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(54) **A DOOR OPENING MECHANISM**

TÜRÖFFNUNGSMECHANISMUS

MÉCANISME D'OUVERTURE DE PORTE

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(73) Proprietor: **Arçelik Anonim Sirketi**

34445 Istanbul (TR)

(72) Inventors:

- **MUTLU, Eren**
34950 Istanbul (TR)

- **MUTLU DOĞAN, Mehmet**
34950 Istanbul (TR)

- **AYAROĞLU, Emre**
34950 Istanbul (TR)

- **AYVAZOĞLU, Cumhur**
34950 Istanbul (TR)

- **DONMEZ, Ersin**
34950 Istanbul (TR)

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Description

TECHNICAL FIELD

[0001] The present invention relates to a door opening mechanism enabling opening particularly refrigerator doors.

PRIOR ART

[0002] "Hands-free" refrigerators having automatic door opening mechanisms enabling users to access into a refrigerator without using hands, are known and used in the art. In automatic refrigerator door opening mechanisms, the force applied on a door should exceed the vacuum effect also acting on the door in order to open the door automatically. However, while being opened by this force, a door may damage a user and/or the items in its proximity by colliding. Therefore, automatic door opening mechanisms are needed which do not inflict damage on a user while performing smoothly the door opening function.

[0003] In addition, automatic door opening mechanisms are expected to perform the door opening function independent of door weights varying due to the products placed thereon.

[0004] Another problem observed in refrigerators with automatic door opening mechanisms and solved by the present invention is that in case a door impacts a user, the reaction (force) applied by the user on the door is likely to damage the door opening mechanism.

[0005] State of the art European patent document no. EP2020579 mentions an actuator enabling opening the doors of refrigerators or freezers.

[0006] State of the art German patent document no. DE102013223431 mentions an electromagnetic door opening device for opening refrigerator doors.

[0007] The documents JP2006046745A, KR20100003347U and JP2003247775A disclose door opening devices for refrigerators. The document CN1 04328971A discloses an automatic door opening device and refrigerator comprising the same.

[0008] None of the state of the art documents include a solution such as the one in the present invention.

BRIEF DESCRIPTION OF THE INVENTION

[0009] The aim of the present invention is to realize a door opening mechanism enabling opening particularly refrigerator doors.

[0010] Another aim of the present invention is to realize a door opening mechanism which may be used with current refrigerators.

[0011] A further aim of the present invention is to realize a door opening mechanism capable of terminating a door opening process by detecting difficulties likely to occur during opening of a door.

DETAILED DESCRIPTION OF THE INVENTION

[0012] The door opening mechanism realized to achieve the aims of the present invention is illustrated in the accompanying drawings, wherein:

Figure 1: is a schematic view of an embodiment of the invention.

Figure 2: is a view of an embodiment in which the sensor is connected to the slide.

Figure 3: is a view of an embodiment in which the sensor is connected to the plate coupled to the drive unit.

Figure 4: is a view of an embodiment in which the sensor is connected to the plate coupled to the reducer.

[0013] The elements in the figures are numbered individually and the correspondence of these numbers are given hereinafter.

1. Door opening mechanism
2. Body
3. Driving unit
4. Reducer
5. Rack

51. Slide
52. Bracket

6. Button
7. Sensor
8. Plate

[0014] In its most basic form, the door opening mechanism (1) enabling opening particularly refrigerator doors, comprises

- at least one body (2),
- at least one driving unit (3) providing actuation to open a door by rotating a shaft,
- at least one reducer (4) enabling reducing the speed of the rotational motion generated by the driving unit (3) thereby increasing the torque thereof,
- at least one gear rack (5) at least a portion of which engages the reducer (4), actuated by the reducer (4), enabling opening a refrigerator door by pushing said door in at least a part of said actuation, comprising at least one bracket (52), and
- at least two buttons (6) whose state can be changed by being contacted by the bracket (52), placed so as to be able to contact the bracket (52) at points where the motion of the gear rack (5) is intended to be terminated, wherein the bracket (52) is arranged to press on the buttons (6) at the points where the actuation of the gear rack (5) is intended to be terminated.

[0015] The door opening mechanism (1) enabling opening particularly refrigerator doors, comprises in its most basic form, at least one body (2) and a driving unit (3) connected to said body (2). The driving unit (3) may be any structure generating actuation by rotating a shaft, such as an electric engine. The rotational motion generated by the driving unit (3) is then transmitted to the reducer (4). The reducer (4) reduces the speed of the rotational motion, thereby increasing the torque thereof. In turn, the reducer (4) transmits said motion to the gear rack (5). The gear rack (5) moves linearly due to the force applied by the reducer (4). The gear rack (5) moves so as to apply a force on the door intended to be opened at the position where the movement mechanism (1) is placed. The gear rack (5) has at least one bracket (52). Said bracket (52) is capable of pressing on the buttons (6) at the points where it is intended to terminate the movement of the gear rack (5). At least one button (6) is provided capable of contacting the bracket (52) at the position where the gear rack (5) projects the least from the body (2), and at least one button (6) is provided capable of contacting the bracket (52) at the position where the gear rack (5) projects the farthest from the body (2). The stroke of the gear rack (5) can be increased or decreased by changing the positions of the buttons (6).

[0016] The door opening mechanism (1) of the invention is placed such that the gear rack (5) can apply a force on the door in door opening direction. For example, the door opening mechanism (1) of the invention can be placed to the internal volume of a refrigerator. The force that the gear rack (5) should apply on a refrigerator door when it is desired to open the refrigerator door, depends on a number of factors. For example, the air with room temperature introduced when the refrigerator door is opened and closed, encounters a cold environment in the refrigerator and its temperature and therefore its volume decreases. The decreased volume creates a negative pressure (vacuum) in the refrigerator. Furthermore, the loading state of the refrigerator door also affects the opening force. Since the gear rack (5) should generate a force to overcome all of these forces, the torque of the motion received from the driving unit (3) is increased by the reducer (4).

[0017] In an embodiment of the invention, the door opening mechanism (1) of the invention can be triggered by a button, a visual or audible command, a proximity sensor and the like. In this embodiment, at least one control unit (not shown in the figures) is provided, receiving said triggers and accordingly enabling driving the driving unit (3). A sensor capable of detecting a trigger enabling the door to be opened, is preferably placed at a region where a user can interact with. In case the door opening mechanism is used in a refrigerator, the signal triggering opening of the door can be generated by a button, camera, proximity sensor, RFID reader, or an NFC sensor, placed on the exterior of the refrigerator door. The above-mentioned triggers are only exemplary and the triggers and the sensors which may be used are not limited to

these. A plurality of triggers may also be used.

[0018] In the door opening mechanism (1) of the invention, a structure is provided detecting that the driving unit (3) is hampered due to applying a resistance against the door intended to be opened, a jamming of the door for any reason whatsoever, and not being able to open the door. This structure comprises at least one sensor (7).

[0019] In an embodiment of the invention, the structure detecting that the driving unit (3) is hampered, preferably comprises at least one slide (51) connected to the gear rack (5) and at least one sensor (7) enabling detecting whether said slide (51) is moving. The slide (51) preferably has lower and higher portions like a battlement on a bastion. In this embodiment, the sensor (7) is preferably an optocoupler comprising at least one light source and at least one light detector. At least a portion of the slide (51) can pass in between the light detector and the light source. When the higher portion of the slide (51) enters in between the light detector and the light source, the light beams emitted from the light source cannot reach the light detector. In this case, let us assume that the outlet of the sensor (7) is boolean 0. When the lower portion of the slide (51) enters in between the light detector and the light source, the light beams emitted from the light source can reach the light detector. In this case, the outlet of the sensor (7) would be boolean 1. The sensor (7) can also be configured to assign boolean 1 when the light beams cannot reach the light detector, and boolean 0 when the light beams can reach the light detector. The slide (51) comprises a plurality of lower and higher portions preferably placed consecutively. Thus, when the slide (51) is moving within the sensor (7), the outlet of the sensor (7) continuously switches between boolean 0 and 1 values. When the outlet of the sensor (7) is constant, this implies that the slide (51) and therefore the gear rack (5) is not moving.

[0020] In an embodiment of the invention, the structure detecting that the driving unit (3) is hampered, preferably comprises at least one plate (8) engageable to the shaft of the driving unit (3) or to any gear of the reducer (4), and rotating together with the component it has engaged. In this embodiment, the movement mechanism (1) of the invention comprises at least one sensor (7) enabling detecting whether the plate (8) is moving. The plate (8) preferably has leaves like a daisy. In this embodiment, the sensor (7) is preferably an optocoupler comprising at least one light source and at least one light detector. At least a portion of the plate (8) can pass in between the light detector and the light source. When a leaf portion of the plate (8) enters in between the light detector and the light source, the light beams emitted from the light source cannot reach the light detector. In this case, let us assume that the outlet of the sensor (7) is boolean 0. When the portion of the plate (8) between the leaves enters in between the light detector and the light source, the light beams emitted from the light source can reach the light detector. In this case, the outlet of the sensor (7) would be boolean 1. The sensor (7) can also be con-

figured to assign boolean 1 when the light beams cannot reach the light detector, and boolean 0 when the light beams can reach the light detector. The plate (8) comprises a plurality of leaves preferably placed consecutively, and there are gaps in between consecutive leaves. Thus, when the plate (8) is moving within the sensor (7), the outlet of the sensor (7) continuously switches between boolean 0 and 1 values. When the outlet of the sensor (7) is constant, this implies that the plate (8) and therefore the driving unit (3) is not moving. Whereas a non-moving driving unit (3) would imply that the door has encountered a resistance.

[0021] The movement mechanism (1) of the invention comprises at least one control unit (not shown in the figures) adapted to execute at least one of the operations including: driving the driving unit (3) directly or by means of an interface circuit, detecting the state of the button (6), receiving data from the sensor (7), determining according to said data received from the sensor (7) whether there is resistance against a door intended to be opened, and upon determining presence of a resistance, halting driving of the driving unit (3) or driving the driving unit (3) in an opposite direction to bring the door to its initial position. The control unit determines that the door has encountered a resistance when the sensor (7) output is constant although the driving unit (3) is being driven. In this case, the control unit can halt driving the driving unit (3) or can bring the gear rack (5) to its initial position by driving the driving unit (3) in the opposite direction.

[0022] In an embodiment of the invention, the control unit can halt driving the driving unit (3) or can bring the gear rack (5) to its initial position by driving the driving unit (3) in the opposite direction also when it determines that the slide (51) of the gear rack or the plate (8) is moving in a speed slower than a predetermined speed although the driving unit (3) is being driven.

[0023] The door opening mechanism (1) of the invention can conveniently be used with current refrigerators by being placed to the internal chamber of a refrigerator so as to correspond to the door intended to be opened automatically.

Claims

1. A door opening mechanism (1) enabling opening particularly refrigerator doors, **comprising**
 - at least one body (2),
 - at least one driving unit (3) providing actuation to open a door by rotating a shaft,
 - at least one reducer (4) enabling reducing the speed of the rotational motion generated by the driving unit (3) thereby increasing the torque thereof, and
 - at least one gear rack (5) at least a portion of which engages the reducer (4), actuated by the reducer (4), enabling opening a refrigerator door

by pushing said door in at least a part of said actuation, comprising at least one bracket (52), **characterized by**

- at least two buttons (6) whose state can be changed by being contacted by the bracket (52), placed so as to be able to contact the bracket (52) at the points where the actuation of the gear rack (5) is intended to be terminated, wherein the bracket (52) is arranged to press on the buttons (6) at the points where the actuation of the gear rack (5) is intended to be terminated.

2. A door opening mechanism (1) according to claim 1, wherein positions of the buttons (6) are variable for changing the stroke of the gear rack (5).

3. A door opening mechanism (1) according to claim 1 or 2, wherein at least one button (6) is arranged to contact the bracket (52) at a position where the gear rack (5) projects least from the body (2), and at least one button (6) is arranged to contact the bracket (52) at a position where the gear rack (5) projects farthest from the body (2).

4. A door opening mechanism (1) according to any one of preceding claims, wherein the driving unit (3) and the reducer (4) are positioned at one side of the gear rack (5), and the buttons (6) are positioned at the opposite side of the gear rack (5) with respect to the driving unit (3) and the reducer (4).

Patentansprüche

1. Ein Türöffnungsmechanismus (1), der das Öffnen insbesondere von Kühlschränktüren ermöglicht, **umfasst**

- mindestens ein Körper (2),
- mindestens eine Antriebseinheit (3), die eine Betätigung zum Öffnen einer Tür durch Drehen einer Welle bereitstellt,
- mindestens ein Untersetzungsgetriebe (4), dass eine Verringerung der Geschwindigkeit der durch die Antriebseinheit (3) erzeugten Drehbewegung ermöglicht, wodurch deren Drehmoment erhöht wird, und
- mindestens eine Zahnstange (5), von der mindestens ein Teil in das Untersetzungsgetriebe (4) eingreift, betätigt durch das Untersetzungsgetriebe (4), Ermöglichen des Öffnens einer Kühlschränktür durch Drücken der Tür bei mindestens einem Teil der Betätigung, umfassend mindestens eine Halterung (52), der **gekennzeichnet ist durch**
 - mindestens zwei Tasten (6), deren Zustand **durch** Kontaktierung **durch** den Bügel (52) veränderbar ist, platziert, um den Bügel (52) an den

Stellen kontaktieren zu können, an denen die Betätigung der Zahnstange (5) beendet werden soll, wobei die Halterung (52) angeordnet ist, um auf die Knöpfe (6) an den Punkten zu drücken, wo die Betätigung der Zahnstange (5) beendet werden soll.

2. Ein Türöffnungsmechanismus (1), wie in Anspruch 1 aufgeführt, **ist dadurch gekennzeichnet, dass** die Positionen der Knöpfe (6) variabel sind, um den Hub der Zahnstange (5) zu ändern.
3. Ein Türöffnungsmechanismus (1), wie in Anspruch 1 oder 2 aufgeführt, wobei mindestens ein Knopf (6) angeordnet ist, um die Halterung (52) an einer Position zu kontaktieren, wo die Zahnstange (5) am wenigsten von dem Körper (2) vorsteht, und mindestens ein Knopf (6) so angeordnet ist, dass er die Halterung (52) an einer Position berührt, wo die Zahnstange (5) am weitesten von dem Körper (2) vorsteht.
4. Ein Türöffnungsmechanismus (1), wie in einem der vorherigen Ansprüchen aufgeführt, wobei die Antriebseinheit (3) und das Untersetzungsgetriebe (4) auf einer Seite der Zahnstange (5) positioniert sind, und die Knöpfe (6) auf der gegenüberliegenden Seite der Zahnstange (5) in Bezug auf die Antriebseinheit (3) und das Untersetzungsgetriebe (4) positioniert sind.

le support (52) étant conçu pour appuyer sur les boutons (6) aux endroits où l'actionnement de la crémaillère (5) est destiné à être interrompu.

- 5 2. Un mécanisme d'ouverture de porte (1) selon la déclaration 1, dans lequel les positions des boutons (6) sont variables pour changer la course de la crémaillère (5).
- 10 3. Un mécanisme d'ouverture de porte (1) selon la déclaration 1 ou 2, dans lequel au moins un bouton (6) est agencé pour entrer en contact avec le support (52) dans une position où la crémaillère (5) fait le moins saillie par rapport au corps (2), et au moins un bouton (6) est agencé pour entrer en contact avec le support (52) dans une position où la crémaillère (5) fait le plus saillie par rapport au corps (2).
- 15 4. Un mécanisme d'ouverture de porte (1) selon l'une quelconque des déclarations précédentes, dans lequel l'unité d'entraînement (3) et le réducteur (4) sont positionnés sur un côté de la crémaillère (5), et les boutons (6) sont positionnés sur le côté opposé de la crémaillère (5) par rapport à l'unité d'entraînement (3) et au réducteur (4).
- 20
- 25
- 30

Revendications

1. Un mécanisme d'ouverture de porte (1) permettant d'ouvrir en particulier les portes d'un réfrigérateur, **comprenant**
 - au moins un corps (2),
 - au moins une unité d'entraînement (3) permettant d'ouvrir une porte en faisant tourner un arbre,
 - au moins un réducteur (4) permettant de réduire la vitesse du mouvement de rotation généré par l'unité motrice (3) et d'en augmenter ainsi le couple, et
 - au moins une crémaillère (5) dont au moins une partie engage le réducteur (4), actionnée par le réducteur (4), permettant d'ouvrir une porte de réfrigérateur en poussant ladite porte dans au moins une partie dudit actionnement, comprenant au moins un support (52), **caractérisé par**
 - au moins deux boutons (6) dont l'état peut être modifiés par contact avec le support (52), placés de manière à pouvoir entrer en contact avec le support (52) aux endroits où l'actionnement de la crémaillère (5) est destiné à être interrompu,

Figure 1

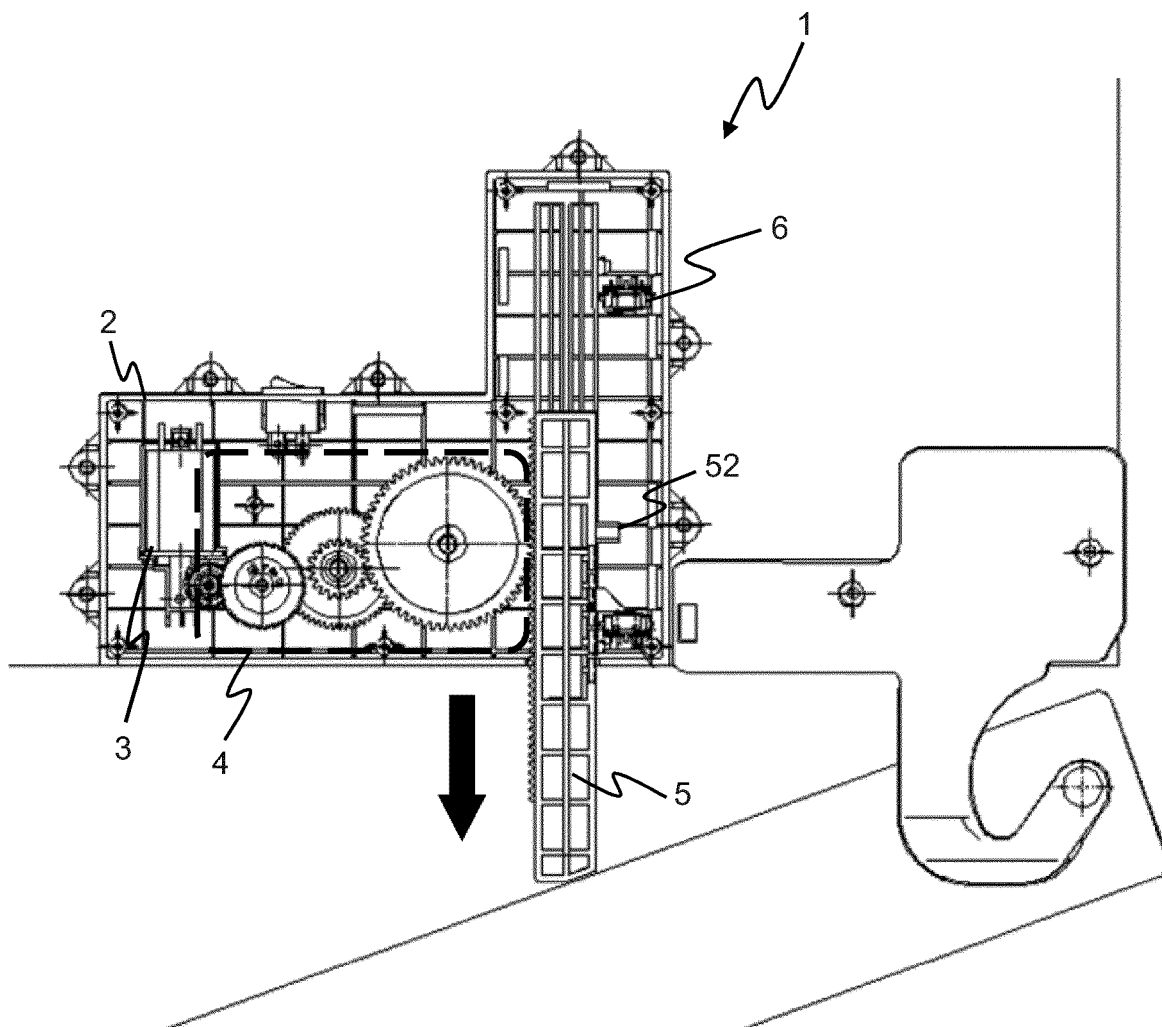


Figure 2

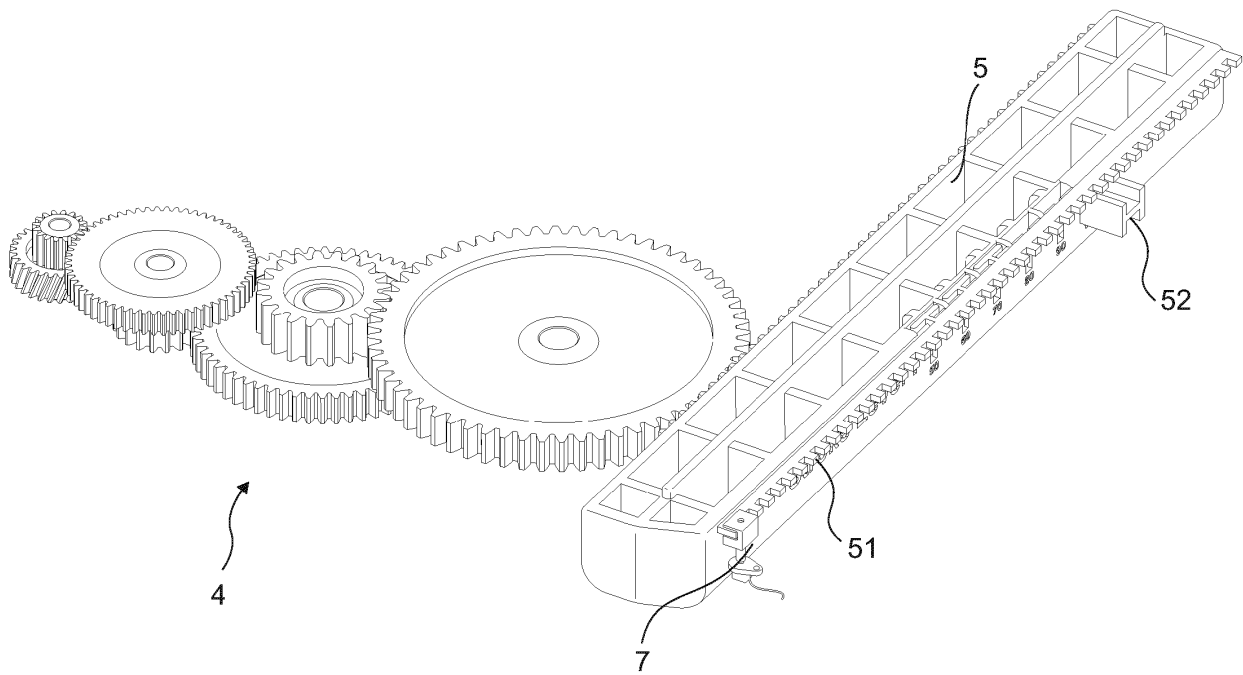


Figure 3

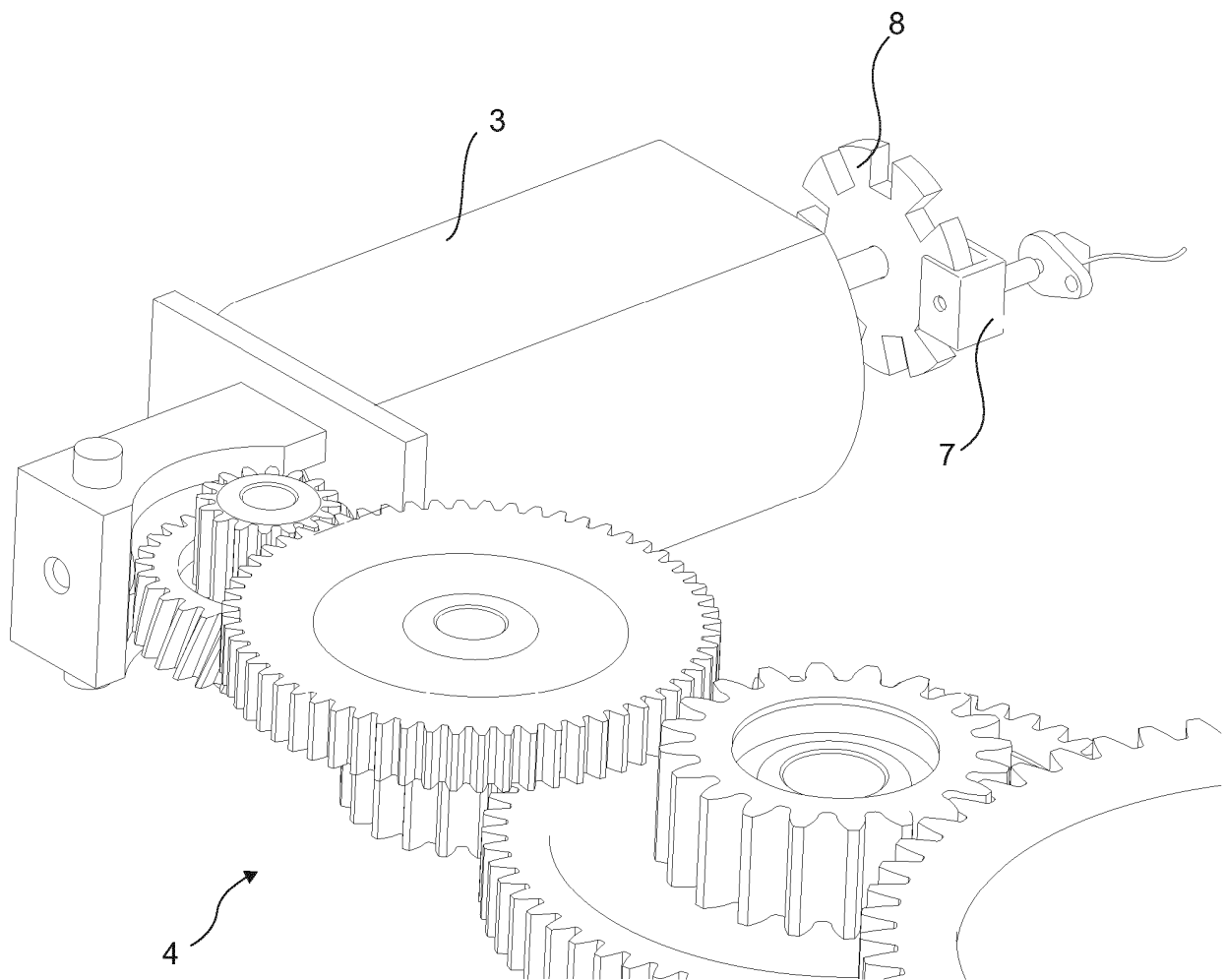
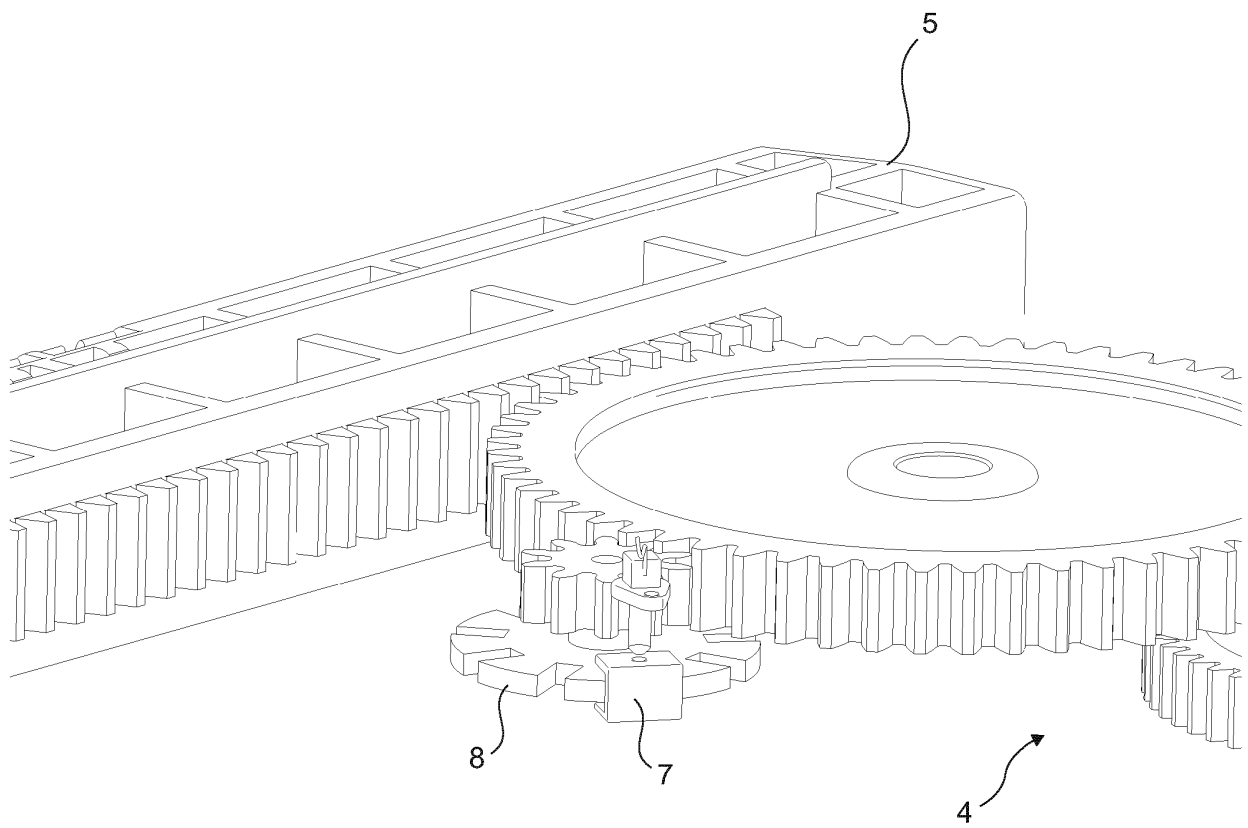


Figure 4



REFERENCES CITED IN THE DESCRIPTION

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