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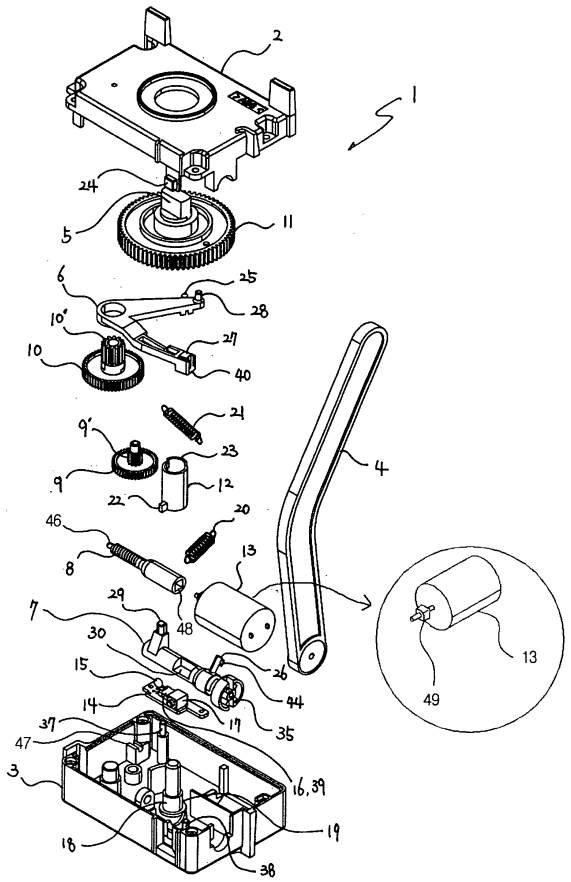
(54) Ice maker-driving device for refrigerator and method for operating the same

(57) The present invention relates to an ice maker-driving device for a refrigerator and a method for operating the same wherein the ice-making container (36) connected to the ice-separating lever (5) and rotated by initial circuit set is reversely rotated before forward rotation and has a protruded coupling part having a predetermined angle formed on the other side thereof, without any co-operation with the ice-separating lever (5), so as to be coupled with a case-fixing part, thereby allowing the ice-making container (36) to be twistedly rotated at one side thereof according to the reverse rotation of the ice-separating lever (5), such that the separation of ice cubes is conducted and also the stress and tense state of the parts caused by their freezing are removed to prevent their malfunction, thereby efficiently achieving the ice-separating and storing operations.

Fig. 1



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to an automatic ice maker for use in a refrigerator, and more particularly, to an ice maker-driving device for a refrigerator which generally includes an ice quantity-checking part, an ice-separating part, a test switch, a control circuit for operating them, a driving shaft having a power transmission unit, all kinds of reduction gears and a worm gear, and the like.

Background of the Related Art

[0002] As one example of the prior art, Korean Patent No.1992-1971 (entitled 'refrigerator attached with automatic ice maker' as filed on March 7, 1989) discloses a refrigerator with an automatic ice maker which removes ice cubes from an ice-making tray when a temperature on the ice-making tray detected by a temperature sensor is below a predetermined set icing completion temperature and feeds water to the ice-making tray again to perform an ice-making operation, the refrigerator including: a determining unit adapted to determine whether the fed water is normal or not when the temperature of the ice-making tray detected by the temperature sensor after feeding the water to the ice-making tray is below a predetermined temperature; and an alarming unit adapted to perform an alarming operation based on the determination result of the determining unit. In the conventional refrigerator with the automatic ice maker, the alarming function is additionally provided to warn that the ice-making tray is operated without the feeding of the water thereto when the water in a water-feeding tank separately mounted to the automatic ice maker is in short supply.

[0003] As another example of the prior art, Korean Utility Model Registration No.1993-4478 (entitled 'refrigerator attached with automatic ice maker' as filed on March 11, 1989) discloses a refrigerator with an automatic ice maker wherein water is fed to an ice-making tray and frozen thereinto to make ice cubes, the ice cubes are removed from the ice-making tray and stored in an ice-storing container, and then, the quantity of stored ice is checked by a lever that is changed in position in accordance with the quantity of ice stored in the ice-storing container, such that when the quantity of ice stored in the ice-storing container is below a predetermined value, ice-making and ice-storing operations are repeatedly performed, and thus, if the quantity of ice stored in the ice-storing container is over the predetermined value, a stored ice quantity checking switch adapted to operated by means of the lever is operated to stop the ice-making operation. In the above-mentioned conventional practice, when it is checked that the quantity of stored ice is over the predetermined value by means of the ice quantity-checking lever adapted to check the quantity of ice stored in the ice-storing container, the ice-making operation is controlled by the switch (sensor).

[0004] As yet another example of the prior art, Korean Patent No.228819 (entitled 'automatic ice maker' as filed on November 29, 1994) discloses an automatic ice maker which has an ice-making tray rotatably connected to one end of an operating gear moved by a motor, such that water is automatically fed to the ice-making tray and the ice-making tray is rotated by a predetermined angle under the control of a controller adapted to sense the completion of the ice-making operation so as to separate the ice cubes from the ice-making tray, thereby automatically completing the ice-making operation. The above-mentioned automatic ice maker includes the motor, the operating gear, the ice-making tray, and the controller, so as to rotate the ice-making tray.

[0005] As still another example of the prior art, Korean Patent No.182735 (entitled 'power control method for automatic ice maker' as filed on November 15, 1996) discloses a power control method for an automatic ice maker which includes: the steps of placing an ice-making tray to its original position by means of a driving motor so as to supply water to the ice-making tray; feeding water to the ice-making tray so as to make ice cubes thereinto; separating the ice cubes from the ice-making tray if the ice-making operation is completed; and if it is determined that the driving motor is overloaded, reversely rotating the driving motor so as to release the overloaded state of the driving motor.

[0006] In the above-mentioned prior art, further, the overloading of the driving motor is made when the ice-making tray escapes from its original position, the overloading of the driving motor is determined when the voltage loaded to the driving motor is measured and higher than a reference voltage of the driving motor, and the reverse rotation of the driving motor in the revere-rotating step is conducted so as to prevent the ice-making tray from escaping from its original position. According to the features of the above-mentioned prior art, the power control method for the automatic ice maker includes the step of reversely rotating the driving motor so as to release the overloading state of the driving motor.

[0007] As further another example of the prior art, Korean Patent No.182736 (entitled 'automatic ice maker for refrigerator' as filed on November 19, 1996) discloses an automatic ice maker for a refrigerator wherein if a maximum rotating angle exceeds by the malfunction of a sensing switch (sensor) upon the rotation of an ice-making tray by a motor, the ice-making tray, a cam gear and various parts are damaged, which is caused in the same manner even when the reverse rotation of the ice-making tray to return the ice-making tray to its original position after ice cubes are separated from the ice-making tray, the automatic ice maker for the refrigerator including: a first stopper mounted at a position higher than a position where the cam gear stops at a maximum rotating position; and a second stopper mounted at a position higher than

a position where the cam gear stops at a horizontal position. In this prior art, that is, the automatic ice maker only includes the first and second stoppers.

[0008] As still yet another example of the prior art, Korean Patent No.422969 (entitled 'driving device for automatic ice maker' as filed on June 16, 2001) discloses a driving device for an automatic ice maker that changes the coupling relation between a worm gear and a driving motor and obtains the simple cooperating relation among the parts thereof, wherein an ice-making tray is rotated by the operation of the driving motor, the ice cubes are separated from the ice-making tray, and the ice-making tray is reversely rotated to return to its ice-making position. In the above-mentioned prior art, the rotation and the reverse rotation of the ice-making tray by means of the driving motor are well known in this field.

[0009] As described above, the shape, structure and practical functions of the automatic ice maker for a refrigerator are well known in this field, and therefore, the present invention relates to an improved automatic ice maker for a refrigerator.

[0010] Also, since water is changed into ice cubes during the ice-making process, the volume of water is increased such that the water having a density of 1.00g/cm3 is changed into an ice cube having a density of 0.9168g/cm3, and if 10ml volume of water of 0°C in a space where a piece of ice cube in the ice-making container is made is frozen, the volume of water becomes about 11ml such that as the volume is expanded to cause the pressure in the ice-making container to be increased, thereby making it difficult to separate the ice cubes tightly attached on the ice-making container only by means of the rotation of 180° of the ice-making container. In order to solve this problem, the ice-making container is constructed to be twisted at one side thereof when it is rotated over 180° in the horizontal state thereof, which causes one-sided driving to be repeatedly conducted to generate the stress only on one side of gears, thereby shortening the lifespan of the parts and failing to easily separate the ice cubes from the ice-making container.

SUMMARY OF THE INVENTION

[0011] Accordingly, the present invention has been made in view of the above-mentioned problems occurring in the prior art, and it is an object of the present invention to provide an improved ice maker-driving device for a refrigerator and a method for operating the same wherein the structures and functions of conventional automatic ice makers are modified to provide simple and efficient driving and the organic coupling relation among parts is improved in such a manner that the parts are rigidly cooperated with one another, thereby achieving the reduction of error rate and the strong durability against internal or external vibration and impact.

[0012] It is another object of the present invention to provide an ice maker-driving device for a refrigerator and a method for operating the same wherein in order to solve the problem that when the ice cubes in an ice-making container are separated by the rotation of an ice-separating lever by means of a motor after the quantity of ice stored in an ice-storing container is checked in a low level by an ice quantity-checking lever, the ice-making container connected to the ice-separating lever and rotated by initial circuit set is reversely rotated before forward rotation and has a protruded coupling part having a predetermined angle formed on the other side thereof, without any cooperation with the ice-separating lever, so as to be coupled with a case-fixing part, thereby allowing the ice-making container to be twistedly rotated at one side thereof according to the reverse rotation of the ice-separating lever, such that the separation of ice cubes is conducted and also the stress and tense state of the parts caused by their freezing are removed to prevent their malfunction, thereby smoothly achieving the ice-separating and storing operations.

[0013] To accomplish the above objects, according to the present invention, there is provided an ice maker-driving device for a refrigerator which is adapted to change water in an ice-making container into ice cubes by the driving of an ice quantity-checking lever and an ice-separating lever according to the transmission of power from a motor by using a plurality of worm and reduction gears mounted in a body thereof, adapted to check the quantity of ice stored in an ice-storing container by means of the ice quantity-checking lever and an ice quantity-checking sensor to rotate the ice-making container in which the ice cubes are filled by 180° by means of the ice-separating lever if the quantity of ice stored in the ice-storing container is in short supply and to fill the ice cubes in the ice-storing container, and adapted to return the ice quantity-checking lever to its original position, stop the movement of the ice-separating lever and return to a stand-by state, if the quantity of ice stored in the ice-storing container is in sufficient supply, the ice maker-driving device including: a body having an upper case and a lower case; a motor mounted in the lower case and adapted to be driven by the supply of power thereto; a worm gear compressedly fastened to the motor and rotated by the rotation of the motor; a first wheel gear adapted to change the rotating direction of the horizontal shaft of the worm gear; a second wheel gear adapted to be rotated by means of a first reduction gear mounted on the flat surface of the first wheel gear; a third wheel gear adapted to be rotated by means of a second reduction gear mounted on the flat surface of the second wheel gear; an ice-separating lever formed on the upper portion of the third wheel gear; cam section bent parts and a fixing shaft-coupling part formed on the underside of the third wheel gear; a stopper adapted to be fastened to the fixing shaft-coupling part; a stopper-locking projection formed on the fixing shaft-coupling part so as to restrict the operation of a rotary radius control projection formed on the stopper; a fixing shaft formed on the lower case and adapted to be supported by means of the fixing shaft-coupling part; a spin control protrusion formed on the

fixing shaft and a spin control groove formed on the stopper in such a manner as to be coupled between the fixing shaft and the fixing shaft-coupling part and to control the operation of a spin lever; a fixing projection formed on the spin lever so as to fix the spin lever by means of a lever-fixing protrusion formed on the stopper; a cam driving protrusion adapted to be moved along the cam section bent parts formed on the underside of the third wheel gear so as to perform ice quantity checking and signal process; a cam control protrusion adapted to be moved along the cam section bent parts together with the ice-separating lever formed on the third wheel gear; a magnet adapted to transmit a signal to a hall sensor so as to perform the signal process in an organic relation with the movement of the cam control protrusion; a receiving and fixing clip formed on a check lever so as to house the magnet therein; a check lever spring adapted to apply predetermined elasticity to the check lever so as to prevent the malfunctions of parts and ensure the positioning of the check lever; a first spring-fastening part adapted to fix the check lever spring thereto; a first spring-fixing part formed on the lower case so as to fix the check lever spring thereto; a printed circuit board with the hall sensor adapted to receive the signal from the magnetic force of the magnet; the hall sensor mounted on the printed circuit board; a sensor cover adapted to protect the hall sensor; a check box mounted on the printed circuit board so as to test an initial operation of the body; an interference-preventing groove formed on the spin lever so as to avoid the superposing of the spin lever on the check lever during the movement of the check lever and to perform the signal process on the signal received from the magnet, thereby performing effective space utilization of the body; a spin lever spring adapted to apply predetermined elasticity so as to ensure the positioning of the spin lever; a second spring-fastening part adapted to fix the spin lever spring thereto; a second spring-fixing part formed on the lower case so as to fix the spin lever spring thereto; a test button formed on the upper case and adapted to activate the check box so as to perform an initial test for the driving of the body; and an ice quantity-checking lever adapted to be coupled to a fixing part of the spin lever by means of the test button so as to perform initial ice quantity checking.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The above and other objects, features and advantages of the present invention will be apparent from the following detailed description of the preferred embodiments of the invention in conjunction with the accompanying drawings, in which:

[0015] FIG.1 is an exploded perspective view showing the whole structure of an ice maker-driving device according to the present invention;

[0016] FIG.2a is a back view showing the position of an ice quantity-checking lever and the state of a stopper upon a full ice level in the ice maker-driving device according to the present invention;

[0017] FIG.2b is a back view showing the position of an ice quantity-checking lever and the state of a stopper upon a low ice level in the ice maker-driving device according to the present invention

[0018] FIG.3a is a perspective view showing the use state of a spin lever when a sensor is turned at an on state in the ice maker-driving device according to the present invention.

[0019] FIG.3b is a perspective view showing the use state of the spin lever when the sensor is at an off state in the ice maker-driving device according to the present invention;

[0020] FIG.4a is a perspective and partly cut plan view showing the initial driving states of a check lever along cam section bent parts in the ice maker-driving device according to the present invention;

[0021] FIG.4b is a perspective and partly cut plan view showing the driving states of the reverse rotation of the check lever along the cam section bent parts in the ice maker-driving device according to the present invention;

[0022] FIG.4c is a perspective and partly cut plan view showing the driving states of the check lever along the cam section bent parts upon the full ice level in the ice maker-driving device according to the present invention;

[0023] FIG.4d is a perspective and partly cut plan view showing the driving states of the check lever along the cam section bent parts upon the low ice level in the ice maker-driving device according to the present invention;

[0024] FIG.4e is a perspective and partly cut plan view showing the final driving states of the check lever along the cam section bent parts in the ice maker-driving device according to the present invention;

[0025] FIG.5 is a view showing the reverse twisting state upon initial driving of the ice maker-driving device according to the present invention;

[0026] FIG.6 is a perspective view showing the cam structure formed on the underside of a third wheel gear and the operating state thereof in the ice maker-driving device according to the present invention;

[0027] FIG.7 is a perspective view showing the whole assembling state of the ice maker-driving device according to the present invention;

[0028] FIG.8a is a flow chart showing the initial setting procedure of the ice maker-driving device according to the present invention; and

[0029] FIG.8b is a flow chart showing the basic operation cycle of the ice maker-driving device according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0030] Hereinafter, an explanation on an ice maker-driving device according to a preferred embodiment of the present invention will be given with reference to the attached drawings.

[0031] FIG.1 is an exploded perspective view showing

the whole structure of an ice maker-driving device according to the present invention. As shown in FIG. 1, the ice maker-driving device according to the present invention includes: a body 1 having an upper case 2 and a lower case 3; a motor 13 mounted in the lower case 3 and adapted to be driven by the supply of power thereto; a worm gear 8 compressedly fastened to the motor 13 and rotated by the rotation of the motor 13; a first wheel gear 9 adapted to change the rotating direction of the horizontal shaft of the worm gear 8; a second wheel gear 10 adapted to be rotated by means of a first reduction gear 9' mounted on the flat surface of the first wheel gear 9; a third wheel gear 11 adapted to be rotated by means of a second reduction gear 10' mounted on the flat surface of the second wheel gear 10; an ice-separating lever 5 formed on the upper portion of the third wheel gear 11; cam section bent parts 32 and a fixing shaft-coupling part 34 formed on the underside of the third wheel gear 11; a stopper 12 adapted to be fastened to the fixing shaft-coupling part 34; a stopper-locking projection 12' formed on the fixing shaft-coupling part 34 so as to restrict the operation of a rotary radius control projection 23 formed on the stopper 12; a fixing shaft 18 formed on the lower case 3 and adapted to be supported by means of the fixing shaft-coupling part 34; a spin control protrusion 19 formed on the fixing shaft 18 and a spin control groove 31 formed on the stopper 12 in such a manner as to be coupled between the fixing shaft 18 and the fixing shaft-coupling part 34 and to control the operation of a spin lever 7; a spin control protrusion 19 and a spin control groove 31 formed on the stopper 12 coupled between the fixing shaft 18 and the fixing shaft-coupling part 34 and operated by the friction force against the fixing shaft-coupling part 34 and adapted to control the operation of a spin lever 7; a fixing projection 33 formed on the spin lever 7 so as to fix the spin lever 7 by means of a lever-fixing protrusion 22 formed on the stopper 1; a cam driving protrusion 29 adapted to be moved along the cam section bent parts 32 formed on the underside of the third wheel gear 11 so as to perform ice quantity checking and signal process; a cam control protrusion 28 adapted to be moved along the cam section bent parts 32 together with the ice-separating lever 5 formed on the third wheel gear 11; a magnet 27 adapted to transmit a signal to a hall sensor 39 so as to perform the signal process in an organic relation with the movement of the cam control protrusion 28; a receiving and fixing clip 40 formed on a check lever 6 so as to house the magnet 27 therein; a check lever spring 21 adapted to apply predetermined elasticity to the check lever 6 so as to prevent the malfunctions of parts and ensure the positioning of the check lever 6; a first spring-fastening part 25 adapted to fix the check lever spring 21 thereto; a first spring-fixing part 37 formed on the lower case 3 so as to fix the check lever spring 21 thereto; a printed circuit board 14 with the hall sensor 39 adapted to receive the signal from the magnetic force of the magnet 27; the hall sensor 39 mounted on the printed circuit board 14; a sensor cover 16 adapted to protect the hall sensor 39; a check box 17 mounted on the printed circuit board 14 so as to test an initial operation of the body 1; an interference-preventing groove 30 formed on the spin lever 7 so as to avoid the superposing of the spin lever 7 on the check lever 6 during the movement of the check lever 6 and to perform the signal process on the signal received from the magnet 27, thereby performing effective space utilization of the body 1; a spin lever spring 20 adapted to apply predetermined elasticity so as to ensure the positioning of the spin lever 7; a second spring-fastening part 26 adapted to fix the spin lever spring 29 thereto; a second spring-fixing part 38 formed on the lower case 3 so as to fix the check lever spring 21 thereto; a spring escape-preventing projection 44 formed on the second spring-fastening part 26 of the spin lever 7 so as to prevent the spin lever spring 20 coupled to the second spring-fastening part 26 from being separated by the rotation of the spin lever 7; a test button 24 formed on the upper case 2 and adapted to activate the check box 17 so as to perform an initial test for the driving of the body 1; and an ice quantity-checking lever 4 adapted to be coupled to a fixing part 35 of the spin lever 7 by means of the test button 24 so as to perform initial ice quantity checking.

[0032] FIGS.2a to 3b are perspective views showing the use states of the stopper 12 according to the position of the ice quantity-checking lever 4 and the operation of the hall sensor 39 and the position of the spin lever 7 in the ice maker-driving device according to the present invention. The spin lever 7 is operated to allow the magnet 27 of the check lever 6 to be near the hall sensor 39 by means of the elasticity of the spin lever spring 20, and in this case, the spin lever 7 is fixed by means of the lever-fixing protrusion 22 of the stopper 12 and is restricted in its rotation. As shown in the figures, however, if the quantity of ice stored in the ice-storing container is sufficient in use (in a full level), the ice quantity-checking lever 4 is locked to the stored ice cubes and does not fall to a predetermined depth, and the spin lever 7 connected to the ice quantity-checking lever 4 also stops such that the magnet 27 does not approach to the hall sensor 39, thereby making the signal kept in a high (on) state.

[0033] However, if the quantity of ice stored in the ice-storing container is in short supply in use (in a low level), the ice quantity-checking lever 4 falls to a predetermined depth in the ice-storing container, and the spin lever 7 connected to the ice quantity-checking lever 4 is rotated with respect to the fixing shaft 18 by means of the friction force of the stopper 12 against the third wheel gear 11.

[0034] FIGS.4a to 4e are perspective and partly cut plan views showing the state variations of the cam control protrusion 28 of the check lever 6 and the cam driving protrusion 29 of the spin lever 7 along the cam section bent parts 32 in case of the reverse rotation of the check lever 6 in the initial state of the body 1, in case of the full ice level, in case of the low ice level, and in case of the final driving state, wherein the surfaces of the cam section bent parts 32 formed on the underside of the third wheel

gear 11 are broken so as to show the above-mentioned state variations. The check lever 6 which is separately driven in the conventional practice is configured to a unitary body such that upon the rotation of the ice-separating lever 5, the cam control protrusion 28 of the spin lever 7 is varied in the position and is driven along the cam section bent parts 32 in an organic relation with the check lever 6 moved along or fixed to the cam section bent parts 32 formed on the underside of the third wheel gear 11.

[0035] Referring to FIG. 1 and FIGS.4a to 4e, so as to fixedly couple the worm gear 8 to the motor 13, the worm gear 8 has a fixing hole 48 formed on the distal end thereof, and the fixing hole 48 is of a generally square shape. Thus, a fixing member 49 that is fitted to the rotary shaft of the motor 13 is fixedly inserted into the fixing hole 48, thereby transmitting the rotary force of the motor 13 to the worm gear 8.

[0036] Preferably, also, the fixing member 49 is rounded along the front periphery thereof so as to be easily inserted into the fixing hole 48 of the worm gear 8 and has a thickness of 2mm or more so as to be fixedly fitted to the fixing hole 48 of the worm gear 8.

[0037] The worm gear 8 rotated by the rotation of the motor 13 has a mounting protrusion 46 formed at the front end thereof in such a manner as to be coupled to a gear-mounting groove 47 formed in the lower case 3.

[0038] The gear-mounting groove 47 is adapted to prevent the worm gear 8 coupled to the mounting protrusion 46 from being moved or rolled and has the same length as the mounting protrusion 42 inserted thereinto or has a little extended length from the mounting protrusion 42 so as to prevent the worm gear 8 from being forwardly and backwardly moved by the gap caused by the rotary shaft of the motor 13.

[0039] FIG.5 is a view showing the reverse twisting state of the ice-making container so as to separate the ice cubes from the ice-making container, and after the ice-making is completed in the initial driving of the ice maker-driving device, as shown in FIG.7, an initial output signal is transmitted so as to reversely rotate the motor 13 such that the ice-separating lever 5 is reversely rotated by 45° , and since the other side support projection 42 of the ice-making container 36 coupled to the ice-separating lever 5 cooperates with a support inclined part 43 of a housing of the ice-making container 36 upon the reverse rotation of the ice-separating lever 5, the ice-making container 36 is twisted by 45° or more.

[0040] FIG.6 is a perspective view showing the cam structure formed on the underside of the third wheel gear 11, wherein the stopper 12 coupled to the fixing shaft 18 is rotated by the friction force against the fixing shaft-coupling part 34 and has the lever-fixing protrusion 22 adapted to fix the spin lever 7 thereto. The cam section bent parts 32 has the locking projection 12' adapted to prevent the stopper 12 from being unlimitedly rotated by the friction between the fixing shaft 18 and the fixing shaft-coupling part 34 in fixing the spin lever 7 by means of the lever-fixing protrusion 22.

[0041] FIGS.8a and 8b are flow charts showing the ice maker-driving device according to the present invention, wherein the operation time for the ice quantity-checking of the timer is shorter than that in the conventional practice, and after the initial setting and the ice-making are finished, the ice-making container is reversely rotated to have the rotary angle of 45°.

[0042] As described above, there is provided the ice maker-driving device for a refrigerator which is operated to perform an ice quantity-checking operation after the ice-making operation of the ice-making container and to supply the ice cubes to the ice-storing container. However, in the conventional practice, the ice-making container is generally driven in a forward rotating direction after the ice-making operation, and it is not easy to adopt the cam structure or stopper by which the reverse rotation of the ice-making container is performed by a predetermined angle or more. Further, it is very difficult to expect the necessity of the adoption of the cam structure or stopper in the conventional practice.

[0043] Also, it is difficult to separate the ice cubes expanded in the ice-making container from the ice-making container only with the rotation of the ice-making container according to the ice quantity-checking operation. Thus, in order to solve this problem, the ice-making container is fixed at one side and is reversely rotated at the other side thereof, such that the ice-making container is twisted to protect the freezing and to separate the ice cubes therefrom before the ice-separating operation.

[0044] Further, the arrangement of the parts in the body is effectively made such that the ice quantity-checking lever and the locking projection of the rotary radius control stopper are freely formed, the stopper is rigidly fixed to the fixing shaft of the lower case, and the worm gear has the durability against impacts and vibration, thereby achieving a semi-permanent lifespan and a substantially low error rate. Also, the stable supply of power from a capacitor ensures the operation of the sensor mounted on the printed circuit board, thereby obtaining durability and persistent operation in the device.

[0045] While the present invention has been described with reference to the particular illustrative embodiments, it is not to be restricted by the embodiments but only by the appended claims. It is to be appreciated that those skilled in the art can change or modify the embodiments without departing from the scope and spirit of the present invention.

Claims

1. An ice maker-driving device for a refrigerator which is adapted to change water in an ice-making container into ice cubes by the driving of an ice quantity-checking lever and an ice-separating lever according to the transmission of power from a motor by using a plurality of worm and reduction gears mounted in a body thereof, adapted to check the quantity of ice

stored in an ice-storing container by means of the ice quantity-checking lever and an ice quantity-checking sensor to rotate the ice-making container in which the ice cubes are filled by 180° by means of the ice-separating lever if the quantity of ice stored in the ice-storing container is in short supply and to fill the ice cubes in the ice-storing container, and adapted to return the ice quantity-checking lever to its original position, stop the movement of the ice-separating lever and return to a stand-by state, if the quantity of ice stored in the ice-storing container is in sufficient supply, the ice maker-driving device comprising:

a body (1) having an upper case (2) and a lower case (3);
a motor (13) mounted in the lower case (3) and adapted to be driven by the supply of power thereto;
a worm gear (8) compressedly fastened to the motor (13) and rotated by the rotation of the motor (13);
a first wheel gear (9) adapted to change the rotating direction of the horizontal shaft of the worm gear (8);
a second wheel gear (10) adapted to be rotated by means of a first reduction gear (9') mounted on the flat surface of the first wheel gear (9);
a third wheel gear (11) adapted to be rotated by means of a second reduction gear (10') mounted on the flat surface of the second wheel gear (10);
an ice-separating lever (5) formed on the upper portion of the third wheel gear (11);
cam section bent parts (32) and a fixing shaft-coupling part (34) formed on the underside of the third wheel gear (11);
a stopper (12) adapted to be fastened to the fixing shaft-coupling part (34);
a stopper-locking projection (12') formed on the fixing shaft-coupling part (34) so as to restrict the operation of a rotary radius control projection (23) formed on the stopper (12);
a fixing shaft (18) formed on the lower case (3) and adapted to be supported by means of the fixing shaft-coupling part (34);
a spin control protrusion (19) formed on the fixing shaft (18) and a spin control groove (31) formed on the stopper (12) in such a manner as to be coupled between the fixing shaft (18) and the fixing shaft-coupling part (34) and to control the operation of a spin lever (7);
a fixing projection (33) formed on the spin lever (7) so as to fix the spin lever (7) by means of a lever-fixing protrusion (22) formed on the stopper (12);
a cam driving protrusion (29) adapted to be moved along the cam section bent parts (32) formed on the underside of the third wheel gear (11) so as to perform ice quantity checking and signal process;
a cam control protrusion (28) adapted to be moved along the cam section bent parts (32) together with the ice-separating lever (5) formed on the third wheel gear (11);
a magnet (27) adapted to transmit a signal to a hall sensor (39) so as to perform the signal process in an organic relation with the movement of the cam control protrusion (28);
a receiving and fixing clip (40) formed on a check lever (6) so as to house the magnet (27) therein;
a check lever spring (21) adapted to apply predetermined elasticity to the check lever (6) so as to prevent the malfunctions of parts and ensure the positioning of the check lever (6);
a first spring-fastening part (25) adapted to fix the check lever spring (21) thereto;
a first spring-fixing part (37) formed on the lower case (3) so as to fix the check lever spring (21) thereto;
a printed circuit board (14) with the hall sensor (39) adapted to receive the signal from the magnetic force of the magnet (27);
the hall sensor (39) mounted on the printed circuit board (14);
a sensor cover (16) adapted to protect the hall sensor (39);
a check box (17) mounted on the printed circuit board (14) so as to test an initial operation of the body (1);
an interference-preventing groove (30) formed on the spin lever (7) so as to avoid the superposing of the spin lever (7) on the check lever (6) during the movement of the check lever (6) and to perform the signal process on the signal received from the magnet (27), thereby performing effective space utilization of the body (1);
a spin lever spring (20) adapted to apply predetermined elasticity so as to ensure the positioning of the spin lever (7);
a second spring-fastening part (26) adapted to fix the spin lever spring (20) thereto;
a second spring-fixing part (38) formed on the lower case (3) so as to fix the spin lever spring (20) thereto;
a test button (24) formed on the upper case (2) and adapted to activate the check box (17) so as to perform an initial test for the driving of the body (1); and an ice quantity-checking lever (4) adapted to be coupled to a fixing part (35) of the spin lever (7) by means of the test button (24) so as to perform initial ice quantity checking.

2. A method for operating an ice maker-driving device for a refrigerator which is adapted to change water in an ice-making container into ice cubes by the driving of an ice quantity-checking lever and an ice-sep-

arating lever according to the transmission of power from a motor by using a plurality of worm and reduction gears mounted in a body thereof, adapted to check the quantity of ice stored in an ice-storing container by means of the ice quantity-checking lever and an ice quantity-checking sensor to rotate the ice-making container in which the ice cubes are filled by 180° by means of the ice-separating lever if the quantity of ice stored in the ice-storing container is in short supply and to fill the ice cubes in the ice-storing container, and adapted to return the ice quantity-checking lever to its original position, stop the movement of the ice-separating lever and return to a stand-by state, if the quantity of ice stored in the ice-storing container is in sufficient supply, the method comprising the steps of:

sending an initial output signal so as to reversely rotate the motor (13) after the ice-making operation is finished to thereby cause the ice-separating lever (5) to be reversely rotated by 45° in response to the initial output signal; and allowing the other side support projection (42) of the ice-making container (36) coupled to the ice-separating lever (5) to abut against a support inclination part (43) of the housing of the ice-making container (36) upon the inclination of 45° of the ice-separating lever (5), such that the ice-making container (36) is twisted so as to separate the ice cubes therefrom when the ice-making container (36) is inclined to 45° or more during the reverse rotation of the ice-separating lever (5) by means of the motor (13).

3. The ice maker-driving device according to claim 1, wherein the stopper (12) is fastened directly to the fixing shaft (18) such that the worm gear (8), the first to third wheel gears (9, 10 and 11), the ice quantity-checking lever (4), the ice-separating lever (5), the check lever (6), and the spin lever (7) have predetermined durability against the vibration and impact applied from the inside and outside during the operation of the body (1).

4. The ice maker-driving device according to claim 1, wherein the check lever (6) is formed integrally with the cam section bent parts (32) adapted to have the ice quantity-checking and ice-separating functions, without any separation of an operating part housing the magnet (27) therein from an operating part operating the ice quantity-checking lever (4), so as to control the operation between the magnet (27) and the hall sensor (39), to reduce the number of parts to cause the malfunctions and error rate of the parts to be decreased, and to obtain a small-sized device.

5. The ice maker-driving device according to claim 1, wherein the printed circuit board (14) has an uninterruptible stable current supply inductive capacitor (15) mounted thereon, the capacitor (15) being adapted to store input power therein and to output stable current therefrom, so as to ensure the long lifespan and stability of the sensor and circuit on the printed circuit board upon over current and to prepare the interruption of the operation of the hall sensor (39) by an unexpected temporary power supply stop state.

6. The ice maker-driving device according to claim 1, wherein the stopper (12) is longer in length than the fixing shaft-coupling part (34) so as to have the spin control protrusion (19) extended from the thickness of the stopper (12) forming the spin control groove (31), thereby rigidly coupling the spin control protrusion (19) formed on the fixing shaft (18) to the spin control groove (31) formed on the stopper (12).

7. The ice maker-driving device according to claim 1, wherein the second spring-fastening part (26) of the spin lever (7) has a spring escape-preventing projection (44) formed thereon.

8. The ice maker-driving device according to claim 1, wherein the worm gear (8) has a fixing hole (48) formed on the distal end thereof so as to be fixedly coupled to the motor (13), the fixing hole (48) into which a fixing member (49) fixedly fitted to the rotary shaft of the motor (13) is fixedly coupled to transmit the rotary force of the motor (13) to the worm gear (8), and wherein the fixing member (49) is rounded along the front periphery thereof so as to be easily inserted into the fixing hole (48) of the worm gear (8) and has a thickness of 2mm or more so as to be fixedly fitted to the fixing hole (48) of the worm gear (8).

9. The ice maker-driving device according to claim 1, wherein the worm gear (8) rotated by the rotation of the motor (13) has a mounting protrusion (46) formed at the front end thereof, and a gear-mounting groove (47) is formed in the lower case (3) in such a manner as to be coupled to the mounting protrusion (46), the gear-mounting groove (47) being adapted to prevent the worm gear (8) coupled to the mounting protrusion (46) from being moved or rolled and having the same length as the mounting protrusion (46) inserted thereinto or having a predetermined extended length from the length of the mounting protrusion (46) so as to prevent the worm gear (8) from being forwardly and backwardly moved.

Fig. 1

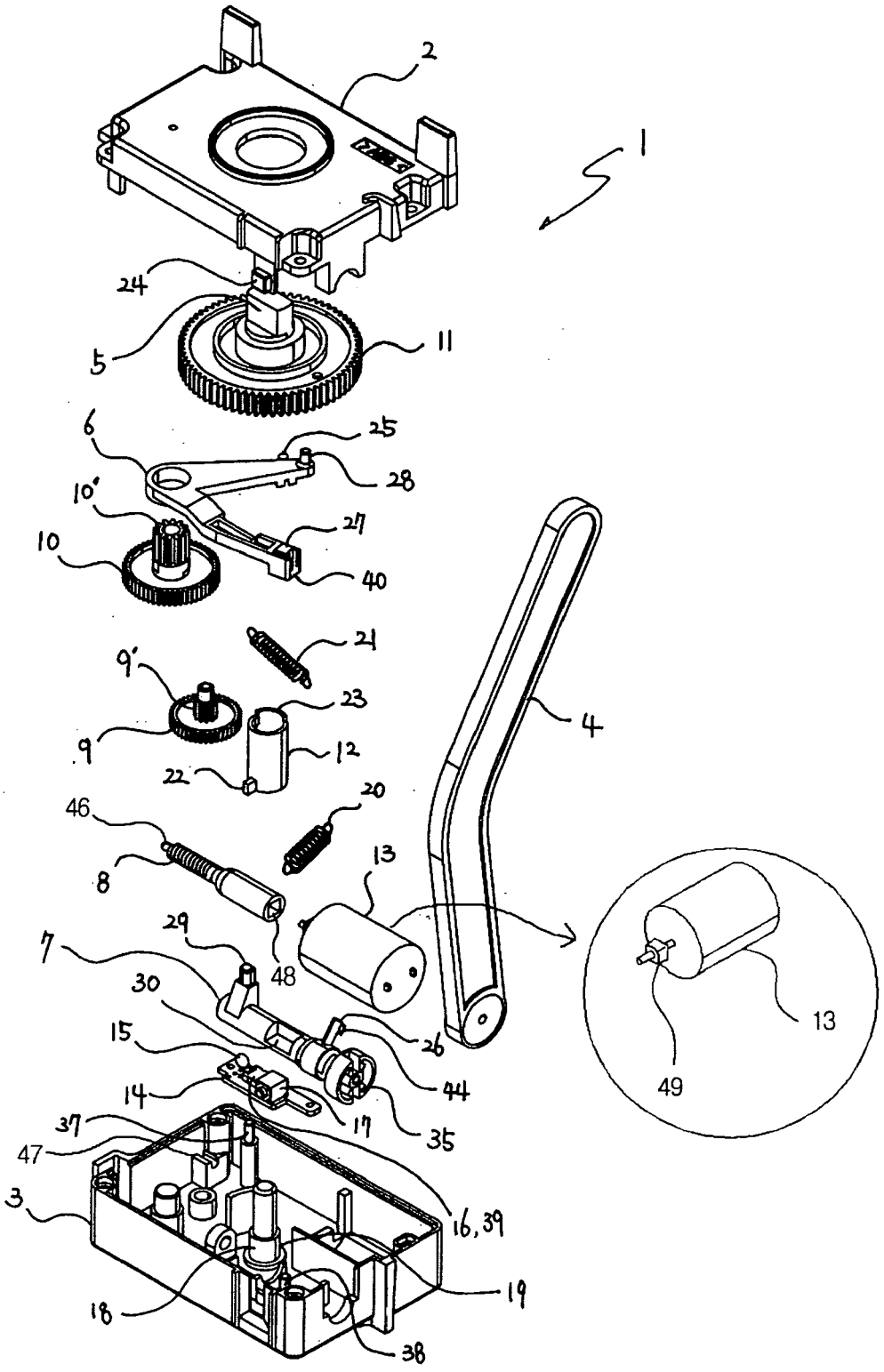

2
1
24
5
11
6
25
28
10'
27
10
40
21
9'
23
9
12
22
20
46
8
13
29
48
7
30
26
15
44
14
17
35
37
47
16,39
3
19
18
38
4
13
49

Fig. 2a

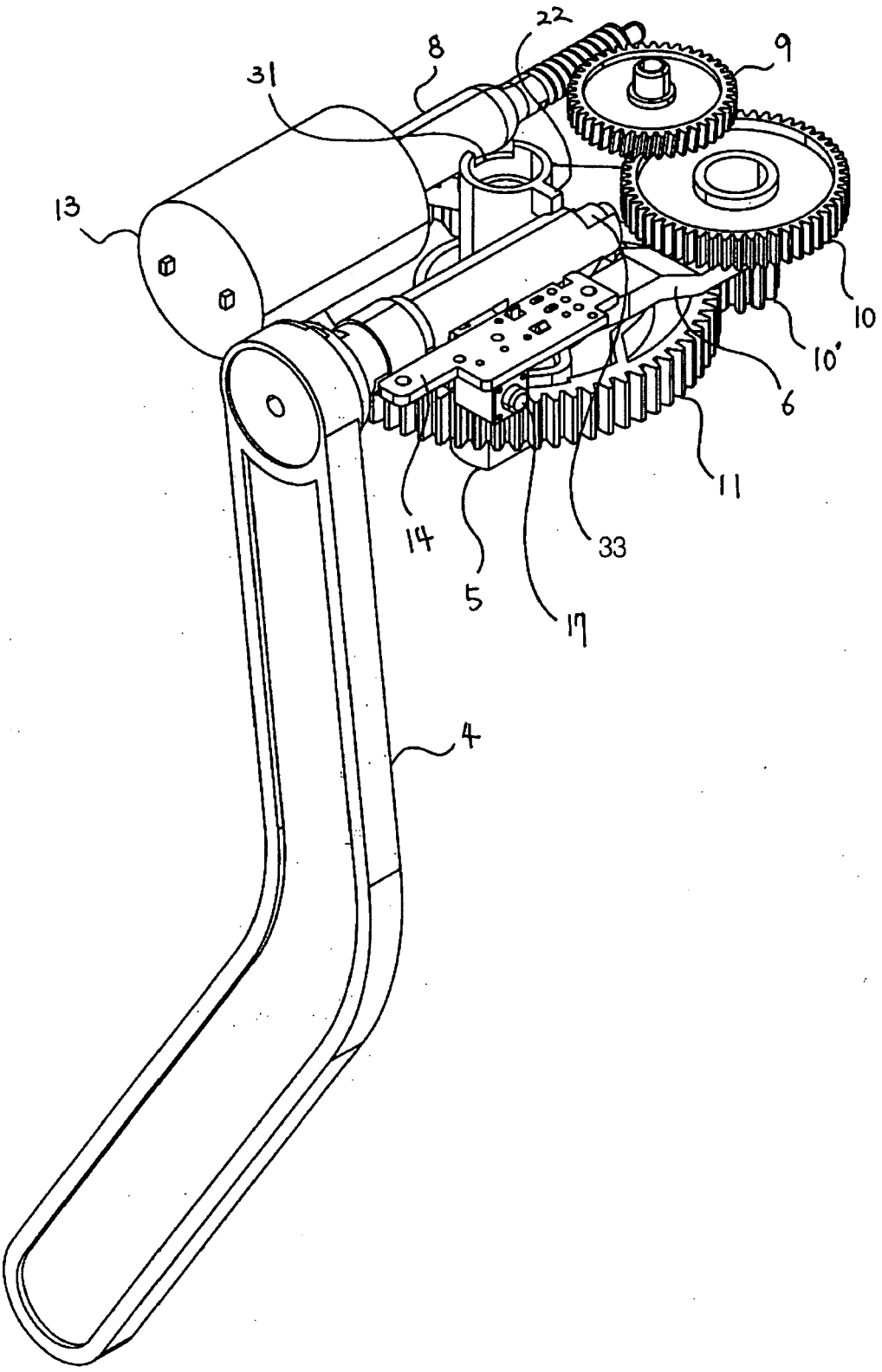


Fig. 2b

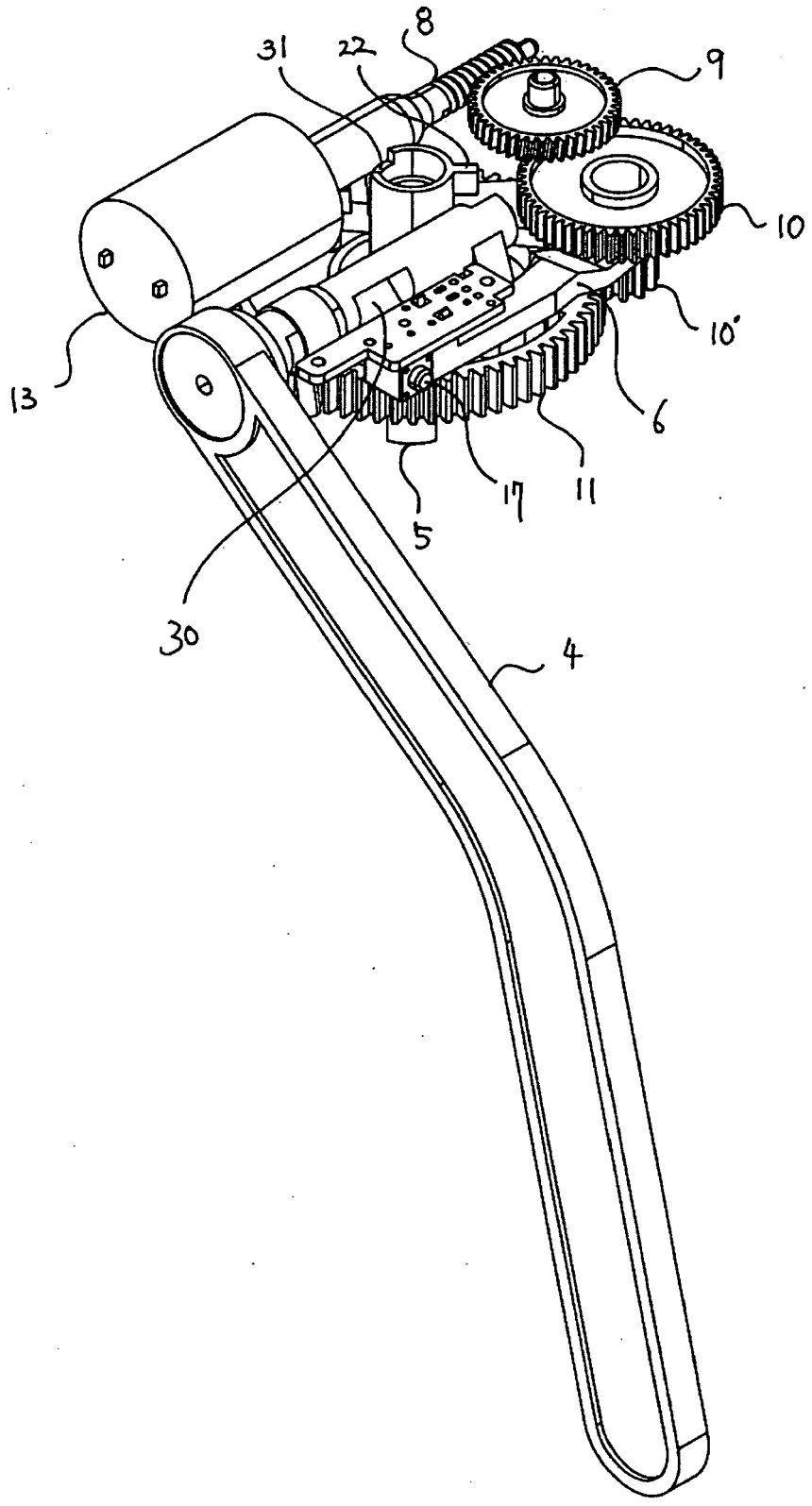


Fig. 3a

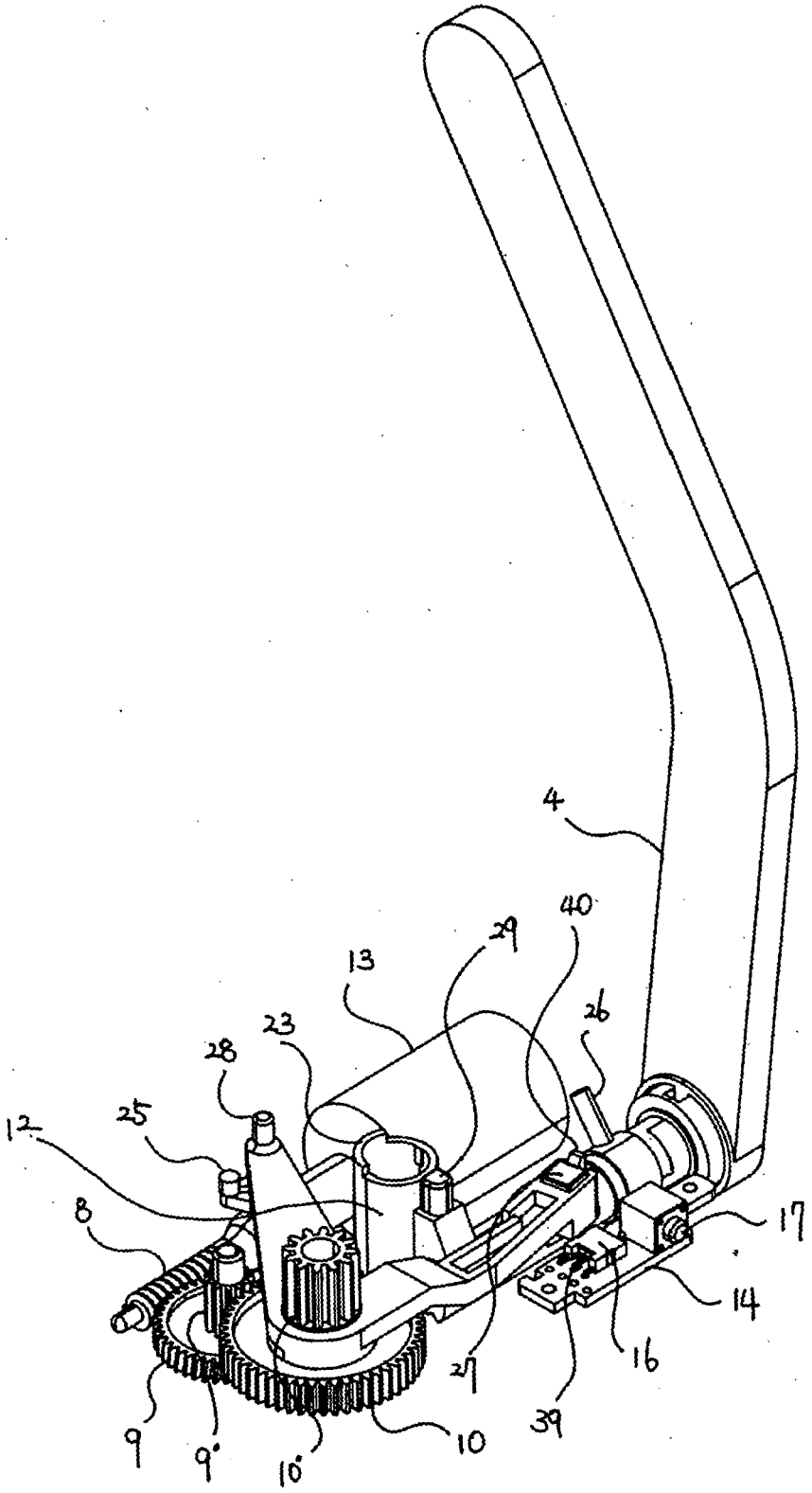


Fig. 3b

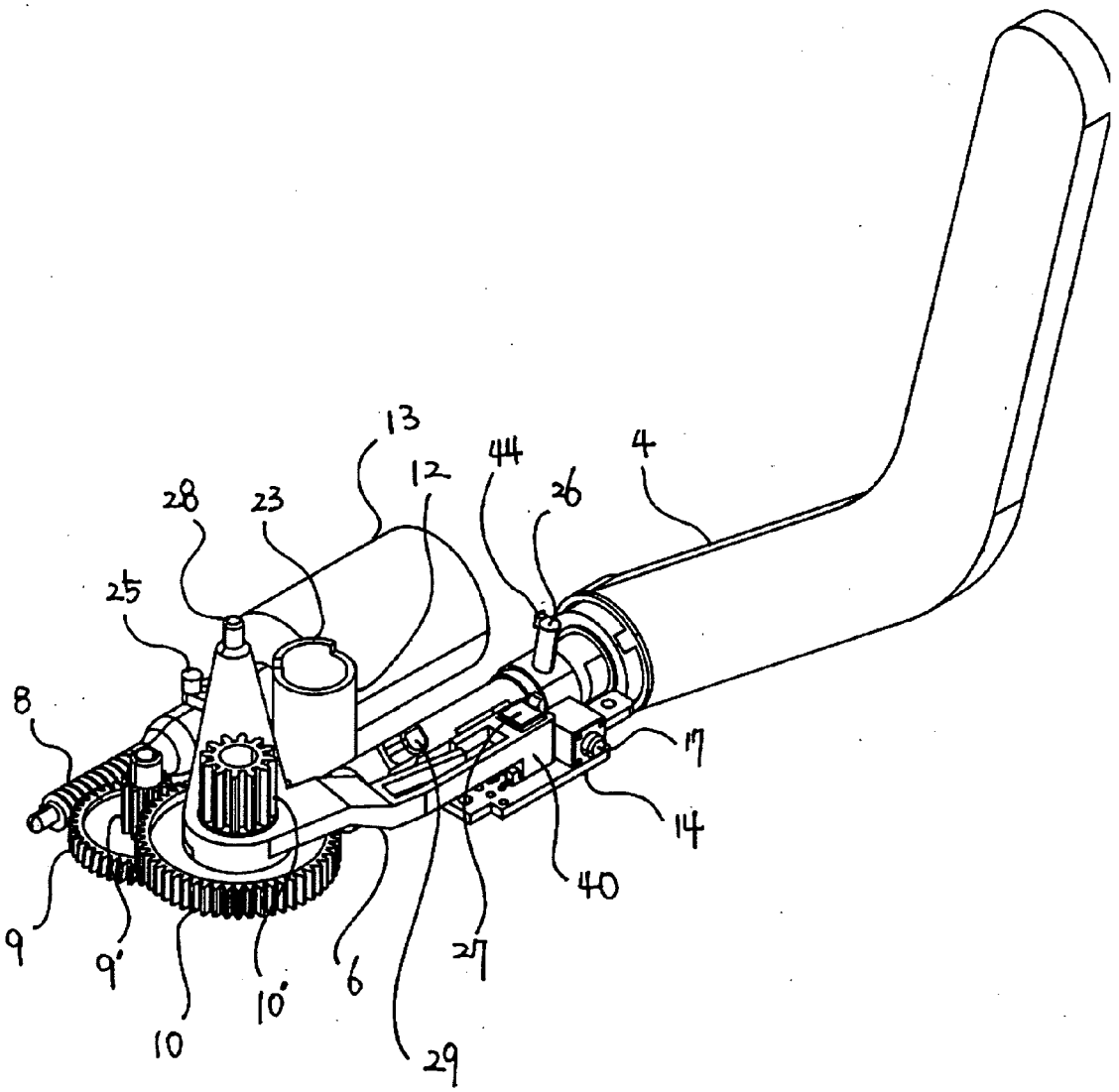
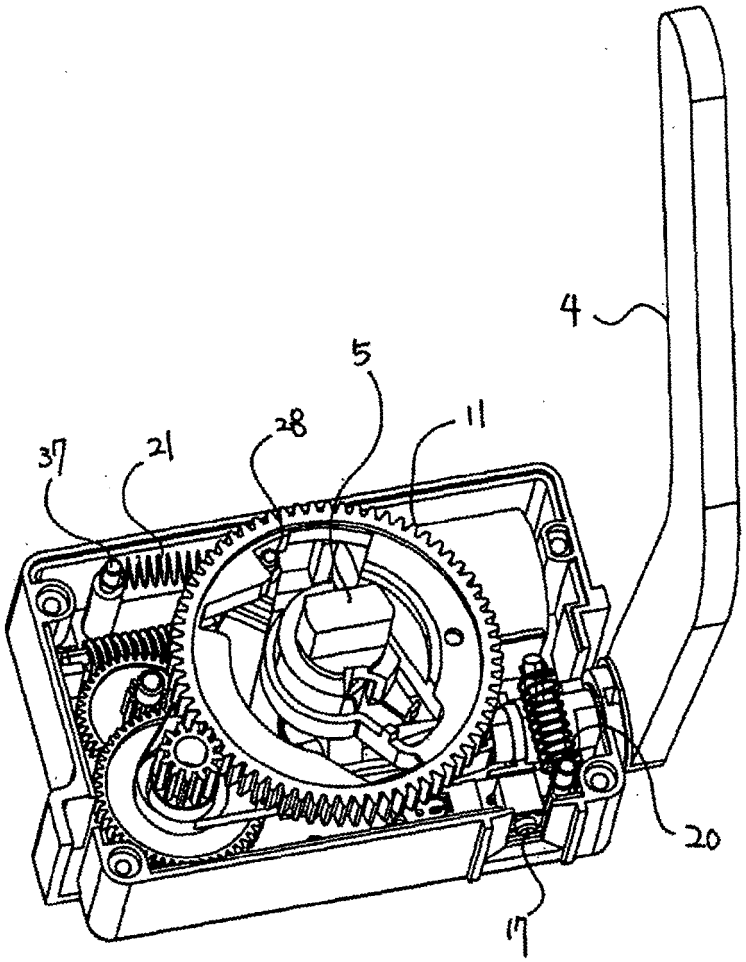


Fig. 4a



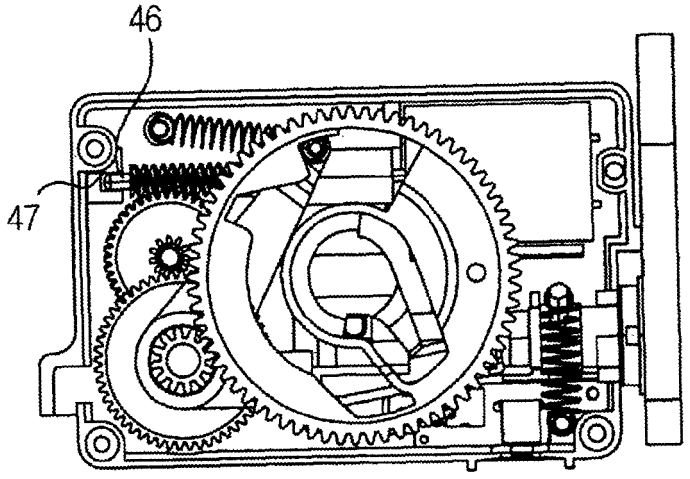
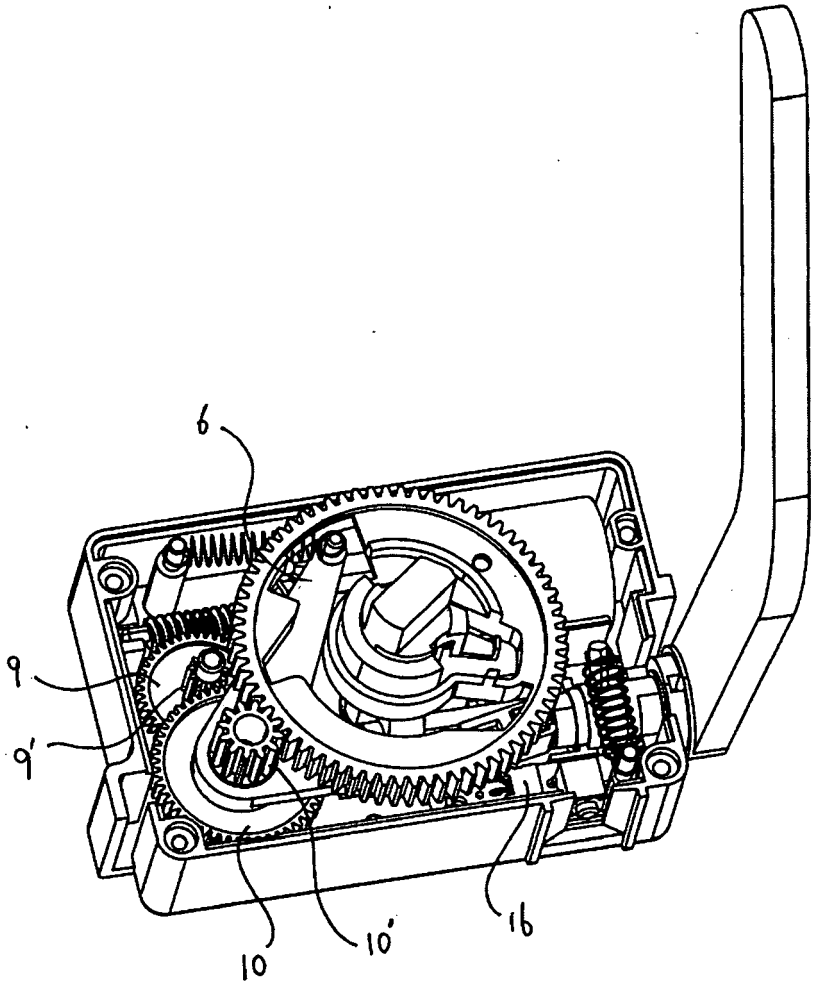


Fig. 4b



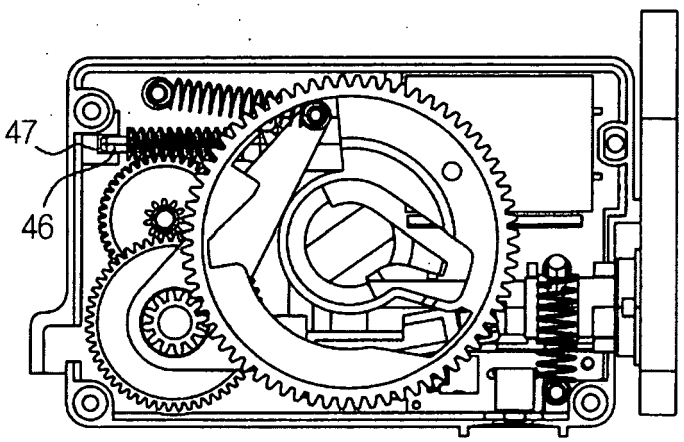


Fig. 4c

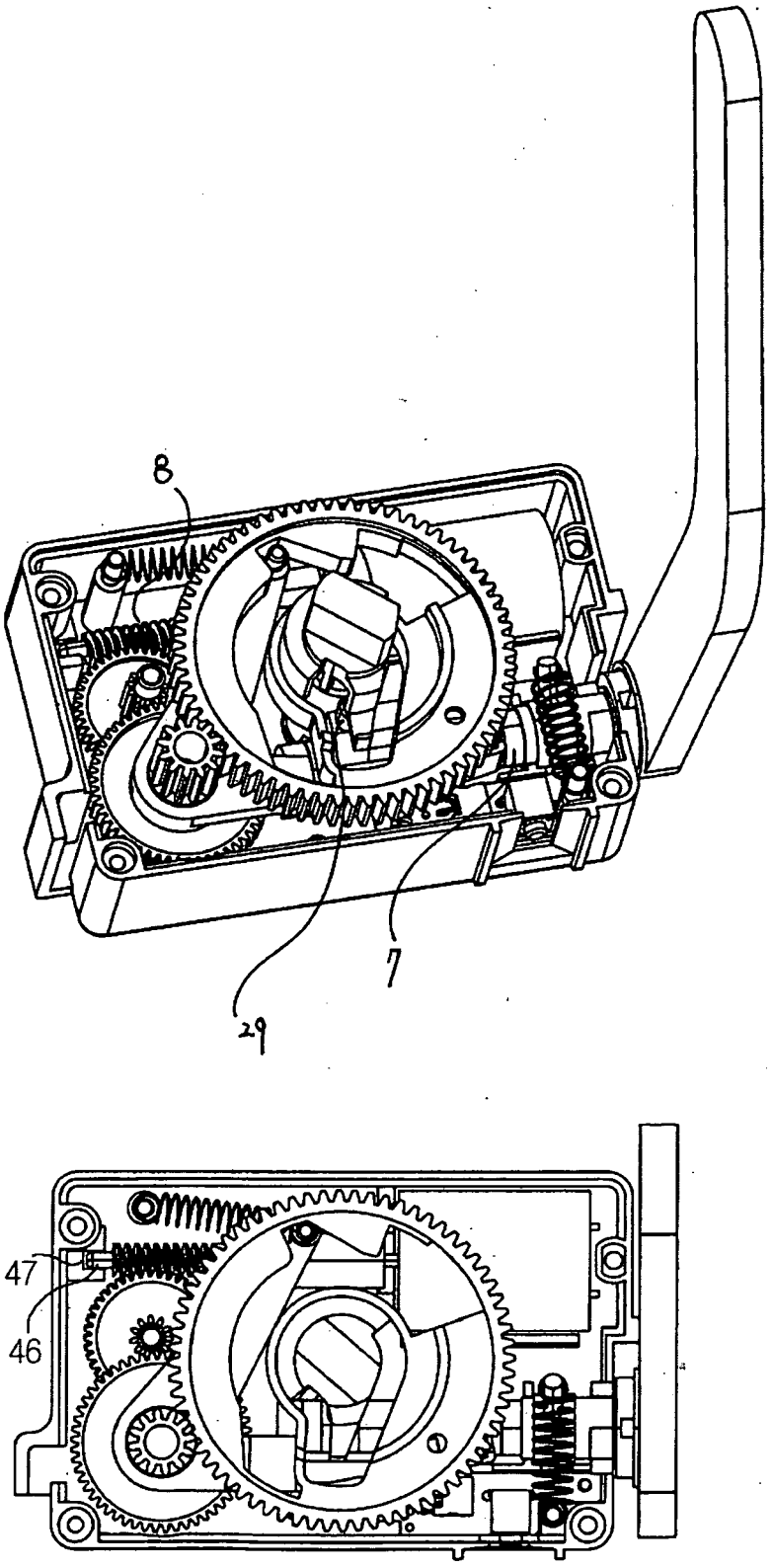
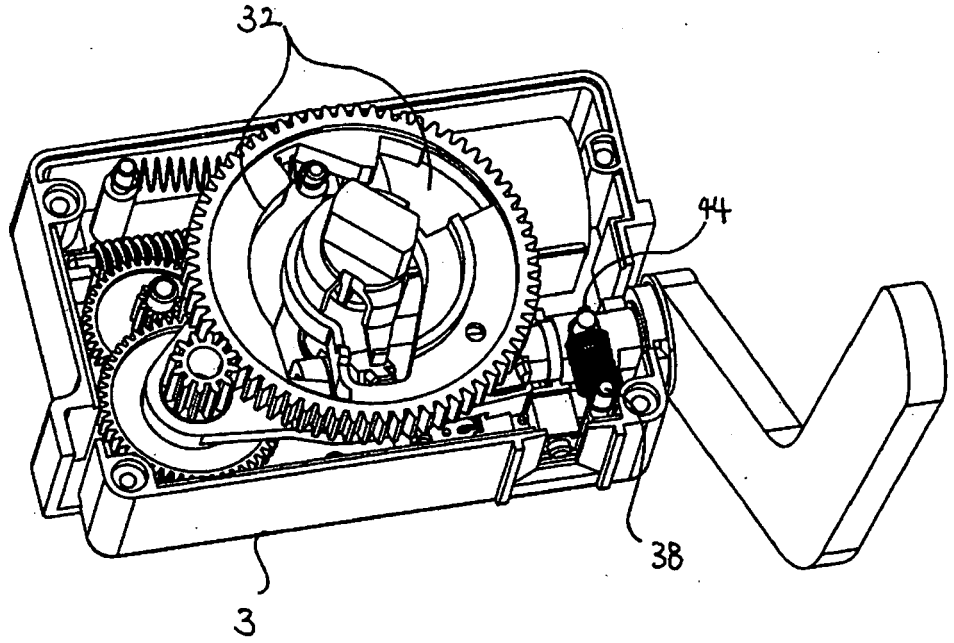


Fig. 4d



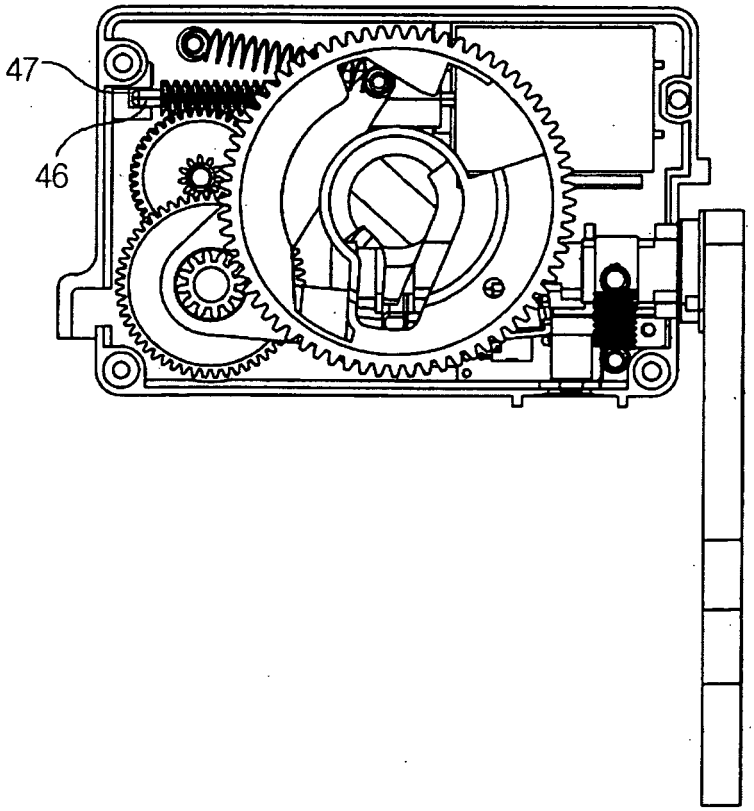
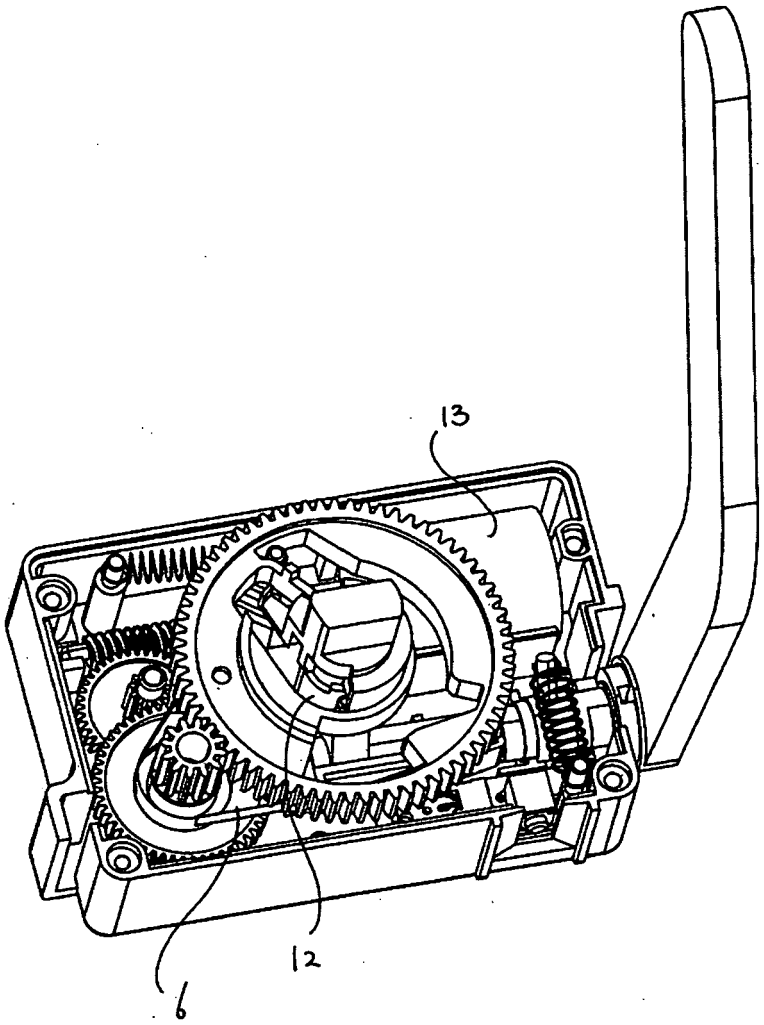


Fig. 4e



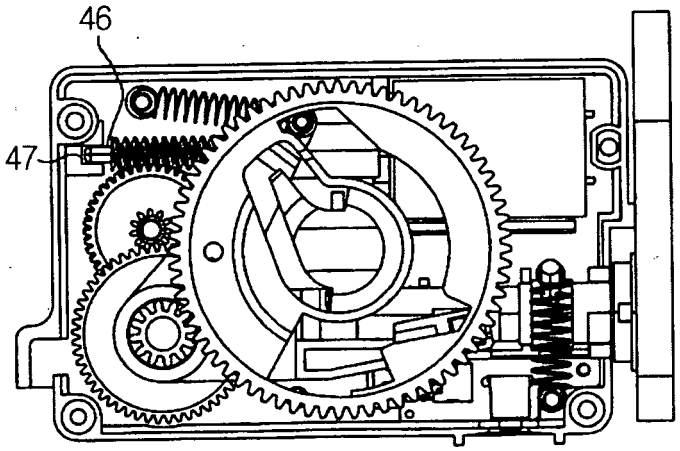


Fig. 5

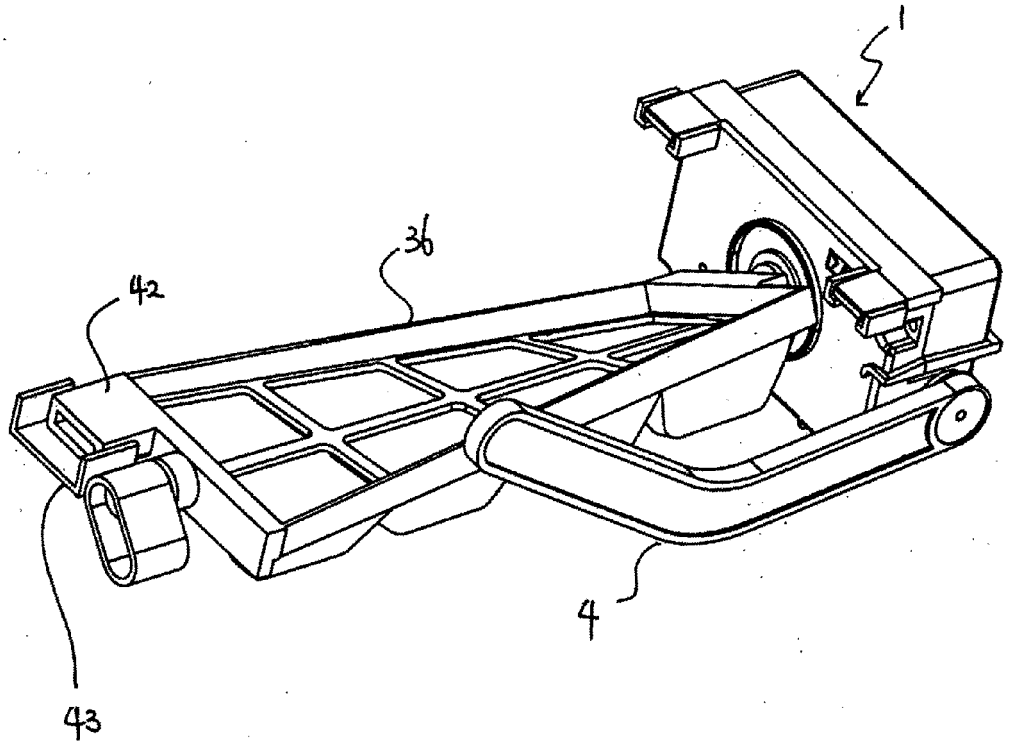


Fig. 6

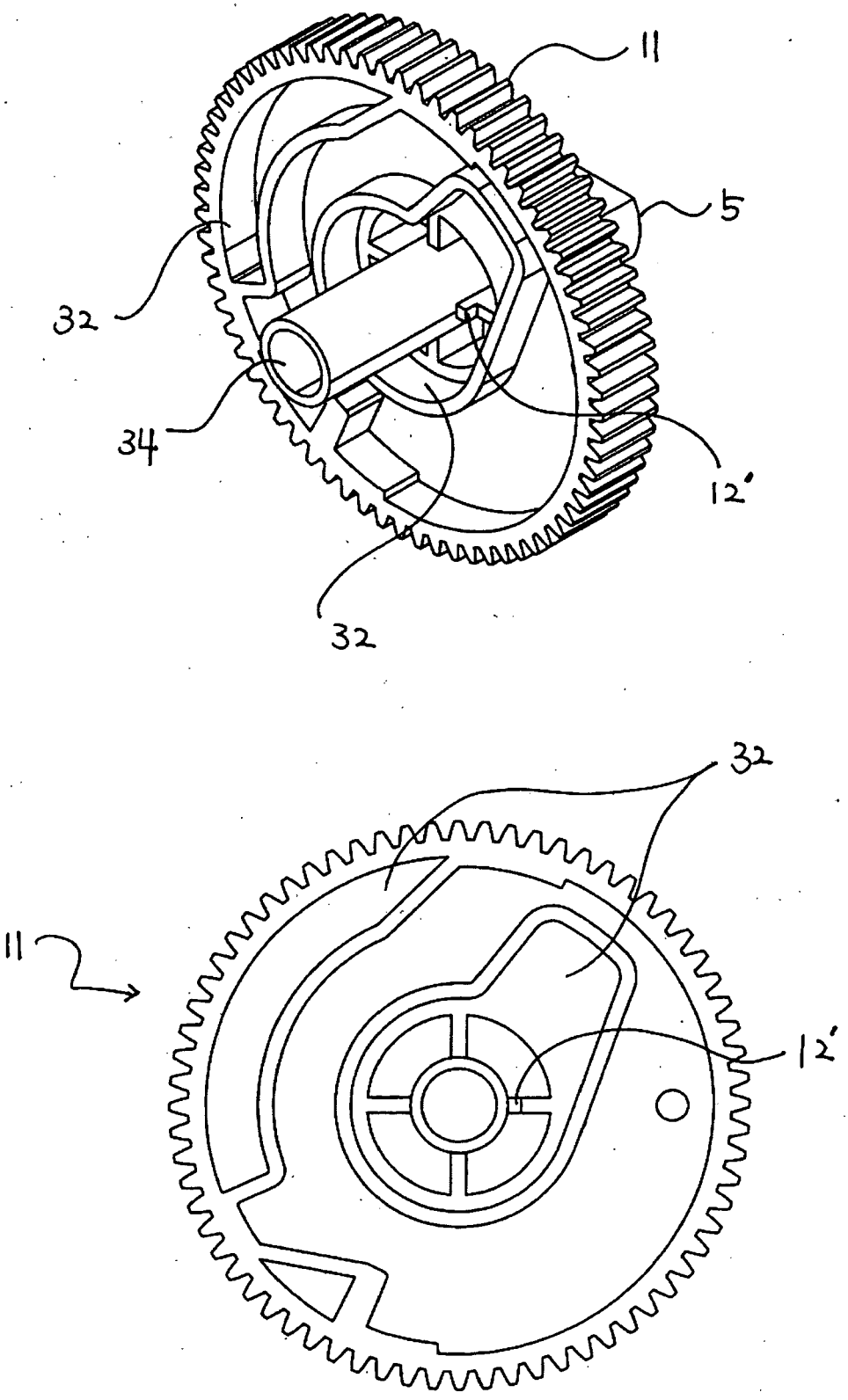


Fig. 7

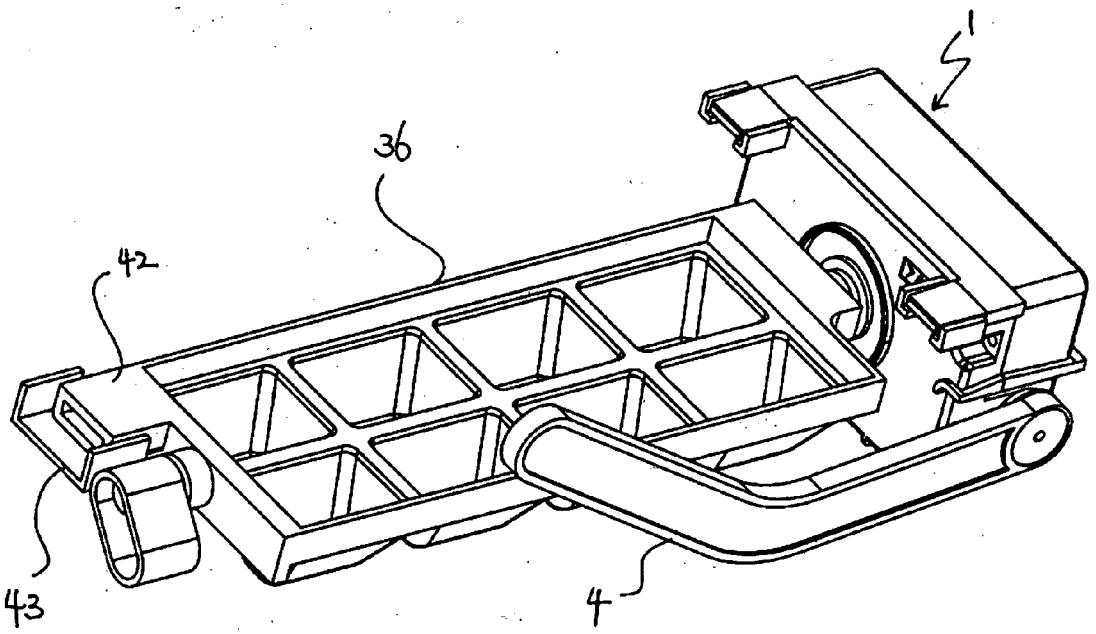


Fig. 8a

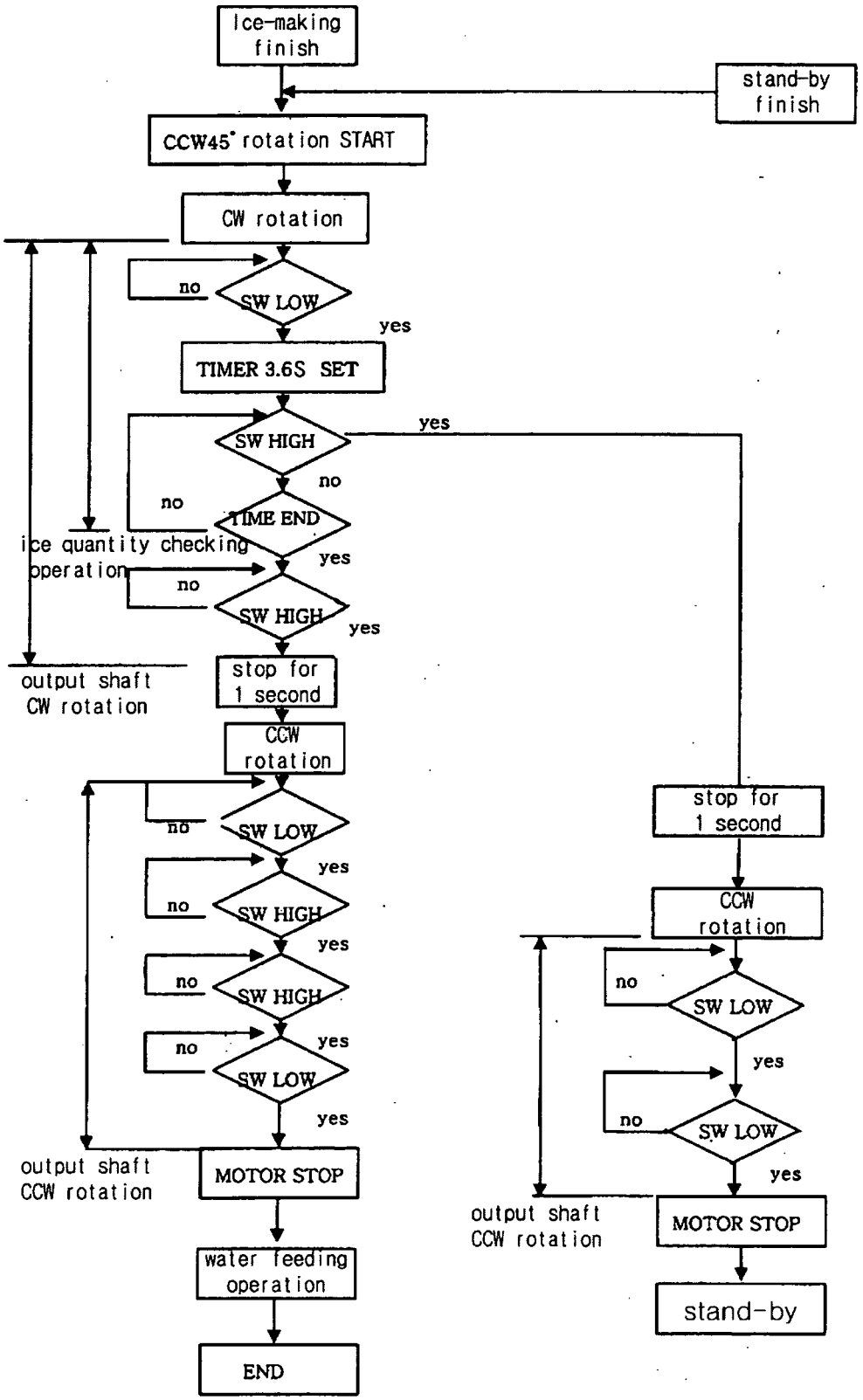
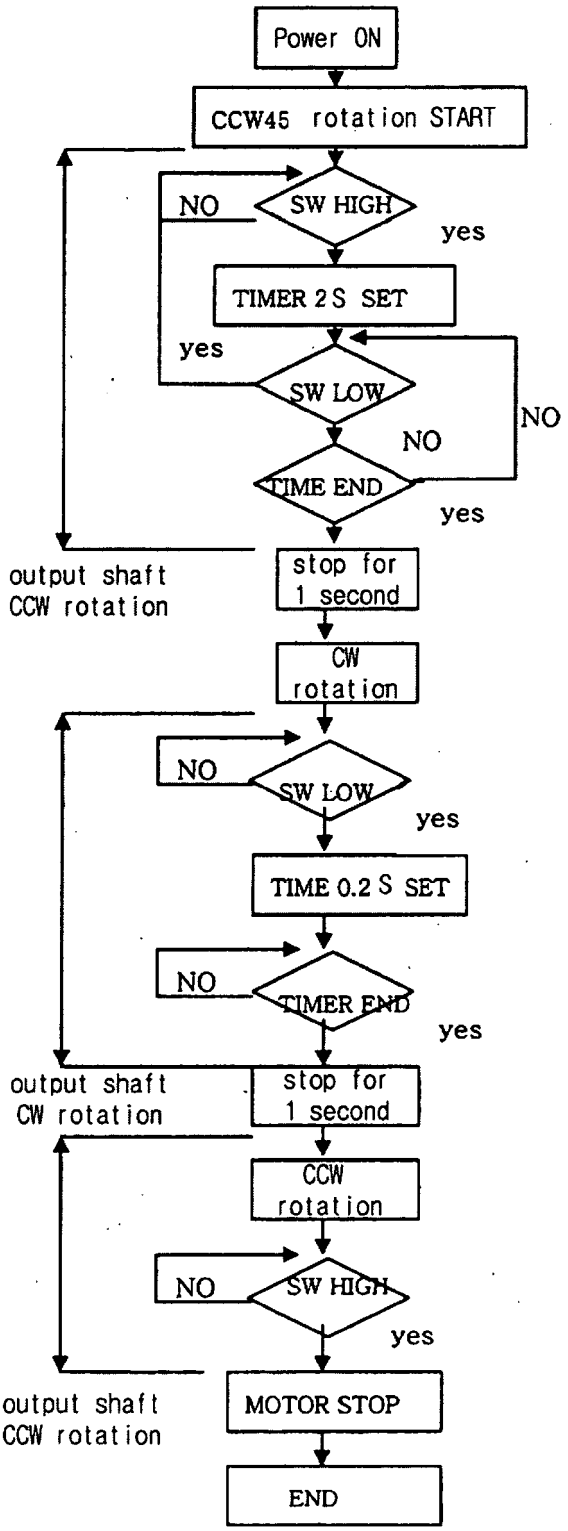

Ice-making finish
stand-by finish
CCW45° rotation START
CW rotation
no
SW LOW
yes
TIMER 3.6S SET
SW HIGH
yes
no
no
TIME END
ice quantity checking operation
yes
no
SW HIGH
yes
output shaft CW rotation
stop for 1 second
CCW rotation
no
SW LOW
yes
no
SW HIGH
yes
no
SW HIGH
yes
no
SW LOW
yes
output shaft CCW rotation
MOTOR STOP
water feeding operation
END
stop for 1 second
CCW rotation
no
SW LOW
yes
no
SW LOW
yes
output shaft CCW rotation
MOTOR STOP
stand-by

Fig. 8b


Power ON
CCW45 rotation START
NO
SW HIGH
yes
TIMER 2S SET
yes
SW LOW
NO
NO
TIME END
yes
output shaft
CCW rotation
stop for
1 second
CW
rotation
NO
SW LOW
yes
TIME 0.2 S SET
NO
TIMER END
yes
output shaft
CW rotation
stop for
1 second
CCW
rotation
NO
SW HIGH
yes
output shaft
CCW rotation
MOTOR STOP
END

Europäisches Patentamt
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EUROPEAN SEARCH REPORT

Application Number
EP 08 01 4238

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	DE 196 51 335 A1 (SAMSUNG ELECTRONICS CO LTD [KR]) 3 July 1997 (1997-07-03) * the whole document * -----	1	INV. F25C5/06
A	US 6 148 620 A (KUMAGAI HIDEO [JP] ET AL) 21 November 2000 (2000-11-21) * the whole document * -----	1	

TECHNICAL FIELDS SEARCHED (IPC)

F25C

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
Munich	16 December 2008	Jessen, Flemming

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

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Application Number
EP 08 01 4238

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1,3-9

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 08 01 4238

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1,3-9

Ice maker-driving device having a test button.

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2. claim: 2

Method for operating an ice maker-driving device comprising the step of reversely rotating the ice-separating lever.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 08 01 4238

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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16-12-2008

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 19651335 A1	03-07-1997	CN 1160173 A	24-09-1997
		FR 2742853 A1	27-06-1997
		JP 2880138 B2	05-04-1999
		JP 9178312 A	11-07-1997
		US 5768900 A	23-06-1998
US 6148620 A	21-11-2000	JP 3542271 B2	14-07-2004
		JP 11325677 A	26-11-1999

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- KR 19921971 **[0002]**
- KR 19934478 **[0003]**
- KR 228819 **[0004]**
- KR 182735 **[0005]**
- KR 182736 **[0007]**
- KR 422969 **[0008]**