**Mechanism for opening and closing a vehicle door**

The present invention relates to motor vehicles having at least one hinged door. The invention provides an electrically-operated mechanism for opening and closing a door or doors. The invention is particularly useful for operation of the two hinged doors normally found at the rear of a delivery van.

The invention achieves the above objects by providing an opening/closing electric mechanism for a hinged vehicle door, comprising a base plate (14) attachable to a fixed portion of the vehicle (16), a geared reversible electric motor (18) supported by said base plate (14) and a controller (22) being provided to effect all electrical operations. A short arm (24) attached to the output shaft (26) of the geared motor (20), and a long arm (30) having a first and a second extremity (32,34) revolvably attached to the short arm (24) at the first extremity (32). There is further provided an adapter plate (36) attachable to an inner surface of said door (12); and a pivot member revolvably attaching said second extremity (34) of said long arm (30) to said adapter plate (35); and means for activating/deactivating said motor (18) by means of said controller (22).
The present invention relates to motor vehicles having at least one hinged door. More particularly, the invention provides an electrically-operated mechanism for opening and closing a door or doors. It is particularly useful for operation of the two hinged doors normally found at the rear of a delivery van.

Power-operated doors can be electrically or pneumatically operated. In large vehicles such as busses and trucks the pneumatic systems are paramount because the extra weight of the air compressor and its driving arrangement are of only minor concern, and pneumatic power can be used also for other purposes such as braking and for door-opening/closing. However, for mid-sized vehicles such as multi-passenger utility vehicles and delivery vans such mechanism is appropriate. The preferred option for powered door operation is electric operation.

The delivery or collection of goods in urban areas is often fraught with the risk of causing a traffic blockage and the further risk of a fine being imposed for parking. The rear doors of a van usually require opening and shutting twice for each delivery, as with an open door, goods are open to theft from the vehicle. Often the person delivering/collecting goods is interested in concluding his task at the earliest possible moment. However the van rear doors often need to be opened/closed while the hands of the person delivering/collecting goods are occupied in carrying said goods. These are the difficulties which are addressed by the present invention.

A delivery person must perform the following operations: stop the vehicle, unlock the two rear doors, open the doors, take out the goods to be delivered, place the goods nearby, close the doors, lock the doors and lift the goods. The same in reverse order must be performed when picking up goods.

Almost all the prior art on the subject of power-operated vehicle doors refers to the operation of a sliding door at the side of the vehicle. US Patent No. 6,739,646 and US Patent Application No. US2006156630 are however open for interpretation as a sliding or hinged door.

In US Patent No. 4,121,382 Dietrich et al. disclose a design for opening/closing a hinged door of a motor vehicle. As illustrated the idea could probably be adapted also for the rear doors of a van. One difficulty is that where the operating torque is applied concentric to the door hinges, very highly stressed components are needed to operate the apparatus. The main drawback of the proposed arrangement is that it cannot be added as a retrofit item - and it is highly unlikely that a manufacturer would incorporate in an original design a large feature which is required by only some customers.

It is therefore one of the objects of the present invention to obviate the disadvantages of prior art and to provide an apparatus which can be installed by retrofit to a standard vehicle.

It is a further object of the present invention to provide an apparatus which is suitable for the rear doors of a delivery van.

It is a further object of the present invention to provide a mechanism to be fitted in a vehicle without any changes to the vehicle.

It is a further object of the present invention to provide a remote control system which will enable the delivery person to perform a delivery better, quicker, easier, and more efficiently.

It is yet a further object of the present invention to provide a system where the remote control unit is worn on the waist of the delivery person.

Finally, it is an object of the present invention to provide a system which would save time, physical strength and reduce manpower.

The present invention achieves the above objects by providing an opening/closing electric mechanism for a hinged vehicle door, comprising:

- a base plate rigidly attachable to a fixed portion of the vehicle;
- a geared reversible electric motor supported by said base plate;
- a controller being provided to effect all electrical operations;
- a short arm rigidly attached to the output shaft of said geared motor;
- a long arm having a first and a second extremity, revolvably attached to said short arm at said first extremity;
- an adapter plate rigidly attachable to an inner surface of said door;
- a pivot member revolvably attaching said second extremity of said long arm to said adapter plate; and

means for activating/deactivating said motor by means of said controller.

A preferred embodiment of the present invention there is provided an electrically operated mechanism wherein said means for activating/deactivating said motor includes a hand-worn device (such as a watch) arranged for remote communication with a signal receiving device operationally connected to said motor controller.

In a further preferred embodiment of the present invention there is provided a mechanism wherein said
means for activating/deactivating said motor includes at least one mechanically-operated electric switch operationally connected to said motor controller and being opened/closed by a mechanical device associated with a moving part of said mechanism which comes into contact with said at least one mechanically-operated electric switch to reduce the motor power supply slightly before said door is either fully open and just before said door is fully closed.

[0018] In another preferred embodiment of the present invention there is provided a security mechanism wherein said motor controller senses motor current and responds to an unusually high current by cutting off the motor power supply.

[0019] In a further preferred embodiment of the present invention there is provided a mechanism further provided with a door opening/closing switching device operationally connected to a control member located within reach of the vehicle driver.

[0020] In a further preferred embodiment of the present invention the mechanism comprises a worm and gear transmission.

[0021] In a further preferred embodiment of the present invention there is provided a mechanism wherein said long arm is further provided with a length adjustment device.

[0022] In yet a further preferred embodiment of the present invention there is provided a mechanism wherein said long arm is further provided with a collapse mechanism for emergency use.

[0023] In another preferred embodiment of the present invention there is provided a vehicle provided with at least two doors, said doors being each provided with a mechanism.

[0024] In another preferred embodiment of the present invention there is provided a vehicle wherein said doors are operated in a predetermined sequence.

[0025] In a most preferred embodiment of the present invention there is provided a vehicle wherein said doors are operated in a predetermined sequence.

[0026] It will thus be realized that the novel device of the present invention serves to meet the needs of delivery/collection vans and can usefully be employed in ambulances and by handicapped people.

[0027] It should be noted that the present invention does not refer to unlatching the doors. In the present invention the doors are securely held closed and a latch may not have to be used due to the construction of the mechanism. If a latch is used, it can be solenoid or motor opened by any of many known methods, as seen for example in US Patents Nos. 6,131,337, 6,685,239 and 6,942,260 and many others.

[0028] An automatically operated vehicle door requires certain safety features which are provided in the present invention as will be seen in the detailed description.

FULL DESCRIPTION OF THE INVENTION

[0029] The invention will now be described further with reference to the accompanying drawings, which represent by example preferred embodiments of the invention. Structural details are shown only as far as necessary for a fundamental understanding thereof. The described examples, together with the drawings, will make apparent to those skilled in the art how further forms of the invention may be realized.

[0030] In the drawings:

FIG. 1 is a perspective non-detailed view of a preferred embodiment of the mechanism according to the invention;

FIG. 2 illustrates schematically a preferred embodiment of the remote control unit;

FIG. 3 is an elevational view of a detail of the mechanism, seen with the vehicle door closed;

FIG. 4 is an elevational view of the same detail of the mechanism, seen with the vehicle door opened;

FIG. 5 is a flowchart relating to motor control;

FIG. 6 is a pictorial of an embodiment wherein the vehicle driver is provided with control means;

FIG. 7 is a plan view of the mechanism having opened a vehicle door;

FIG. 8 is a plan view of the mechanism having closed this vehicle door;

FIG. 9 is an elevational view of part of a safety device for temporarily reducing the length of the long arm;

FIG. 10 is an elevational view of the same item seen in normal use;

FIG. 11 is a perspective view of an arrangement for disconnecting the long arm from the mechanism;

FIGS. 12 and 13 are detail views illustrating an electrical safety device for the mechanism;

FIGS. 14 and 15 are plan views of the vehicle illustrating a preferred door opening closing sequence; and

FIG. 16 is a plan view of a preferred remote control.

[0031] There is seen in FIG. 1 an opening/closing electric mechanism 10 for a hinged vehicle door 12. In the following figures the components thereof will be seen in greater detail.

FIG. 1 illustrates schematically a preferred embodiment of the mechanism according to the invention;
A short arm 24 is rigidly attached to the output shaft 26 of the gearbox 20. A pivot point 28 is provided at the free extremity of the short arm 24.

A long arm 30 having a first and a second extremity 32, 34 is revolvably attached to the short arm 24 at the first extremity 32. The mode of attachment will be seen more clearly in FIGS. 3 and 4.

An adapter plate 36 is rigidly attached to an inner surface of the door 12, and supports a part 38 of a pivot member. This item will be more clearly seen in FIGS. 9, 10 and 11.

A second portion 40 of the pivot member is revolvably attached to the second extremity 34 of the long arm 30. A removable pin 42 revolvably connects the two parts of the pivot 38, 40.

Means for activating/deactivating the motor 18 by means of the controller 22.

The mechanism is suitable for retrofit on existing vehicles.

With reference to the rest of the figures, similar reference numerals have been used to identify similar parts.

Referring now to FIG. 2, there is seen a schematic illustration of a wrist worn remote control unit. The unit 52 is in the form of a wrist watch having a central touch switch 53 slightly protruding from the housing. The housing is flexibly supported by the straps 51.

The unit is worn on the wrist (as a watch) and by touching switch 53 a signal is generated whether to close or open the doors.

FIG. 3 illustrates a further detail of the mechanism 10 seen in FIG. 1. Means for activating/deactivating the motor 18 via the motor controller 22 are seen in FIG. 3.

The switches 44, 46 are opened/closed by a shaped plate member 48 attached to or being part of the short arm 24 rigidly connected to the motor gearbox output shaft 26. The shaped plate member 48 has a first arm 58 which contacts the switch 44 to first disconnect switch 100 and then reduces the current of the motor slightly before the door 12 is fully closed. A second arm 60 contacts the switch 46 in order to reduce the current to zero so as to open the door softly and smoothly and avoid shutting the door, as seen in FIG. 4.

The advantage of the above arrangement just before the end of travel is to allow the momentum of the moving parts to complete the stroke and thus prevent possible damage to the mechanism if it were stopped by one of the stop pins 62 seen in the figure.

Also seen in the figure is the long arm 30 having a first and a second extremity 32, 34 revolvably attached at the first extremity 32 to the short arm seen as 24 in FIG. 1 but now being in the form of a shaped plate 48. Each extremity 32, 34 is further provided with a further hinge point 64 lying in a plane perpendicular to the plane of the extremity attachment axes. The two-axis attachment allows for movement in two planes horizontal and vertical of the arm. As can be seen in the drawings pivots 32 and 34 are almost in straight line (180°) thus when the arm 30 is adjusted door 12 is secured locked.

Seen in FIG. 4 is the same detail of the mechanism 10 seen in the previous figure, though now the door 12 is shown in the fully open position. On command the motor 18, seen in FIG. 1, drives the mechanism in the reverse direction to return to the fully closed position seen in FIG. 3.

Referring now to FIG. 5, the flow diagram represents a safety control arrangement which is integral to the controller 22. The arrangement prevents the motor 18 from forcing the door 12 open/closed if an obstruction is encountered by the door 12. On meeting such obstruction the increased mechanical resistance causes a sharp rise in the current drawn by the motor. This sharp rise is sensed by the controller 22 which responds by immediately cutting off motor power. This arrangement protects from injury a person having a body or limb in the path of the door. Also if the door contacts an adjoining vehicle no damage will result, and of course the device protects the motor itself from burn-out.

When an electric motor is started a current several times higher than the normal operating current results. In order to prevent undesired shut-down due to this current the controller 22 is programmed to ignore the high current generated during the first 1 to 2 seconds of operation, as seen in the flowchart.

FIG. 6 shows a switching device 66 operationally connected to a motor controller 68. The switching device 66 is located within reach of the vehicle driver, on the dashboard 70. The two operating buttons are arranged that a first actuation opens a rear door (12 in FIG. 1) while a second actuation closes the door.

Alternatively, one switch could operate the first door while the second by the controller after a predetermined span of time.

A further embodiment could be that the switch which deactivates the first door will activate the second door.

FIG. 7 illustrates the mechanism 10 for door opening/closing, seen in a 90° open position, while FIG. 8 shows the door 12 closed.

Turning now to FIGS. 9 and 10 there is depicted an embodiment of the long arm 72 provided with a collapse mechanism for emergency use.

The long arm 72 is divided into an outer portion 76 and an inner portion 78, free to slide inside the outer portion 76.

A toggle mechanism 80 has a handle portion 82 pivoted at 74 to the outer portion 76 and an extremity
into the inner portion. The short member 88 has a second extremity 90 pivoted to the inner portion.

Under normal operation, the axes of all three pivots 74, 86, 90 are in the same plane and the door 12 is extended as seen in FIG. 9.

In an emergency, for example a road accident, the inner portion 76 of the long arm 72 can be released by pressing on the handle portion 82 as seen in FIG. 10. This release of any force exerted on the long arm 72 then allows disconnection of the long arm by removal of the pin 42.

The figure also shows a connection between the long arm 72 and the short arm 24. This will be described in detail with reference to FIGS. 12 and 13.

FIG. 11 shows the removable pin 42 which connects a part 38 of a pivot member attached to the adapter plate 36 which is rigidly attached to an inner surface of the door 12 seen in FIG. 1.

Also seen is the second extremity 34 of the long arm 72.

Removal of pin 42 releases the mechanism from the door 12. The pin 42 can, of course, be readily reinserted before the mechanism is to resume normal operation.

FIGS. 12 and 13 show a detail of a further safety device at the connection between the short arm 24 which is rigidly attached to the output shaft 26 of the gearbox 20 seen in FIG. 1. A pivot point 28 is a pin rigidly connected to the short arm 24 disposed at the free extremity of said of the short arm 24. A short slot 92 is seen in the long arm 72, and the pin 28 freely rides therein. A spring 94 acting through a shaped element 98 urges the pin 24 to lie in contact with the right extremity of the slot 92. At this position the pin 24 closes a switch 100 and remains in the same position during normal operation, as seen in FIG. 12.

However, if the door meets an obstruction the spring 94 is overcome and the pin 24 moves to the other end of the slot 92 resulting in opening of the switch 100 as seen in FIG. 13. The resulting signal is conveyed to the controller 22 (FIG. 1) which immediately stops the motor to prevent injury to persons in contact with the door 12 (FIG. 1) and to prevent damage to either the door 12 or an object in contact therewith.

In FIGS. 14 and 15 there is seen a vehicle 102 provided with two doors 12. The doors 12 are each provided with the mechanism 10 as described with reference to FIG. 1.

Preferably the vehicle 102 is provided with doors 12 which are operated in a predetermined sequence.

In the example seen in FIG. 14 the right door is opened first, and the left door thereafter. Door closure is in the reverse order as seen in FIG. 15.

The doors 12 seen are at the rear of the vehicle 102, which in this example is a goods delivery van.

The unit 52 is in the form of a wrist watch having a central touch switch 53 slightly protruding from the housing. The housing is flexibly supported by the straps 51.

The unit is worn on the wrist (as a watch) and by touching switch 53 a signal is generated whether to close or open the doors.

The scope of the described invention is intended to include all embodiments coming within the meaning of the following claims. The foregoing examples illustrate useful forms of the invention, but are not to be considered as limiting its scope, as those skilled in the art will be aware that additional variants and modifications of the invention can readily be formulated without departing from the meaning of the following claims.

Claims

1. An opening/closing electric mechanism for a hinged vehicle door, comprising:
   - a base plate rigidly attachable to a fixed portion of the vehicle;
   - a geared reversible electric motor supported by said base plate;
   - a controller being provided to effect all electrical operations;
   - short arm rigidly attached to the output shaft of said geared motor;
   - a long arm having a first and a second extremity, revolvably attached to said short arm at said first extremity;
   - an adapter plate rigidly attachable to an inner surface of said door;
   - a pivot member revolvably attaching said second extremity of said long arm to said adapter plate; and
   means for activating/deactivating said motor by means of said controller.

2. An electrically operated mechanism as claimed in claim 1, wherein said mechanism includes a remote control device arranged for remote communication with a signal receiving device operationally connected to said motor controller.

3. An electrically operated mechanism as claimed in claim 2, wherein said remote control device is in the form of a wrist watch.

4. The mechanism as claimed in claim 1, wherein said means for activating/deactivating said motor includes at least one mechanically-operated electric switch operationally connected to said motor controller and being opened/closed by a mechanical device associated with a moving part of said mechanism which comes into contact with said at least one
mechanically-operated electric switch to reduce the motor power supply slightly before said door is either fully open and just before said door is fully closed.

5. The mechanism as claimed in claim 1, wherein said motor controller senses motor current and responds to an unusually high current after the motor has started by cutting off the motor power supply.

6. The mechanism as claimed in claim 1, further provided with a door opening/closing switching device operationally connected to a control member located within reach of the vehicle driver.

7. The mechanism as claimed in claim 1, wherein said long arm is further provided with a length adjustment device.

8. The mechanism as claimed in claim 1, wherein said long arm is further provided with a collapse mechanism for emergency use.

9. A remotely-activated electrically operated opening/closing mechanism for a hinged vehicle door, substantially as described hereinbefore and with reference to the accompanying drawings.

10. A vehicle provided with at least two doors, said doors being each provided with said mechanism as claimed in claim 1.

11. The vehicle as claimed in claim 10, wherein said doors are operated in a predetermined sequence.

12. The vehicle as claimed in claim 10, wherein said doors are at the rear of said vehicle.

13. The vehicle as claimed in claim 10, being a goods delivery van.
REFERENCES CITED IN THE DESCRIPTION

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