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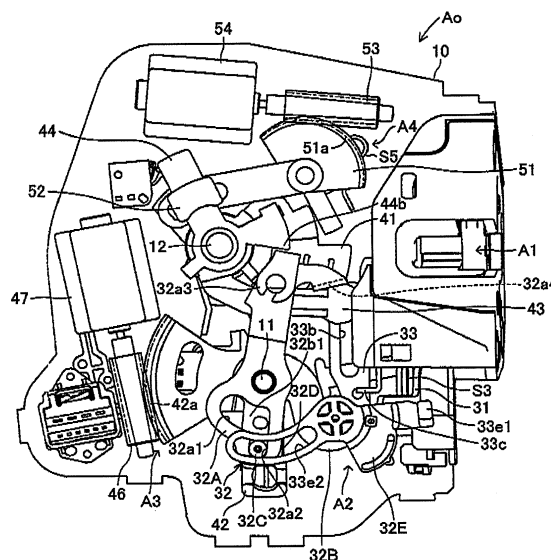
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(54) **Double-lock type vehicle door lock device**

(57) A vehicle door lock device includes an inside open lever that is operated at the time of a door opening operation of an inside door handle, an open link that is linked to the inside open lever, a lock mechanism that switches the position of the open link, and a double-lock

mechanism that restricts or allows the operation of the lock mechanism. The lock mechanism includes an active lever, a sub-lever, a control lever, a first stopper, a second stopper, and a torsion spring. The double-lock mechanism includes a double-lock lever and a connecting member.

FIG. 1



Description

TECHNICAL FIELD

[0001] The disclosure relates to a vehicle door lock device, and more particularly, to a double-lock type vehicle door lock device that includes a lock mechanism and a double-lock mechanism.

BACKGROUND DISCUSSION

[0002] JP-A-2002-38797 discloses a vehicle door lock device including a latch mechanism, an inside open lever, an open link, a lock mechanism, and a double-lock mechanism. The latch mechanism is assembled to a door of a vehicle and holds the door in a closed state with respect to a body. The inside open lever is rotatably linked to the door and is driven with the operation of an inside door handle that is provided on the door inside the vehicle. The open link is rotatably linked to the door, is provided between the inside open lever and a lift lever of the latch mechanism, and is switchable between an unlock position where the door opening operation of the inside open lever is transmitted to the lift lever and a lock position where the door opening operation is not transmitted to the lift lever, with a door opening operation of the inside door handle. The lock mechanism switches the open link between the unlock position and the lock position. The double-lock mechanism is switchable between a double-lock set state where an operation of the lock mechanism is restricted and a double-lock unset state where the operation of the lock mechanism is allowed.

[0003] If the open link is positioned at the lock position and the inside open lever is operated in a door opening direction with the door opening operation of the inside door handle when the double-lock mechanism is in the double-lock unset state and the operation of the lock mechanism is allowed in the vehicle door lock device disclosed in JP-A-2002-38797, a so-called one-motion operation (or a double-pulling operation) is obtained at the lock mechanism and the open link is switched to the unlock position from the lock position. Accordingly, the door can be opened by the door opening operation of the inside door handle. Meanwhile, if the door lock device is set so that the above-mentioned one-motion operation is obtained, it is possible to open the door by performing the door opening operation of the inside door handle one time (a single pulling operation). Further, if the door lock device is set so that the above-mentioned double-pulling operation is obtained, it is possible to open the door by returning the inside door handle, of which the door opening operation has been performed one time, once and performing the door opening operation again (double-pulling operation).

[0004] The vehicle door lock device disclosed in JP-A-2002-38797 is set so that the one-motion operation is obtained, and employs the following structure. That is, the active lever (which is linked to the open link and can

switch the open link to the unlock position or the lock position) is moved to the unlock position from the lock position by a locking lever and a hooked lever. The locking lever (the component of the lock mechanism that is described as the locking operation lever in JP-A-2002-38797) is rotationally driven to the unlock position from the lock position by the door opening operation of the inside open lever. The hooked lever (which is made of linear spring steel in JP-A-2002-38797 and is a component of the lock mechanism elastically deformable when a force is transmitted between the active lever of the lock mechanism and the hooked lever) is assembled to the locking lever and can be rotationally driven integrally with the locking lever.

[0005] Therefore, when the above-mentioned one-motion operation is obtained, the hooked lever is elastically deformed and transmits a force to the active lever while being bent and the delay of the door opening operation of the inside door handle occurs at the early stage of the movement of the active lever to the unlock position from the lock position. Accordingly, there is a concern that the operation feeling deteriorates. Meanwhile, it may be possible to reduce the bending of the above-mentioned hooked lever by changing the shape, the material, and the like of the hooked lever. However, in this case, there is a concern that the size or cost of the device is increased.

SUMMARY

[0006] According to an aspect of this disclosure, a double-lock type vehicle door lock device includes: a latch mechanism that is assembled to a door of a vehicle and is configured to hold the door in a closed state with respect to a body; an inside open lever that is rotatably linked to the door and is driven with the operation of an inside door handle provided on the door inside the vehicle; an open link that is rotatably linked to the door, is provided between the inside open lever and a lift lever of the latch mechanism, and is switchable between an unlock position where a door opening operation of the inside open lever is transmitted to the lift lever and a lock position where the door opening operation is not transmitted to the lift lever, with a door opening operation of the inside door handle; a lock mechanism that switches the open link between the unlock position and the lock position; and a double-lock mechanism that is switchable between a double-lock set state where an operation of the lock mechanism is restricted and a double-lock unset state where the operation of the lock mechanism is allowed. The lock mechanism includes: an active lever that is rotatably linked to the door and is held at either one of an unlock position and a lock position; a sub-lever that is assembled to the active lever to be rotatable relative to the active lever by a predetermined amount, is linked to the open link, and switches the open link between the unlock position and the lock position; a first stopper that is provided at the active lever and restricts the rotation

of the sub-lever in an unlocking direction at a first fixed position; a control lever that includes a first urging member for urging the sub-lever toward the first fixed position in the unlocking direction, is rotated relative to the active lever and the sub-lever, is engageable with and disengageable from the active lever, and is rotatable from a second fixed position in the unlocking direction by the door opening operation of the inside open lever; a second stopper that is provided at the active lever and restricts the rotation of the control lever in a locking direction at the second fixed position; and a second urging member that urges the control lever toward the second fixed position in the locking direction. When the open link is switched to the lock position from the unlock position by a movement of the active lever to the lock position from the unlock position, the sub-lever is operated integrally with the active lever. When the open link is switched to the unlock position from the lock position by a movement of the active lever to the unlock position from the lock position, the sub-lever is set to interlock with the active lever through the first urging member. The double-lock mechanism includes: a double-lock lever that is rotatably linked to the door and is switchable between an unset position corresponding to the double-lock unset state and a set position corresponding to the double-lock set state; and a connecting member that is assembled to the control lever to be movable relative to the control lever in a radial direction thereof and integral to the control lever in a rotation direction thereof, is movable in the radial direction of the control lever, and engageable with and disengageable from the active lever by a rotation of the double-lock lever. When the double-lock lever is positioned at the unset position, the active lever and the control lever are rotatable relative to the double-lock lever while being connected to each other by the second stopper and the connecting member so as to be rotatable integrally with each other. When the active lever is positioned at the lock position and the double-lock lever is positioned at the set position, a movement of the active lever to the unlock position is restricted by the double-lock lever, and the connecting member is disengaged from the active lever, so that a movement of the control lever from the second fixed position against an urging force of the second urging member is allowed.

[0007] It is noted that a general double-lock type vehicle door lock device also includes an outside open lever that is driven with the operation of the outside door handle provided on the door outside a vehicle. Accordingly, the open link is set so as to be capable of being driven by the door opening operation of the outside open lever with the door opening operation of the outside door handle, like the door opening operation of the inside open lever with the door opening operation of the above-mentioned inside door handle. However, the door lock device is set so that a one-motion operation (or a double-pulling operation) is not obtained by the door opening operation of the outside door handle.

[0008] According to the above configuration, if the door

opening operation of the inside door handle is performed when the open link is positioned at the unlock position by the lock mechanism, the lock mechanism is in the unlock state, and the double-lock mechanism is in the double-lock unset state (at the time of unlocking) in the double-lock type vehicle door lock device, the door opening operation of the inside open lever is transmitted to the lift lever of the latch mechanism through the open link that is positioned at the unlock position, with the door opening operation. Accordingly, the opening operation of the latch mechanism is performed and the door can be opened by the door opening operation of the inside door handle. Meanwhile, if the door opening operation of the outside door handle is performed in this case (at the time of unlocking), the door opening operation of the outside open lever is transmitted to the lift lever of the latch mechanism through the open link, which is positioned at the unlock position, and the opening operation of the latch mechanism is performed along with the door opening operation. Accordingly, the door can be opened even by the door opening operation of the outside door handle.

[0009] Further, if the door lock device is set so that a so-called double-pulling operation is obtained with the door opening operation of the inside door handle, when the open link is positioned at the lock position by the lock mechanism, the lock mechanism is in the lock state, and the double-lock mechanism is in the double-lock unset state (at the time of locking), the opening operation of the latch mechanism is performed by the double-pulling operation of the inside door handle (a first pulling operation and a second pulling operation after the inside door handle returns once). Accordingly, the door can be opened.

[0010] In this case (at the time of locking), the control lever, the active lever, the sub-lever, and the like are not switched to the unlock position from the lock position and the open link positioned at the lock position is driven by the door opening operation of the inside open lever with the door opening operation of the inside door handle, at the early and middle stages of the first door opening operation of the inside door handle (first pulling operation). Further, the control lever, the active lever, the sub-lever, and the like are switched to the unlock position from the lock position and the open link continues to be driven by the door opening operation of the inside open lever at the latter stage of the first pulling operation.

[0011] For this reason, at the early and middle stages of the first pulling operation, the movement of the open link is not transmitted to the lift lever of the latch mechanism and the latch mechanism is maintained in the closed state (latched state), so that the door cannot be opened. Further, the control lever, the active lever, the sub-lever, and the like are switched to the unlock position from the lock position at the latter stage of the first pulling operation, so that the open link is switched to the unlock position from the lock position. However, in this case, the open link is driven by a predetermined distance and is in a so-

called panic state. Accordingly, since a driving force is not transmitted to the lift lever of the latch mechanism from the open link, the opening operation of the latch mechanism is not performed, so that the door cannot be opened.

[0012] Meanwhile, in the above-mentioned panic state, the control lever and the active lever are switched to the unlock position and held. However, since being rotated relative to the active lever against the urging force of the first urging member by a predetermined angle, the sub-lever is not switched to the unlock position. For this reason, if the sub-lever is rotated relative to the active lever in the unlocking direction by the urging force of the first urging member while the open link is moved to the return position when the inside door handle returns once, the above-mentioned panic state is released, so that the sub-lever and the open link are switched to the unlock position.

[0013] Accordingly, since the control lever, the active lever, the sub-lever, and the like are switched to the unlock position and the open link is moved to the unlock position at the time of the second pulling operation of the inside door handle, the door opening operation of the inside open lever is transmitted to the lift lever of the latch mechanism through the open link, which is positioned at the unlock position, along with the door opening operation of the inside door handle at the time of unlocking. Therefore, the opening operation of the latch mechanism is performed, so that the door can be opened by the second door opening operation of the inside door handle.

[0014] Meanwhile, at the time of locking, the active lever and the control lever may be rotated relative to the double-lock lever while being connected to each other by the second stopper and the connecting member so as to be rotated integrally with each other. Accordingly, when the control lever is rotated in the unlocking direction by the door opening operation of the inside open lever with the door opening operation of the inside door handle, the active lever is rotated integrally with the control lever in the unlocking direction. Therefore, the delay of the door opening operation of the inside door handle does not occur at the early stage of the movement of the active lever to the unlock position from the lock position. As a result, it is possible to improve the operation feeling at the time of the door opening operation of the inside door handle. Meanwhile, even when the door lock device is set so that a so-called one-motion operation is obtained with the door opening operation of the inside door handle at the time of locking, these advantages are obtained likewise.

[0015] Further, when the open link is positioned at the lock position by the lock mechanism, the lock mechanism is in the lock state, and the double-lock mechanism is in the double-lock set state (at the time of double-locking), the active lever is positioned at the lock position, the double-lock lever is positioned at the set position, the movement of the active lever to the unlock position is restricted by the double-lock lever, and the movement of the control

lever from the second fixed position against the urging force of the second urging member (the movement in the unlocking direction) is allowed by the disengagement of the connecting member from the active lever.

[0016] For this reason, regardless of which door opening operation of the inside door handle is performed in this case (at the time of double-locking), the control lever is rotated in the unlocking direction by the door opening operation of the inside open lever at the latter stage of the door opening operation but misses the active lever, so that the active lever positioned at the lock position is not rotated toward the unlock position. Accordingly, the lock mechanism is maintained in the lock state in this case, so that the door cannot be opened by the door opening operation of the inside door handle.

[0017] Meanwhile, regardless of which door opening operation of the outside door handle is performed at the time of the above-mentioned locking and double-locking, the control lever, the active lever, the sub-lever, and the like are not switched to the unlock position from the lock position and the open link is maintained at the lock position. For this reason, if the door opening operation of the outside door handle is performed at the time of the above-mentioned locking and double-locking, the door opening operation of the outside open lever is transmitted to the open link, which is positioned at the lock position, with the door opening operation but is not transmitted to the lift lever of the latch mechanism from the open link that is positioned at the lock position. Accordingly, the opening operation of the latch mechanism is not performed in this case, so that the door cannot be opened by the door opening operation of the outside door handle.

[0018] In the above-described double-lock type vehicle door lock device, a single member may serve as the first urging member for urging the sub-lever toward the first fixed position in the unlocking direction and the second urging member for urging the control lever toward the second fixed position in the locking direction. In this case, it is possible to make the door lock device simple and inexpensive as compared to when the first and second urging members are formed of separate members.

[0019] In the above-described double-lock type vehicle door lock device, the door lock device may include a locking lever that is rotatably linked to the door and is connected to the active lever so as to interlock with the active lever, and the locking lever may be linked to a locking knob, which is provided on the door inside the vehicle, so as to interlock with the locking knob. In this case, at the time of double-locking, the movement of the active lever, which interlocks with the locking lever, to the unlock position is restricted by the double-lock lever and the active lever is held at the lock position. Accordingly, even though the locking knob is operated, the locking knob and the locking lever are not moved, so that it may not be possible to move the locking lever to the unlock position from the lock position. Therefore, it is possible to improve the security of the door lock device.

[0020] In the above-described double-lock type vehi-

cle door lock device, the connecting member may include a pin portion that is slidably fitted to an arc-shaped elongated hole of the double-lock lever and passes through the arc-shaped elongated hole, and a slide portion that is assembled to an arm portion of the control lever to be movable relative to the arm portion in the radial direction thereof and integral to the arm portion in the rotation direction thereof, and by the rotation of the double-lock lever, the connecting member may be movable in the radial direction of the control lever and engageable with and disengageable from the arm portion of the active lever by a tip portion of the pin portion.

[0021] In the above-described double-lock type vehicle door lock device may further include a housing that houses the inside open lever, the open link, the lock mechanism and the double-lock mechanism, and the housing may be assembled to the door together with the latch mechanism.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] The foregoing and additional features and characteristics of this disclosure will become more apparent from the following detailed description considered with the reference to the accompanying drawings, wherein:

Fig. 1 is a side view of a double-lock type vehicle door lock device according to an embodiment disclosed here as seen from the inside of a vehicle when a vehicle interior member of a housing is removed; Fig. 2 is a side view showing the overlapping relationship between components of the vehicle door lock device shown in Fig. 1;

Fig. 3 is a side view of the structure of main parts of the vehicle door lock device when a lock mechanism of the vehicle door lock device shown in Fig. 1 is in an unlock state and a double-lock mechanism is in a double-lock unset state (at the time of unlocking), as seen from the inside of a vehicle;

Fig. 4 is a cross-sectional view taken along a line IV-IV of Fig. 3;

Fig. 5 is an exploded perspective view of a latch mechanism of the vehicle door lock device shown in Fig. 1;

Fig. 6 is a side view of the structure of main parts of the vehicle door lock device when the lock mechanism of the vehicle door lock device shown in Fig. 1 is in a lock state and the double-lock mechanism is in a double-lock unset state (at the time of locking), as seen from the inside of a vehicle;

Fig. 7 is a side view of the structure of main parts of the vehicle door lock device when the lock mechanism of the vehicle door lock device shown in Fig. 1 is in a lock state and the double-lock mechanism is in a double-lock set state (at the time of double locking), as seen from the inside of a vehicle; and

Fig. 8 is a side view of the vehicle door lock device when an inside door handle is operated to open a

door in the state shown in Fig. 7.

DETAILED DESCRIPTION

[0023] An embodiment disclosed here will be described below. Figs. 1 to 5 show the structure of a double-lock type vehicle door lock device Ao. The vehicle door lock device Ao is mounted on a right rear door (not shown) that is provided on the right rear portion of a vehicle, and includes a latch mechanism A1. Further, the vehicle door lock device includes a housing 10 that is assembled to the door together with the latch mechanism A1. Furthermore, the vehicle door lock device Ao includes an opening mechanism A2, a lock mechanism A3, and a double-lock mechanism A4 that are assembled to the housing 10. In Figs. 1 and 2, a vehicle interior member (cover) of the housing 10 is removed. Further, Figs. 6 to 8 show the operations of the double-lock type vehicle door lock device Ao.

[0024] The latch mechanism A1 is configured to hold the door in a closed state (a state where the door is closed) with respect to a body (a vehicle body (not shown)), and includes a latch 21 that is detachably engaged with a striker (not shown) fixed to the body as shown in Fig. 5. Meanwhile, for example, other components of the latch mechanism A1 other than a lift lever 23 are not shown in Fig. 3, but the exploded latch mechanism A1 is shown in Fig. 5. The latch mechanism is assembled to the door while being assembled to the housing 10.

[0025] The latch 21 is engaged with the striker, so that the latch mechanism A1 can hold the door in a closed state (can latch the door). Further, if the latch 21 is disengaged from the striker when the door is closed, the latch mechanism A1 can change the state of the door from a closed state to an open state (a state where the door can be opened with respect to the body) (the latch mechanism may unlatch the door).

[0026] As shown in Fig. 5, the latch mechanism A1 includes the latch 21, a pole 22, the lift lever 23, and a stopper 24, cushions C1 and C2, a torsion spring S1 for the latch, and a torsion spring S2 for the pole. These components are assembled to a base plate 25, a case 26, and a sub-base plate 27 by a screw 28 and a pin 29. The base plate 25 is assembled to the door with a seal member 91 shown in Fig. 5 interposed therebetween.

[0027] The opening mechanism A2 operates the latch mechanism A1 (see Figs. 1, 2, and 5) to an unlatched state from a latched state in order to allow the door to be opened with respect to the body. The opening mechanism A2 includes an outside open lever 31 (see Figs. 1, 2, and 5), an inside open lever 32 (see Figs. 1, 2, and 8), and an open link 33 (see Figs. 1 to 3 and Figs. 6 to 8).

[0028] The outside open lever 31 is rotatably assembled to the housing 10 together with a torsion spring S3 (a spring for urging the outside open lever 31 toward the initial position in a clockwise direction of Fig. 5). Further, as is known, the outside open lever is directly linked to

a lower end portion 33a of the open link 33 (see Fig. 2) at a housing inner end portion 31a (see Figs. 2 and 5), and is linked to an outside door handle (not shown), which is provided on the door outside the vehicle through a link mechanism (not shown), at a housing outer end portion 31b (see Fig. 5). For this reason, the outside open lever 31 is rotated against the urging force of a torsion spring S3 by the pulling operation of the outside door handle (door opening operation). Meanwhile, a clip 31c (see Fig. 5) is assembled to the outside open lever 31.

[0029] The inside open lever 32 is rotatably linked to the door, and includes first and second inside open levers 32A and 32B as shown in Figs. 1 and 2. Further, the inside open lever includes a connecting pin 32C and a slider 32D that can connect/separate the first inside open lever with/from the second inside open lever. The first inside open lever 32A is rotatably assembled to a support shaft 11 provided in the housing 10, is linked to an inside door handle (not shown) that is provided on the door inside a vehicle by a known structure, and is rotated in the counterclockwise direction of Figs. 1 and 2 by the pulling operation of the inside door handle (door opening operation).

[0030] The first inside open lever 32A includes an arc-shaped elongated hole 32a1, the center of which corresponds to the support shaft 11, and a linear elongated hole 32a2 that is formed at one end of the arc-shaped elongated hole 32a1 and extends in a radial direction of the support shaft 11. Further, the first inside open lever 32A includes a connection portion 32a3 that is connected to an inside door handle (not shown), and a protrusion 32a4 (bent portion) that can be engaged/disengaged with/from an engaging protrusion portion 44b of a control lever 44 of the lock mechanism A3 to be described below.

[0031] The second inside open lever 32B is rotatably assembled to the support shaft 11 that is provided in the housing 10, can be rotated integrally with the first inside open lever 32A when the connecting pin 32C and the slider 32D are held at a position of Figs. 1 and 2 (connection position) (child-proof OFF state), and is separated from the first inside open lever 32A and cannot be rotated when the connecting pin 32C and the slider 32D are held at a position moved upward from the position of Figs. 1 and 2 (separation position) by a predetermined distance (child-proof ON state).

[0032] As is known, the second inside open lever 32B can be engaged/disengaged with/from the lower surface of an L-shaped pressing portion 33c of the open link 33 at the tip portion thereof (which is covered with a child-proof lever 32E in the state shown in Figs. 1 and 2). Accordingly, when the first inside open lever 32A is rotated in the counterclockwise direction of Figs. 1 and 2 in the state shown in Figs. 1 and 2, the second inside open lever is rotated integrally with the first inside open lever 32A and may press the open link 33 toward the upper side in Fig. 1. Further, the second inside open lever 32B includes a linear arm portion 32b1 which extends in the radial direction of the support shaft 11 and to which the

slider 32D is slidably fitted.

[0033] The connecting pin 32C is integrally assembled to the slider 32D, and is fitted to the arc-shaped elongated hole 32a1 or the linear elongated hole 32a2 of the first inside open lever 32A. Accordingly, the connecting pin may be moved together with the slider 32D along the linear arm portion 32b1 of the second inside open lever 32B by the child-proof lever 32E.

[0034] The child-proof lever 32E moves the connecting pin 32C and the slider 32D along the linear arm portion 32b1 of the second inside open lever 32B, and is tiltably assembled to the housing 10 at the middle portion thereof. The child-proof lever includes an operation knob 32e1 that protrudes to the outside of the housing 10 and may be manually operated, and an arc-shaped elongated hole 32e2, the center of which corresponds to the support shaft 11 in the child-proof OFF state shown in Fig. 1.

[0035] The child-proof lever 32E may be tilted to a predetermined position from the state shown in Fig. 1 in a clockwise direction. The connecting pin 32C is fitted to the linear elongated hole 32a2 of the first inside open lever 32A in the state shown in Fig. 1, so that the first inside open lever 32A and the second inside open lever 32B are integrally connected to each other. For this reason, during the pulling operation of the inside door handle (not shown), the first inside open lever 32A is rotated integrally with the second inside open lever 32B and the connecting pin 32C and the slider 32D are moved along the arc-shaped elongated hole 32e2 of the child-proof lever 32E.

[0036] Further, when the child-proof lever 32E is tilted to a predetermined position, the connecting pin 32C is fitted to the arc-shaped elongated hole 32a1 of the first inside open lever 32A and the connection between the first and second inside open levers 32A and 32B performed by the connecting pin 32C and the slider 32D is released. For this reason, during the pulling operation of the inside door handle (not shown), only the first inside open lever 32A is rotated and the second inside open lever 32B is not rotated.

[0037] The open link 33 is provided between the lift lever 23 of the latch mechanism 20 and the open levers 31 and 32 in the housing 10, and is rotatably connected to and supported by the housing inner end portion 31a of the outside open lever 31 at the lower end portion 33a thereof. Accordingly, the open link is rotated between an unlock position shown in Figs. 1 to 3 and a lock position shown in Figs. 6 to 8 by a sub-lever 43 that is a component of the lock mechanism A3.

[0038] The open link 33 includes an elongated hole 33b that extends in the vertical direction in the state shown in Figs. 1 to 3 and is formed between an upper end of the open link and the middle portion thereof, and a L-shaped pressing portion 33c at the middle portion. When the open link 33 is positioned at the unlock position shown in Figs. 1 to 3, the pressing portion 33c can be engaged with the lift lever 23 of the latch mechanism 20 (can transmit the door opening operation of each of the

open levers 31 and 32 to the lift lever 23) in order to set the door in an open state. When the open link 33 is positioned at the lock position shown in Figs. 6 to 8, the pressing portion cannot be engaged with the lift lever 23 of the latch mechanism 20 (cannot transmit the door opening operation of each of the open levers 31 and 32 to the lift lever 23).

[0039] Further, the open link 33 receives the door opening operation of the outside open lever 31 (the pulling operation of the outside door handle) at the lower end portion 33a, or receives the door opening operation of the inside open lever 32 (the pulling operation of the inside door handle) at the pressing portion 33c (in detail, the lower surface of the pressing portion). Accordingly, the open link is moved to a pressing position that is positioned on the upper side by a predetermined distance in the drawing from the shown position (return position). For this reason, when the open link 33 receives the door opening operation of the outside open lever 31 or the inside open lever 32 at the lower end portion 33a or the pressing portion 33c at the unlock position shown in Figs. 1 to 3 in the closed state of the door and is moved upward, the lift lever 23 of the latch mechanism A1 is pushed and rotated by the upper end of the pressing portion 33c of the open link 33 and the latch mechanism A1 is operated to the unlatched state from the latched state. Accordingly, the state of the door can be changed to the open state from the closed state. That is, when the open link 33 is positioned at the unlock position shown in Figs. 1 to 3, the door is unlocked.

[0040] Meanwhile, when the open link 33 receives the door opening operation of the outside open lever 31 or the inside open lever 32 at the lower end portion 33a or the pressing portion 33c at the lock position shown in Figs. 6 to 8 in the closed state of the door and is moved upward, the upper end of the pressing portion 33c of the open link 33 is not engaged with the lift lever 23 of the latch mechanism A1 and the latch mechanism A1 is held at the latched state. Accordingly, the door is held in the closed state. That is, when the open link 33 is positioned at the lock position shown in Figs. 6 to 8, the door is locked.

[0041] The lock mechanism A3 switches the open link 33 between the unlock position shown in Figs. 1 to 3 and the lock position shown in Figs. 6 to 8. The lock mechanism includes an active lever 41, a locking lever 42, a sub-lever 43, a control lever 44, and a torsion spring 45. The active lever 41 is assembled to a support shaft 12, which is provided in the housing 10, together with the sub-lever 43, the control lever 44, and the torsion spring 45, and is rotatably supported by the support shaft 12.

[0042] The active lever 41 includes an engagement elongated hole 41a that is linked to the locking lever 42, a first stopper 41b that can be engaged/disengaged with/from a protrusion 43b of the sub-lever 43, and a second stopper 41c that can be engaged/disengaged with/from a protrusion 44c of the control lever 44. Further, the active lever 41 includes an engaging stepped portion 41d that

can be engaged/disengaged with/from a protrusion 51b of a double-lock lever 51 of a double-lock mechanism A4 to be described below, and an arm portion 41e that can be engaged/disengaged with/from a pin portion 52a of a connecting member 52 of a double-lock mechanism A4 to be described below.

[0043] The first stopper 41b is provided at the active lever 41, and restricts the rotation of the sub-lever 43 with respect to the active lever 41 in an unlocking direction (a counterclockwise direction in the drawing), for example, at a first fixed position shown in Fig. 3. The second stopper 41c is provided at the active lever 41, and restricts the rotation of the control lever 44 with respect to the active lever 41 in a locking direction (a clockwise direction in the drawing), for example, at a second fixed position shown in Fig. 3.

[0044] The locking lever 42 is rotatably assembled to the support shaft 11. The locking lever includes a sector gear 42a that meshes with a worm 46 (see Fig. 1), and an engagement pin portion 42b (see Fig. 2) that is linked to the engagement elongated hole 41a of the active lever 41. Accordingly, the worm 46 may be rotationally driven by an electric motor 47 that can be driven in a normal direction and a reverse direction. Meanwhile, the active lever 41 is adapted to be held at the unlock position (the position shown in Figs. 1 to 3 and Fig. 8) or the lock position (the position shown in Figs. 6 and 7) by a spring S4 that is assembled in the housing 10.

[0045] Accordingly, when the worm 46 is rotationally driven by the electric motor 47, the locking lever 42 is tilted and the active lever 41 is rotationally driven to the lock position shown in Fig. 6 from the unlock position shown in Figs. 1 to 3 or rotationally driven to the unlock position shown in Figs. 1 to 3 from the lock position shown in Fig. 6. Meanwhile, the electric motor 47 is a known electric motor that is driven according to a locking operation and an unlocking operation (for example, the remote control operation of a lock/unlock switch provided at a key blade outside a vehicle).

[0046] Further, the locking lever 42 includes an operation portion 42c (see Figs. 3 and Figs. 6 to 8) that is linked to a locking knob (not shown) provided on the door inside a vehicle. The operation portion 42c is adapted to be tilted integrally with the sector gear 42a and the engagement pin portion 42b. Accordingly, when a locking knob (not shown), which is provided on the door inside a vehicle, is operated and the operation portion 42c is tilted, the engagement pin portion 42b of the locking lever 42 is integrally tilted and the active lever 41 is rotationally driven. Meanwhile, the sector gear 42a is also integrally rotated in this case, so that the worm 46 and the electric motor 47 are rotated together with each other.

[0047] The sub-lever 43 is rotatably assembled to the support shaft 12 and can be rotated relative to the active lever 41 by a predetermined amount. The sub-lever includes an engagement pin portion 43a (see Fig. 3 and Figs. 6 to 8) that is linked to the elongated hole 33b of the open link 33. Further, the sub-lever 43 includes a

protrusion 43b that can be engaged/disengaged with/from the first stopper 41b of the active lever 41 and a locking portion 43c with which one end of the torsion spring 45 is engaged.

[0048] The control lever 44 is rotatably assembled to the support shaft 12. The control lever includes an arm portion 44a that extends in the radial direction of the support shaft 12, and a protruding portion 44b (see Figs. 1 and 8) that can be engaged/disengaged with/from the protrusion 32a4 of the first inside open lever 32A. Further, the control lever 44 includes a protrusion 44c (see Fig. 3 and Figs. 6 to 8) that can be engaged/disengaged with/from the second stopper 41c of the active lever 41, and a locking portion 44d with which the other end of the torsion spring 45 is engaged.

[0049] The torsion spring 45 is provided between the sub-lever 43 and the control lever 44, urges the sub-lever so that the sub-lever 43 is rotated relative to the active lever 41 in the counterclockwise direction shown in Fig. 3 (unlocking direction), and urges the control lever 44 so that the control lever 44 is rotated relative to the active lever 41 in the clockwise direction shown in Fig. 3 (locking direction). For this reason, in the state shown in Fig. 3, the protrusion 43b of the sub-lever 43 is elastically engaged with the first stopper 41b of the active lever 41 and the protrusion 44c of the control lever 44 is elastically engaged with the second stopper 41c of the active lever 41.

[0050] Accordingly, the sub-lever 43 is rotated integrally with the active lever 41 in the locking direction (the clockwise direction shown in Fig. 3) (when the open link 33 is switched to the lock position shown in Figs. 6 to 8 from the unlock position shown in Figs. 1 to 3 with the rotation of the active lever 41 in the locking direction), and is rotated while interlocking with the active lever 41 through the control lever 44 and the torsion spring 45 in the unlocking direction (the counterclockwise direction shown in Fig. 3) (when the open link 33 is switched to the unlock position shown in Figs. 1 to 3 from the lock position shown in Figs. 6 to 8 with the rotation of the active lever 41 in the unlocking direction).

[0051] The double-lock mechanism A4 can be switched to a double-lock set state where the operation of the lock mechanism A3 is restricted or a double-lock unset state where the operation of the lock mechanism A3 is allowed. The double-lock mechanism includes a double-lock lever 51 and a connecting member (bush) 52. The double-lock lever 51 is provided in the housing 10, and is rotatably assembled to a support shaft 13 provided in the housing 10. The double-lock lever can be switched between an unset position corresponding to the double-lock unset state (the position shown in Figs. 1 to 3 or Fig. 6) and a set position corresponding to the double-lock set state (the position shown in Fig. 7 or 8).

[0052] The double-lock lever 51 includes a sector gear 51a that meshes with a worm 53, a protrusion 51b that can be engaged/disengaged with/from the engaging stepped portion 41d of the active lever 41, and an arc-

shaped elongated hole 51c of which the center corresponds to the support shaft 12 in the double-lock unset state. The worm 53 may be rotationally driven by an electric motor 54 that can be driven in a normal direction and a reverse direction. Meanwhile, the double-lock lever 51 is adapted to be held at the unset position (the position shown in Figs. 1 to 3 and Fig. 6) or the set position (the position shown in Figs. 7 and 8) by a spring S5 that is assembled in the housing 10.

[0053] Accordingly, when the worm 53 is rotationally driven in a set direction in the lock state shown in Fig. 6 by the electric motor 54, the double-lock lever 51 is rotationally driven to the set position shown in Fig. 7 from the unset position shown in Fig. 6. Further, when the worm 53 is rotationally driven in an unset direction in a double-lock state shown in Fig. 7 by the electric motor 54, the double-lock lever 51 is rotationally driven to the unset position shown in Fig. 6 from the set position shown in Fig. 7. Meanwhile, the electric motor 54 is a known electric motor that is driven according to a setting operation and an unsetting operation (for example, the remote control operation of a set/unset switch provided at a key blade outside a vehicle).

[0054] As shown in Figs. 3 and 4, the connecting member 52 includes a pin portion 52a that is slidably fitted to the arc-shaped elongated hole 51c of the double-lock lever 51 and passes through the arc-shaped elongated hole, and a slide portion 52b that can be moved relative to the arm portion 44a of the control lever 44 in a radial direction and is integrally assembled to the arm portion of the control lever in a rotation direction. The connecting member 52 may be moved in a radial direction of the control lever 44 (the extending direction of the arm portion 44a) by the rotation (tilting) of the double-lock lever 51, and can be engaged/disengaged with/from the arm portion 41e of the active lever 41 at the tip portion of the pin portion 52a (a portion protruding so as to pass through the double-lock lever 51).

[0055] Meanwhile, when the double-lock lever 51 is positioned at the unset position (Figs. 1 to 3 and Fig. 6) in this embodiment, the active lever 41 and the control lever 44 may be rotated relative to the double-lock lever 51 while being connected to each other by the second stopper 41c and the connecting member 52 so as to be rotated integrally with each other. When the active lever 41 is positioned at the lock position and the double-lock lever 51 is positioned at the set position (Figs. 7 and 8), the movement of the active lever 41 to the unlock position is restricted by the double-lock lever 51, the connecting member 52 is disengaged from the arm portion 41e of the active lever 41, and the movement of the control lever 44 from the fixed position (the position shown in Fig. 7) against the urging force of the torsion spring 45 (the movement in the unlocking direction) is set to be allowed (see Fig. 8).

[0056] Further, in this embodiment, when the lock mechanism A3 is in the lock state and the double-lock mechanism A4 is the double-lock unset state (at the time

of locking) as shown in Fig. 6, engagement timing where the protrusion 32a4 of the first inside open lever 32A and the engaging protrusion portion 44b of the control lever 44 are engaged with each other (drive start timing where the control lever 44 starts to be driven by the inside open lever 32) is set to be delayed by a predetermined time as compared to press timing where the open link 33 is pressed by the tip portion of the second inside open lever 32B (drive start timing where the open link 33 starts to be driven by the inside open lever 32) (set to delay timing where the open link 33 positioned at the lock position is moved to the unlock position) so that a so-called double-pulling operation is obtained with the door opening operation of the inside door handle.

[0057] In this embodiment having the above-mentioned structure, if the door opening operation of the inside door handle is performed when the open link 33 is positioned at the unlock position by the lock mechanism A3, the lock mechanism A3 is in the unlock state, and the double-lock mechanism A4 is in the double-lock unset state (at the time of unlocking) as shown in Fig. 3, the door opening operation of the inside open lever 32 is transmitted to the lift lever 23 of the latch mechanism A1 through the open link 33, which is positioned at the unlock position, and the opening operation of the latch mechanism A1 is performed along with the door opening operation. Accordingly, the door can be opened by the door opening operation of the inside door handle.

[0058] Meanwhile, if the door opening operation of the outside door handle is performed in this case (at the time of unlocking), the door opening operation of the outside open lever 31 is transmitted to the lift lever 23 of the latch mechanism A1 through the open link 33, which is positioned at the unlock position, and the opening operation of the latch mechanism A1 is performed along with the door opening operation. Accordingly, the door can be opened even by the door opening operation of the outside door handle.

[0059] Further, when the open link 33 is positioned at the lock position by the lock mechanism A3, the lock mechanism A3 is in the lock state, and the double-lock mechanism A4 is in the double-lock unset state (at the time of locking) as shown in Fig. 6, a so-called double-pulling operation is obtained with the door opening operation of the inside door handle, and the opening operation of the latch mechanism A1 is performed by the double-pulling operation of the inside door handle (a first pulling operation and a second pulling operation after the inside door handle returns once). Accordingly, the door can be opened by the door opening operation of the inside door handle.

[0060] In this case, the control lever 44, the active lever 41, the sub-lever 43, and the like are not switched to the unlock position from the lock position and the open link 33 positioned at the lock position is driven (is pressed upward) by the door opening operation of the inside open lever 32 with the door opening operation of the inside door handle, at the early and middle stages of the first

door opening operation of the inside door handle (first pulling operation). Further, the control lever 44, the active lever 41, the sub-lever 43, and the like are switched to the unlock position from the lock position and the open link 33 continues to be driven (is pressed upward) by the door opening operation of the inside open lever 32 at the latter stage of the first pulling operation.

[0061] For this reason, at the early and middle stages of the first pulling operation, the movement of the open link 33 is not transmitted to the lift lever 23 of the latch mechanism A1 and the latch mechanism A1 is maintained at the closed state (latched state), so that the door cannot be opened. Further, the control lever 44, the active lever 41, the sub-lever 43, and the like are switched to the unlock position from the lock position at the latter stage of the first pulling operation, so that the open link 33 is switched to the unlock position from the lock position. However, in this case, the open link 33 is driven (is pressed upward) by a predetermined distance and is in a so-called panic state (a state where the side surface of the pressing portion 33c of the open link 33 is engaged with the side portion of the lift lever 23). Accordingly, since a driving force (rotation) is not transmitted to the lift lever 23 of the latch mechanism A1 from the open link 33, the opening operation of the latch mechanism A1 is not performed, so that the door cannot be opened.

[0062] Meanwhile, in the above-mentioned panic state, the control lever 44 and the active lever 41 are switched to the unlock position and held by the spring S4. However, since the sub-lever 43 is being rotated relative to the active lever 41 against the urging force of the torsion spring 45 by a predetermined angle, the sub-lever 43 is not switched to the unlock position. For this reason, if the sub-lever 43 is rotated relative to the active lever 41 in the unlocking direction by the urging force of the torsion spring 45 while the open link 33 is moved to the return position when the inside door handle returns once, the above-mentioned panic state is released, so that the sub-lever 43 and the open link 33 are switched to the unlock position.

[0063] Accordingly, since the control lever 44, the active lever 41, the sub-lever 43, and the like are switched to the unlock position and the open link 33 is moved to the unlock position at the time of the second pulling operation of the inside door handle, the door opening operation of the inside open lever 32 is transmitted to the lift lever 23 of the latch mechanism A1 through the open link 33, which is positioned at the unlock position, with the door opening operation of the inside door handle like at the time of the above-mentioned unlocking. Therefore, the opening operation of the latch mechanism A1 is performed, so that the door can be opened by the second door opening operation of the inside door handle.

[0064] Meanwhile, at the time of locking, the active lever 41 and the control lever 44 may be rotated relative to the double-lock lever 51 while being connected to each other by the second stopper 41c and the connecting member 52 so as to be rotated integrally with each other.

Accordingly, when the control lever 44 is rotated in the unlocking direction by the door opening operation of the inside open lever 32 with the door opening operation of the inside door handle, the active lever 41 is rotated integrally with the control lever 44 in the unlocking direction. Therefore, the delay of the door opening operation of the inside door handle does not occur at the early stage of the movement of the active lever 41 to the unlock position from the lock position. As a result, it is possible to improve the operation feeling at the time of the door opening operation of the inside door handle.

[0065] Further, when the open link 33 is positioned at the lock position by the lock mechanism A3, the lock mechanism A3 is in the lock state, and the double-lock mechanism A4 is in the double-lock set state (at the time of double-locking) as shown in Fig. 7, the active lever 41 is positioned at the lock position, the double-lock lever 51 is positioned at the set position, the movement of the active lever 41 to the unlock position is restricted by the double-lock lever 51, the connecting member 52 is disengaged from the active lever 41, and the movement of the control lever 44 from the second fixed position (the position shown in Fig. 7) against the urging force of the torsion spring 45 (the movement in the unlocking direction) is allowed.

[0066] For this reason, regardless of which door opening operation of the inside door handle is performed in this case (at the time of double-locking), the control lever 44 is rotated in the unlocking direction by the door opening operation of the inside open lever 32 at the latter stage of the door opening operation but misses the active lever 41, so that the active lever 41 positioned at the lock position is not rotated toward the unlock position. Accordingly, the lock mechanism A3 is maintained in the lock state in this case, so that the door cannot be opened by the door opening operation of the inside door handle.

[0067] Meanwhile, even though any door opening operation of the outside door handle is performed at the time of the above-mentioned locking and double-locking, the control lever 44, the active lever 41, the sub-lever 43, and the like are not switched to the unlock position from the lock position and the open link 33 is maintained at the lock position. For this reason, if the door opening operation of the outside door handle is performed at the time of the above-mentioned locking and double-locking, the door opening operation of the outside open lever 31 is transmitted to the open link 33, which is positioned at the lock position, along with the door opening operation but is not transmitted to the lift lever 23 of the latch mechanism A1 from the open link 33 that is positioned at the lock position. Accordingly, the opening operation of the latch mechanism A1 is not performed in this case, so that the door cannot be opened by the door opening operation of the outside door handle.

[0068] Further, in this embodiment, the control lever 44 is urged in the locking direction and the sub-lever 43 is urged in the unlocking direction by the torsion spring 45. Accordingly, the torsion spring 45 is shared by (serves

as) a first urging member for urging the sub-lever 43 toward the first fixed position (for example, the position shown in Fig. 2) in the unlocking direction and a second urging member for urging the control lever 44 toward the second fixed position (for example, the position shown in Fig. 2) in the locking direction. For this reason, it is possible to make the door lock device simple and inexpensive as compared to when the first and second urging members are provided separate members.

[0069] Further, in this embodiment, the locking lever 42, which is connected to the active lever 41 so as to be capable of interlocking with the active lever, is connected to a locking knob, which is provided on the door inside a vehicle, so as to be capable of interlocking with the locking knob. For this reason, at the time of double-locking, the movement of the active lever 41, which interlocks with the locking lever 42, to the unlock position is restricted by the double-lock lever 51 and held at the lock position. Accordingly, even though the locking knob is operated, the locking knob and the locking lever 42 are not moved, so that it is not possible to move the locking lever 42 to the unlock position from the lock position. For this reason, it is possible to improve the security of the door lock device.

[0070] In the above-mentioned embodiment, the torsion spring 45 is shared by the first urging member for urging the sub-lever 43 against the active lever 41 in the unlocking direction and the second urging member for urging the control lever 44 against the active lever 41 in the locking direction. However, the first and second urging members may be separately provided.

[0071] Moreover, in the above-mentioned embodiment, the vehicle door lock device Ao is described, which is adapted to obtain a so-called double-pulling operation with the door opening operation of the inside door handle. However, the inventive concept may also be applied to a vehicle door lock device, which is adapted to obtain a so-called one-motion operation with the door opening operation of the inside door handle (is adapted to advance timing, where the open link 33 positioned at the lock position is moved to the unlock position, as compared to the above-mentioned embodiment), in the same manner.

[0072] Further, in the above-mentioned embodiment, the first and second inside open levers 32A and 32B of the inside open lever 32 have been connected/separated to/from each other by the connecting pin 32C and the slider 32D that are moved by the child-proof lever 32E. However, the inventive concept may be applied to a vehicle door lock device, where a portion corresponding to the first inside open lever 32A of the inside open lever and a portion corresponding to the second inside open lever 32B of the inside open lever are formed integrally with each other, (a vehicle door lock device where a child-proof function is not set) in the same manner.

[0073] Furthermore, in the above-mentioned embodiment, the locking lever 42 is connected to the locking knob, which is provided on the door inside a vehicle, so as to be capable of interlocking with the locking knob.

However, the locking lever 42 may not be connected to the locking knob (the locking knob may not be provided). Moreover, in the above-mentioned embodiment, the vehicle door lock device Ao is mounted on a right rear door provided on the right rear portion of a vehicle. However, the inventive concept may also be applied to not only a vehicle door lock device that is mounted on a left rear door but also a vehicle door lock device that is mounted on a right front door or left front door, in the same manner. A vehicle door lock device includes an inside open lever that is operated at the time of a door opening operation of an inside door handle, an open link that is linked to the inside open lever, a lock mechanism that switches the position of the open link, and a double-lock mechanism that restricts or allows the operation of the lock mechanism. The lock mechanism includes an active lever, a sub-lever, a control lever, a first stopper, a second stopper, and a torsion spring. The double-lock mechanism includes a double-lock lever and a connecting member.

Claims

1. A double-lock type vehicle door lock device comprising:
 - a latch mechanism that is assembled to a door of a vehicle and is configured to hold the door in a closed state with respect to a body;
 - an inside open lever that is rotatably linked to the door and is driven with the operation of an inside door handle provided on the door inside the vehicle;
 - an open link that is rotatably linked to the door, is provided between the inside open lever and a lift lever of the latch mechanism, and is switchable between an unlock position where a door opening operation of the inside open lever is transmitted to the lift lever and a lock position where the door opening operation is not transmitted to the lift lever, with a door opening operation of the inside door handle;
 - a lock mechanism that switches the open link between the unlock position and the lock position; and
 - a double-lock mechanism that is switchable between a double-lock set state where an operation of the lock mechanism is restricted and a double-lock unset state where the operation of the lock mechanism is allowed,
 - wherein the lock mechanism includes:
 - an active lever that is rotatably linked to the door and is held at either one of an unlock position and a lock position;
 - a sub-lever that is assembled to the active lever to be rotatable relative to the active lever by a predetermined amount, is linked

to the open link, and switches the open link between the unlock position and the lock position;

a first stopper that is provided at the active lever and restricts the rotation of the sub-lever in an unlocking direction at a first fixed position;

a control lever that includes a first urging member for urging the sub-lever toward the first fixed position in the unlocking direction, is rotated relative to the active lever and the sub-lever, is engageable with and disengageable from the active lever, and is rotatable from a second fixed position in the unlocking direction by the door opening operation of the inside open lever;

a second stopper that is provided at the active lever and restricts the rotation of the control lever in a locking direction at the second fixed position; and

a second urging member that urges the control lever toward the second fixed position in the locking direction,

wherein when the open link is switched to the lock position from the unlock position by a movement of the active lever to the lock position from the unlock position, the sub-lever is operated integrally with the active lever,

wherein when the open link is switched to the unlock position from the lock position by a movement of the active lever to the unlock position from the lock position, the sub-lever is set to interlock with the active lever through the first urging member,

wherein the double-lock mechanism includes:

a double-lock lever that is rotatably linked to the door and is switchable between an unset position corresponding to the double-lock unset state and a set position corresponding to the double-lock set state; and

a connecting member that is assembled to the control lever to be movable relative to the control lever in a radial direction thereof and integral to the control lever in a rotation direction thereof, is movable in the radial direction of the control lever, and engageable with and disengageable from the active lever by a rotation of the double-lock lever,

wherein when the double-lock lever is positioned at the unset position, the active lever and the control lever are rotatable relative to the double-lock lever while being connected to each other by the second stopper and the connecting member so as to be rotatable integrally with each other, and

wherein when the active lever is positioned at the lock position and the double-lock lever is positioned at the set position, a movement of the active lever to the unlock position is restricted by the double-lock lever, and the connecting member is disengaged from the active lever, so that a movement of the control lever from the second fixed position against an urging force of the second urging member is allowed,

2. The double-lock type vehicle door lock device according to claim 1, wherein a single member serves as the first urging member for urging the sub-lever toward the first fixed position in the unlocking direction and the second urging member for urging the control lever toward the second fixed position in the locking direction.

3. The double-lock type vehicle door lock device according to claim 1 or 2, further comprising:

a locking lever that is rotatably linked to the door and is connected to the active lever so as to interlock with the active lever, wherein the locking lever is linked to a locking knob, which is provided on the door inside the vehicle, so as to interlock with the locking knob.

4. The double-lock type vehicle door lock device according to any one of claims 1 to 3, wherein the connecting member includes:

a pin portion that is slidably fitted to an arc-shaped elongated hole of the double-lock lever and passes through the arc-shaped elongated hole; and
a slide portion that is assembled to an arm portion of the control lever to be movable relative to the arm portion in the radial direction thereof and integral to the arm portion in the rotation direction thereof, and

wherein, by the rotation of the double-lock lever, the connecting member is movable in the radial direction of the control lever, and engageable with and disengageable from the arm portion of the active lever by a tip portion of the pin portion.

5. The double-lock type vehicle door lock device according to any one of claims 1 to 4, further comprising:

a housing that houses the inside open lever, the open link, the lock mechanism and the double-lock mechanism, wherein the housing is assembled to the door together with the latch mechanism.

FIG. 1

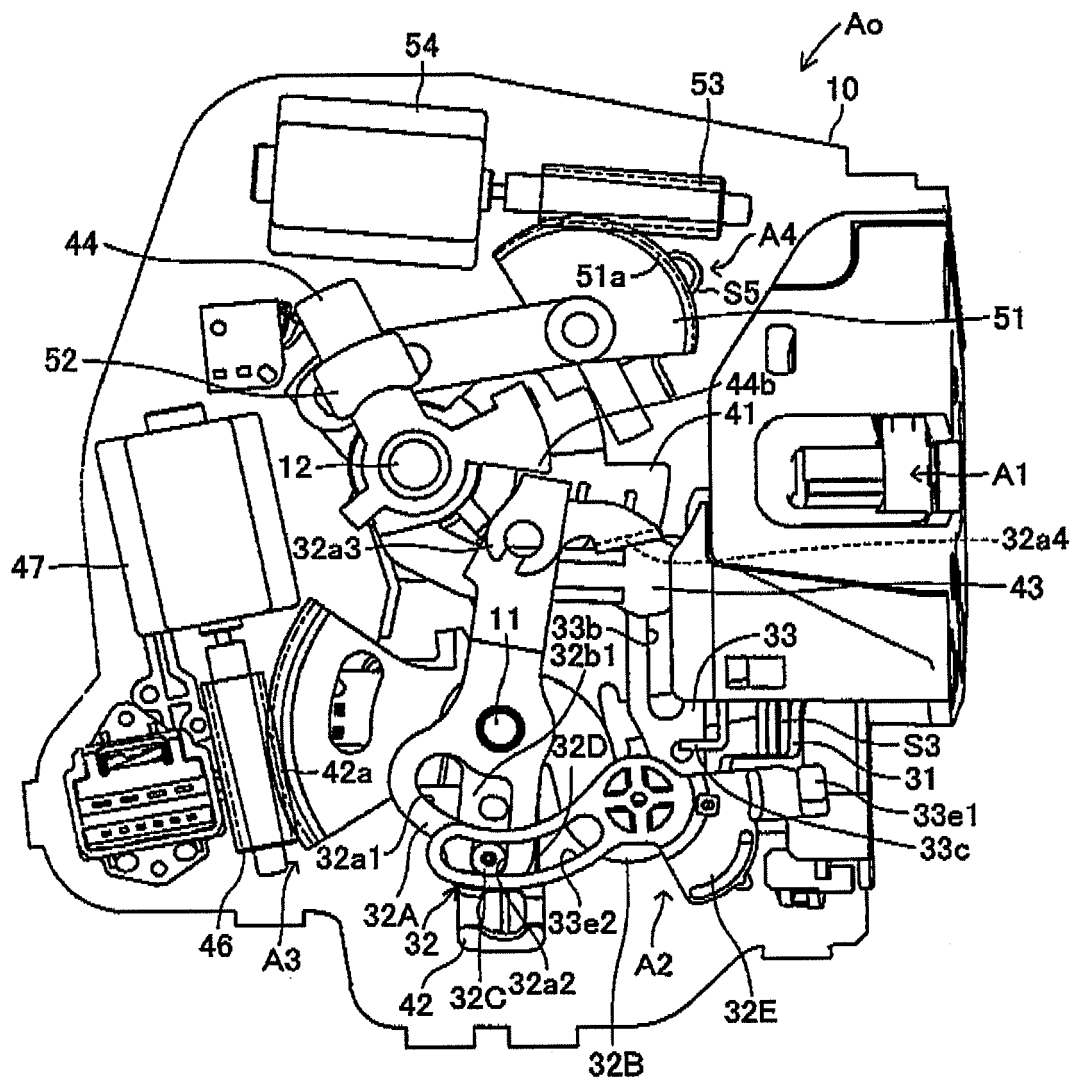


FIG. 2

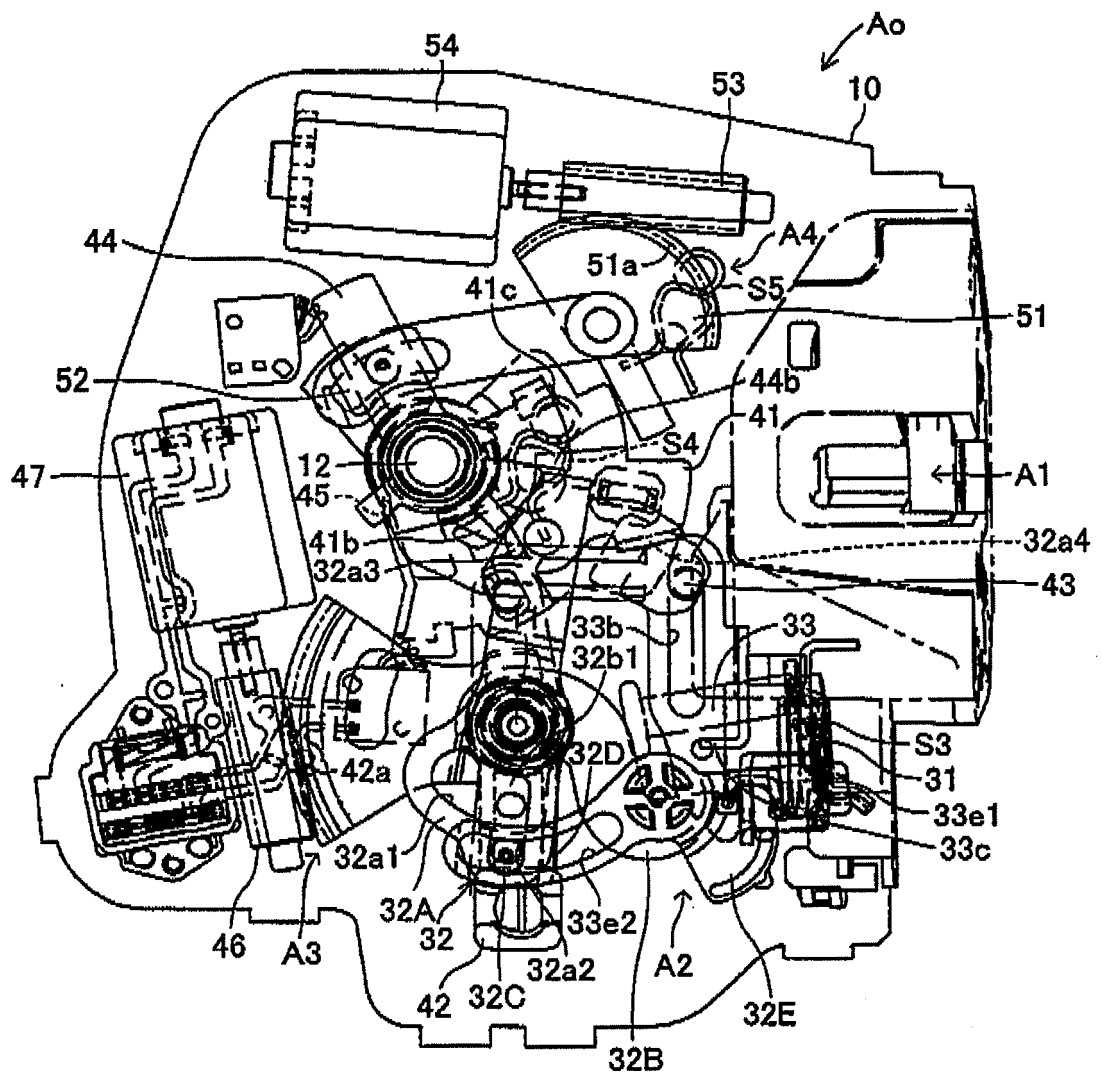


FIG. 3

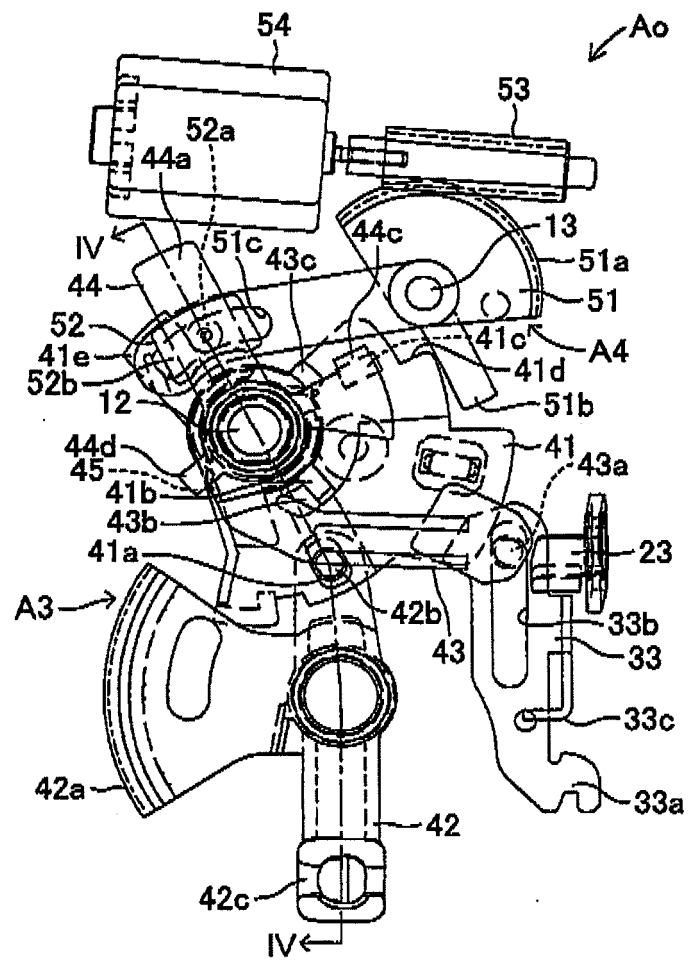


FIG. 4

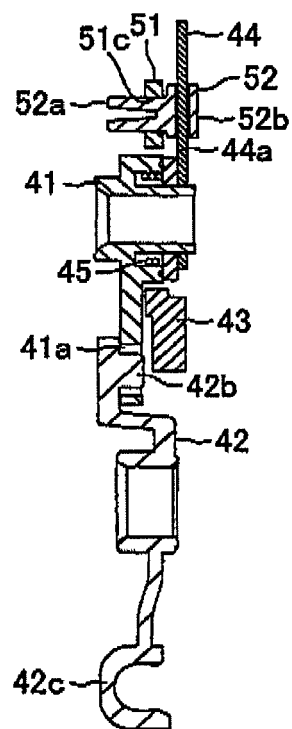


FIG. 5

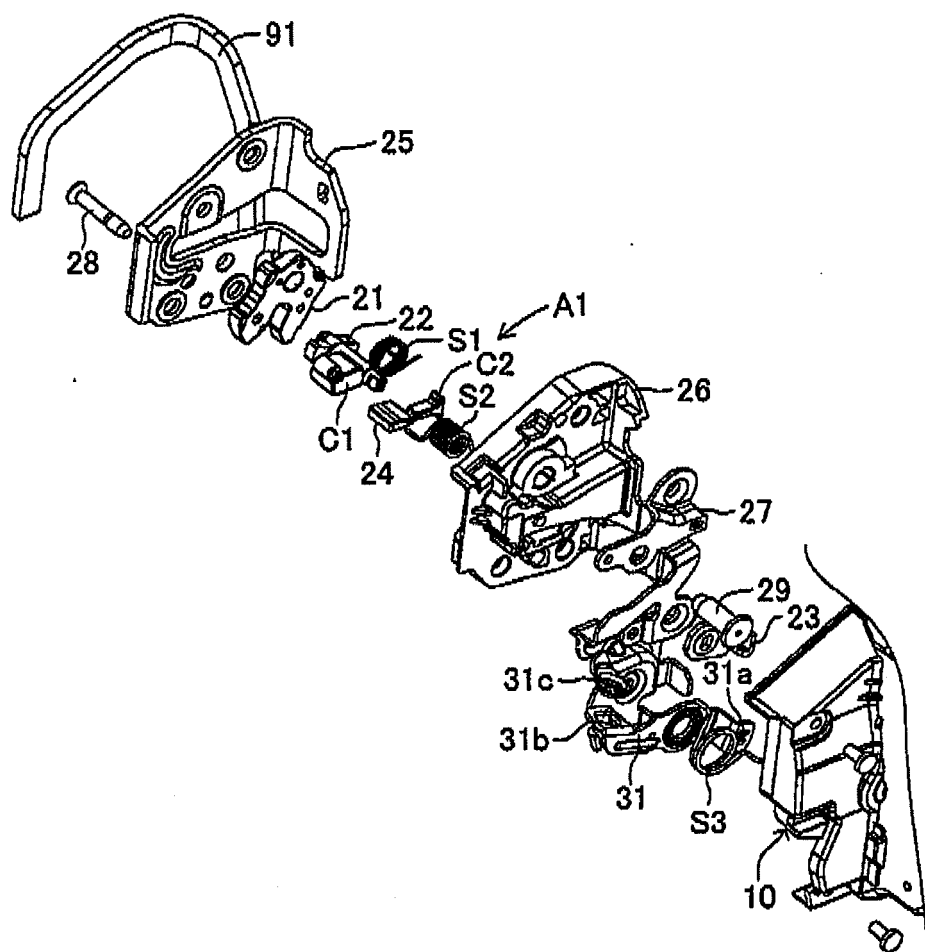


FIG. 6

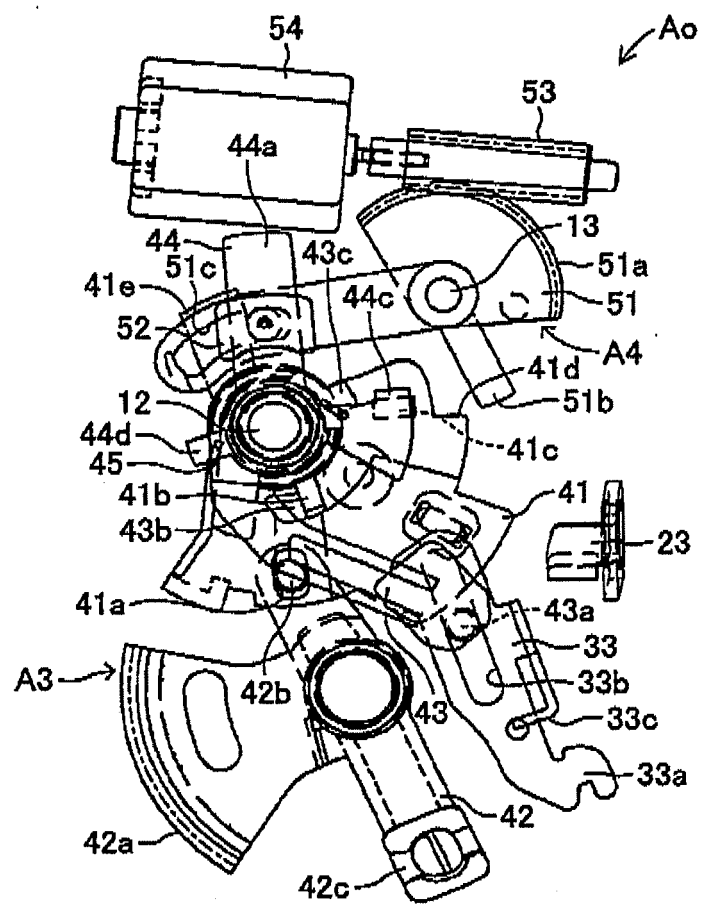


FIG. 7

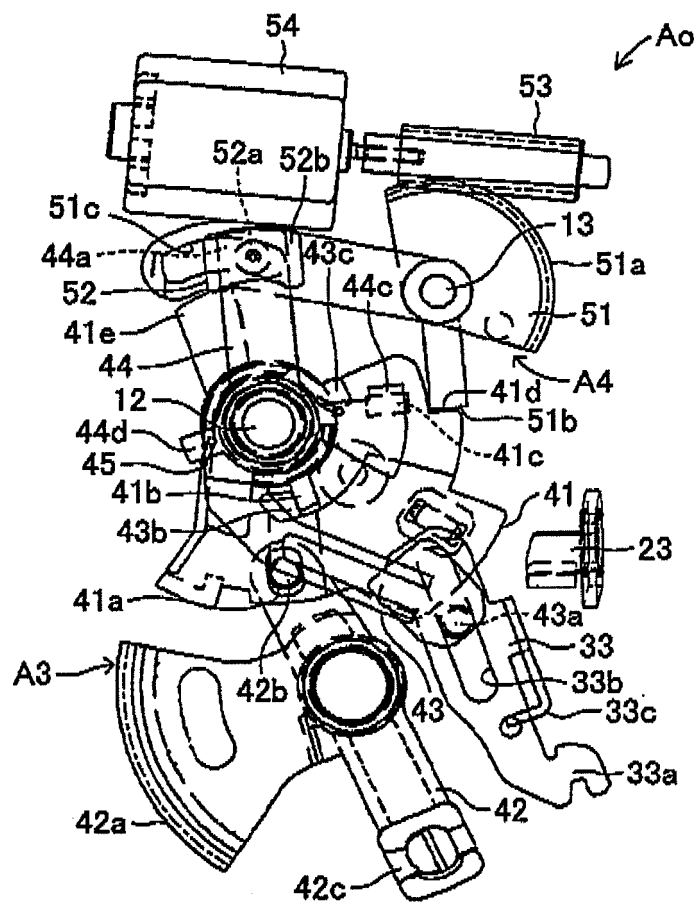
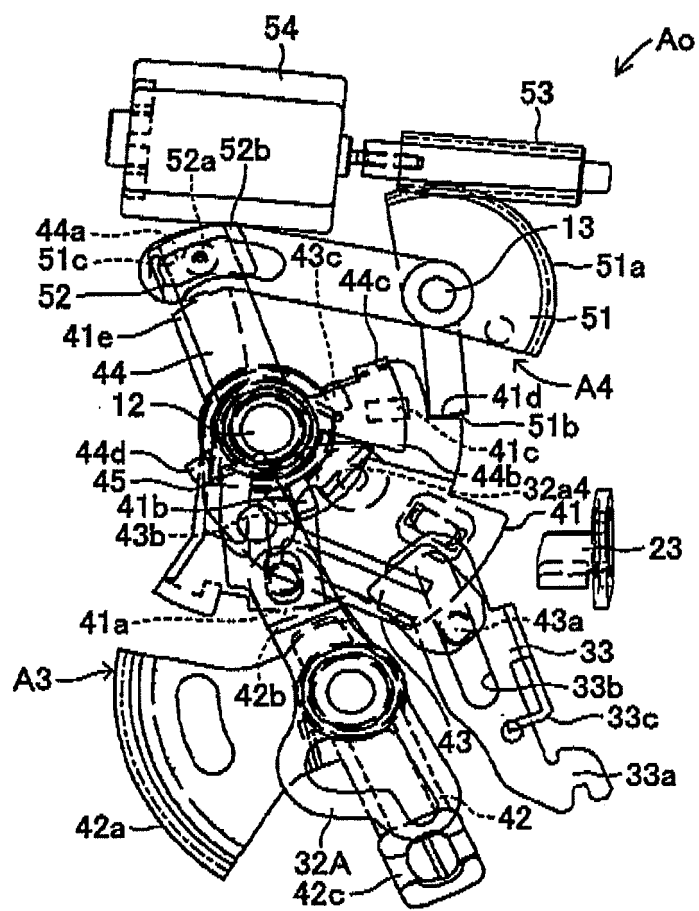


FIG. 8



REFERENCES CITED IN THE DESCRIPTION

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