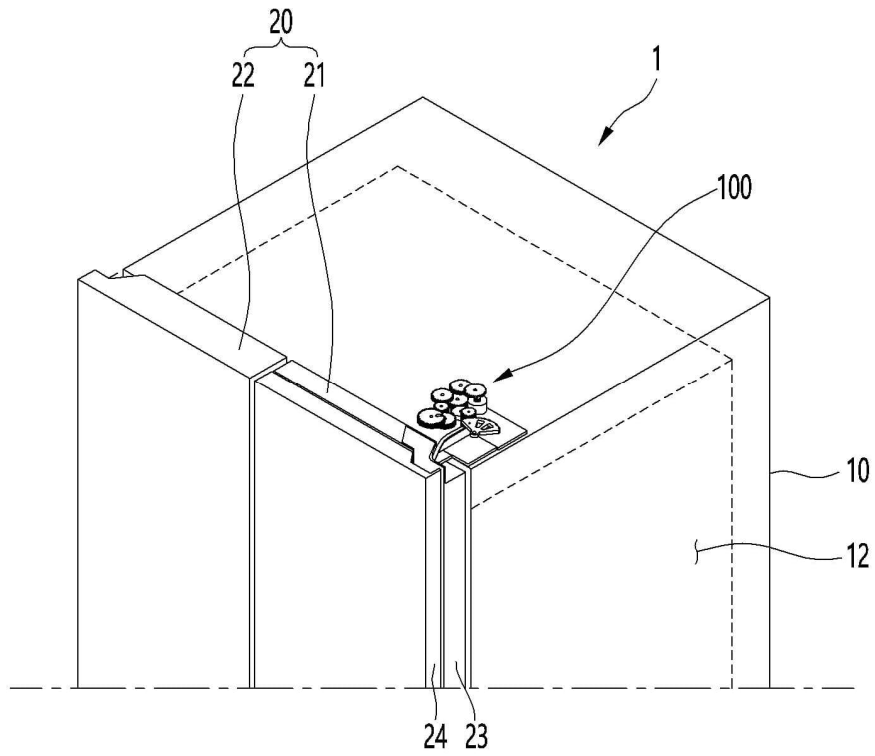


FIG. 2

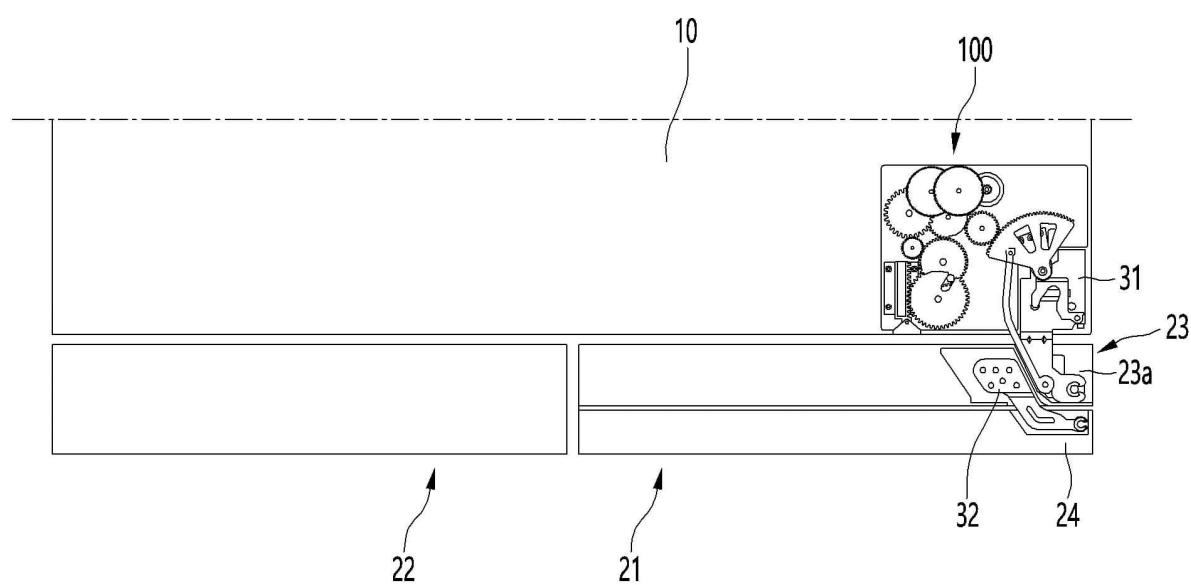


FIG. 3

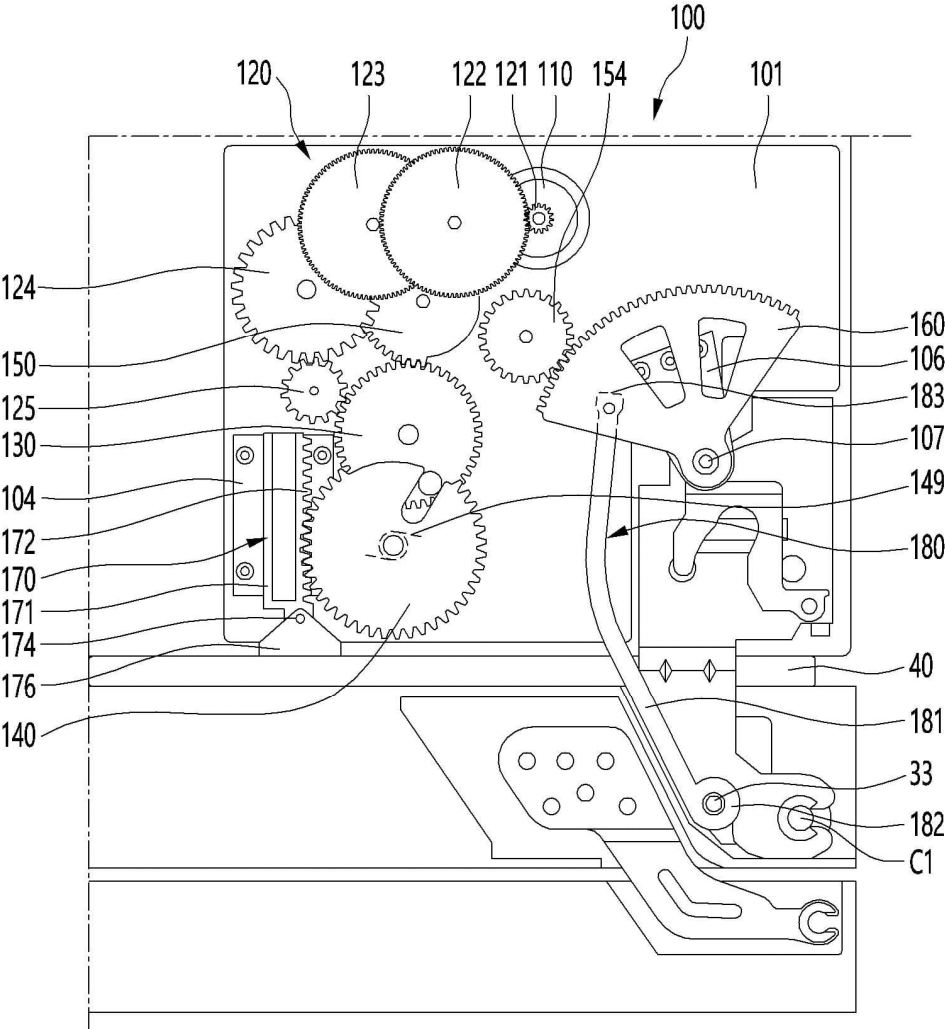


FIG. 4

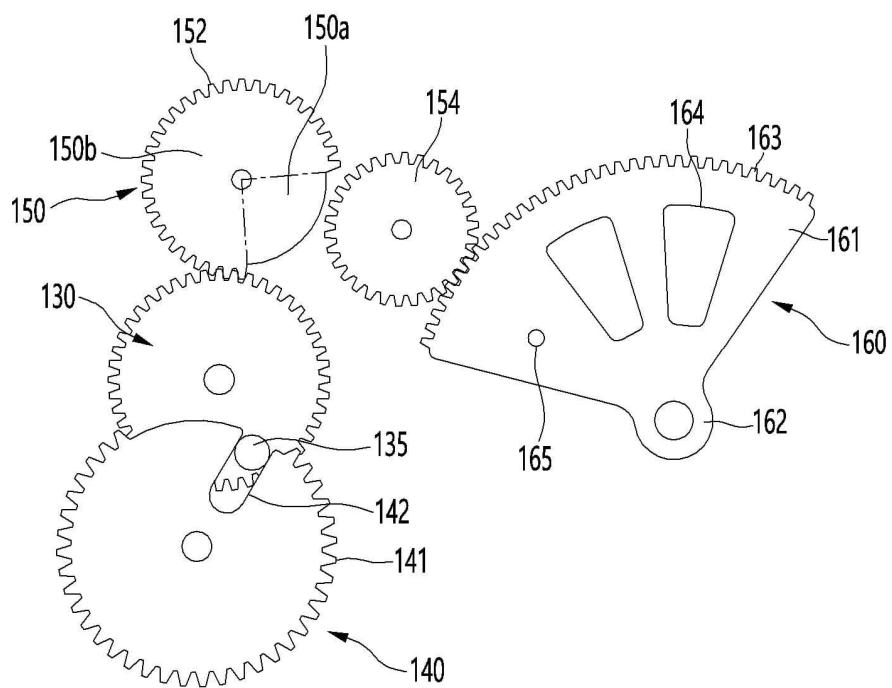


FIG. 5

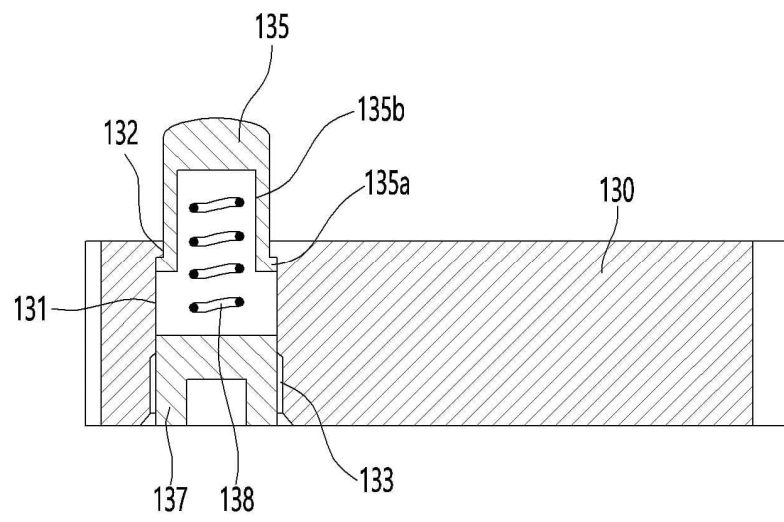
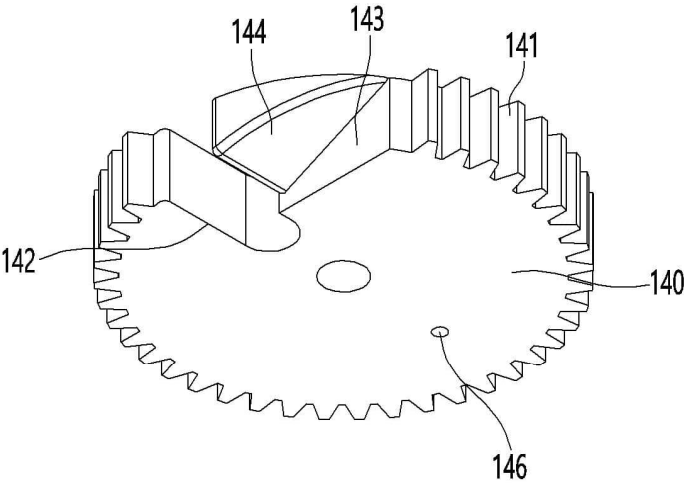
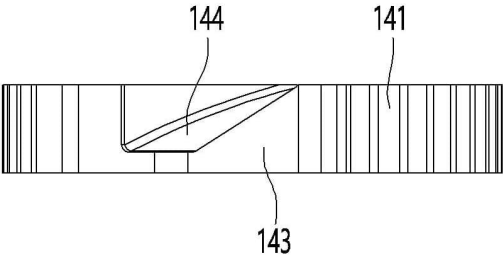


FIG. 6



(a)



(b)

FIG. 7

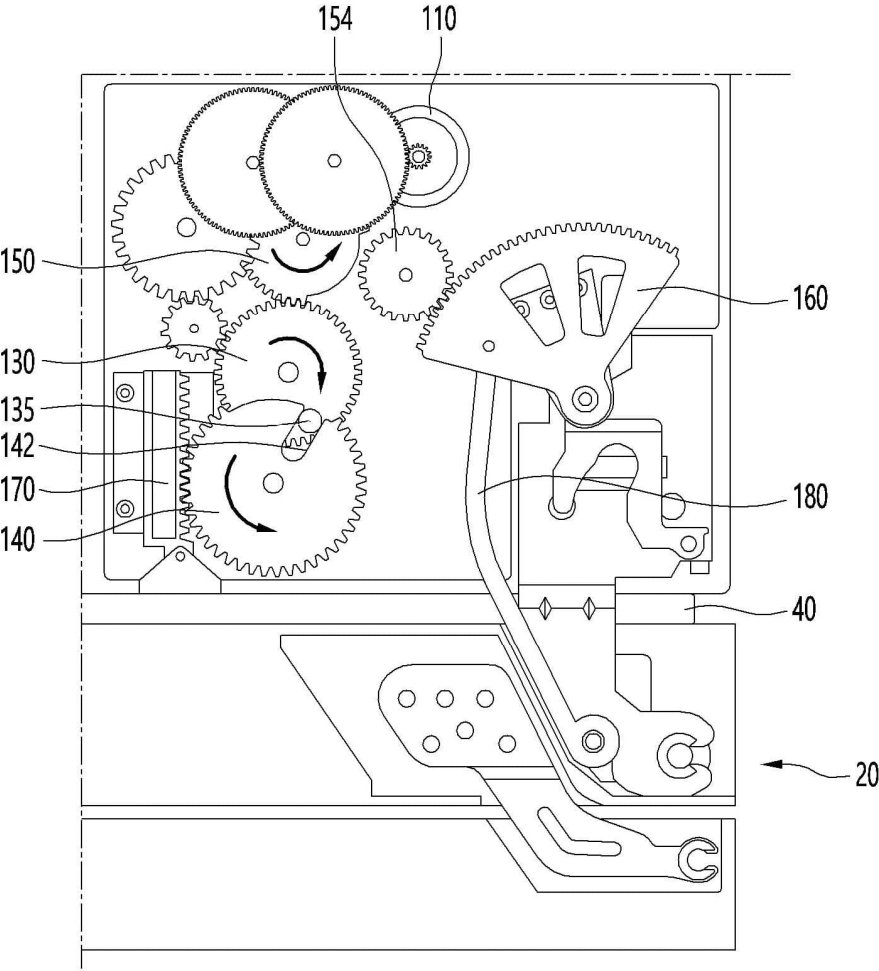


FIG. 8

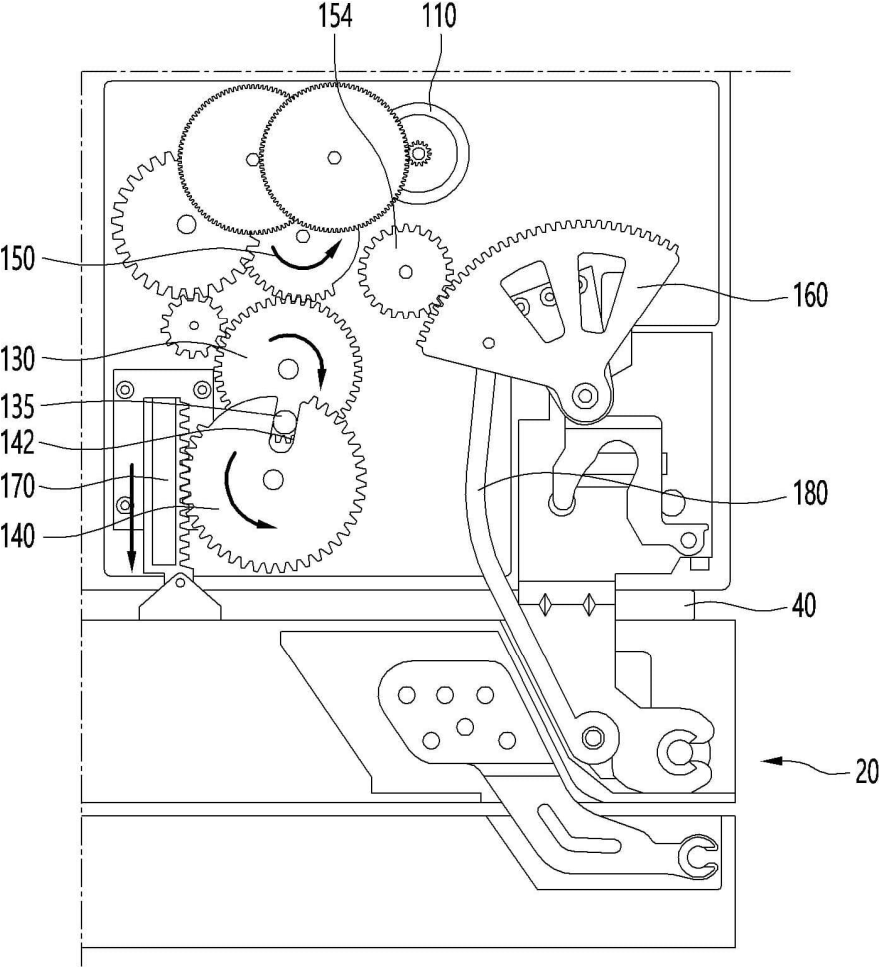


FIG. 9

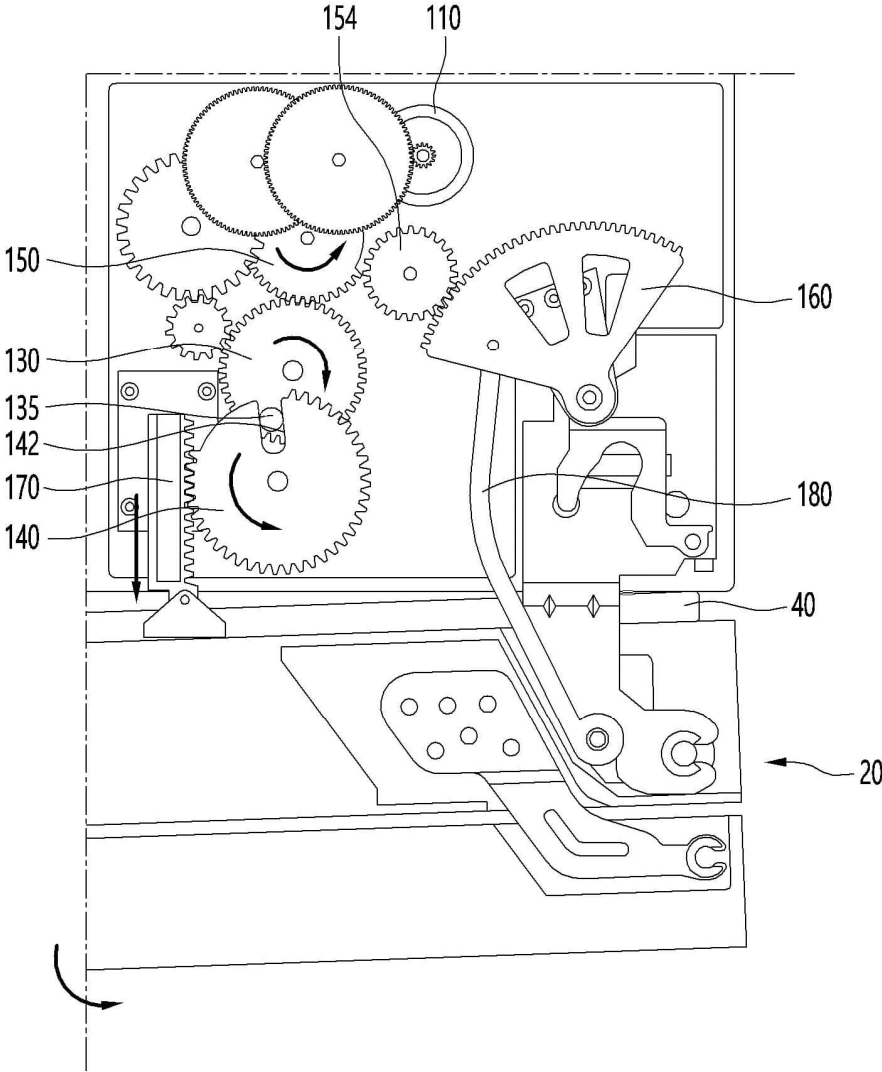


FIG. 10

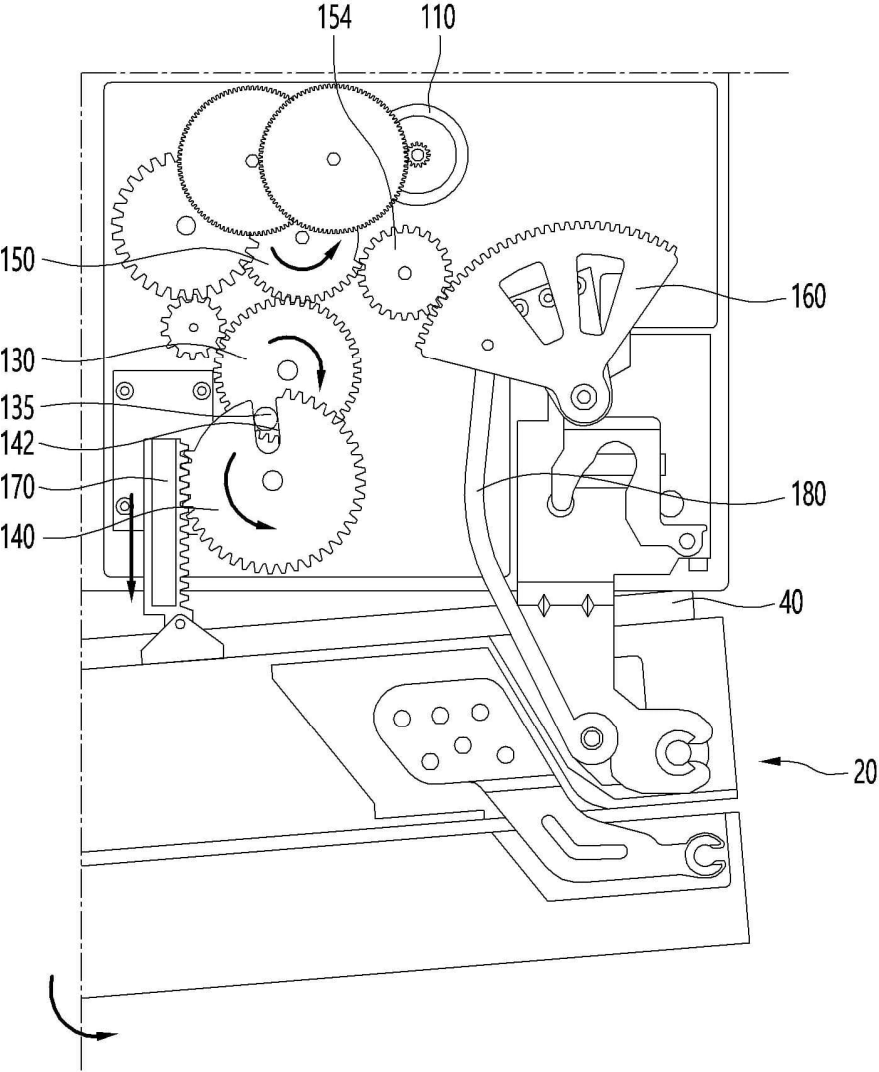


FIG. 11

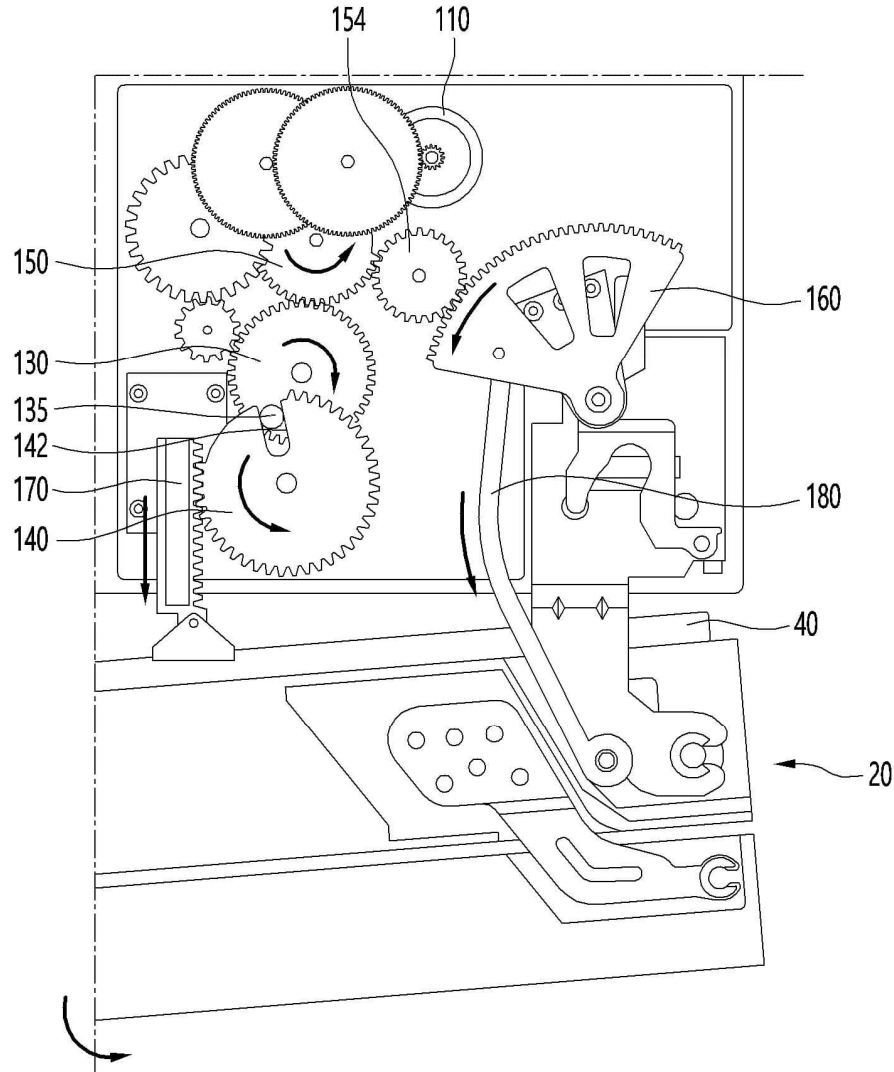


FIG. 12

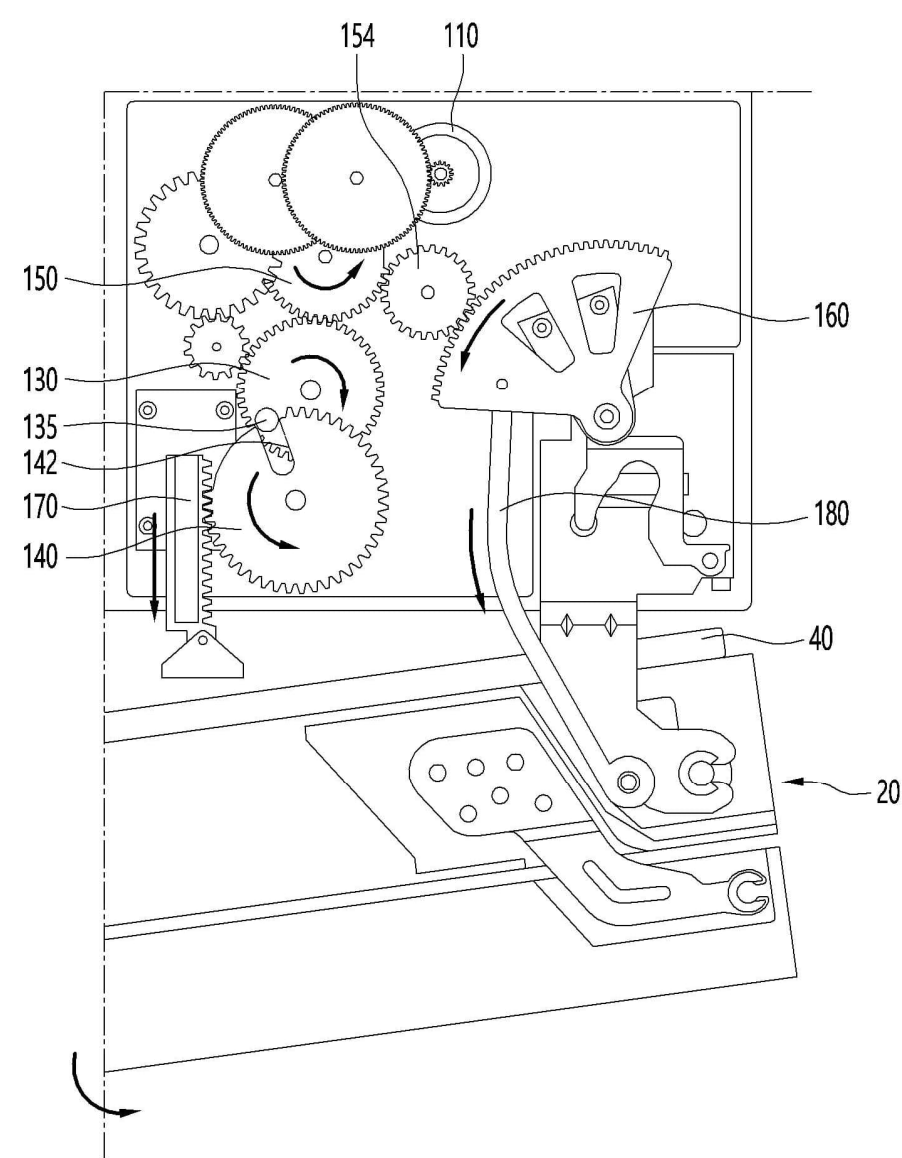


FIG. 13

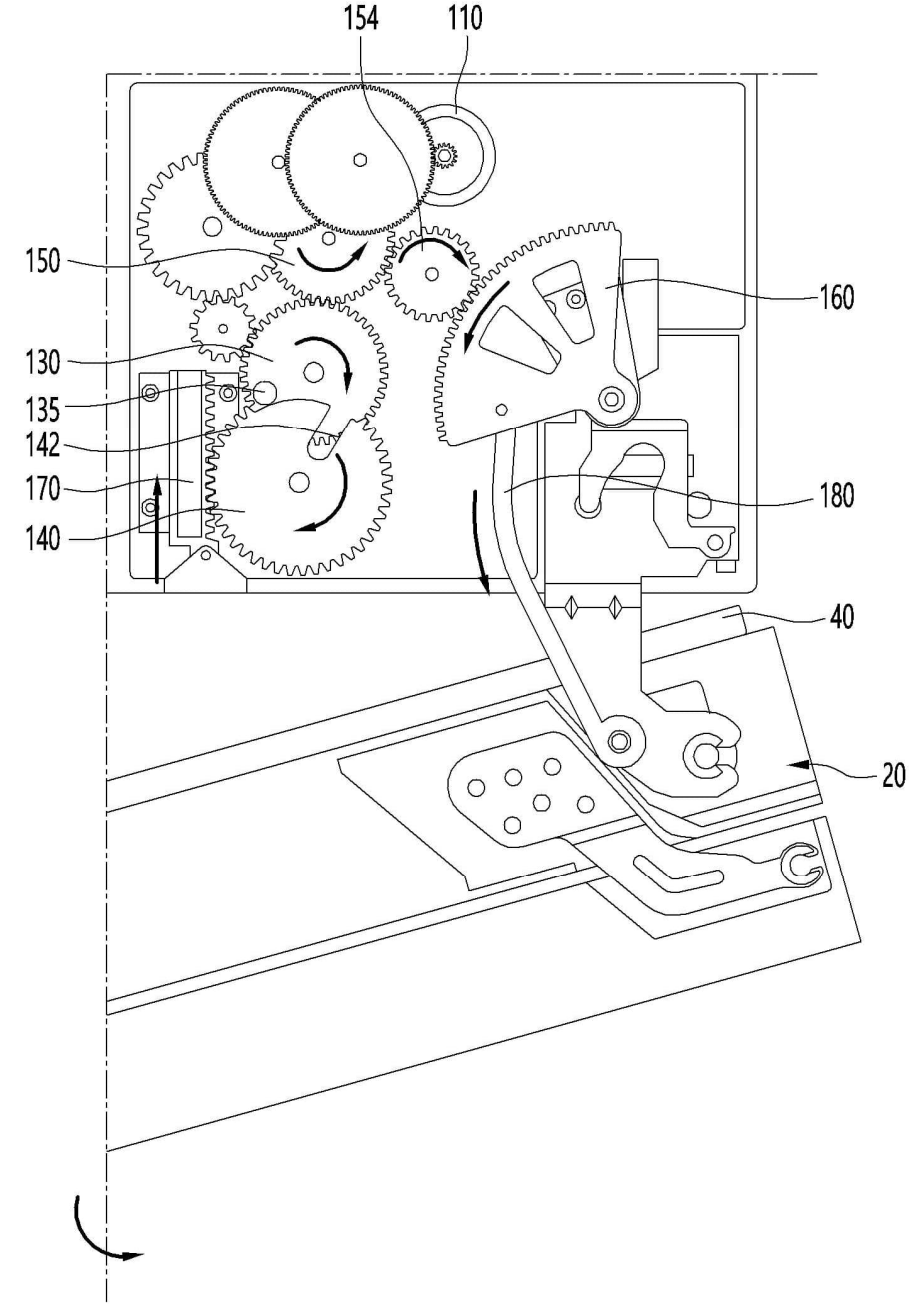


FIG. 14

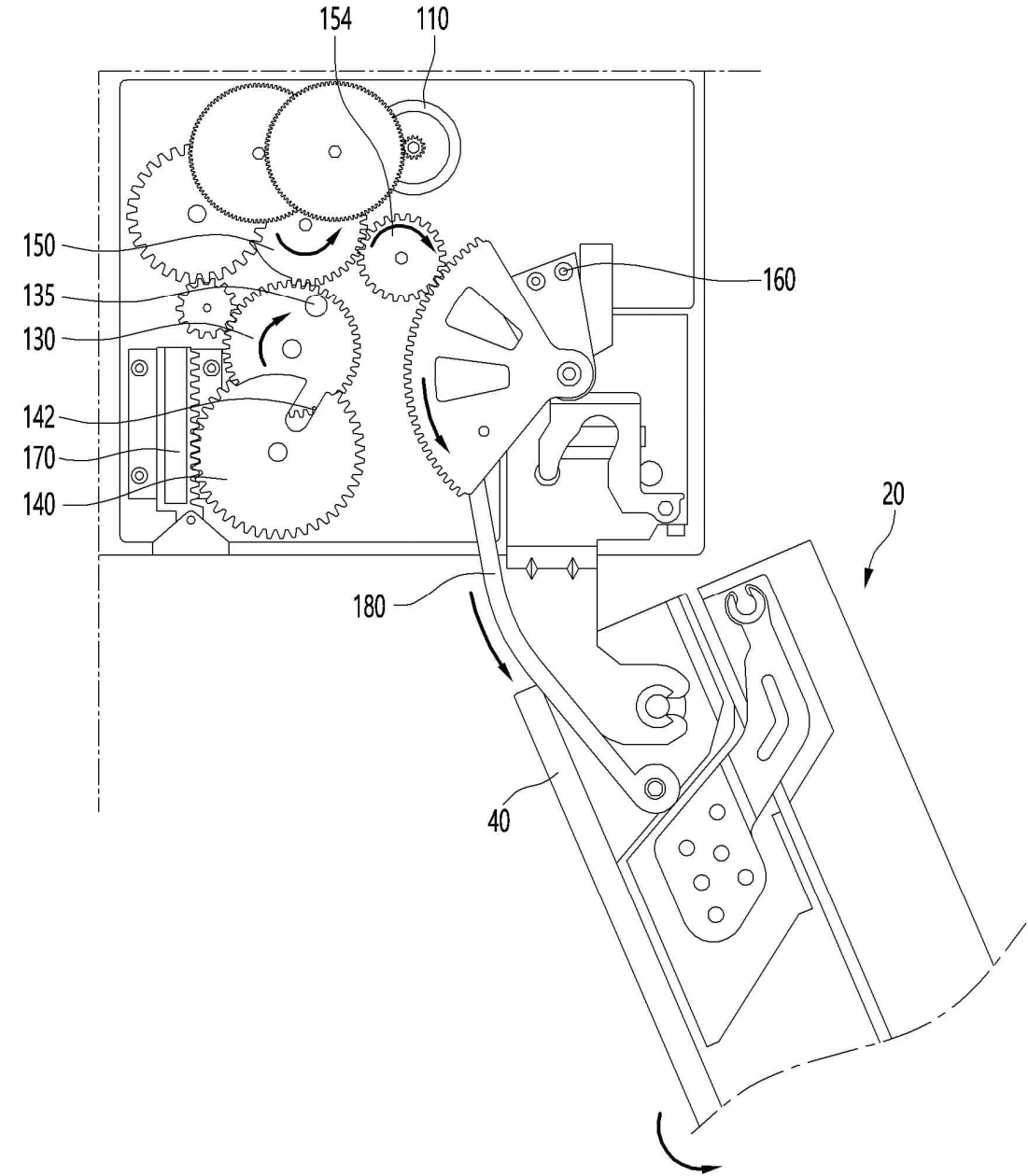


FIG. 15

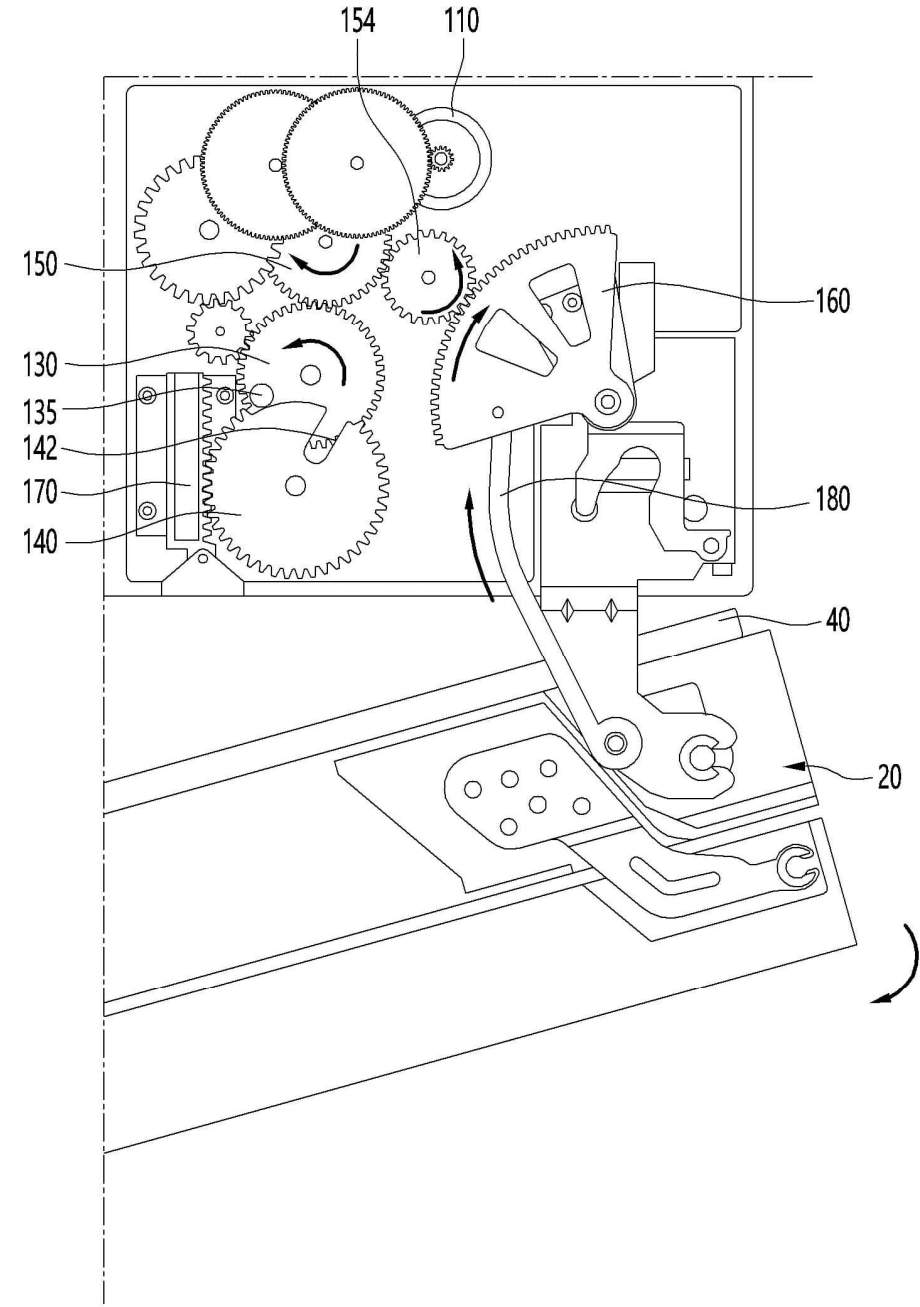


FIG. 16

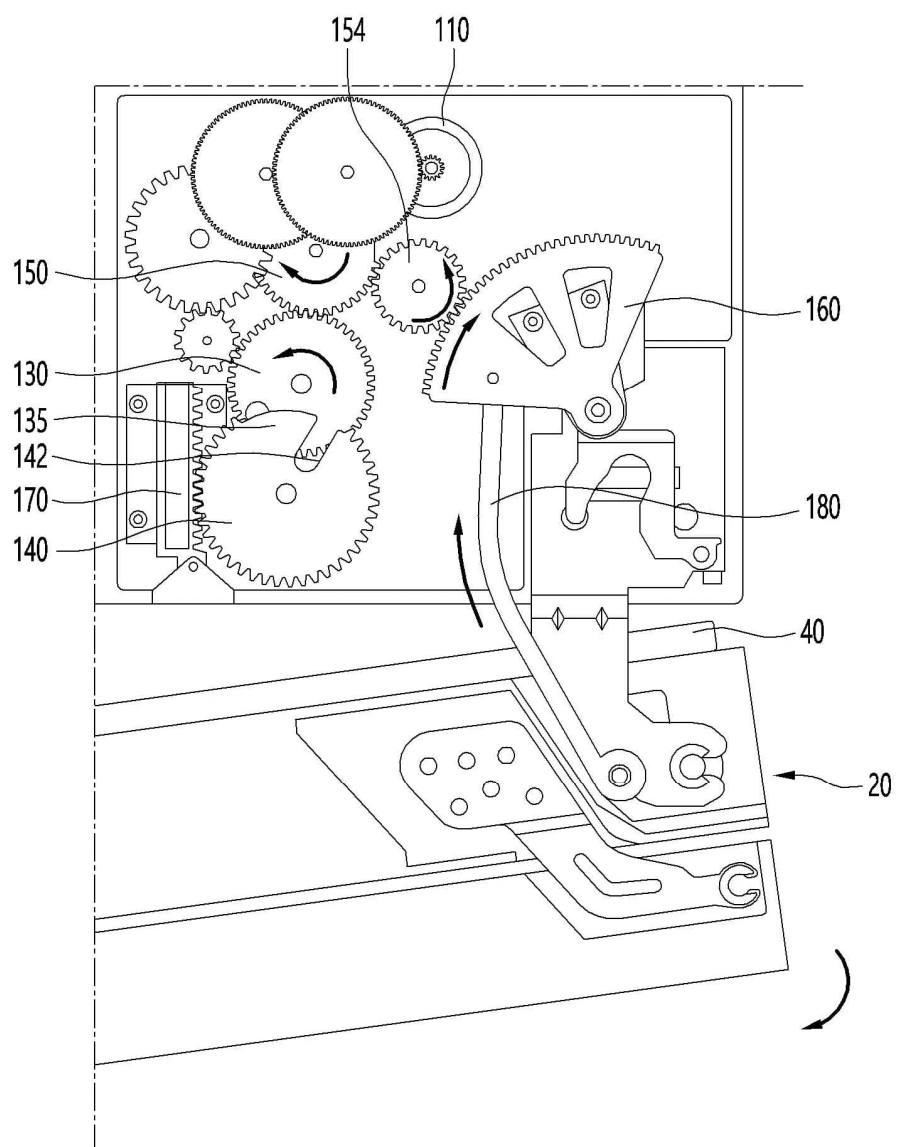


FIG. 17

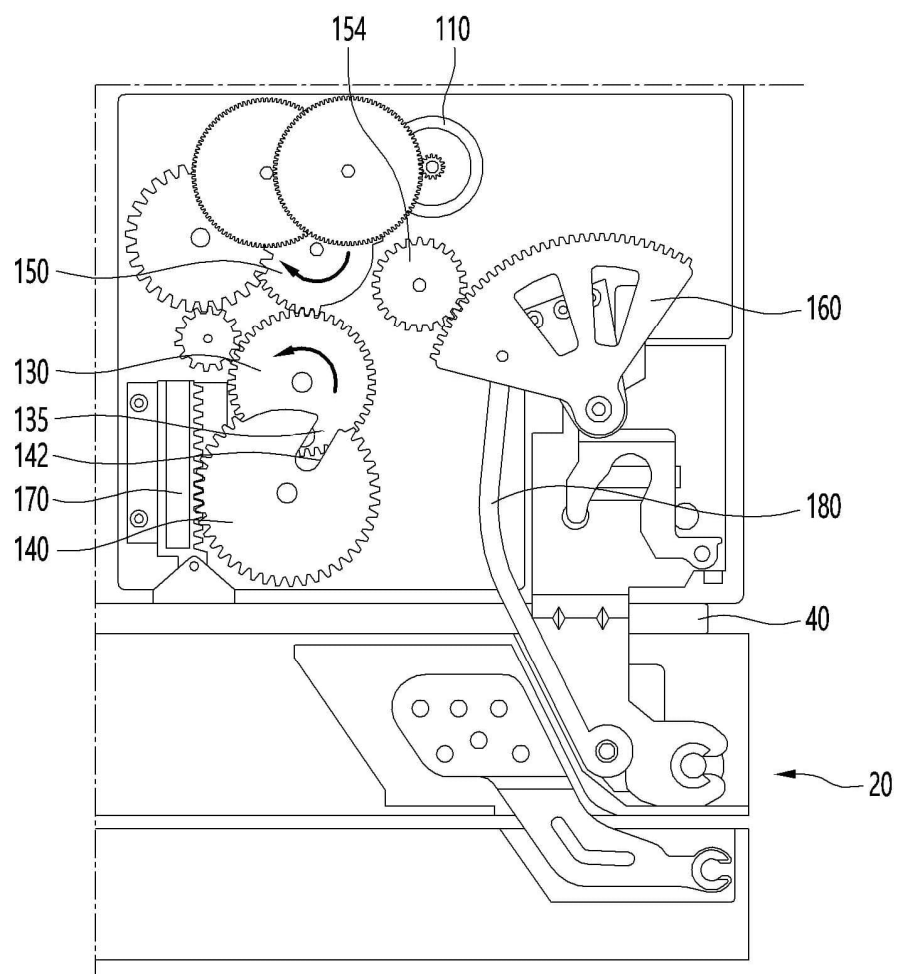


FIG. 18

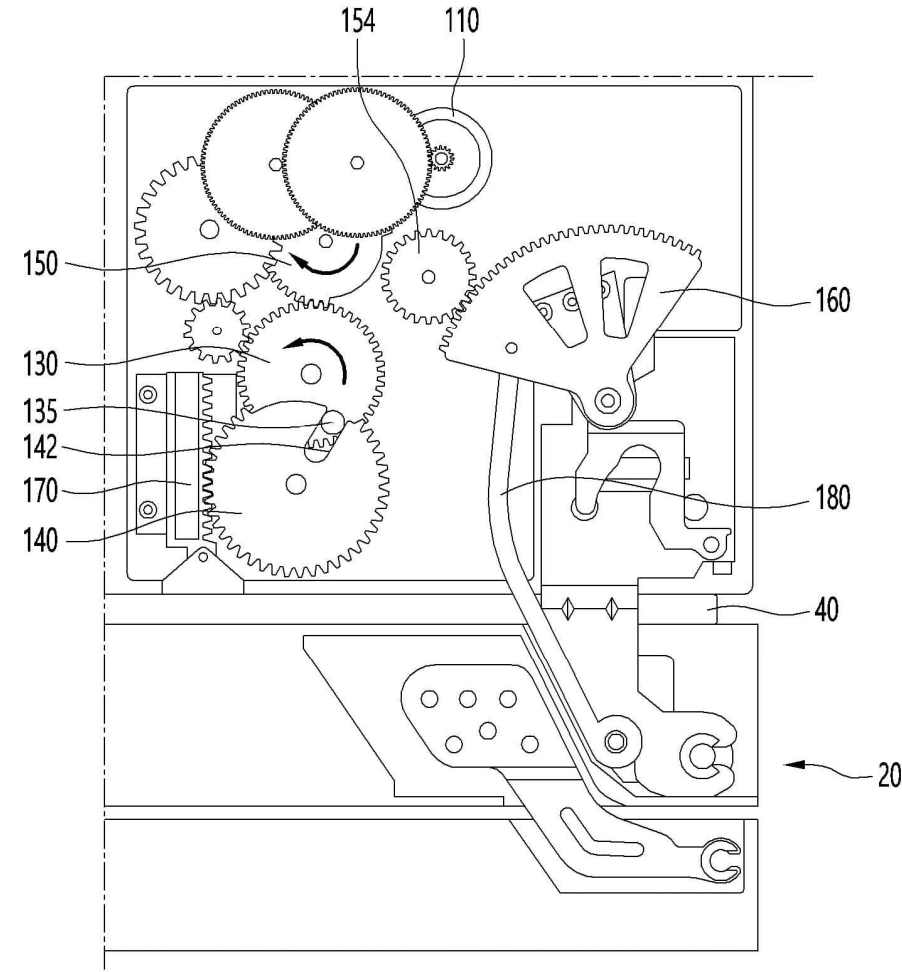
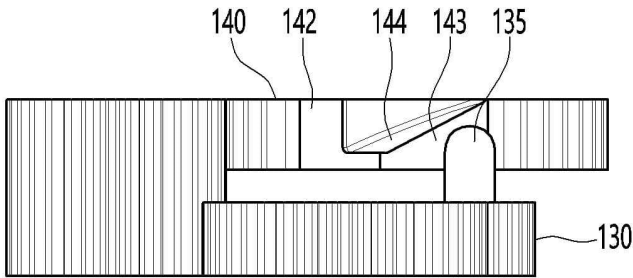
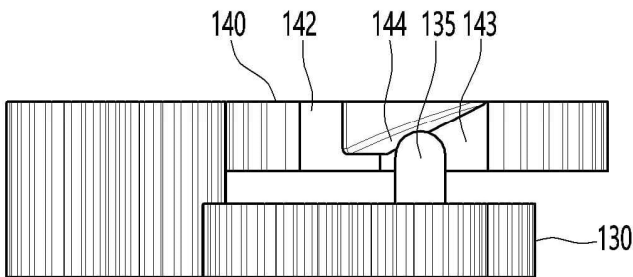


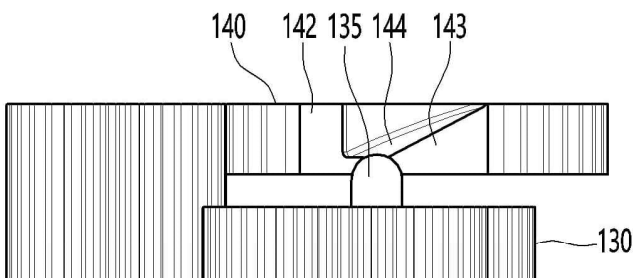
FIG. 19



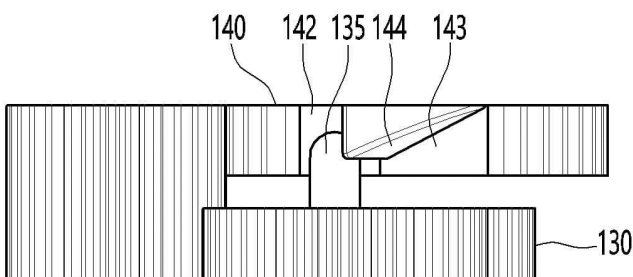
(a)



(b)



(c)



(d)

FIG. 20

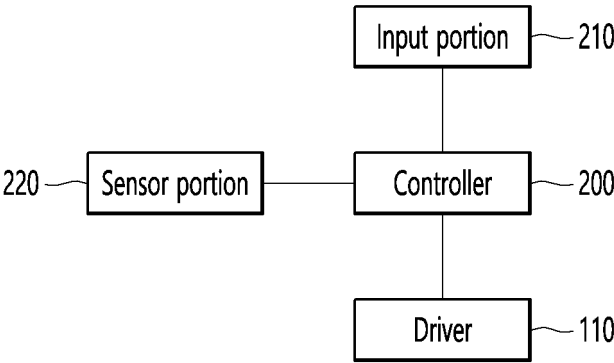


FIG. 21

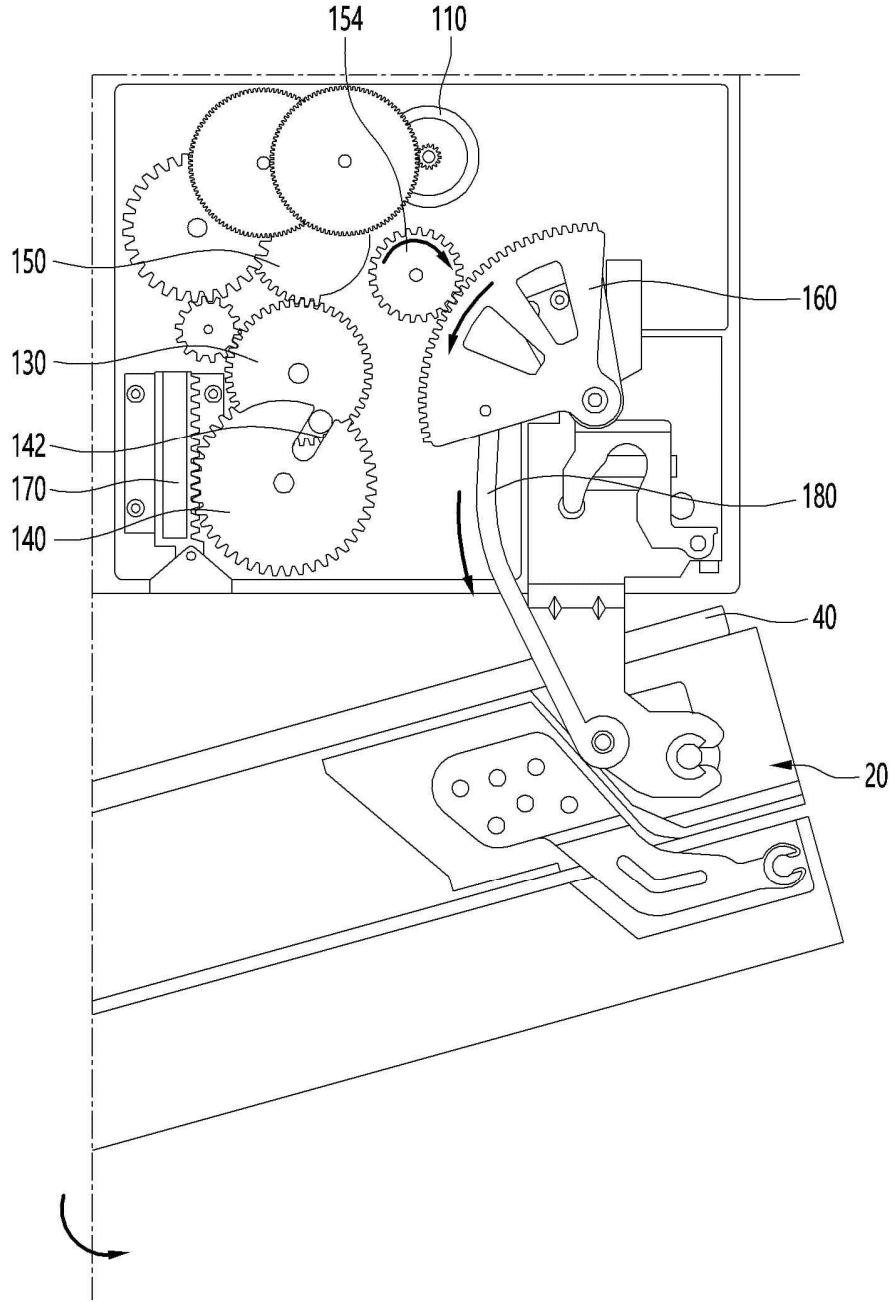
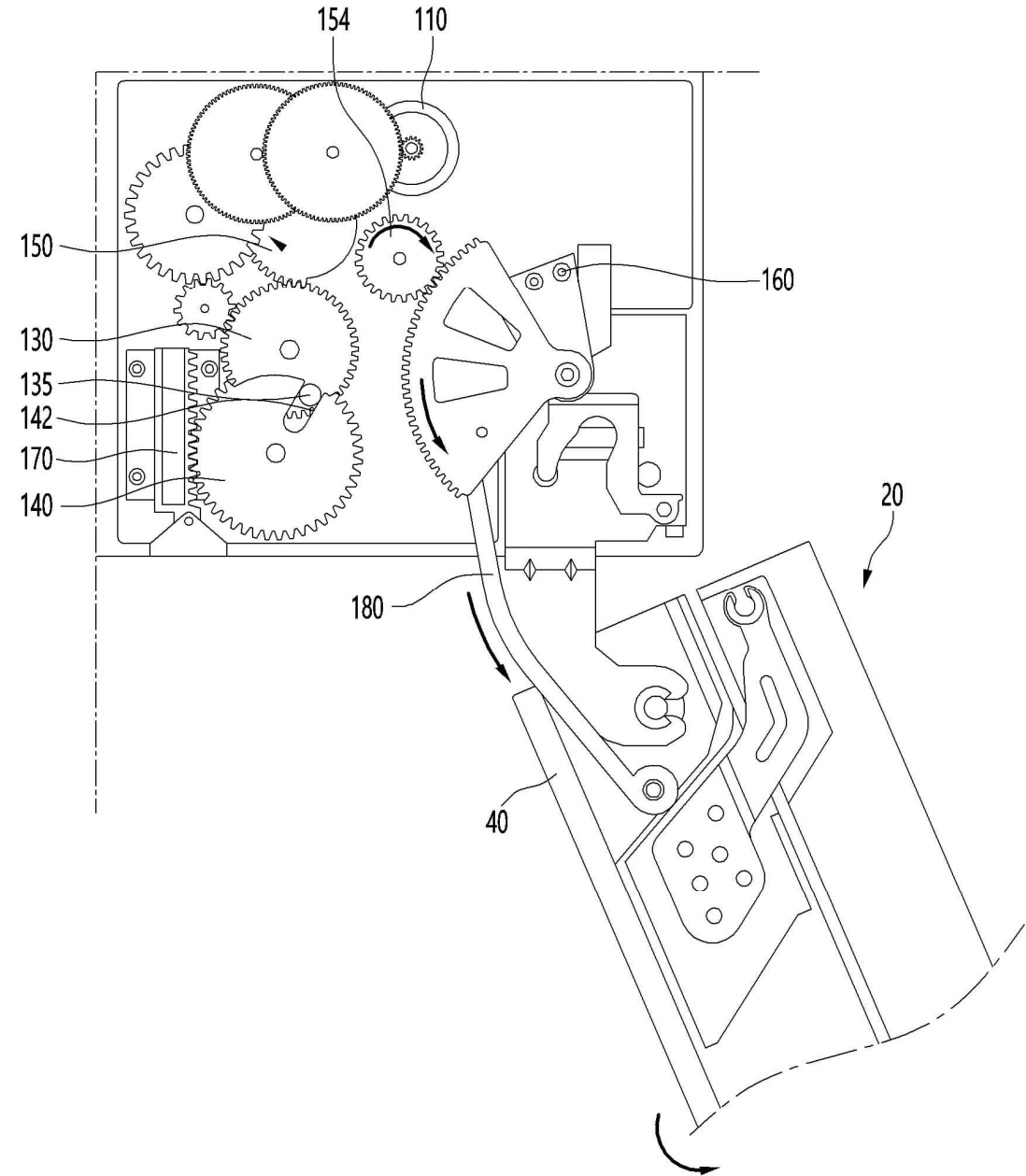


FIG. 22



Claims

Amended claims for EP-phase
(clean)

1. A refrigerator, comprising:
a cabinet having a storage space;
5 a door that opens and closes the storage space; and
a door opening and closing device configured to open the door,
wherein the door opening and closing device comprises:
a driver that generates power;
a power transmission portion that transmits the power of the driver;
10 a first operating portion that operates by receiving the power of the driver; and
a second operating portion that operates by receiving the power of the driver and is disposed at a position spaced apart
from a rotation center of the door,
wherein when the driver operates for an auto opening of the door, the first operating portion starts to operate, and the
second operating portion starts to operate after the first operating portion starts to operate.
15
2. The refrigerator of claim 1,
wherein the door opening and closing device further comprises:
a first transmission unit configured to transmit the power of the driver to the first operating portion during an auto
opening process of the door; and
20 a second transmission unit configured to transmit the power of the driver to the second operating portion.
3. The refrigerator of claim 2,
wherein the first operating portion comprises a rack gear connected to the first transmission unit, preferably wherein the
first operating portion comprises:
25 a first member including the rack gear; and
a second member rotatably connected to the first member and in contact with a rear surface of the door.
4. The refrigerator of claim 2,
wherein the second operating portion comprises:
30 a body extending from the cabinet toward the door;
a first coupling portion located at one side of the body and coupled to the door; and
a second coupling portion located at another side of the body and coupled to the second transmission unit.
5. The refrigerator of claim 2,
35 wherein in the auto opening process of the door, the first transmission unit blocks transmission of the power while the
first operating portion is operated.
6. The refrigerator of claim 5,
wherein the door opening and closing device further comprises an elastic body providing an elastic force to the first
40 operating portion or the first transmission unit so that the first operating portion returns to an initial position in a state in which the
transmission of the power is blocked.
7. The refrigerator of claim 1,
wherein in a period of an auto opening process of the door, the first operating portion and the second operating portion
45 move together in a door opening direction.

8. The refrigerator of claim 1,
wherein in an auto opening process of the door, the first operating portion moves from an initial position to an end position, and the second operating portion moves from an initial position to a door opening position,
wherein before the second operating portion moves to the door opening position, the first operating portion returns to
5 the initial position again after being moved to the end position.

9. The refrigerator of claim 8,
wherein in the auto closing process of the door, the second operating portion moves from the door opening position to the initial position in a state in which the first operating portion is stopped at the end position.

10. The refrigerator of claim 2,
wherein in a manual opening process of the door, the second transmission unit blocks a rotational force of the door from being transmitted to the driver, and/or
in the auto opening process of the door, the second transmission unit receives the power of the driver from the first
15 transmission unit.

11. The refrigerator of claim 2,
wherein the first transmission unit comprises:
a first transmission gear having a moving portion; and
20 a second transmission gear having a slot in which the moving portion is accommodated and connected to the first operating portion,
wherein when the first transmission gear is rotated in one direction in a state in which the moving portion is located in the slot, the second transmission gear is rotated together,
wherein when the first transmission gear is rotated in the one direction in a state in which the moving portion is
25 disengaged from the slot, the second transmission gear is not rotated.

12. The refrigerator of claim 11,
wherein in the auto opening process of the door, the first operating portion moves from an initial position to an end position,
30 wherein when the first operating portion moves to the end position, the moving portion is disengaged from the slot.

13. The refrigerator of claim 12,
wherein the second transmission gear comprises a recess communicating with the slot, and an inclined surface in contact with the moving portion as a surface forming the recess,
35 wherein in an auto closing process of the door, when the second transmission gear rotates in another direction, the moving portion is moved from the recess into the slot along the inclined surface.

14. The refrigerator of claim 2,
wherein the second transmission unit comprises:
40 a first transmission portion;
a second transmission portion connectable to or disconnectable from the first transmission portion; and
a third transmission portion connected to the second transmission portion and the second operating portion.

15. The refrigerator of claim 14,
45 wherein the first transmission portion comprises a first portion in which gear teeth are absent, and a second portion in which gear teeth are present,

wherein in a state in which the door is closed, the first transmission portion is located at a disconnected position where the first portion is aligned with the second transmission portion,

wherein in the auto opening process of the door, when the first transmission portion is rotated by a predetermined angle, the second portion is connected to the second transmission portion.

Claims

Amended claims for EP-phase
(marked-up)

~~{Claim 1}~~

1. A refrigerator, comprising:

a cabinet having a storage space;

a door that opens and closes the storage space; and

a door opening and closing device configured to open the door,

wherein the door opening and closing device comprises:

a driver that generates power;

a power transmission portion that transmits the power of the driver;

a first operating portion that operates by receiving the power of the driver; and

a second operating portion that operates by receiving the power of the driver and is disposed at a position spaced apart from a rotation center of the door,

wherein when the driver operates for an auto opening of the door, the first operating portion starts to operate, and the second operating portion starts to operate after the first operating portion starts to operate.

~~{Claim 2}~~

2. The refrigerator of claim 1,

wherein the door opening and closing device further comprises:

a first transmission unit configured to transmit the power of the driver to the first operating portion during an auto opening process of the door; and

a second transmission unit configured to transmit the power of the driver to the second operating portion.

~~{Claim 3}~~

3. The refrigerator of claim 2,

wherein the first operating portion comprises a rack gear connected to the first transmission unit, preferably wherein the first operating portion comprises:

a first member including the rack gear; and

a second member rotatably connected to the first member and in contact with a rear surface of the door.

~~{Claim 4}~~

~~The refrigerator of claim 3,~~

~~wherein the first operating portion comprises:~~

~~a first member including the rack gear; and~~

~~a second member rotatably connected to the first member and in contact with a rear surface of the door.~~

~~{Claim 5}~~

4. The refrigerator of claim 2,

wherein the second operating portion comprises:

a body extending from the cabinet toward the door;

a first coupling portion located at one side of the body and coupled to the door; and

a second coupling portion located at another side of the body and coupled to the second transmission unit.

~~{Claim 6}~~

5. The refrigerator of claim 2,

wherein in the auto opening process of the door, the first transmission unit blocks transmission of the power while the first operating portion is operated.

~~{Claim 7}~~

6. The refrigerator of claim ~~6~~5,

wherein the door opening and closing device further comprises an elastic body providing an elastic force to the first operating portion or the first transmission unit so that the first operating portion returns to an initial position in a state in which the transmission of the power is blocked.

~~{Claim 8}~~

7. The refrigerator of claim 1,

wherein in a period of an auto opening process of the door, the first operating portion and the second operating portion move together in a door opening direction.

~~{Claim 9}~~

8. The refrigerator of claim 1,

wherein in an auto opening process of the door, the first operating portion moves from an initial position to an end position, and the second operating portion moves from an initial position to a door opening position,

wherein before the second operating portion moves to the door opening position, the first operating portion returns to the initial position again after being moved to the end position.

~~{Claim 10}~~

9. The refrigerator of claim 98,

wherein in the auto closing process of the door, the second operating portion moves from the door opening position to the initial position in a state in which the first operating portion is stopped at the end position.

~~{Claim 11}~~

10. The refrigerator of claim 2,

wherein in a manual opening process of the door, the second transmission unit blocks a rotational force of the door from being transmitted to the driver, and/or

in the auto opening process of the door, the second transmission unit receives the power of the driver from the first transmission unit.

~~{Claim 12}~~

~~The refrigerator of claim 2,~~

~~wherein in the auto opening process of the door, the second transmission unit receives the power of the driver from the first transmission unit.~~

~~{Claim 13}~~

11. The refrigerator of claim 2,

wherein the first transmission unit comprises:

a first transmission gear having a moving portion; and

a second transmission gear having a slot in which the moving portion is accommodated and connected to the first operating portion,

wherein when the first transmission gear is rotated in one direction in a state in which the moving portion is located in the slot, the second transmission gear is rotated together,

wherein when the first transmission gear is rotated in the one direction in a state in which the moving portion is disengaged from the slot, the second transmission gear is not rotated.

~~{Claim 14}~~

12. The refrigerator of claim 1311,

wherein in the auto opening process of the door, the first operating portion moves from an initial position to an end position,

wherein when the first operating portion moves to the end position, the moving portion is disengaged from the slot.

~~{Claim 15}~~

13. The refrigerator of claim 1312,

wherein the second transmission gear comprises a recess communicating with the slot, and an inclined surface in contact with the moving portion as a surface forming the recess,

wherein in an auto closing process of the door, when the second transmission gear rotates in another direction, the moving portion is moved from the recess into the slot along the inclined surface.

~~{Claim 16}~~

~~14.~~ The refrigerator of claim 2,

wherein the second transmission unit comprises:

a first transmission portion;

a second transmission portion connectable to or disconnectable from the first transmission portion; and

a third transmission portion connected to the second transmission portion and the second operating portion.

~~{Claim 17}~~

~~15.~~ The refrigerator of claim ~~14~~14,

wherein the first transmission portion comprises a first portion in which gear teeth are absent, and a second portion in which gear teeth are present,

wherein in a state in which the door is closed, the first transmission portion is located at a disconnected position where the first portion is aligned with the second transmission portion,

wherein in the auto opening process of the door, when the first transmission portion is rotated by a predetermined angle, the second portion is connected to the second transmission portion.

~~{Claim 18}~~

~~The refrigerator of claim 17;~~

~~wherein at the disconnected position of the first transmission portion, the door is manually openable.~~

~~{Claim 19}~~

~~The refrigerator of claim 18;~~

~~wherein in a manual opening process of the door, the second operating portion is movable to the door opening position by the rotational force of the door.~~

~~{Claim 20}~~

~~A refrigerator, comprising:~~

~~a cabinet having a storage space;~~

~~a door that opens and closes the storage space; and~~

~~a door opening and closing device configured to open the door,~~

~~wherein the door opening and closing device comprises:~~

~~a driver that generates power;~~

~~an operating portion that operates by receiving the power of the driver and is disposed at a position spaced apart from a rotation center of the door;~~

~~a first transmission portion configured to transmit the power of the driver; and~~

~~a second transmission portion connectable to or disconnectable from the first transmission portion;~~

~~wherein in a state in which the door is closed, the first transmission portion is located at a disconnected position where the first transmission portion is disconnected to the second transmission portion,~~

~~wherein when the driver operates for an auto opening of the door, the first transmission portion moves to a connected position to be connected to the second transmission portion in an auto opening process of the door.~~