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(54) **Locking device**

(57) Locking device for vehicle doors, that comprises an actuatable pin (2) that draws said door from a pre-locking position to a final locking position, the device having a casing (3) with a slide that guides the movement of the pin, and a rotary ring (5), and integrally joined to the rotational axis of said ring are a drive cam (8) adapted for moving the pin along the slide in one direction, until

it reaches the pre-locking position, and the crank of a crank-slider mechanism that connects the ring with the pin, and which moves the pin along the slide in the opposite direction as the ring continues its rotation, until it reaches the final locking position. All of this is adapted in such a way that the pin has to describe an alternating up and down movement with each cycle of the ring's rotation.

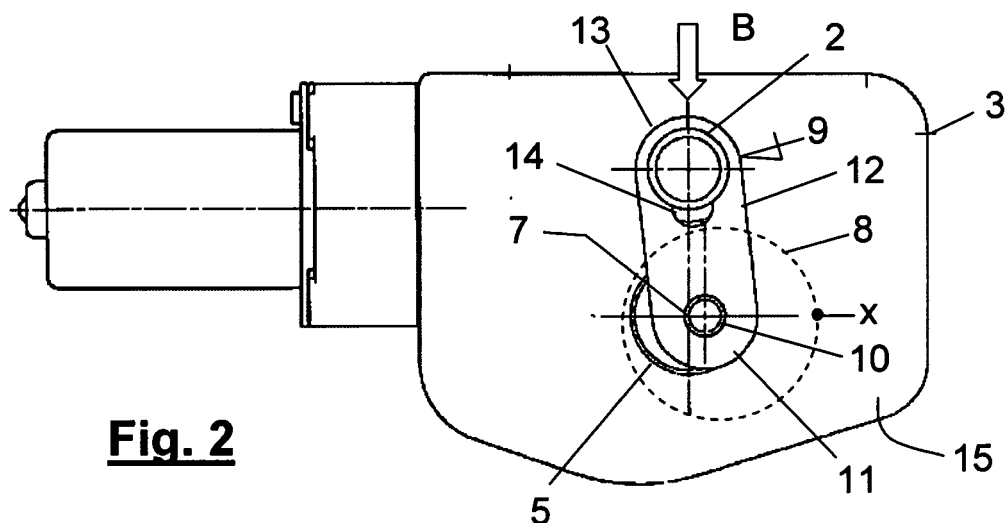


Fig. 2

Description

Technical field of the invention

[0001] The invention relates to a locking device for motor vehicle doors that comprise an actuatable part that draws the door from a pre-locking position to a final locking position.

Background of the invention

[0002] There are known locking systems for hinged or sliding doors of motor vehicles, comprising a catch mounted on the chassis of the vehicle that projects towards the locking device of the door, which is generally mounted on one of its edges, in such a way that when the door is driven to a pre-locking position, the catch connects or engages with a fork bolt positioned for this purpose in the door locking device. This fork bolt acts as a fastener and makes it impossible to open the door accidentally, so that it connects the door with the chassis of the car. In turn, the bolt is actuated by an electric motor that moves it in a certain direction in relation to the locking device, which, on connecting with the fixed catch on the chassis, draws the door towards the chassis from the pre-locking position to a final locking position, thus guaranteeing a tight closure.

[0003] The means that transmits the power of the electric motor to the bolt, causing it to move, has to transmit sufficient power to said bolt to move the door with its movement and it must simultaneously move the bolt in the right direction to cause the correct final locking of the door. It is for this reason that the ideal movement is linear, following a straight path.

[0004] Locking devices of this type must overcome other problems. Primarily, the system that transmits the movement from the motor to the bolt must be correctly designed in order to avoid damage to the locking device, particularly when the door is closed with excessive force or when the catch is not in the correct position, meaning in both cases that the catch knocks against the bolt when it is in the pre-locking position, causing it to move and consequently resulting in a forced movement of the parts in the transmission system, which could be contrary to the movement of the electric motor, thus possibly damaging the locking device.

Explanation of the invention

[0005] The locking device that is the object of this invention, which is particularly applicable to motor vehicle doors, overcomes the aforementioned problems. This device comprises an actuatable fork bolt, or pin, that draws the door from a pre-locking position to a final locking position.

[0006] Essentially, the device in the invention is characterised in that it comprises a casing with a slide, through which the aforementioned pin passes, guiding

the movement of the pin, and a rotary ring that is propelled by a drive mechanism actuated by an electric motor. Integrally joined to the rotational axis of said ring are a drive cam adapted to move the pin along the slide in one direction, as the ring turns, until it reaches the pre-locking position, and the crank of a crank-slider mechanism that links the ring with the pin and moves the pin along the slide in the opposite direction as the ring continues its rotation, until it reaches the final locking position. All this is adapted in such a way that pin has to describe an alternating up and down movement with each cycle of the ring's rotation, sequentially occupying the pre-locking and final locking positions.

[0007] According to another characteristic of the invention, the slide that acts as a guide for the pin is straight, which means that the pin moves from the pre-locking position to the final locking position and vice versa, following a straight path.

[0008] Preferably, the rotational axis of the ring is positioned on the imaginary prolongation of the slide, which means that an accidental movement of the pin would not apply any torque to the ring, thus protecting the drive mechanism against unwanted movements.

[0009] According to another characteristic of the invention, the crank comprises a disc that is solidly joined to the rotational axis of the ring, or to the body of the ring, with a pivot joined to one of the ends of the connecting rod, the other end of which has a slot through which the pin passes, guided by the slide. All this is adapted in such a way that when the pin is moved by the cam towards the pre-locking position, the pin slides along the slot without touching the outer end of the aforementioned slot, and once the pin has reached the pre-locking position where the ring continues to rotate, the outer end of the slot touches the pin and moves it towards the final locking position.

[0010] According to another feature of the invention, the pin is adapted to rotate around its longitudinal axis in order to reduce friction with the drive cam.

[0011] In a preferred embodiment the slide is positioned on an outer wall of the casing, with one end of the pin accessible from the outside of the aforementioned casing, and the end of the pivot joined to the connecting rod, which describes a circular movement when the ring moves, is also accessible from the outside of the casing, meaning that the connecting rod that links the aforementioned pivot with the pin is outside the casing.

Brief description of the drawings

[0012] In the attached drawings a preferred embodiment of the locking device that is the object of the invention is illustrated by means of a non-limiting example. In said drawings:

Fig. 1, is a side view of the locking device, in which the pin is in the pre-locking position, which corresponds with the furthest position from the ro-

- tary ring's rotational axis;
- Fig. 2, is a side view of the device shown in Fig. 1 in which the pin, having moved in relation to the position shown in Fig. 1, is in an intermediate position between the pre-locking and final locking position; and
- Fig. 3, is a side view of the device shown in Fig. 1, in which the pin is in the final locking position, which corresponds with the nearest position to the rotational axis of the device's rotary ring.

Detailed description of the drawings

[0013] The locking device 1 shown in the drawings comprises a pin 2, which acts as a fork bolt for connection with a catch positioned for this purpose in a conventional lock mounted on the door or boot of the vehicle. The pin 2 is operated by an electric motor and can be moved in relation to the locking device, which is mounted on the chassis of the vehicle. Said movement in relation to the locking device 1 causes the conventional lock to move towards the locking device 1 and the chassis, in turn moving the door from a pre-locking position to a final locking position to overcome the resistance of the joints, thus guaranteeing a tight closure.

[0014] The rotational movement of the axis of the electric motor, which is not shown in the drawings, is transmitted by means of a set of gears, in a way that is in itself well known, to a rotary ring 5 that is joined, with the ability to rotate, to a casing 3 that surrounds and protects the locking device 1.

[0015] Said pin 2 can move along a slide 4 that guides it, positioned for this purpose on the outer wall 15 of the device's casing 3. The slide in the drawings is straight and its imaginary prolongation coincides with the rotational axis 7 of the rotary ring 5 that is joined to the electric motor.

[0016] The device comprises a drive cam 8 integrally joined to the rotational axis 7 of the rotary ring 5, in such a way that the cam 8 turns at the same time as the ring 5 when the latter is moved by the gears of the electric motor.

[0017] The cam 8 is adapted in such a way that, when the pin 2 is in the final locking position shown in Fig. 3, its rotational movement moves the pin 2 towards the pre-locking position, as shown in Fig. 1.

[0018] Effectively, the drive cam 8 moves the pin 2 along the slide 4 in the direction shown by arrow A in Fig. 1, until the pin occupies the pre-locking position, at which point the outermost point x of the drive cam 8, in relation to the rotational axis 7 of the rotary ring 5 and the cam 8, is in the position shown in Fig. 1, aligned between the pin 2 and the aforementioned rotational axis 7.

[0019] With the drive cam 8 in contact with the pin 2 and the pin aligned with the rotational axis 7 of the cam 8, any force applied to the pin 2 in the opposite direction to that of arrow A in Fig. 1, will not apply any torque to the rotary ring 5, thus preventing the gears and the axis

of the motor, which is in a resting position, from having to turn suddenly.

[0020] From the situation shown in Fig. 1, in which the door is in a pre-locking position, the electric motor is activated and the gears transmit the rotational movement of the motor to the rotary ring 5, which in turn causes the crank of a crank-slider mechanism 9 to turn, converting the circular movement of the rotary ring 5 in to a straight-line movement of the pin 2. This situation is shown in Fig. 2, in which the rotary ring 5 has turned through 90° in a clockwise direction in relation to the situation shown in Fig. 1.

[0021] The crank can be integrally joined to the rotational axis 7 of the rotary ring 5, or the ring itself can act as the crank as is shown by the example in the drawings. It is possible to see from said drawings that the rotary ring 5 has a pivot 10, at a certain distance from the rotational axis 7, which is joined to the end 11 of the connecting rod 12 of the crank-slider mechanism 9, which connects the aforementioned rotary ring 5 with the pin 2. For this purpose, the opposite end 13 of the connecting rod 12 has a slot 14 through which the pin 2 passes, so that as the pivot 10 moves, the connecting rod 12 moves the pin 2, making it move in the direction shown by arrow B in Fig. 2, towards the final locking position, which causes the door to move towards the chassis of the vehicle.

[0022] As the rotation of the rotary ring 5 continues, the pin 2 moves along the slide 4 until it reaches the position shown in Fig. 3, which corresponds with the final locking position, at which point the electric motor stops and the rotary ring 5 stops turning. The rotary ring 5 will have turned through 90° in a clockwise direction in relation to the situation shown in Fig. 2.

[0023] When the vehicle door is open, the pin must return to the original pre-locking position shown in Fig. 1. For this to happen, the electric motor is actuated again so that the rotary ring 5 rotates, in turn rotating the drive cam 8 until its outer edge comes into contact with the pin 2, pushing it and making it move along the slide 4, in the direction shown by arrow A in Fig. 1.

[0024] When the rotary ring 5 begins its rotational movement, the movement of the pivot 10 will in turn move the connecting rod 12, but the pin 2 may remain still, as it will initially slide along the slot 14 of the connecting rod 12.

[0025] In short, the pin 2 has to describe an alternating up and down movement, following a straight path, with each cycle of the rotary ring's 5 rotation, sequentially occupying the pre-locking and final locking positions.

[0026] To reduce friction between the drive cam 8 and the pin 2, the latter can be adapted to rotate around its longitudinal axis, meaning that, as well as moving from the final locking position to the pre-locking position, following a straight path, the pin 12 would rotate around its longitudinal axis, propelled by the rotational movement of the drive cam 8 around the rotational axis 7.

Claims

1. Locking device (1), particularly applicable to motor vehicle doors, which comprise an actuatable pin (2) that draws the door from a pre-locking position to a final locking position, **characterised in that** said device comprises a casing (3) with a slide (4), through which said pin passes, guiding the movement of the pin, and a rotary ring (5) that is propelled by a drive mechanism actuated by an electric motor. Integrally joined to the rotational axis (7) of said ring are
 - a drive cam (8) adapted to move the pin, as the ring rotates, along the slide in one direction (A), until it reaches the pre-locking position,
 - and the crank of a crank-slider mechanism (9) that connects the ring with the pin, and which moves the pin along the slide in the opposite direction (B) as the ring continues its rotation, until it reaches the final locking position,

all adapted in such a way that the pin has to describe an alternating up and down movement with each cycle of the ring's rotation, sequentially occupying the pre-locking and final locking positions.
2. Locking device (1) according to claim 1, **characterised in that** the slide (4) that acts as a guide for the pin (2) is straight, which means that the pin moves from the pre-locking position to the final locking position and vice versa, following a straight path.
3. Locking device (1) according to claim 2, **characterised in that** the rotational axis (7) of the ring (5) is positioned on the imaginary prolongation of the slide (4).
4. Locking device (1) according to the previous claims, **characterised in that** the crank comprises a disc that is solidly joined to the rotational axis (7) of the ring (5), or to the body of the ring, with a pivot (10) joined to one of the ends (11) of the connecting rod (12), the other end (13) of which has a slot (14) through which the pin (2) passes, guided by the slide (4). All this is adapted in such a way that when the pin (2) is moved by the cam (8) towards the pre-locking position, the pin (2) slides along the slot (14) without touching the outer end of the aforementioned slot (14), and once the pin has reached the pre-locking position where the ring continues to rotate, the outer end of the slot touches the pin and moves it towards the final locking position.
5. Locking device (1) according to the previous claims, **characterised in that** the pin (2) is adapted to rotate around its longitudinal axis in order to reduce friction with the drive cam (8).
6. Locking device (1) according to claims 3 to 6, **characterised in that** the slide (4) is positioned on an outer wall (15) of the casing (3), with one end of the pin (2) accessible from the outside of the aforementioned casing, and the end of the pivot (10) joined to the connecting rod (12), which describes a circular movement when the ring (5) moves, is also accessible from the outside of the casing, meaning that the connecting rod that links the aforementioned pivot with the pin is outside the casing.

