



US 20090188029A1

(19) **United States**

(12) **Patent Application Publication**
TA et al.

(10) **Pub. No.: US 2009/0188029 A1**

(43) **Pub. Date: Jul. 30, 2009**

(54) **OPENING DEVICE**

(75) Inventors: **Jingning TA**, Hong Kong (CN);
Zhiqiang WU, Shenzhen (CN);
Oliver Chillwa HO, Hong Kong (CN);
Qiang CHEN, Shenzhen (CN)

Correspondence Address:
Muncy, Geissler, Olds & Lowe, PLLC
P.O. BOX 1364
FAIRFAX, VA 22038-1364 (US)

(73) Assignee: **Johnson Electric S.A.**

(21) Appl. No.: **12/362,867**

(22) Filed: **Jan. 30, 2009**

(30) **Foreign Application Priority Data**

Jan. 30, 2008 (CN) 200810065309

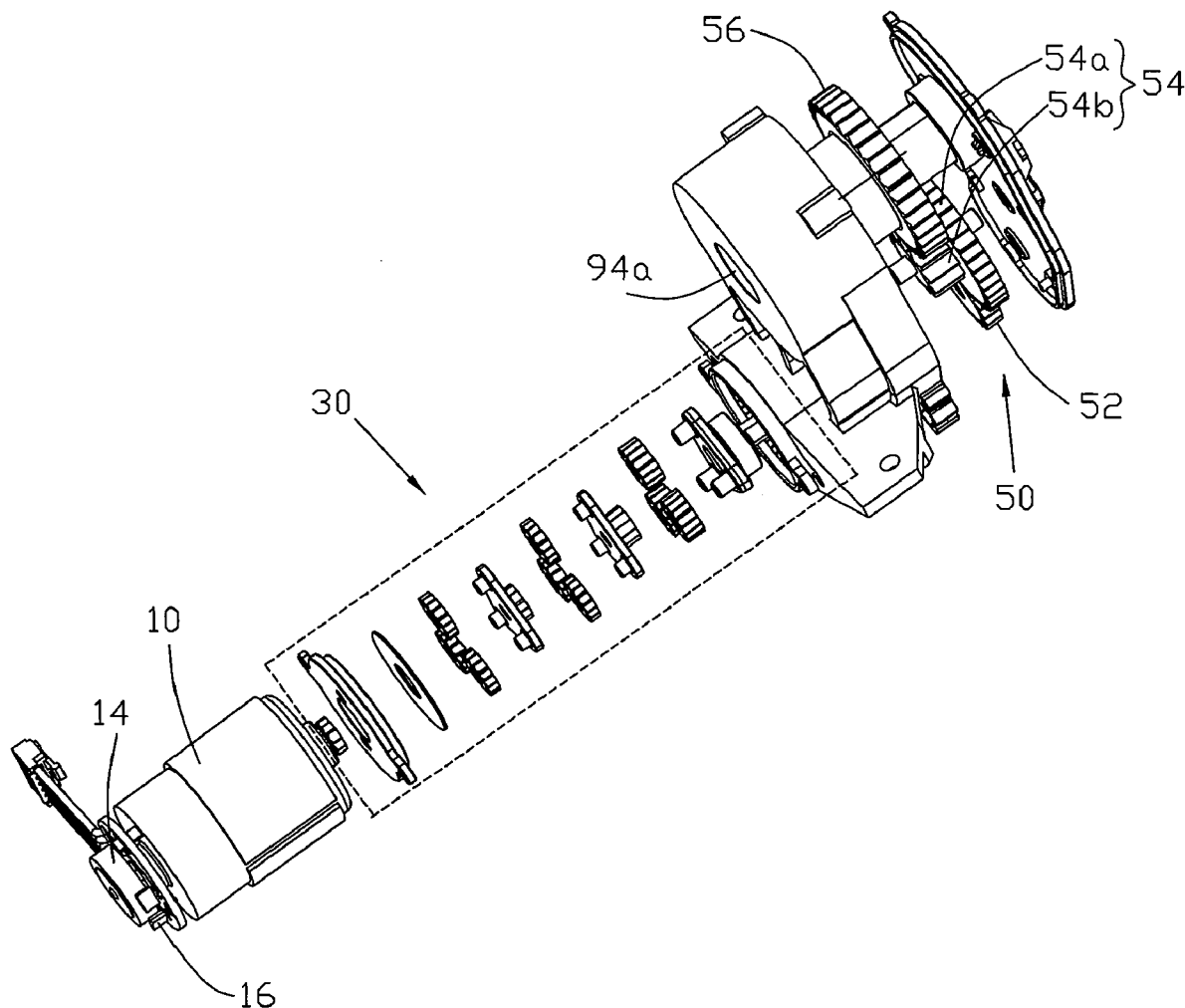
Publication Classification

(51) **Int. Cl.**
A47K 13/10 (2006.01)

(52) **U.S. Cl.** **4/246.1**

(57) **ABSTRACT**

An opening device has a drive motor with a motor shaft, an output axle for pivotably driving a member between a first position and a second position and a gear train connecting the motor shaft to the output axle. A gear case houses the gear train. The gear train has an output gear arranged to drive the output axle and the output axle is slidably received in a hole in the output gear. Thus the output axle can be assembled to the output gear or be disassembled from the output gear without disassembling the gear case. The gear case has at least one moveable baffle plate arranged to prevent the output axle from accidentally separating from the output gear once assembled.



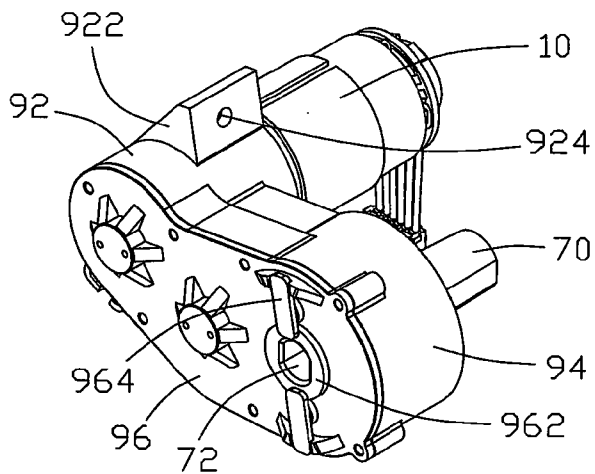


FIG. 1

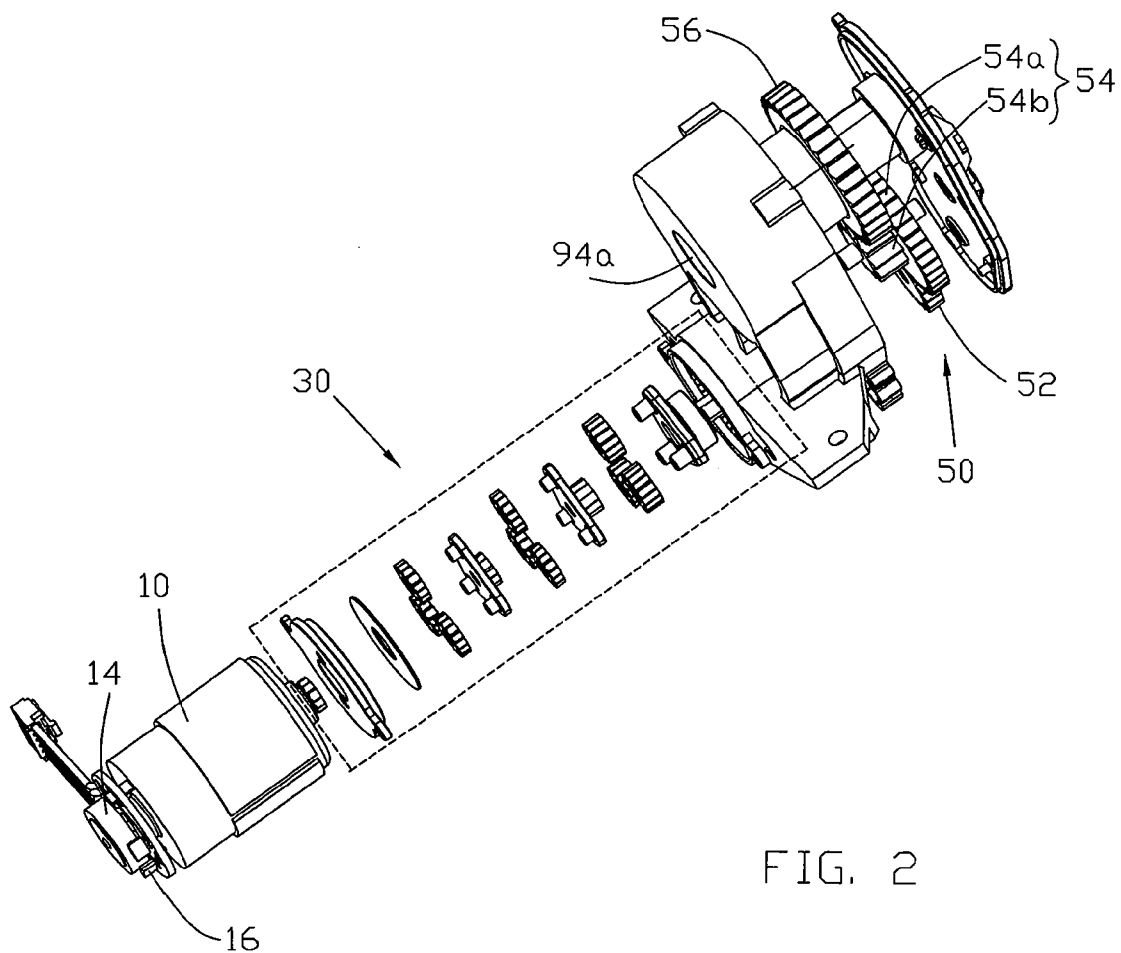


FIG. 2

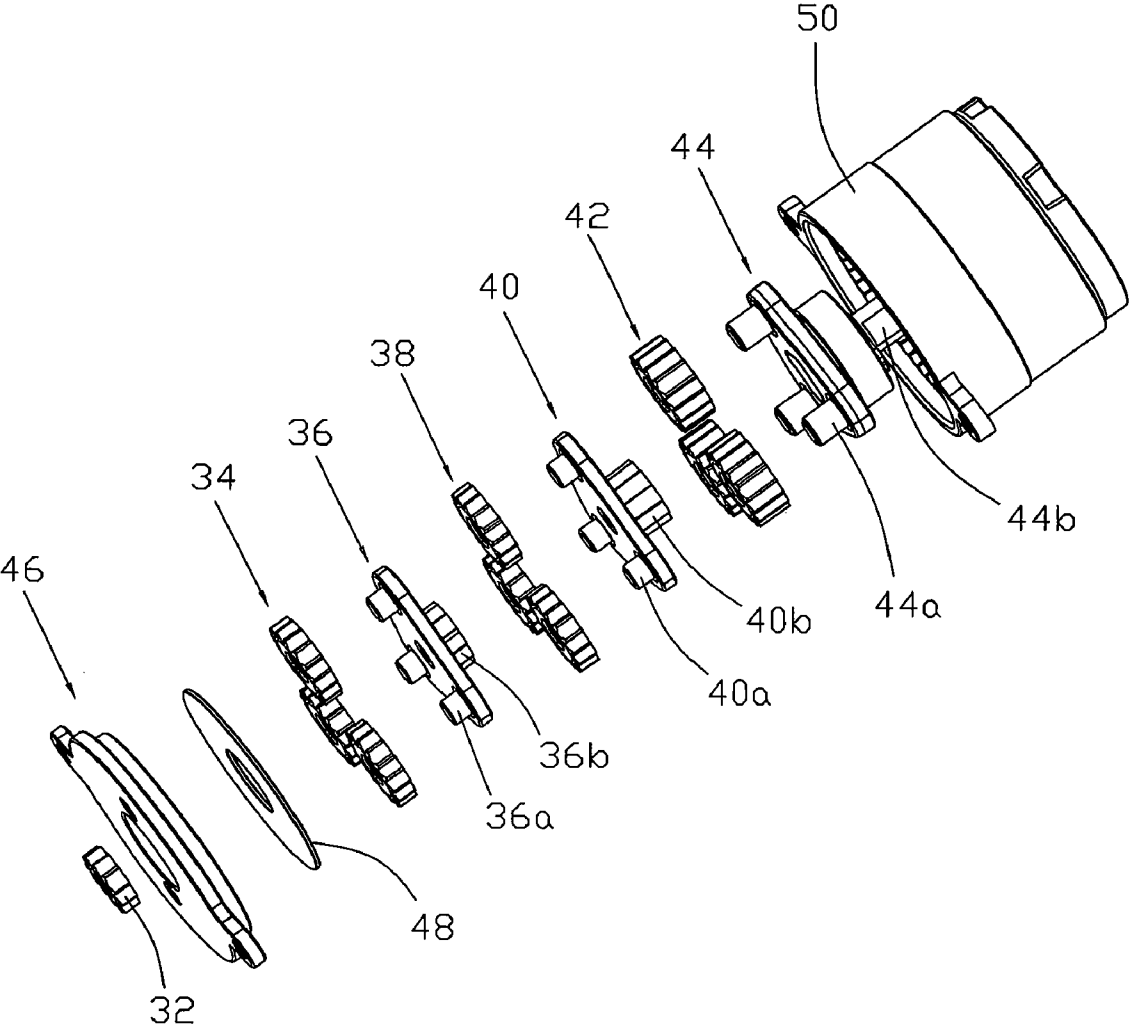


FIG. 3

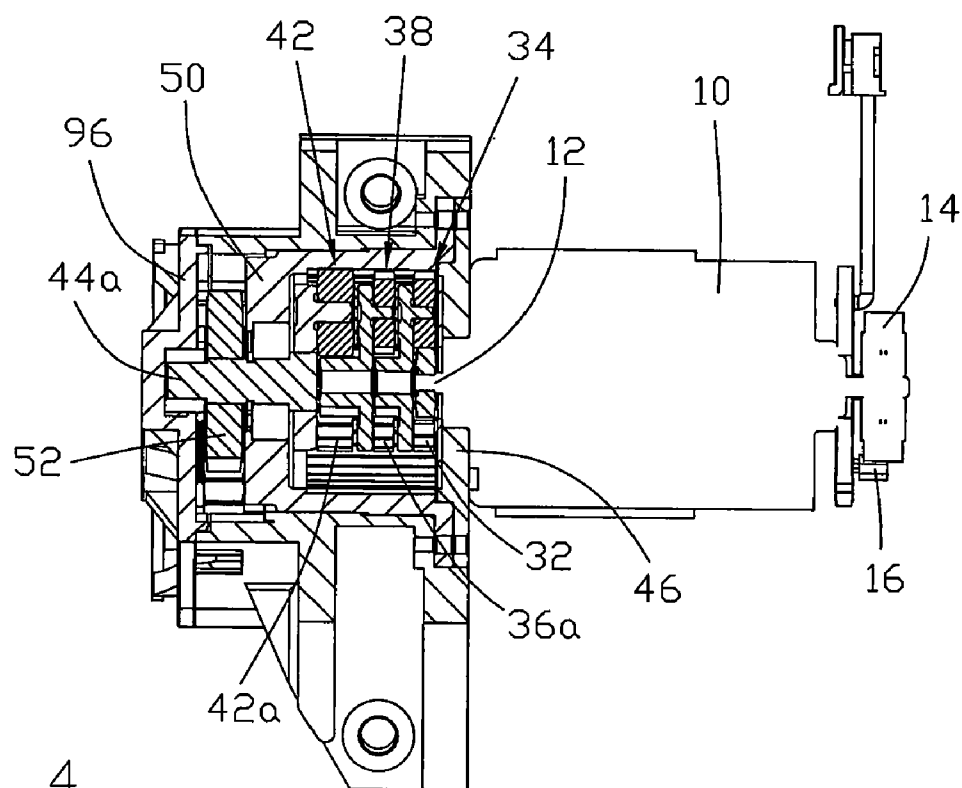


FIG. 4

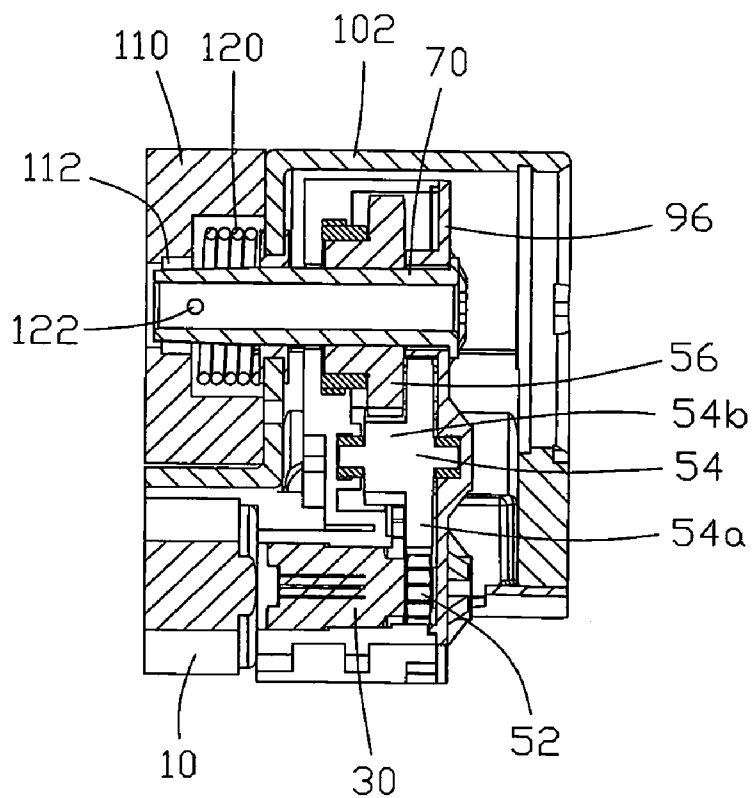


FIG. 7

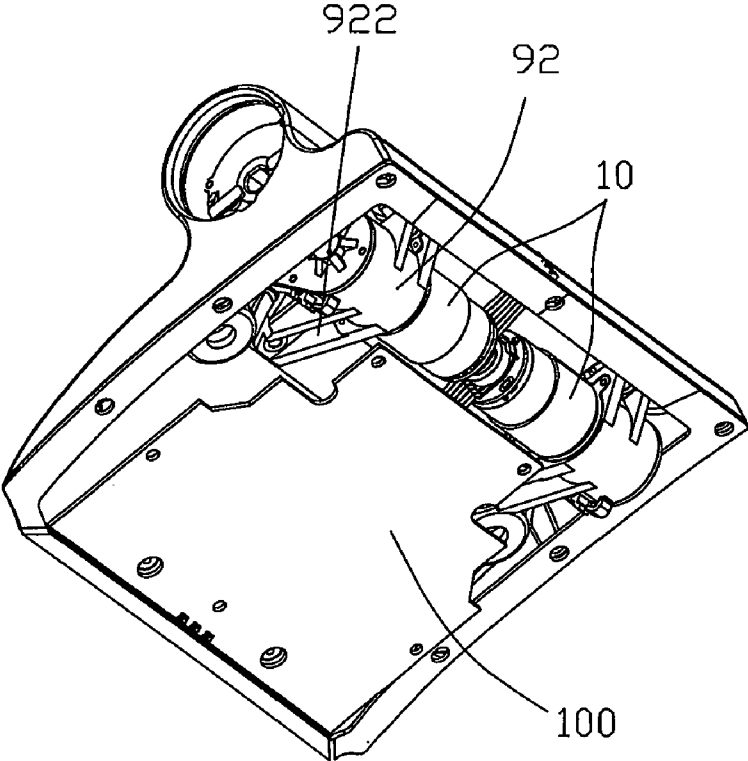


FIG. 5

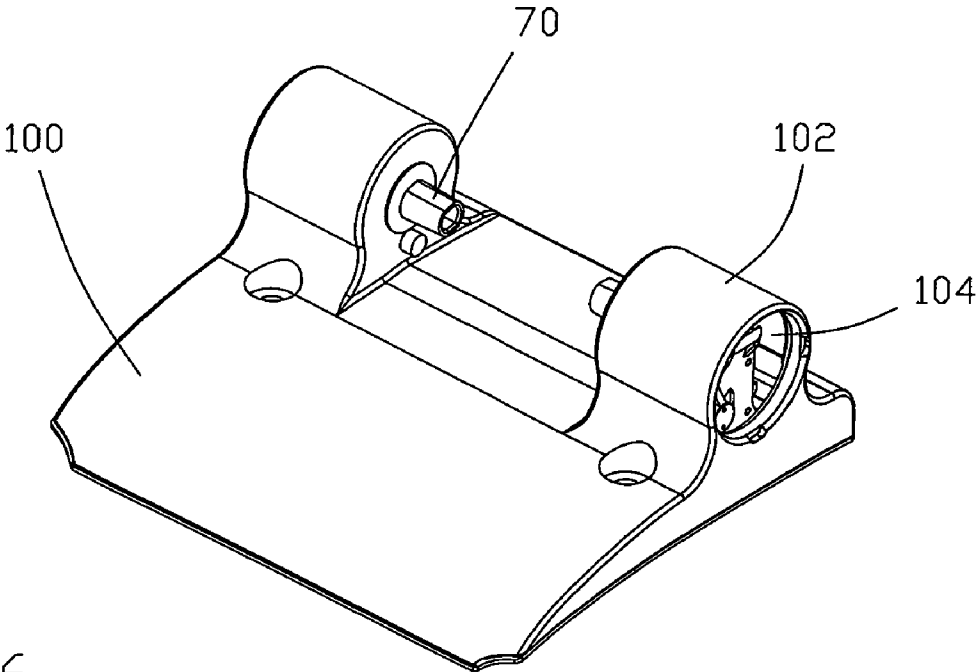


FIG. 6

OPENING DEVICE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This non-provisional patent application claims priority under 35 U.S.C. §119(a) from Patent Application No. 200810065309.3 filed in The People's Republic of China on Jan. 30, 2008.

FIELD OF THE INVENTION

[0002] The present invention relates to an opening device, in particular, to a motor drive unit for an opening device for a toilet.

BACKGROUND OF THE INVENTION

[0003] Traditional toilets require a user to manually open and close the cover or seat by direct contact therewith, which is neither convenient nor sanitary.

[0004] To solve the above mentioned problem, devices have been developed which automatically open or close the cover or seat. A typical device for a toilet appearing in market comprises a drive motor, a gear box and an output shaft to drive the seat or the cover of the toilet between first and second positions. However, the existing opening device for toilet is of the outer output type, in which the seat or cover needs to be fixed to the outside of the opening device and before the opening device is fixed to the seat or cover of the toilet, the output shaft is fixed to the opening device by a dead joint and generally has no way to disassemble the output shaft from the opening device without disassembling the case.

[0005] Also, as the existing opening devices have the output shaft fixed to the opening device by a dead joint (e.g. as an interference fit), it is not suitable when the coupling part of the seat or cover needs to be fixed to the inside of the opening device. Thus, there is a need for an opening device with the coupling part of the seat or cover being suitable to be fixed to the inside of the opening device.

SUMMARY OF THE INVENTION

[0006] Accordingly, in one aspect thereof, the present invention provides an opening device comprising: a drive motor having a motor shaft; an output axle for pivotably driving a member between a first position and a second position; a gear train connecting the motor shaft to the output axle; and a gear case for housing the gear train, the gear train being provided with an output gear to drive the output axle; wherein the output axle is connected to the gear case and the output gear by a live connection, whereby the output axis can be assembled to the output gear or be disassembled from the output gear without disassembling the gear case; and the outside of the gear case is provided with at least one moveable baffle plate arranged to prevent the output axle from separating from the output gear.

[0007] Preferably, the output axle passes through a through hole in the gear case and the moveable baffle plate is located adjacent the through hole; the moveable baffle plate being moveable between a first position extending over an end of the output axle to prevent the output axle from sliding through the through hole and a second position in which the moveable baffle plate does not interfere with the output axle moving through the through hole.

[0008] Preferably, the gear train comprises a first gear train set extending along the axial direction of the motor shaft and

a second gear train set extending transversely to the axis of the motor shaft; the first gear train set is connected to the motor shaft and the second gear train set is connected to the output axis; the output axle being parallel to the motor shaft.

[0009] Preferably, the second gear train set comprises an input gear driven by the first gear train set, the output gear for driving the output axle and a duplex gear connected between the input gear and the output gear.

[0010] Preferably, the first gear train set is a planetary gear train and comprises a sun gear fixed to the motor shaft, an internal gear and at least one planet gear group meshing with the sun gear and the internal gear.

[0011] Preferably, the planetary gear train has three stages.

[0012] Preferably, the output axle has a through hole along its axis.

[0013] According to a second aspect, the present invention provides an opening assembly comprising: a base having a mounting part; a movable member capable of pivoting relative to the base and having a coupling part; an opening device for driving the movable member between a first position and a second position, the opening device having a drive motor, an output axle for driving the movable member and a gear train connecting a shaft of the drive motor to the output axle, the gear train having an output gear arranged to drive the output axis; a gear case for housing the gear train, the gear case being fixed to the base; wherein the output axle is connected to the gear case and the output gear by a live connection; the output axle being insertable into the coupling part of the cover when the coupling part is aligned with the mounting part of the base, the output axle passing through the gear casing, the output gear, the mounting part and the coupling part; and at least one movable baffle plate provided on the gear case to limit axial movement of the output axle with respect to the output gear after the output axle has been inserted into the coupling part of the movable member.

[0014] Preferably, the assembly also has a torsion spring; one end of the torsion spring being fixed to the base and the other end being fixed to the cover or the output axle.

[0015] Preferably, the base has a second mounting part and each mounting part is provided with a containing hole; the coupling part of the movable member is located between the two mounting parts of the base and the coupling part of the movable member is provided with a coupling hole; the output axle being removably slidably received in the coupling hole of the coupling part and in a hole in the output gear whereby the output axle couples the output gear to the movable member for rotation therewith.

[0016] Preferably, the gear train comprises a first gear train set which extends along the axis of the motor shaft and a second gear train set which extends transversely to the axis of the motor shaft; the first gear train set being connected to the motor shaft and the second gear train set comprises the output gear.

[0017] The embodiments of the present invention allow for the output axle to be freely assembled to the case or disassembled from the case without disassembling the case, allowing the output axle to be inserted in to the case and cover after the opening device is assembled to the base. Thus the opening device of the present invention is suitable for use where the coupling part of the seat or cover needs to be assembled outside as well as inside the opening device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] A preferred embodiment of the invention will now be described, by way of example only, with reference to figures of the accompanying drawings, in which:

[0019] FIG. 1 is an isometric view of an opening device according to a preferred embodiment of the present invention;

[0020] FIG. 2 is a partially exploded view of the device of FIG. 1;

[0021] FIG. 3 is an exploded view of a first gear train set, being a part of the device of FIG. 1;

[0022] FIG. 4 is a sectional view of the gear train set of FIG. 3;

[0023] FIG. 5 is an isometric view of two opening devices assembled to a base of a toilet seat according to an embodiment of the present invention;

[0024] FIG. 6 is an isometric view from above of the base of FIG. 5; and

[0025] FIG. 7 is a sectional view illustrating the connection between the seat or cover, the base and the opening device.

[0026] In the figures, identical structures, elements or parts that appear in more than one figure are generally labeled with a same reference numeral in all the figures in which they appear. Dimensions of components and features shown in the figures are generally chosen for convenience and clarity of presentation and are not necessarily shown to scale.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0027] FIG. 1 and FIG. 2 illustrate an opening device according to a preferred embodiment of the present invention. The opening device can be used in toilets or other applications needing a member to be pivotably moved between first and second positions. The present embodiment will use a toilet as an example to explain the invention in which the movable member is either the seat of the toilet or a cover for the seat of the toilet. The opening device comprises a drive motor 10, a first gear train set 30, a second gear train set 50, an output axle 70 and a gear case. The gear case comprises a first case part 92 for housing the first gear train set 30, a second case part 94 for housing the second gear train set 50 and a lid 96. The outside of the first case part 92 is provided with a pair of mounting bases 922 and each mounting base 922 is provided with a mounting hole 924. The lid 96 is provided with a through hole 962 for the output axle 70 to pass through and a pair of movable baffle plates 964 are rotatably fixed to the outside of the lid 96 and located on opposite sides of the through hole 962. By rotating the movable baffle plates 964, their ends can be moved to extend over the through hole 962 to prevent the output axle 70 from sliding out of the through hole 962 and their ends can be moved away from the through hole 962 to allow the output axle 70 to enter the through hole 962. The center of the output axle 70 is provided with a through hole 72 for the electric wires (not shown) from the cover of seat of the toilet (movable member) to pass through.

[0028] The drive motor 10 comprises an motor shaft 12 (see FIG. 4), a ring magnet 14 fixed to the end of the shaft 12, a position sensor 16 fixed to a circuit board at the end of the motor 10 and located adjacent to the ring magnet 14. In the present embodiment, the position sensor is a Hall sensor, which can produce high and low voltage signals corresponding to the number of times the ring magnet 14 rotates. A micro processor (not shown) associated with the toilet can judge the number of times the motor shaft 12 rotates, so as to determine the position of the cover or seat by processing the signals produced by the Hall sensor.

[0029] Referring now to FIG. 3 and FIG. 4, the first gear train set 30 is a NGW planetary gear which extends in the axial direction of the motor shaft 12. The planetary gear

comprises a first sun gear 32, a first planet gear group 34, a first carrier 36, a second planet gear group 38, a second carrier 40, a third planet gear group 42, a third carrier 44, a mounting plate 46, a backing plate 48 and an internal gear 49. The first sun gear 32 is fixed to the motor shaft 12 by a dead joint to rotate with it (see FIG. 4). The first planet gear group 34, the second planet gear group 38 and the third planet gear group 42 are separately rotatably fixed to mounting axes 36a, 40a and 44a of the first carrier 36, the second carrier 40 and the third carrier 44 and are together in mesh with the internal gear 49. In the present embodiment, each planet gear group has three planet gears. The first planet gear group 34 meshes with the first sun gear 32. The sides of the first carrier 36 and the second carrier 40 remote from the motor 10 are provided with a second sun gear 36b and a third sun gear 40b respectively and the second sun gear 36b and the third sun gear 40b separately mesh with the second planet gear group 38 and the third planet gear group 42. All the planet gear groups mesh with the internal gear 49 and are able to roll along it. The side of the third carrier 44 remote from the motor is provided with an output shaft 44b. The mounting plate 46 is fixed to one side of the internal gear 49 adjacent the motor 10 and is used to mount the planetary gear to the motor 10. The backing plate 48 is located between the mounting plate 46 and the first planet gear group 34 to reduce the friction between the first planet gear group 34 and the mounting plate 46.

[0030] Referring to FIGS. 2 & 7, the second gear train set 50 is a parallel axes gear set which extends transversely to the axis of the motor shaft 12, to offset the axis of the output axle from the axis of the motor shaft. The second gear train set comprises an input gear 52, a duplex gear 54 and the output gear 56, each of which have an axis that extends parallel to the axis of the motor shaft 12. The input gear 52 is connected to the output shaft 44b of the planetary gear by a dead joint (interference or press fit) to rotate with it. The duplex gear 54 comprises a first meshing part 54a and a second meshing part 54b; the first meshing part 54a meshes with the input gear 52 and the second meshing part 54b meshes with the output gear 56. The tooth number of the first meshing part 54a is more than the tooth number of the second meshing part 54b such that the output gear rotates more slowly than the output shaft. The input gear 52, the duplex gear 54 and the output gear 56 are all housed in the second case part 94. The lid 96 is fixed to the open ends of the first case part 92 and the second case part 94.

[0031] Referring to FIGS. 5 to 7, two opening devices are assembled to a base 100 of a toilet seat assembly. The base 100 comprises two mounting parts 102 having, at a center thereof, a containing hole 104. The coupling part 110 (see FIG. 7) of the seat and cover of the toilet is located between the two mounting parts 102 of the base 100. The two opening devices are fitted to the base 100 from below by the mounting bases 922, that is, screws pass through the holes 924 in the mounting bases 922 and are screwed in to screw holes in the base 100. The second case part 94 extends from the bottom side of the base 100 upward into the containing hole 104 and, when the coupling part 110 of the seat or cover is placed between the two mounting parts 102 and after the coupling hole 112 of the coupling part 110 is aligned with the through hole of the output gear 56, the output axle 70 is passed through the through hole 962 of the lid 96 from the containing hole 104 and inserted into the coupling hole 112 of the seat or the cover after passing through the through hole 94a of the second case part 94 via the through hole of the output gear 56. The outer

surface of the output axle **70** is a cylinder shape with two diagonally opposite flat portions extending in the axial direction and the shapes of the mounting hole of the output gear **56** and the coupling hole **112** of the seat or the cover is adapted to mate with the shape of the cross section of the output axle **70**, so that when the output gear **56** rotates, the output axle **70** and the seat or cover will also rotate with it. The output axle **70** is thus arranged to be slidably received in the hole in the output gear and in the coupling hole **112** but is form locked or keyed to cause the output gear and the cover or seat to pivotably rotate or move with it.

[0032] A torsion spring **120** is fixed to the output axle **70** by a socket joint. One end (not shown) of the spring is fixed to the base **100** and the other end **122** is fixed to the output axle **70**. When the cover or seat of the toilet is located at a setting angle such as 70 degrees, the torsion spring **120** is in a relaxed or free state. When the cover or seat is located at a position more than or less than the setting angle, the torsion spring **120** will be in a deformation state, having the tendency to resiliently push the cover or seat back to the setting angle. It is to be understood that the other end **122** of the torsion spring **120** can also be fixed to the cover or seat of the toilet.

[0033] In use, the motor shaft **12** drives the output axle **70** to rotate via the first and second gear train sets **30**, **50**, so as to drive the cover or seat between first and second positions. When the micro processor determines that the opening angle of the cover or seat has reached a predetermined desired angle, such as 110 degrees, by processing the signal produced by the position sensor **16**, the power to the motor is turned off, so the motor shaft **12** stops rotating and the cover or seat stops at the desired position.

[0034] In the opening device of the present invention, the output axle **70** can be freely assembled to the case or disassembled from the case without disassembling the case. Before the cover or seat of the toilet is assembled to the base **100** of the toilet, the output axle **70** can be conveniently disassembled from the opening device for the convenience of aligning the coupling part of the cover or the seat between the two mounting parts **102** of the base **100**. After the coupling part of the cover or seat is correctly aligned between the two mounting parts **102** of the base **100**, the output axle **70** is passed through the through hole **962** of the lid **96** from the containing hole **104** and inserted into the coupling hole **112** of the seat or cover after passing through the through hole **94a** of the second case part **94** via the mounting hole of the output gear **56**. Thus, the opening device of the present invention is suitable for use whether the coupling part of the seat or cover needs to be assembled inside the opening device or needs to be assembled outside the opening device. As the second gear train set **50** is a parallel axes gear set which extends in a direction transverse to the axis of the motor shaft **12**, the output axle **70** is spaced from but parallel to of the motor shaft **12**.

[0035] Although the invention is described with reference to one or more preferred embodiments, it should be appreciated by those skilled in the art that various modifications are possible. Therefore, the scope of the invention is to be determined by reference to the claims that follow.

[0036] In the description and claims of the present application, each of the verbs “comprise”, “include”, “contain” and “have” and variations thereof, are used in an inclusive sense, to specify the presence of the stated item but not to exclude the presence of additional items.

1. A opening device comprising: a drive motor having a motor shaft; an output axle for pivotably driving a member between a first position and a second position; a gear train connecting the motor shaft to the output axle; and a gear case for housing the gear train, the gear train being provided with an output gear to drive the output axle; wherein the output axle is connected to the gear case and the output gear by a live connection, whereby the output axis can be assembled to the output gear or be disassembled from the output gear without disassembling the gear case; and the outside of the gear case is provided with at least one moveable baffle plate arranged to prevent the output axle from separating from the output gear.

2. The opening device of claim 1, wherein the output axle passes through a through hole in the gear case, and the moveable baffle plate is located adjacent the through hole; the moveable baffle plate being moveable between a first position extending over an end of the output axle to prevent the output axle from sliding through the through hole and a second position in which the movable baffle plate does not interfere with the output axle moving through the through hole.

3. The opening device of claim 1, wherein the gear train comprises a first gear train set extending along the axial direction of the motor shaft, and a second gear train set extending transversely to the axis of the motor shaft; the first gear train set is connected to the motor shaft, and the second gear train set is connected to the output axis; the output axle being parallel to the motor shaft.

4. The opening device of claim 3, wherein the second gear train set comprises an input gear driven by the first gear train set, the output gear for driving the output axle, and a duplex gear connected between the input gear and the output gear.

5. The opening device of claim 3, wherein the first gear train set is a planetary gear train and comprises a sun gear fixed to the motor shaft, an internal gear, and at least one planet gear group meshing with the sun gear and the internal gear.

6. The opening device of claim 5, wherein the planetary gear train has three stages.

7. The opening device of claim 1, wherein the output axle has a through hole along its axis.

8. An opening assembly comprising: a base having a mounting part; a movable member capable of pivoting relative to the base and having a coupling part; an opening device for driving the movable member between a first position and a second position, the opening device having a drive motor, an output axle for driving the movable member, and a gear train connecting a shaft of the drive motor to the output axle, the gear train having an output gear arranged to drive the output axis; a gear case for housing the gear train, the gear case being fixed to the base; wherein the output axle is connected to the gear case and the output gear by a live connection; the output axle being insertable into the coupling part of the cover when the coupling part is aligned with the mounting part of the base, the output axle passing through the gear casing, the output gear, the mounting part and the coupling part; and at least one movable baffle plate provided on the gear case to limit axial movement of the output axle with respect to the output gear after the output axle has been inserted into the coupling part of the movable member.

9. The assembly of claim 8, further comprising a torsion spring; one end of the torsion spring being fixed to the base, and the other end being fixed to the cover or the output axle.

10. The assembly of claim 8, wherein the base further comprises a second mounting part, and each mounting part is

provided with a containing hole; the coupling part of the movable member is located between the two mounting parts of the base, and the coupling part of the movable member is provided with a coupling hole; the output axle being removably slidably received in the coupling hole of the coupling part and in a hole in the output gear whereby the output axle couples the output gear to the movable member for rotation therewith.

11. The assembly of claim **8**, wherein the gear train comprises a first gear train set which extends along the axis of the motor shaft, and a second gear train set which extends trans-

versely to the axis of the motor shaft; the first gear train set being connected to the motor shaft, and the second gear train set comprises the output gear.

12. An assembly according to claim **11**, wherein the first gear train set is a planetary gear train and comprises a sun gear fixed to the motor shaft, an internal gear, and at least one planet gear group meshing with the sun gear and the internal gear.

13. An assembly according to claim **8**, wherein the planetary gear train has three stages.

* * * * *