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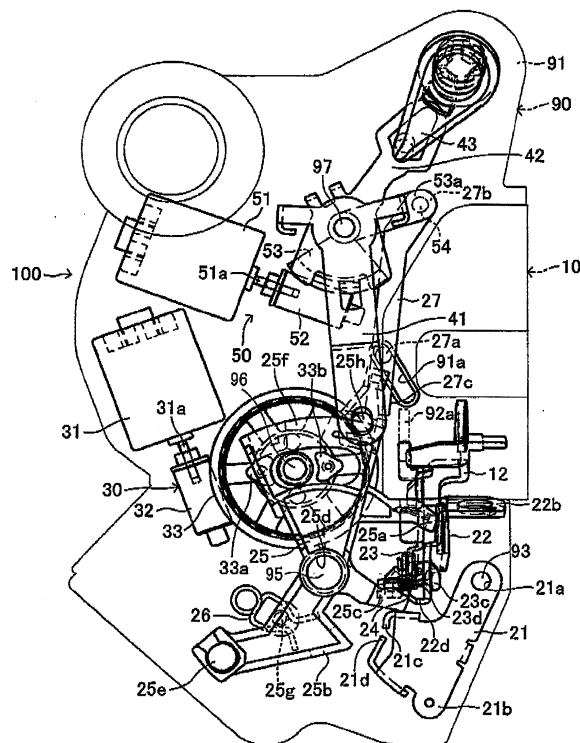
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(54) **Double-locking door lock apparatus for vehicle**

(57) A double-locking door lock apparatus (100) for a vehicle includes a latch mechanism (10), an inside open lever (21), an outside open lever (22), an open link (23), a lock mechanism switching the open link (23) between unlocked and locked states, and a double lock mechanism switching a vehicle door between a double locked state and a double-lock cancelled state, the lock mechanism including an active lever (25) shifting the open link (23) between the unlocked and locked states, and the double lock mechanism including a double lock lever (27) shifted from an unset position to a set position by a setting operation of a double-locking member to restrain the open link (23) from shifting from the locked state to the unlocked state, the double lock lever (27) shifted from the set position to the unset position by an unsetting operation of the double-locking member to allow the open link (23) to shift from the locked state to the unlocked state.

FIG. 2



Description

FIELD OF THE INVENTION

[0001] The present invention relates to a double-locking door lock apparatus for a vehicle.

BACKGROUND

[0002] A door lock apparatus (double-locking door lock apparatus) for a vehicle disclosed in JP3767342B (hereinafter referred to as Reference 1) retains a vehicle door relative to a vehicle body in a closed state. The double-locking door lock apparatus includes a latch mechanism, an inside open lever, an open lever (outside open lever), and an open link. The latch mechanism is attached to the vehicle door together with a housing. The inside open lever rotatably attached to the housing is rotated from an initial position to a rotated position by a door opening operation of an inner side door handle arranged at an inner side of the vehicle door. The outside open lever rotatably attached to the housing is rotated from an initial position to a rotated position by a door opening operation of an outside door handle arranged at an outer side of the vehicle door. The open link is attached to a connecting portion of the outside open lever so as to be tiltable thereto by a predetermined angle. The connecting portion of the outside open lever shifts in accordance with the rotation of the outside open lever. The open link includes an engagement portion (pressing portion) engageable with an engagement portion included in a lift lever of the latch mechanism. When the inside open lever is rotated from the initial position to the rotated position or when the outside open lever is rotated from the initial position to the rotated position, the open link is moved toward the lift lever.

[0003] The double-locking door lock apparatus according to Reference 1 further includes first and second operation mechanisms (lock and double lock mechanisms). The lock mechanism switches the open link between an unlocked state where the open link is engageable with the lift lever and a locked state where the open link is not engageable with the lift lever. The double lock mechanism switches a condition of the vehicle door between a double locked state where the locked state by the lock mechanism is noncancelable and a double-lock cancelled state where the double locked state is cancelled.

[0004] According to the double-locking door lock apparatus described in Reference 1, a lock lever portion including a lock operation lever and a latched lever switches an active lever of the lock mechanism between locked and unlocked positions. The latched lever formed by a linear steel material is configured to be operationally linkable with and disengageable from a latch lever (double lock lever). Further, the inside open lever engageable with the lock lever portion includes first and second inside levers.

[0005] For example, the latch lever (double lock lever) is excluded from the double-locking door lock apparatus disclosed in Reference 1; thereby, the double-locking door lock apparatus may serve as a normal door lock apparatus. Further, even when the lock lever portion may be formed by a single member, the normal door lock apparatus may appropriately function. However, the double-locking door lock apparatus according to Reference 1 has a complex configuration in a manner to include the lock lever portion formed by the lock operation lever and the latched lever (such complex configuration may be unnecessary for the normal door lock apparatus). Accordingly, components used in the double-locking door lock apparatus according to Reference 1, which is provided with the double lock mechanism, may not be simply applied to the normal door lock apparatus that is not provided with the double lock mechanism.

[0006] In addition, for example, even when the inside open lever or a lock knob that is operationally linked with the lock operation lever of the lock lever portion is unwantedly operated and unlocked from an outside of the vehicle by unauthorized means, for example, without the use of a key under a condition where the vehicle door is set in the double locked state by the double-locking door lock apparatus described in Reference 1, the active lever is maintained in the locked position and is not rotated or moved. Accordingly, the vehicle door in a locked state may be restrained from being unwantedly operated and unlocked from the outer side of the vehicle by the unauthorized means; however, such unwanted unlocking operation may not be detected by utilizing a position switch attached to the active lever because the active lever is not rotated (the position switch is usually provided for detecting whether the vehicle door is locked or unlocked).

[0007] A need thus exists for a double-locking door lock apparatus for a vehicle, which may utilize components applied to a normal door lock apparatus.

SUMMARY OF THE INVENTION

[0008] According to an aspect of this disclosure, a double-locking door lock apparatus for a vehicle includes a latch mechanism attached to a vehicle door together with a housing, including a lift lever, and retaining the vehicle door in a closed state relative to a vehicle body, an inside open lever rotatably attached to the housing and rotating from an initial position to a rotated position in accordance with a door opening operation of an inside door handle arranged at an inner side of the vehicle door, an outside open lever rotationally attached to the housing and rotating from an initial position to a rotated position in accordance with a door opening operation of an outside door handle arranged at an outer side of the vehicle door, an open link attached to a connection portion of the outside open lever so as to tilt by a predetermined angle, the connection portion shifting in accordance with the rotation of the outside open lever, the open link including a pressing portion engageable with an engagement por-

tion of the lift lever, the open link being moved toward the lift lever when the inside open lever rotates from the initial position to the rotated position or when the outside open lever rotates from the initial position to the rotated position, a lock mechanism switching the open link between an unlocked state where the open link is linkable with the lift lever and a locked state where the open link is unlinkable with the lift lever, and a double lock mechanism switching a condition of the vehicle door between a double locked state where the locked state by the lock mechanism is noncancelable and a double-lock canceled state where the double locked state is canceled, the lock mechanism including an active lever rotatably attached to the housing, the active lever being shifted from an unlocked position to a locked position by a locking operation of a locking/unlocking member and shifting the open link from the unlocked state to the locked state, the active lever being shifted from the locked position to the unlocked position by an unlocking operation of the locking/unlocking member and shifting the open link from the locked state to the unlocked state, and the double lock mechanism including a double lock lever movably attached to the housing, the double lock lever being shifted from an unset position to a set position by a setting operation of a double-locking member and moving toward the open link so as to engage therewith to restrain the open link from shifting from the locked state to the unlocked state, the double lock lever being shifted from the set position to the unset position by an unsetting operation of the double-locking member and being separated from the open link to allow the open link to shift from the locked state to the unlocked state.

[0009] In the double-locking door lock apparatus configured as above, other components except for components of the double lock mechanism (the double lock lever linking with the open link, a components switching the double lock lever between the unset position and the set position, and the like) are identical to components used in a normal lock apparatus that does not include the double lock mechanism. Accordingly, the other components of the double-locking door lock apparatus except for the components of the double lock mechanism are simply utilized in both the double-locking door lock apparatus and the normal door lock apparatus. Consequently, both the double-locking door lock apparatus and the normal door lock apparatus may be manufactured at low cost.

[0010] In addition, in a condition where the vehicle door is in the aforementioned double locked state, the double lock lever operates together with the open link that is in the locked position. For example, the locking/unlocking member is unwantedly operated and unlocked from an outer side of the vehicle by unauthorized means, for example, without the use of a key; therefore, the active lever shifts from the locked position to the unlocked position. However, the double lock lever is maintained in the set position while engaging with the open link, thereby restraining the open link from shifting from the locked state

to the unlocked state.

[0011] As a result, the open link is maintained in the locked state, therefore restraining the unwantedly unlocking operation from the outside of the vehicle. In addition, at the time of the occurrence of the unwantedly unlocking operation from the outside of the vehicle, the active lever in the locked position shifts to the unlocked position. A position switch arranged at the active lever is operated to thereby detect that the vehicle door in the locked state is unwantedly operated and unlocked from the outer side of the vehicle (the position switch is generally arranged at the active lever in order to detect whether the vehicle door is locked or unlocked).

[0012] According to another aspect of the disclosure, the double lock lever is movably attached to the housing along a guide formed in the housing, and one end portion of the double lock lever is moved toward an engagement arm portion, which is formed at the open link, so that the double lock lever engages with the open link when the double lock lever is in the set position.

[0013] According to still another aspect of the disclosure, the double lock lever is movably attached to the housing along a guide formed in the housing, and a lower end portion of the double lock lever is moved toward an engagement arm portion, which is formed at the open link, so that the double lock lever engages with the open link when the double lock lever is in the set position.

[0014] Accordingly, the double lock lever may be simply formed by a bar-shaped member and a space for the double lock lever in the housing may be minimized.

[0015] According to a further aspect of the disclosure, the guide is formed in the housing so as to extend obliquely downward in a vertical direction of the vehicle.

[0016] Accordingly, when the double lock lever is moved from the set position to the unset position, a distance in which the double lock lever moves along the guide may be shorten compared to a case where the guide extends straight in the vertical direction in housing.

[0017] According to another aspect of the disclosure, further comprising a spring arranged between the outside open lever and the open link, the spring biasing the open link so as to bring the open link into the unlocked state and retaining the open link in a manner that the open link is movable relative to the lift lever so as to return to an initial position, an unlocked state retaining guide retaining the open link in the unlocked state when the active lever is in the unlocked position and the outside open lever rotates between the initial position and the rotated position, a locked state retaining guide retaining the open link in the locked state when the active lever is in the locked position and the outside open lever rotates between the initial position and the rotated position, and a pressing arm portion arranged at the active lever, the pressing arm portion engaging with the open link in the unlocked state by the displacement of the active lever from the unlocked position to the locked position and allowing the open link to tilt, the pressing arm portion disengaging from the open link in the locked state so as to shift the

open link to the unlocked state.

[0018] For example, in a condition where the vehicle door is in the locked state, the outside door handle is operated at the same time as the unlocking operation of the locking/unlocking member is performed. As a result, the vehicle door is brought into a state where unlocking operation may not be implemented appropriately (such state is referred to as a panic state). At this time, the open link is movably supported by the spring relative to the lift lever and is allowed to return to an initial position. Accordingly, the outside open lever is returned to the initial position even when the panic state occurs; therefore, the open link returns to the initial position while shifting from the locked state to the unlocked state. As a result, the double-locking door lock apparatus may smoothly shift the vehicle door from the locked state to an unlocked state.

[0019] According to still another aspect of the disclosure, a plane surface on which a main portion of the lift lever rotates is arranged in parallel to a plane surface on which a main portion of the open link tilts, and a pressing leg portion is arranged at the lift lever and a passive portion is arranged at the open link. The pressing leg portion of the lift lever is arranged so as to press the passive portion of the open link when the vehicle door in an opened state is operated to a closed state under a condition where the active lever is in the locked position and the outside open lever is in the initial position.

[0020] In the double-locking door apparatus configured as above, the vehicle door in the opened state is set to the locked state by shifting the active lever from the unlocked position to the locked position by means of the locking operation of the locking/unlocking member. Then, the vehicle door in the opened state is operated to the closed state without the operation of the outside door handle. At this time, the pressing leg portion of the lift lever presses the passive portion of the open link, therefore shifting the open link from the locked state to the unlocked state and moving the active lever from the locked position to the unlocked position. Accordingly, the vehicle door in the locked state while being in the opened state is operated to the closed state, thereby automatically cancelling the locked state of the vehicle door. In particular, the surface on which the main portion of the lift lever rotates is arranged in parallel to the surface on which the main portion of the open link rotates. Further, the pressing leg portion is arranged at the lift lever and the passive portion is arranged at the open link. Accordingly, the aforementioned automatic cancellation of the locked state of the vehicle door may be performed and may be simply provided to the double-locking door lock apparatus at low cost without additional components.

[0021] According to a further aspect of the disclosure, a pressing arm portion is arranged at the inside open lever and a passive portion is arranged at the active lever. The pressing arm portion of the inside open lever is arranged so as to press the passive portion of the active lever when the vehicle door in the closed state is operated

to the opened state under a condition where the active lever is in the locked position and the inside open lever is in the initial position.

[0022] For example, the door opening operation of the inside door handle is performed under a condition where the vehicle door is in the closed state and the active lever is in the locked position. Then, the inside open lever is moved in a direction to open the vehicle door; therefore, the pressing arm portion of the inside open lever presses the passive portion of the active lever. Accordingly, the active lever is shifted from the locked position to the unlocked position and the open link is moved from the locked state to the unlocked state. Thus, the vehicle door in the locked state while being in the closed state may be automatically unlocked by the door opening operation of the inside door handle; therefore, a so-called one-motion function or a double-pull function (unlocking function) may be obtained. In particular, the pressing arm portion is arranged at the inside open lever and the passive portion is arranged at the active lever; thereby, the one-motion function or the double-pull function may be realized without additional components. Accordingly, the one-motion function or the double-pull function may be simply obtained at low cost.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] The foregoing and additional features and characteristics of the present invention will become more apparent from the following detailed description considered with the reference to the accompanying drawings, wherein:

[0024] Fig. 1 illustrates a lateral view of a double-locking door lock apparatus for a vehicle (under a condition where a vehicle door is in an unlocked state), according to an embodiment of this disclosure, as seen from an interior side of the vehicle;

[0025] Fig. 2 is a lateral view illustrating the double-locking door lock apparatus from which a latch mechanism, a cover of a housing, and the like are removed but from which a lift lever of the latch mechanism is not removed;

[0026] Fig. 3 is a lateral view illustrating a double lock lever shown in Fig. 2 and a configuration related to the double lock lever;

[0027] Fig. 4 shows a relation in a width direction of the vehicle between an outside open lever, a spring, an open link, an active lever, and a lift lever that are illustrated in Fig. 2 and an unlocked state retaining guide that is arranged at the cover of the housing;

[0028] Fig. 5 shows a condition where the outside open lever is moved in a direction to open the vehicle door from a condition illustrated in Fig. 4;

[0029] Fig. 6 is a lateral view illustrating the double-locking door lock apparatus shown in Fig. 2 (under a condition where the vehicle door is in a locked state);

[0030] Fig. 7 shows a relation in the width direction of the vehicle between the outside open lever, the spring,

the open link, the active lever, and the lift lever that are illustrated in Fig. 6 and a locked state retaining guide that is arranged at the active lever;

[0031] Fig. 8 shows a condition where the outside open lever is moved in the direction to open the vehicle door from a condition illustrated in Fig. 7;

[0032] Fig. 9 is an explanatory drawing describing a one-motion function of the double-locking door lock apparatus illustrated in Figs. 1 to 8 ;

[0033] Fig. 10 is an explanatory drawing illustrating a condition where a panic state where unlocking by a locking/unlocking member fails to be implemented occurs in the double-locking door lock apparatus illustrated in Figs. 1 to 8 (in the panic state, the active lever illustrated in Fig. 7 is moved toward an unlock position and the open link is engaged with the lift lever at the same time the outside open lever illustrated in Fig. 7 rotates in the direction to open the vehicle door);

[0034] Fig. 11 is an explanatory drawing describing an automatic lock cancellation function of the double-locking door lock apparatus illustrated in Figs. 1 to 8 ;

[0035] Fig. 12 is an explanatory drawing illustrating a keyless locking function of the double-locking door lock apparatus illustrated in Figs. 1 to 8 ;

[0036] Fig. 13 is a lateral view illustrating a condition where the double-locking door lock apparatus shown in Fig. 2 is in a double locked state;

[0037] Fig. 14 is a lateral view illustrating the double lock lever shown in Fig. 13 and a configuration related to the double lock lever; and

[0038] Fig. 15 shows a relation in the width direction of the vehicle between the double lock lever and the open link that are illustrated in Fig. 14 and the outside open lever, the spring, and the active lever that are illustrated in Fig. 13.

DETAILED DESCRIPTION

[0039] An embodiment of this disclosure will be explained with reference to the illustrations of the figures as follows. A double-locking door lock apparatus 100 for a vehicle, according to the embodiment is illustrated in Figs. 1 to 15. The double-locking door lock apparatus 100 is attached to a right front door of the vehicle. The double-locking door lock apparatus 100 includes a latch mechanism 10, an inside open lever 21, an outside open lever 22, an open link 23, a spring 24, and an active lever 25. The double-locking door lock apparatus 100 further includes an unlocked state retaining guide 92a that is arranged at a cover 92 of a housing 90, a locked state retaining guide 25a and a pressing arm portion 25c that are arranged at the active lever 25, and a double lock lever 27.

[0040] The latch mechanism 10 retains a vehicle door (hereinafter referred to as a door) in a closed state relative to a vehicle body as is well known. The latch mechanism 10 is attached to the housing 90 that includes a main body 91 and the cover 92. The latch mechanism

10 is assembled to the door together with the housing 90. The latch mechanism 10 includes a latch 11 (see Fig. 1), a pole, and a lift lever 12 (see Fig. 2 and Fig. 4) that integrally rotates with the pole. The latch 11 is engageable with and disengageable from a striker fixed at the vehicle body. The pole is engageable with the latch 11 to maintain the latch 11 in the engaged state with the striker while being disengageable from the latch 11 to release the latch 11 from the engaged state with the striker.

[0041] As illustrated in Fig. 4, a rotary shaft 13 of the pole is inserted in an attaching hole 12a of the lift lever 12; thereby, the lift lever 12 is attached to the rotary shaft 13 of the pole so as to be integrally rotatable therewith. The lift lever 12 includes an engagement arm portion 12b (engagement portion) engageable with and disengageable from a pressing head portion 23a (pressing portion) of the open link 23, and a pressing leg portion 12c engageable with and disengageable from a passive body portion 23b (passive portion) of the open link 23. A main portion (fitted to the rotary shaft 13) of the lift lever 12 rotates on a plane surface approximately parallel to a surface seen in Fig. 4.

[0042] The latch 11 of the latch mechanism 10 is maintained in the engaged state with the striker to thereby retain the door in the closed state (a latched state or locked state). Meanwhile, the latch 11 is released from the engaged state with the striker to thereby release the door from the closed state to an opened state (an unlatched state or unlocked state).

[0043] The inside open lever 21 is rotationally operated from an initial position (illustrated in Figs. 2, 6, and 13) to a rotated position (shown in Fig. 9) in accordance with a door opening operation of an inside door handle arranged at an inner side of the door. As shown in Fig. 2, the inside open lever 21 is rotationally attached to the housing 90 via a support shaft 93 inserted in a supporting hole 21a of the inside open lever 21. The inside open lever 21 includes an operating arm portion 21b, a first pressing arm portion 21c, and a second pressing arm portion 21d (pressing arm portion). The operating arm portion 21b is connected via an operating cable W1 to the inside door handle (an operating force transmitting member such as a link may be applied to the operating cable W1). The first pressing arm portion 21c is engageable with and disengageable from an engagement arm portion 22d of the outside open lever 22. The second pressing arm portion 21d is engageable with and disengageable from a passive portion 25b of the active lever 25.

[0044] The outside open lever 22 is rotationally operated from an initial position (shown in Figs. 4, 7, and 11) to a rotated position (illustrated in Figs. 5, 8, 10, and 12) in accordance with a door opening operation of an outside door handle arranged at an outer side of the door. The outside open lever 22 is rotationally attached to the housing 90 via a support shaft 94 inserted in a supporting hole 22a formed in the outside open lever 22 and positioned

approximately perpendicularly to the supporting hole 21a of the inside open lever 21. The outside open lever 22 includes an operating portion 22b, a connecting hole portion 22c (connecting portion), and the engagement arm portion 22d. The operating portion 22b is connected to the outside door handle via an operating force transmitting member such as a link. The connecting hole portion 22b is connected to the open link 23. The engagement arm portion 22d is engageable with and disengageable from the first pressing arm portion 21c of the inside open lever 21. Further, as illustrated in Fig. 4, the outside open lever 22 is biased by a spring 28 toward the initial position of the outside open lever 22. In particular, the spring 28 biases the outside open lever 22 by means of a predetermined biasing force toward the initial position (shown in Fig. 4) of the outside open lever 22 relative to the housing 90. Further, the spring 28 includes a coil portion 28a attached around the support shaft 94 arranged at the housing 90, and a pair of arm portions 28b and 28c extending radially outward from both ends of the coil portion 28a. The arm portion 28b is engaged with the outside open lever 22 while the arm portion 28c is engaged with the housing 90. The spring 28 is illustrated in Fig. 4 only and is not shown in other drawings.

[0045] The open link 23 includes the pressing head portion 23a, the passive body portion 23b, a connecting leg portion 23c, and a supporting portion 23d (see Fig. 2). The connecting leg portion 23c is connected to the connecting hole portion 22c of the outside open lever 22 so that the open link 23 tilts by a predetermined angle in a horizontal direction seen in Fig. 4. The spring 24 is supported by the supporting portion 23d. A main portion (the pressing head portion 23a, the passive body portion 23b, and the like) of the open link 23 tilts on a surface approximately parallel to the plane surface seen in Fig. 4. The surface on which the main portion of the open link 23 tilts is positioned in parallel to the surface on which the main portion of the lift lever 12 rotates. The open link 23 further includes an engagement leg portion 23e, an engagement arm portion 23f, and an engagement body portion 23g. The engagement leg portion 23e is engageable with and disengageable from the pressing arm portion 25c of the active lever 25. The engagement arm portion 23f is engageable with and disengageable from the unlocked state retaining guide 92a and the double lock lever 27. The engagement body portion 23g is engageable with and disengageable from the locked state retaining guide 25a (see Figs. 7 and 8).

[0046] When the inside open lever 21 is rotationally operated from the initial position to the rotated position or when the outside open lever 22 is rotationally operated from the initial position to the rotated position, the open link 23 is moved by the outside open lever 22 toward the lift lever 12, therefore shifting from an initial position shown in Fig. 4 to a rotated position shown in Fig. 5. In addition, when the active lever 25 is moved from a locked position shown in Fig. 6 to an unlocked position shown in Fig. 2, the open link 23 shifts from a locked state shown

in Fig. 7 to an unlocked state shown in Fig. 4. When the active lever 25 is moved from the unlocked position shown in Fig. 2 to the locked position shown in Fig. 6, the open link 23 shifts from the unlocked state shown in Fig. 4 to the locked state shown in Fig. 7.

[0047] In addition, when the open link 23 is in the unlocked state, door opening operations of the inside open lever 21 and the outside open lever 22 in accordance with the door opening operations of the inside door handle and the outside door handle are transmitted via the open link 23 to the lift lever 12. Meanwhile, when the open link 23 is in the locked state, the door opening operations of the inside open lever 21 and the outside open lever 22 in accordance with the door opening operations of the inside door handle and the outside door handle are transmitted to the open link 22 but not transmitted to the lift lever 12.

[0048] The spring 24 is arranged between the outside open lever 22 and the open link 23 while biasing the open link 23 relative to the outside open lever 22 toward a direction to bring the open link 23 into the unlocked state illustrated in Fig. 4. The spring 24 includes a coil portion 24a attached to the supporting portion 23d of the open link 23 and a pair of arm portions 24b and 24c extending radially outward from both ends of the coil portion 24a. The arm portion 24b is engaged with the outside open lever 22 while the arm portion 24c is engaged with the open link 23.

[0049] For example, under a condition where the door is in the locked state, the outside door handle is pulled (operated) at the same time as a locking/unlocking member (for example, a lock knob arranged at the inner side of the door, a key cylinder operational from the outer side of the door, and a locking remote control for driving an electric motor 31 of a first drive mechanism 30) is operated. At this time, the door may not be shifted from the locked state to the unlocked state (such condition will be referred to as a panic state where unlocking by the locking/unlocking member fails to be implemented). In the panic state as illustrated in Fig. 10, the active lever 25 in the locked state as illustrated in Fig. 7 shifts to the unlocked state and the open link 23 is engaged with the lift lever 12 at the same time as the outside open lever 22 illustrated in Fig. 7 rotates in a direction to open the door (the direction will be referred to as a door opening direction). After the panic state occurs in the double-locking door lock apparatus 100, the outside door handle is operated to return from a pulled position to an initial position, thereby returning the outside open lever 22 from the rotated position to the initial position. Then, the open link 23 biased by the function of the spring 24 so as to be brought into the unlocked state is elastically and movably supported by the spring 24 relative to the engagement arm portion 12b of the lift lever 12. As a result, the open link 23 is allowed to return to the initial position shown in Fig. 4.

[0050] The active lever 25 configures a portion of a lock mechanism switching the open link 23 between the

unlocked state (see Figs. 4 and 5) where the open link 23 is linkable with the lift lever 12 and the locked state (see Figs. 7 and 8) where the open link 23 is unlinkable with the lift lever 12. The active lever 25 is shifted from the unlocked position in Fig. 2 to the locked position in Fig. 6 by a locking operation of the locking/unlocking member to thereby bring the open link 23 into the locked state. Meanwhile, the active lever 25 is shifted from the locked position to the unlocked position by an unlocking operation of the locking/unlocking member to thereby bring the open link 23 into the unlocked state. The active lever 25 is rotatably attached to the housing 90 via a support shaft 95 inserted in a supporting hole 25d formed in a boss portion of the active lever 25.

[0051] The active lever 25 includes the locked state retaining guide 25a, the passive portion 25b, the pressing arm portion 25c, and the supporting hole 25d. The active lever 25 further includes an operating portion 25e, a drive portion 25f, a first engagement pin portion 25g, and a second engagement pin portion 25h. The operating portion 25e is operationally connected via the operating cable W2 shown in Fig. 1 to the lock knob arranged at the inner side of the door. The drive portion 25f is operationally connected with the first drive mechanism 30. The first engagement pin portion 25g is operationally connected with a positioning pin 26 (see Fig. 2). The second engagement pin 25h is operationally connected to the key cylinder arranged at the outer side of the door, via a locking control lever 41, a key switch lever 42, an outside lock lever 43, and the like. In addition, the active lever 25 is configured to be retained in the unlocked position or the locked position by the positioning pin 26 attached in the housing 90 and engaged with the first engagement pin portion 25g arranged at the active lever 25 (see Fig. 2).

[0052] The active lever 25 in the unlocked position shown in Figs. 2 and 4 shifts to the locked position shown in Fig. 7, thereby allowing the pressing arm portion 25c to contact the engagement leg portion 23e of the open link 23 so that the open link 23 may tilt. Meanwhile, the active lever 25 in the locked position shown in Figs. 6 and 7 shifts to the unlocked position shown in Figs. 2 and 4, therefore separating the pressing arm portion 25c separated from the engagement leg portion 23e so that the open link 23 may shift to the unlocked state.

[0053] The first drive mechanism 30 drives the active lever 25 to move to the locked position or the unlocked position while including the electric motor 31, a worm shaft 32, and a worm wheel 33. The electric motor 31 is a known electric motor driven by the locking and unlocking operations of the locking/unlocking member such as the locking remote control. The worm shaft 32 is integrally formed with an output shaft 31a of the electric motor 31 and rotationally driven thereby. The worm wheel 33 is attached to the housing 90 via a support shaft 96 so as to be rotated by the worm shaft 32. The worm wheel 33 includes a pair of cams 33a and 33b rotating along with a cam follower arranged at the drive portion 25f of the

active lever 25 (a detailed explanation of the cam follower indicated by dashed lines in Fig. 2 is omitted herein).

[0054] When the active lever 25 is in the unlocked position shown in Fig. 2, the locking operation of the locking/unlocking member such as the locking remote control for driving the electric motor 31 is performed. Then, in the first drive mechanism 30 described above, the worm wheel 33 is rotated counterclockwise (in Fig. 2) by 180 degrees by the worm shaft 32 driven by the electric motor 31; therefore, the active lever 25 shifts from the unlocked position to the locked position shown in Fig. 6. Meanwhile, when the active lever 25 is in the locked position, the unlocking operation of the locking/unlocking member is performed. Then, the worm wheel 33 is rotated clockwise (in Fig. 6) by 180 degrees by the worm shaft 32 driven by the electric motor 31; therefore, the active lever 25 shifts from the locked position to the unlocked position shown in Fig. 2.

[0055] In addition, according to the double-locking door lock apparatus 100 of the embodiment, when the active lever 25 is in the unlocked position as shown in Figs. 2, 4, and 5 and the outside open lever 22 rotates between the initial position and the rotated position, the open link 23 separated from the pressing arm portion 25c is retained in the unlocked state by the unlocked state retaining guide 92a arranged at the cover 92 of the housing 90. When the open link 23 is retained in the unlocked state by the unlocked state retaining guide 92a, the engagement arm portion 23f of the open link 23 is slidably in contact with the unlocked state retaining guide 92a as shown in Fig. 5. A shape of a guide surface (with which the engagement arm portion 23f makes a slidable contact) of the unlocked state retaining guide 92a is designed in consideration of a movement trajectory of a contact portion between the engagement arm portion 12b of the lift lever 12 and the pressing head portion 23a of the open link 23. It is recommended that the shape of the guide surface of the unlocked state retaining guide 92a is designed to restrict the engagement arm portion 12b and the pressing head portion 23a from sliding on the contact portion.

[0056] Further, in a condition when the outside open lever 22 rotates between the initial position and the rotated position under a condition where the active lever 25 is in the locked position shown in Figs. 6, 7, and 8, the open link 23 separated from the pressing arm portion 25c of the active lever 25 is retained in the locked state by the locked state retaining guide 25a arranged at the active lever 25. When the open link 23 is retained in the locked state by the locked state retaining guide 25a, the engagement body portion 23g of the open link 23 is slidably in contact with the locked state retaining portion 25a.

[0057] The double lock lever 27 configures a portion of a double lock mechanism switching a condition of the door between a double locked state where the locked state of the door by the lock mechanism including the active lever 25 is noncancelable and a double-lock can-

celled state where the double locked state is cancelled. In addition, a double-locking member such as a double-locking remote control for driving an electric motor 51 of a second drive mechanism 50 is operated so as to shift the double lock lever 27 from an unset position shown in Fig. 6 to a set position shown in Fig. 13 (such operation of the double-locking member will be referred to as a setting operation). Accordingly, the lock lever 27 is moved close to the open link 23 so as to engage therewith, thereby restraining the open link 23 from shifting from the locked state to the unlocked state. Meanwhile, the double-locking member is operated so as to shift the double lock lever 27 from the set position to the unset position (such operation of the double-locking member will be referred to as an unsetting operation); thereby, the double lock lever 27 disengages from the open link 23 to allow the open link 23 to shift from the locked state to the unlocked state.

[0058] As illustrated in Fig. 3, a supporting pin 27a arranged at an intermediate portion of the double lock lever 27 is slidably connected to a guide groove 91a (guide) formed in the main body 91 of the housing 90. The double lock lever 27 is attached to the main body 91 so as to move along the guide groove 91a. Further, an upper end portion 27b of the double lock lever 27 is connected to the second drive mechanism 50 while a lower end portion 27c (one end portion) of the double door lock lever 27 is movably toward the engagement arm portion 23f of the open link 23 so as to engage therewith and disengage therefrom. The guide groove 91a extends obliquely downward in a vertical direction of the vehicle in the main body 91 of the housing 90. In particular, a distance between an upper end of the latch 11 of the latch mechanism 10 and an upper end of the guide groove 91a is set to be shorter than a distance between a lower end of the latch 11 of the latch mechanism 10 and a lower end of the guide groove 91 a.

[0059] The second drive mechanism 50 drives the double lock lever 27 to the set position or the unset position. The second drive mechanism 50 includes the electric motor 51, a worm shaft 52, a worm wheel 63, and a connecting pin 54. The electric motor 51 is driven in accordance with the setting or unsetting operation of the double-locking remote control and the like. The worm shaft 52 is integrally formed with an output shaft 51a of the electric motor 51 and driven thereby. The worm wheel 53 includes an arm 53a integrally rotating with the worm wheel 53. The worm wheel 53 is a sector gear rotationally driven by the worm shaft 52 and attached to the housing 90 via a support shaft 97. The connecting pin 54 is connected to an end portion of the arm 53a and the upper end portion 27b of the double lock lever 27 so that the arm 53a may be tiltable relative to the double lock lever 27.

[0060] The setting operation of the double-locking member such as the double-locking remote control for operating the electric motor 51 is performed when the double lock lever 27 is in the unset position shown in Fig. 6. Then, in the second drive mechanism 50 configured

as described above, the worm wheel 53 is rotated clockwise (seen in Fig. 6) by a predetermined angle by the worm shaft 52 driven by the electric motor 51. Accordingly, the double lock lever 27 is moved to the set position shown in Figs. 13 and 14. In addition, when the double lock lever 27 is in the set position, the supporting pin 27a is located at the lower end of the guide groove 91a. Meanwhile, the unsetting operation of the double-locking member is performed when the double lock lever 27 is in the set position. Then, the worm wheel 53 is rotated counterclockwise (seen in Fig. 13) by a predetermined angle by the worm shaft 52 driven by the electric motor 51. Accordingly, the double lock lever 27 is moved to the unset position shown in Fig. 6. In addition, when the double lock lever 27 is in the unset position, the supporting pin 27a is located at the upper end of the guide groove 91 a.

[0061] Further, according to the double-locking door lock apparatus 100 of the embodiment, when the door in the opened state is moved to the closed state under a condition where the active lever 25 is in the locked position as shown in Fig. 6 and the outside open lever 22 is in the initial position as shown in Fig. 7, the pressing leg portion 12c of the lift lever 12 is arranged so as to press the passive body portion 23b of the open link 23 (the rotary shaft 13 of the pole is temporarily rotated integrally with the lift lever 12 by a predetermined angle in a clockwise direction seen in Fig. 7 as is well known). Furthermore, when, the door opening operation of the inside door handle is performed under a condition where the active lever 25 is in the locked position and the inside open lever 21 is in the initial position as shown in Fig. 6, the second pressing arm portion 21d of the inside open lever 21 is positioned so as to press the passive portion 25b of the active lever 25.

[0062] Moreover, according to the double-locking door lock apparatus 100 of the embodiment, when the door opening operation of the inside door handle is performed, the first pressing arm portion 21 c of the inside open lever 21 engages with the engagement arm portion 22d of the outside open lever 22 after a predetermined period of time following the time when the second pressing arm portion 21d of the inside open lever 21 engages with the passive portion 25b of the active lever 25. Accordingly, a so-called one-motion function is obtained.

[0063] According to the embodiment, components of the double-locking door lock apparatus 100 configured as described above will operate as follows, for example, (a) when the door opening operation of the inside door handle is performed under a condition where the door is in the unlocked state, (b) when the door opening operation of the outside door handle is performed under a condition where the door is in the unlocked state, (c) when the door opening operation of the outside door handle is performed under a condition where the door is in the locked state, (d) when the door opening operation of the inside door handle is performed under a condition where the door is in the locked state, (e) when the door is locked

under the opened state and then moved to the closed state without the operation of the outside door handle, (f) when the door is locked under the opened state and then moved to the closed state while the door opening operation of the outside door handle is performed, and (g) when the setting operation of the double-locking member is performed under a condition where the door is in the locked state.

[0064] [(a) When the door opening operation of the inside door handle is performed under a condition where the door is in the unlocked state] In a condition where the door is in the closed state and the double-locking door lock apparatus 100 is in the unlocked state as illustrated in Figs. 1 to 4, the inside open lever 21 is operated in a clockwise direction in Fig. 2 in accordance with the door opening operation of the inside door handle. Then, as shown in Figs. 4 and 5, the open link 23 in the unlocked state is moved from the initial position shown in Fig. 4 to the rotated position shown in Fig. 5 by the outside open lever 22 movably pressed by the inside open lever 21, therefore rotating the lift lever 12 in an unlatching direction (corresponding to a clockwise direction in Fig. 4). Accordingly, the door opening operation of the inside open lever 21 is transmitted to the lift lever 12 via the outside open lever 22 and the open link 23 to thereby rotate the lift lever 12 in the unlatching direction. Consequently, the latch mechanism 10 shifts from the latched state to the unlatched state, therefore enabling the door to open.

[0065] [(b) When the door opening operation of the outside door handle is performed under a condition where the door is in the unlocked state] In a condition where the door is in the closed state and the double-locking door lock apparatus 100 according to the embodiment is in the unlocked state as illustrated in Figs. 1 to 4, the outside open lever 22 is operated in the clockwise direction seen in Fig. 4 in accordance with the door opening operation of the outside door handle. Then, as shown in Figs. 4 and 5, the open link 23 in the unlocked state is moved by the outside open lever 22 from the initial position shown in Fig. 4 to the rotated position shown in Fig. 5, therefore rotating the lift lever 12 in the unlatching direction. Accordingly, the door opening operation of the outside open lever 22 is transmitted to the lift lever 12 via the open link 23 to thereby rotate the lift lever 12 in the unlatching direction. Consequently, the latch mechanism 10 shifts from the latched state to the unlatched state, therefore enabling the door to open.

[0066] [(c) When the door opening operation of the outside door handle is performed under a condition where the door is in the locked state] In a condition where the door is in the closed state and the double-locking door lock apparatus 100 is in the locked state as illustrated in Figs. 6 and 7, the outside open lever 22 is operated in the door opening direction in accordance with the door opening operation of the outside door handle. Then, the open link 23 in the locked state shown in Fig. 7 is lifted up while being guided by the locked state retaining guide

25a of the active lever 25 so as to remain in the locked state shown in Fig. 8. At this time, the open link 23 does not engage with the lift lever 12. Accordingly, the door opening operation of the outside open lever 22 is not transferred to the lift lever 12 and the lift lever 12 does not rotate. Consequently, the latch mechanism 10 is maintained in the latched state; therefore, the door is unable to open.

[0067] [(d) When the door opening operation of the inside door handle is performed under a condition where the door is in the locked state] In a condition where the door is in the closed state and the double-locking door lock apparatus 100 is in the locked state as illustrated in Figs. 6 and 7, the inside open lever 21 is operated in the door opening direction in accordance with the door opening operation of the inside door handle. Then, the first pressing arm portion 21c of the inside open lever 21 engages with the engagement arm portion 22d of the outside open lever 22 after the predetermined period of time following the time when the second pressing arm portion 21d of the inside open lever 21 engages with the passive portion 25b of the active lever 25. The open link 23 in the locked state shown in Fig. 7 is brought into the unlocked state shown in Fig. 4 until the first pressing arm portion 21c engages with the engagement arm portion 22d. Afterward, the lift lever 12 is rotated in the unlatching direction similarly as in the case (a). Accordingly, the latch mechanism 10 shifts from the latched state to the unlatched state, therefore enabling the door to open. Thus, the so-called one-motion function (allowing the door in the locked state to shift to the opened state by a single door opening operation) may be performed.

[0068] [(e) When the door is locked under the opened state and then moved to the closed state without the operation of the outside door handle] According to the embodiment, the pressing leg portion 12c is arranged at the lift lever 12 and the passive body portion 23b is arranged at the open link 23. For example, the locking operation of the lock knob is performed under a condition where the door is in the opened state, thereby bringing the door into the locked state as shown in Figs. 6 and 7. Then, the door in the locked state while being in the opened state is brought into the closed state without the operation of the outside door handle. At this time, the latch 11 of the latch mechanism 10 engages with the striker as is well known and the rotary shaft 13 of the pole temporarily rotates integrally with the lift lever 12 by a predetermined angle in the clockwise direction shown in Fig. 7 and then returns to an initial state. Accordingly, when the door is moved from the opened state to the closed state, the pressing leg portion 12c of the lift lever 12 presses the passive body portion 23b of the open link 23.

[0069] Thus, the open link 23 and the pressing arm portion 25c of the active lever 25 are moved from the locked state shown in Fig. 7 to an unlocked state shown in Fig. 11; therefore, the door is automatically cancelled from the locked state. Accordingly, the door in the locked state while being in the opened state is brought into the

closed state, therefore being unlocked without the operation of the outside door handle. Consequently, the door in the locked state shown in Figs. 6 and 7 shifts to the unlocked state as shown in Figs. 1 to 4 and Fig. 11. As a result, a key is restrained from being left inside the vehicle while the door in the locked state while being in the opened state is shifted to the closed state (i.e. a key-less locking function is performed).

[0070] [(f) When the door is locked under the opened state and then moved to the closed state while the door opening operation of the outside door handle is performed] The door is set to the locked state as shown in Figs. 6 and 7 by the locking operation of the lock knob under a condition where the door is in the opened state. Afterward, the door opening operation of the outside door handle is performed and the door in the opened state is brought into the closed state. Accordingly, the unlocking operation of the door by the closing operation of the door as in the aforementioned case (e) may be cancelled. At this time, a condition illustrated in Fig. 7 shifts to a condition illustrated in Fig. 12. In particular, when the door is moved from the opened state to the closed state, the rotary shaft 13 of the pole temporarily rotates integrally with the lift lever 12 by the predetermined angle in the clockwise direction shown in Fig. 7 and then returns to the initial state. At this time, the pressing leg portion 12c of the lift lever 12 swings away from the open link 23 (i.e., the pressing leg portion 12c of the lift lever 12 does not press against the open link 23). Accordingly, the open link 23 is maintained in the locked state and the active lever 25 is maintained in the locked position. Thereafter, the outside door handle is returned to an initial state to return the condition of the outside open lever 22, the open link 23, and the spring 24, and the like that are shown in Fig. 12 to the condition shown in Fig. 7. Thus, the locked state of the door is maintained and may be locked without the key.

[0071] [(g) When the setting operation of the double-locking member is performed under a condition where the door is in the locked state] For example, when the door is in the closed state and the double-locking door lock apparatus 100 is in the locked state as shown in Figs. 6 and 7, the setting operation of the double-locking member is performed. Then, the double lock lever 27 in the unset position shown in Fig. 6 is moved to the set position shown in Figs. 13 and 14 and the lower end portion 27c of the double lock lever 27 is moved toward the engagement arm portion 23f of the open link 23 so that the double lock lever 27 engages with the open link 23.

[0072] Accordingly, under a condition where the door is in the aforementioned double locked state, the double lock lever 27 operates together with the open link 23 that is in the locked position. For example, the lock knob is unwantedly operated and unlocked from an outer side of the vehicle by unauthorized means, for example, without the use of a key; therefore, the active lever 25 shifts from the locked position to the unlocked position. However,

the double lock lever 27 is maintained in the set position while engaging with the open link 23, thereby restraining the open link 23 from shifting from the locked state to the unlocked state. In addition, even when the inside open lever 21 linked with the active lever 25 that is in the locked position is unwantedly operated from the outer side of the vehicle by the unauthorized means so as to open the door, the double lock lever 27 restrains the open link 23 from shifting from the locked state to the unlocked state in the same way as when the lock knob is unwantedly operated and unlocked from the outer side of the vehicle by the unauthorized means.

[0073] As a result, the open link 23 is maintained in the locked state and the door in the locked state may be restrained from being unwantedly operated and unlocked from the outside of the vehicle by the unauthorized means. In addition, when the lock knob is unwantedly operated and unlocked from the outside of the vehicle under a condition where the door is in the double locked state, the active lever 25 shifts from the locked position to the unlocked position. Accordingly, a position switch arranged at the active lever 25 is operated to thereby detect that the door in the locked state is unwantedly operated and unlocked from the outer side of the vehicle (the position switch is generally arranged at the active lever 25 in order to detect whether the door is locked or unlocked).

[0074] According to the double-locking door lock apparatus 100 of the embodiment, the spring 24 arranged between the outside open lever 22 and the open link 23 biases the open link 23 relative to the outside open lever 22 so as to bring the open link 23 into the unlocked state. Further, the spring 24 supports the open link 23 to be movable relative to the lift lever 12 and to be allowed to return to the initial position. In addition, the pressing arm portion 25c of the active lever 25 is disengageable from the open link 23 so as to shift the open link 23 from the locked state to the unlocked state.

[0075] For example, the outside door handle and the locking/unlocking member are simultaneously operated under a condition where the door is in the locked state, therefore bringing the door into the panic state. At this time, the open link 23 is movably supported by the spring 24 relative to the lift lever 12 and is allowed to return to the initial position as shown in Fig. 10. Accordingly, even when the panic state occurs, the outside open lever 22 is returned to the initial position; thereby, the open link 23 returns to the initial position while shifting from the locked state to the unlocked state. As a result, the double-locking door lock apparatus 100 may smoothly shift the door from the locked state to the unlocked state.

[0076] Moreover, even when the double-locking door lock apparatus 100 according to the embodiment is brought into the panic state, the spring 24 arranged between the outside open lever 22 and the open link 23 as shown in Fig. 10 functions as described above. Accordingly, it is not necessary that an additional spring is arranged at the active lever 25; thereby, the active lever

25 may be formed by a single member. Consequently, the double-locking door lock apparatus 100 may be simply configured at low cost by the active lever 25, the spring 24, the open link 23, and the like.

[0077] In addition, according to the double-locking door lock apparatus 100 of the embodiment, the pressing leg portion 12c is arranged at the lift lever 12 and the passive body portion 23b is arranged at the open link 23. Accordingly, for example, the locking operation of the locking/unlocking member is performed to shift the active lever 25 from the unlocked position to the locked position in a condition where the door is in the opened state. Then, the door in the opened state is brought into the closed state without the operation of the outside door handle. At this time, the pressing leg portion 12c of the lift lever 12 presses the passive body portion 23b of the open link 23.

[0078] Consequently, the open link 23 is shifted from the locked state to the unlocked state and the active lever 25 is moved from the locked position to the unlocked position. As a result, the door in the locked state while being in the opened state is moved to the closed state to thereby automatically cancel the locked state of the door.

[0079] The plane surface on which the main portion of the lift lever 12 rotates is arranged in parallel to the surface on which the main portion of the open link 23 rotates. Further, the pressing leg portion 12c is arranged at the lift lever 12 and the passive body portion 23b is arranged at the open link 23. Accordingly, the automatic cancellation of the locked state of the door may be performed and may be simply provided to the double-locking door lock apparatus 100 at low cost without additional components.

[0080] Further, according to the double-locking door lock apparatus 100 of the embodiment, as shown in Fig. 2, the second pressing arm portion 21d is arranged at the inside open lever 21 and the passive portion 25b is arranged at the active lever 25. Accordingly, when the door opening operation of the inside door handle is performed under a condition where the door is in the closed state and the active lever 25 is in the locked position, the inside open lever 21 is operated in the door opening direction and the second pressing arm 21d of the inside open lever 21 presses the passive portion 25b of the open lever 25.

[0081] Accordingly, the active lever 25 is moved from the locked position to the unlocked position and the open link 23 is shifted from the locked state to the unlocked state by utilizing the door opening operation of the inside open lever 21. Consequently, the locked state of the door under the closed state may be automatically cancelled. That is, the one-motion function is obtained.

[0082] According to the double-locking door lock apparatus 100 of the embodiment, the second pressing arm portion 21d is arranged at the inside open lever 21 and the passive portion 25b is arranged at the active lever 25; thereby, the one-motion function is realized. Accordingly, the one-motion function is simply obtained at low

cost without additional components.

[0083] Furthermore, the double-locking door lock apparatus 100 of the embodiment may be applicable as a normal door lock apparatus for the vehicle by excluding the double lock lever 27 that links with the open link 23 and a component (for example, the second drive mechanism 50 and the like) switching the double lock lever 27 between the unset position and the set position. In addition, other components of the double-locking door lock apparatus 100 except for the component (for example, the second drive mechanism 50 and the like) switching the double lock lever 27 between the unset position and the set position are identical to simple components of the normal door lock apparatus that does not include extra components such as the double lock mechanism (for example, the double lock lever 27, the second drive mechanism 50, and the like).

[0084] Accordingly, the other components of the double-locking door lock apparatus 100 except for the component of the double lock mechanism (the double lock lever 27, the second drive mechanism 50, and the like) are simply used in are simply used in both the double-locking door lock apparatus 100 and the normal door lock apparatus. Consequently, both the double-locking door lock apparatus 100 and the normal door lock apparatus may be manufactured at low cost.

[0085] Moreover, according to the double-locking door lock apparatus 100 of the embodiment, the double lock lever 27 is movably attached to the housing 90 along the guide groove 91a formed at the main body 91 of the housing 90. When the double lock lever 27 is in the set position, the lower end portion 27c of the double lock lever 27 is moved toward the engagement arm portion 23f of the open link 23 so that the double lock lever 27 engages with the open link 23. Accordingly, the double lock lever 27 may be simply formed by a bar-shaped member. In addition, a space for the double lock lever 27 in the housing 90 may be minimized. As a result, the size of the double-locking door lock apparatus 100 may be reduced. Moreover, according to the double-locking door lock apparatus 100 of the embodiment, the guide groove 91a extends obliquely downward in the vertical direction of the vehicle in the main body 91 of the housing 90. When the double lock lever 27 is moved from the set position to the unset position, a distance in which the double lock lever 27 moves along the guide groove 91a may be shortened compared to a case where the guide groove 91a extends straight in the vertical direction in the main body 91 of the housing 90.

[0086] In addition, according to the embodiment, when the door is in the locked state while being in the closed state, the door opening operation of the inside door handle is performed. At this time, the first pressing arm portion 21c of the inside open lever 21 engages with the engagement arm portion 22d of the outside open lever 22 (the timing when the outside open lever 22 starts to be moved from the initial position to the rotated position by the door opening operation of the inside open lever

21) after the predetermined period of time following the time when the second pressing arm portion 21d of the inside open lever 21 engages with the passive portion 25b of the active lever 25 (the timing when the active lever 25 starts to be shifted from the locked position to the unlocked position by the door opening operation of the inside open lever 21). Accordingly, the so-called one-motion function (allowing the door in the locked state to shift to the opened state by the single door opening operation) is obtained. Alternatively, the outside open lever 22 may start to be moved from the initial position to the rotated position by the door opening operation of the inside open lever 21 after a predetermined period of time following the time when the active lever 25 is moved from the locked position to the unlocked position by the door opening operation of the inside open lever 21; thereby, a so-called double-pull function (cancelling the locked state of the door by a double-pull operation of the inside door handle) may be established.

[0087] The double-locking door lock apparatus 100 according to the embodiment is configured so that the automatic cancellation of the locked state of the door and the one-motion function may be obtained. Alternatively, the double-locking door lock apparatus 100 may be configured so that the automatic cancellation of the locked state of the door and the one-motion function may not be obtained. Further, according to the embodiment, the double-locking door lock apparatus 100 is applied to the front right door of the vehicle. Alternatively, the double-locking door lock apparatus 100 may be applied to a double-locking door lock apparatus for a front left door, a rear right door, or a rear left door for the vehicle and may be modified so as to be applied thereto according to need.

[0088] Moreover, a configuration (a restraining means for restraining the panic state) where the spring 24 is arranged between the outside open lever 22 and the open link 23 is applied to the double-locking door lock apparatus 100 according to the embodiment, thereby smoothly shifting the door in the locked state to the unlocked state even when the double-locking door lock apparatus 100 is brought into the panic state. Alternatively, a restraining means for restraining the panic state, which is disclosed in JP2006-233507A, may be utilized in the double-locking door lock apparatus 100 according to the embodiment in order to smoothly shift the door in the locked state to the unlocked state even when the panic state occurs in the double-locking door lock apparatus 100. The restraining means described in JP2006-233507A is configured so that an active lever is formed by a main lever, a sub lever, and a spring serving as a biasing member. The main lever is rotated by a locking/unlocking member. The sub lever is operationally linked with an open link provided rotationally relative to the main lever and corresponding to the open link 23 according to the embodiment. The spring biasing the sub lever to the main lever in a predetermined direction is arranged between the sub lever and the main lever.

A double-locking door lock apparatus (100) for a vehicle

includes a latch mechanism (10), an inside open lever (21), an outside open lever (22), an open link (23), a lock mechanism switching the open link (23) between unlocked and locked states, and a double lock mechanism switching a vehicle door between a double locked state and a double-lock cancelled state, the lock mechanism including an active lever (25) shifting the open link (23) between the unlocked and locked states, and the double lock mechanism including a double lock lever (27) shifted from an unset position to a set position by a setting operation of a double-locking member to restrain the open link (23) from shifting from the locked state to the unlocked state, the double lock lever (27) shifted from the set position to the unset position by an unsetting operation of the double-locking member to allow the open link (23) to shift from the locked state to the unlocked state.

Claims

1. A double-locking door lock apparatus (100) for a vehicle, comprising:

a latch mechanism (10) attached to a vehicle door together with a housing (90), including a lift lever (12), and retaining the vehicle door in a closed state relative to a vehicle body;

an inside open lever (21) rotatably attached to the housing (90) and rotating from an initial position to a rotated position in accordance with a door opening operation of an inside door handle arranged at an inner side of the vehicle door;

an outside open lever (22) rotationally attached to the housing (90) and rotating from an initial position to a rotated position in accordance with a door opening operation of an outside door handle arranged at an outer side of the vehicle door;

an open link (23) attached to a connection portion (22c) of the outside open lever (22) so as to tilt by a predetermined angle, the connection portion (22c) shifting in accordance with the rotation of the outside open lever, the open link (23) including a pressing portion (23a) engageable with an engagement portion (12b) of the lift lever (12), the open link (23) being moved toward the lift lever (12) when the inside open lever (21) rotates from the initial position to the rotated position or when the outside open lever (22) rotates from the initial position to the rotated position;

a lock mechanism switching the open link (23) between an unlocked state where the open link (23) is linkable with the lift lever (12) and a locked state where the open link (23) is unlinkable with the lift lever (12); and

a double lock mechanism switching a condition of the vehicle door between a double locked state where the locked state by the lock mech-

anism is noncancelable and a double-lock cancelled state where the double locked state is canceled,

the lock mechanism including an active lever (25) rotatably attached to the housing (90), the active lever (25) being shifted from an unlocked position to a locked position by a locking operation of a locking/unlocking member and shifting the open link (23) from the unlocked state to the locked state, the active lever (25) being shifted from the locked position to the unlocked position by an unlocking operation of the locking/unlocking member and shifting the open link (23) from the locked state to the unlocked state, and the double lock mechanism including a double lock lever (27) movably attached to the housing (90), the double lock lever (27) being shifted from an unset position to a set position by a setting operation of a double-locking member and moving toward the open link (23) so as to engage therewith to restrain the open link (23) from shifting from the locked state to the unlocked state, the double lock lever (27) being shifted from the set position to the unset position by an unsetting operation of the double-locking member and being separated from the open link (23) to allow the open link (23) to shift from the locked state to the unlocked state.

2. The double-locking door lock apparatus (100) according to Claim 1, wherein the double lock lever (27) is movably attached to the housing (90) along a guide (91a) formed in the housing (90), and one end portion (27c) of the double lock lever (27) is moved toward an engagement arm portion (23f), which is formed at the open link (23), so that the double lock lever (27) engages with the open link (23) when the double lock lever (27) is in the set position.
3. The double-locking door lock apparatus (100) according to Claim 1, wherein the double lock lever (27) is movably attached to the housing (90) along a guide (91a) formed in the housing (90), and a lower end portion (27c) of the double lock lever (27) is moved toward an engagement arm portion (23f), which is formed at the open link (23), so that the double lock lever (27) engages with the open link (23) when the double lock lever (27) is in the set position.
4. The double-locking door lock apparatus (100) according to Claim 3, wherein the guide (91a) is formed in the housing (90) so as to extend obliquely downward in a vertical direction of the vehicle.
5. The double-locking door lock apparatus (100) according to any one of Claims 1 to 4, further comprising:

ing:

a spring (24) arranged between the outside open lever (22) and the open link (23), the spring (24) biasing the open link (23) so as to bring the open link (23) into the unlocked state and retaining the open link (23) in a manner that the open link (23) is movable relative to the lift lever (12) so as to return to an initial position;
 an unlocked state retaining guide (92a) retaining the open link (23) in the unlocked state when the active lever (25) is in the unlocked position and the outside open lever (22) rotates between the initial position and the rotated position;
 a locked state retaining guide (25a) retaining the open link (23) in the locked state when the active lever (25) is in the locked position and the outside open lever (22) rotates between the initial position and the rotated position; and
 a pressing arm portion (25c) arranged at the active lever (25), the pressing arm portion (25c) engaging with the open link (23) in the unlocked state by the displacement of the active lever (25) from the unlocked position to the locked position and allowing the open link (23) to tilt, the pressing arm portion (25c) disengaging from the open link (23) in the locked state so as to shift the open link (23) to the unlocked state.

6. The double-locking door lock apparatus (100) according to Claim 5, wherein a plane surface on which a main portion of the lift lever (12) rotates is arranged in parallel to a plane surface on which a main portion of the open link (23) tilts, and a pressing leg portion (12c) is arranged at the lift lever (12) and a passive portion (23b) is arranged at the open link (23), and wherein the pressing leg portion (12c) of the lift lever (12) is arranged so as to press the passive portion (23b) of the open link (23) when the vehicle door in an opened state is operated to a closed state under a condition where the active lever (25) is in the locked position and the outside open lever (22) is in the initial position.
7. The double-locking door lock apparatus (100) according to Claim 5 or 6, wherein a pressing arm portion (21d) is arranged at the inside open lever (21) and a passive portion (25b) is arranged at the active lever (25), and wherein the pressing arm portion (21d) of the inside open lever (21) is arranged so as to press the passive portion (25b) of the active lever (25) when the vehicle door in the closed state is operated to the opened state under a condition where the active lever (25) is in the locked position and the inside open lever (21) is in the initial position.

FIG. 1

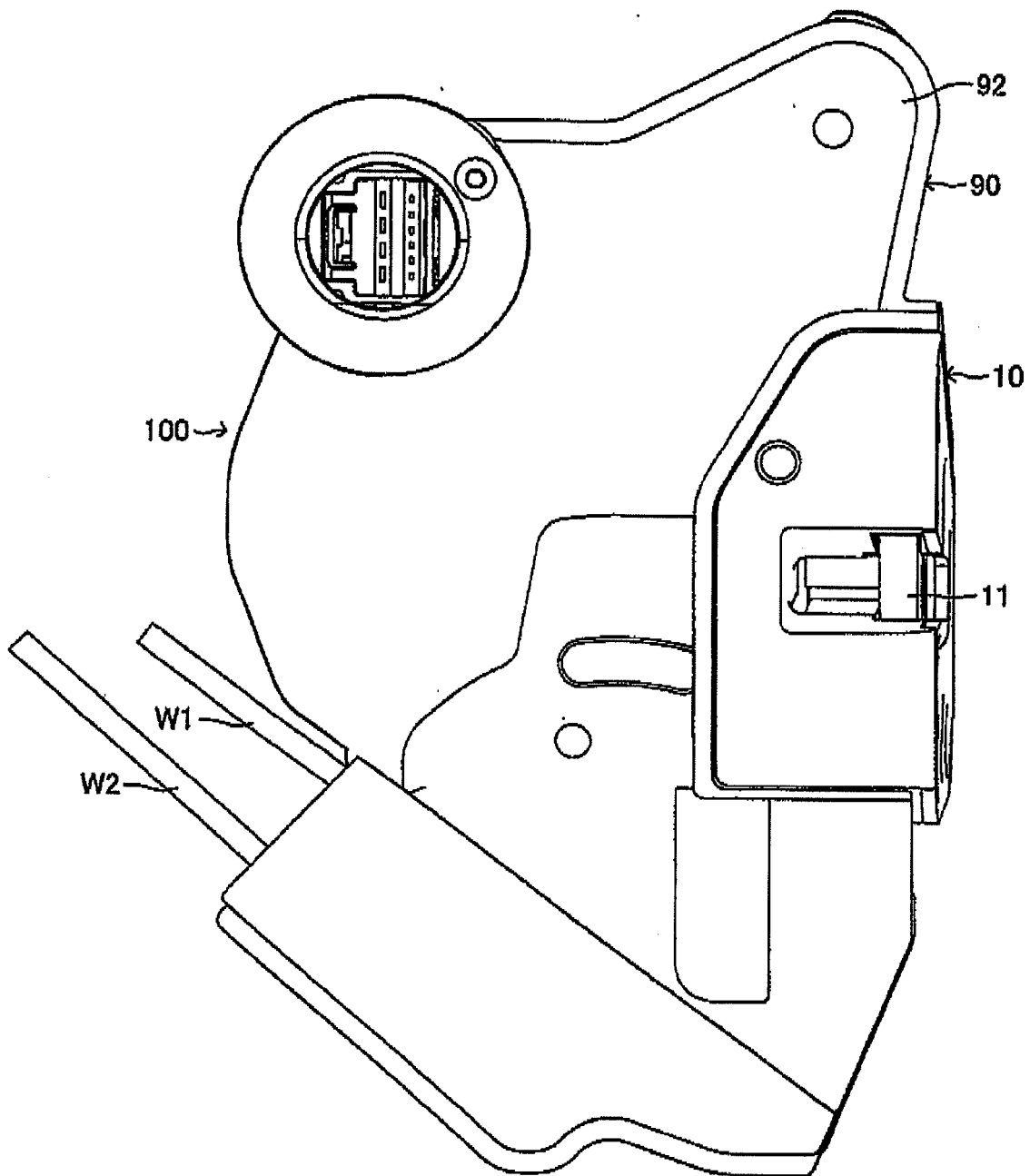


FIG. 2

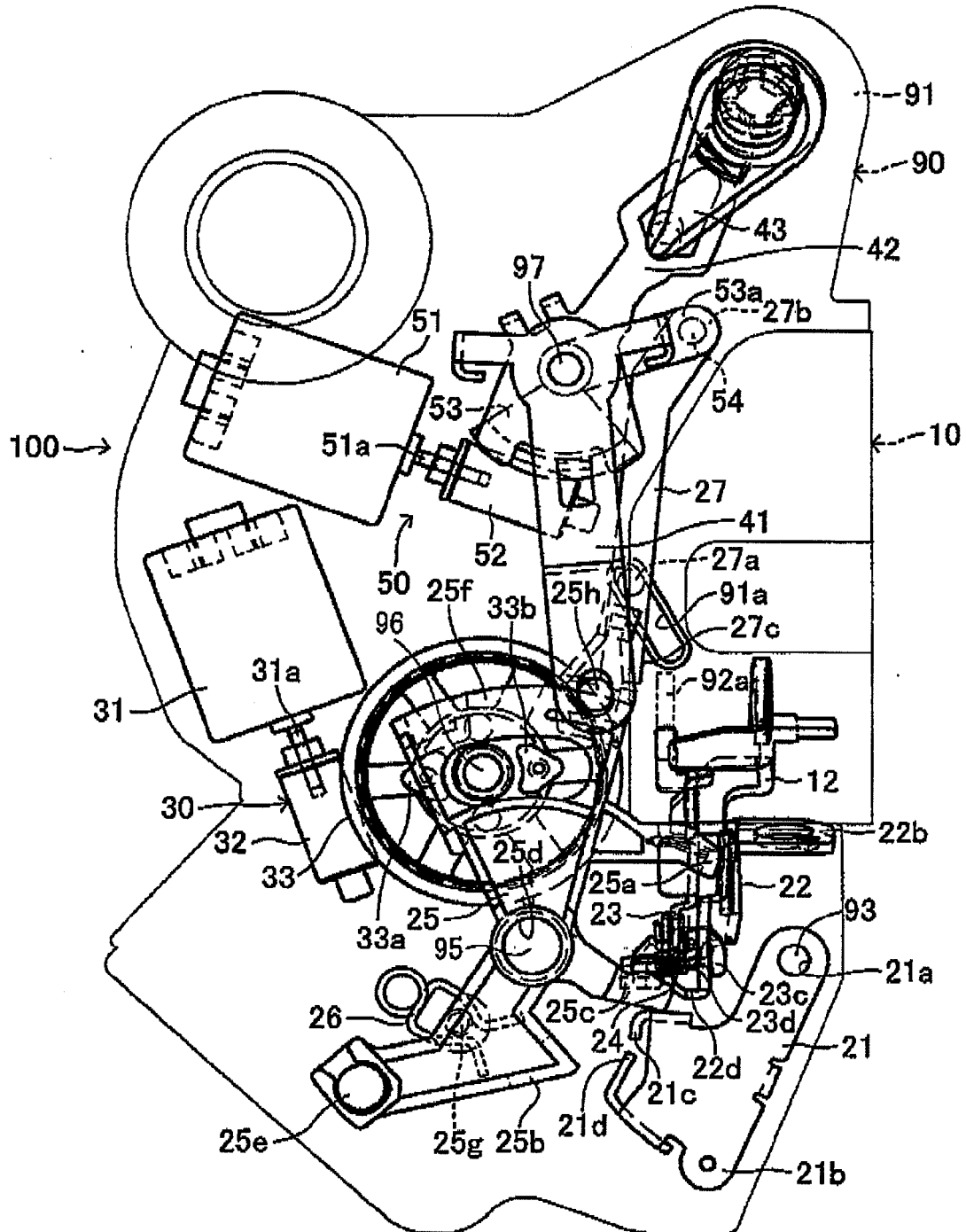


FIG. 3

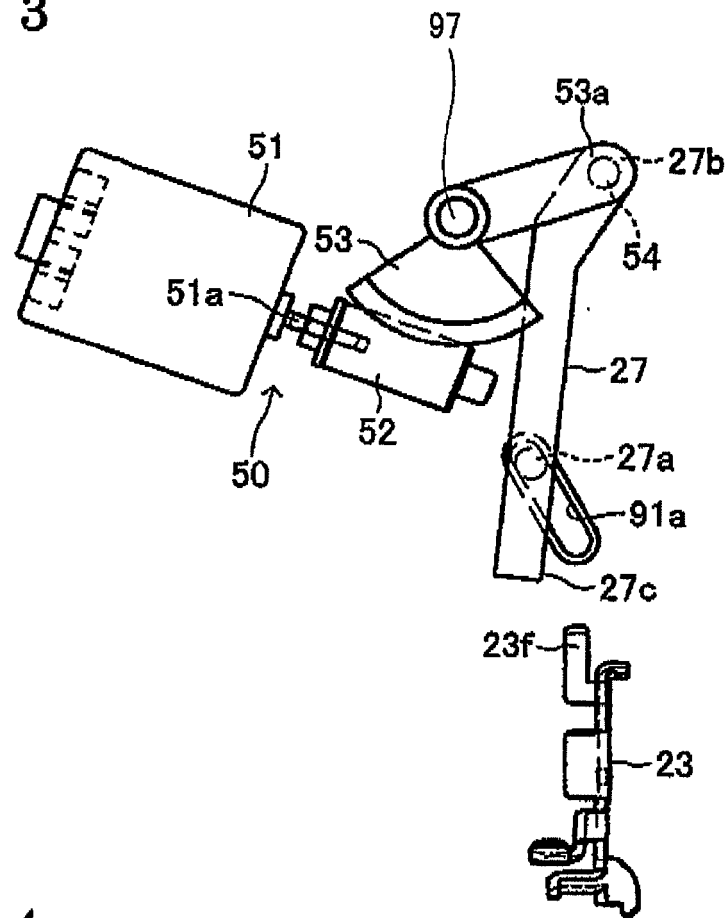


FIG. 4

Interior side ← → Exterior side

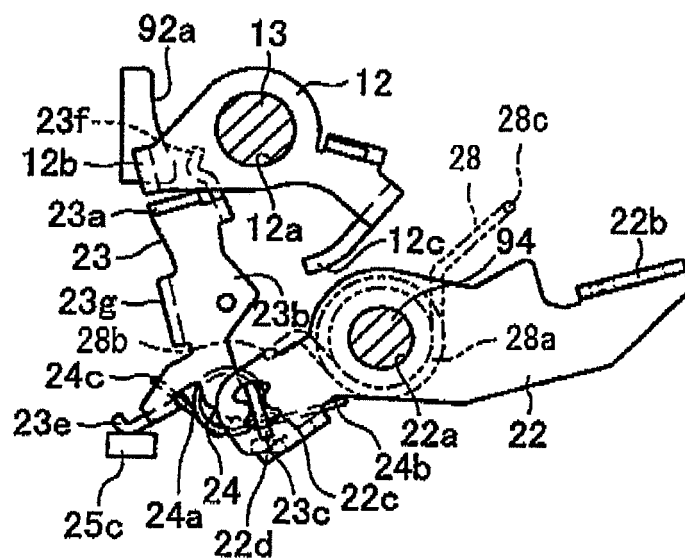


FIG. 5

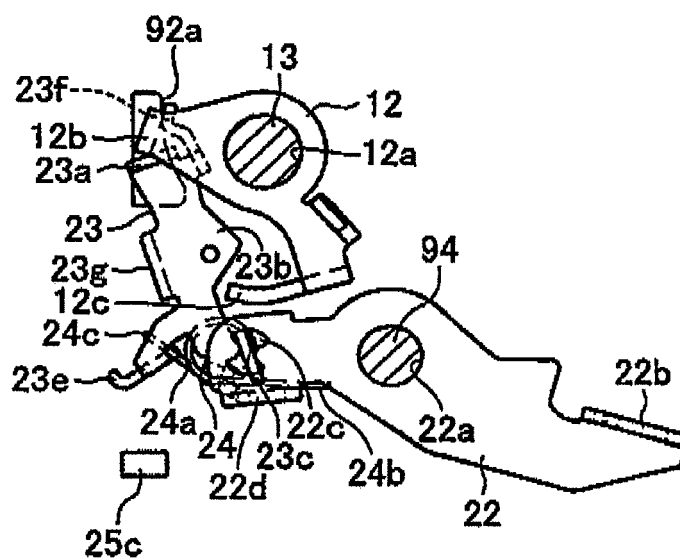


FIG. 6

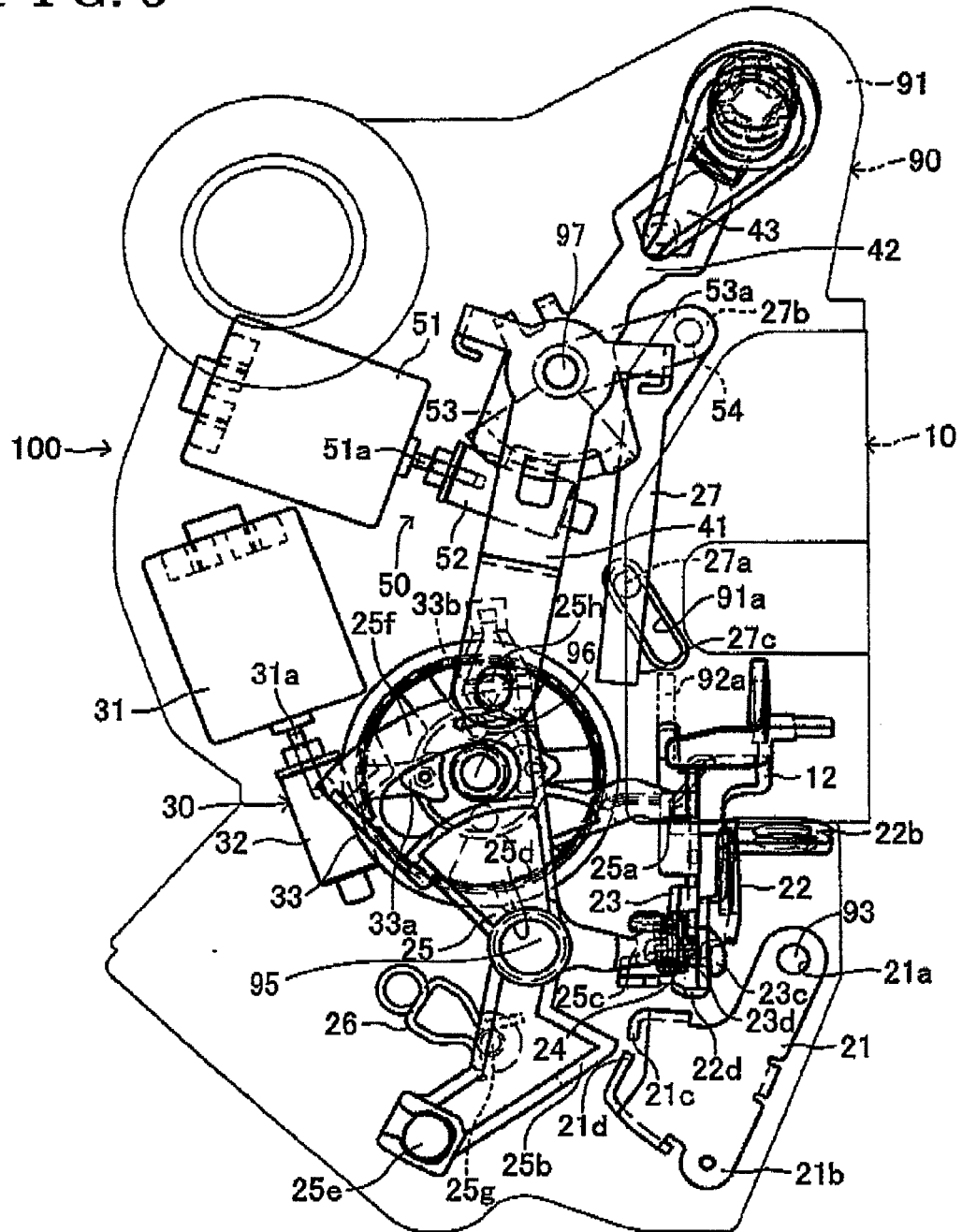


FIG. 9

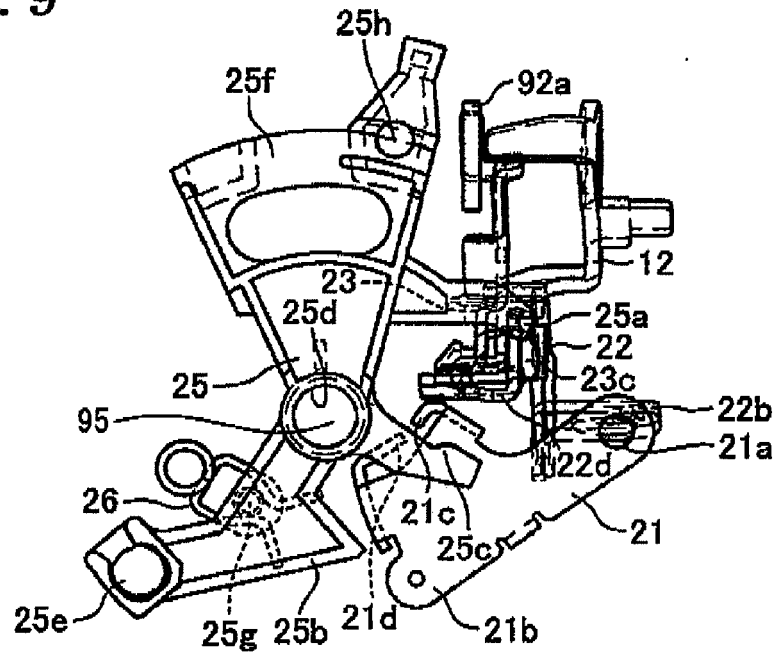


FIG. 10

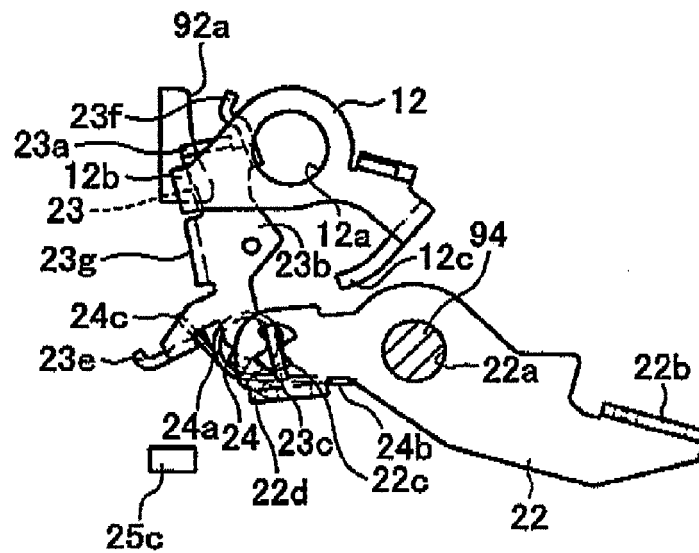


FIG. 11

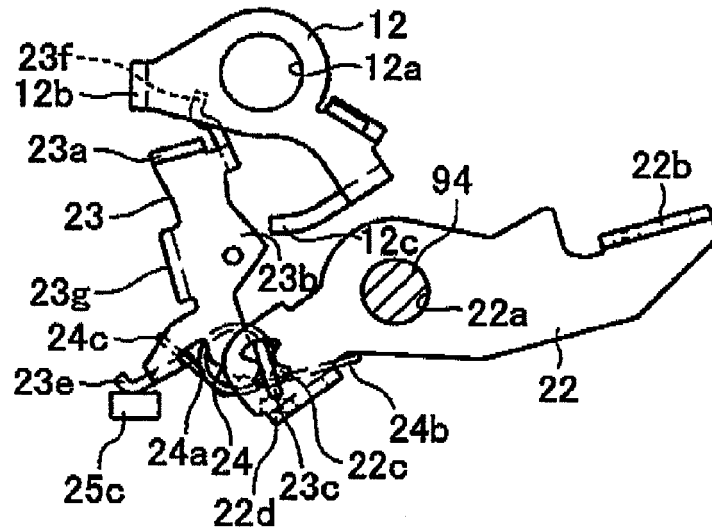


FIG. 12

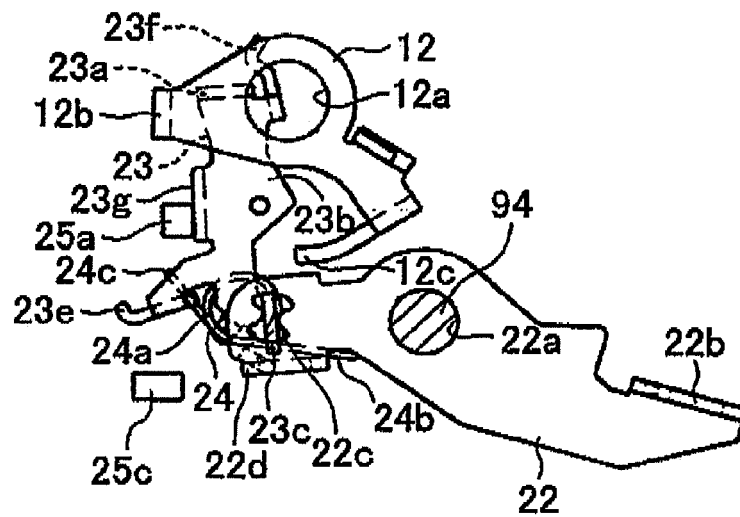


FIG. 13

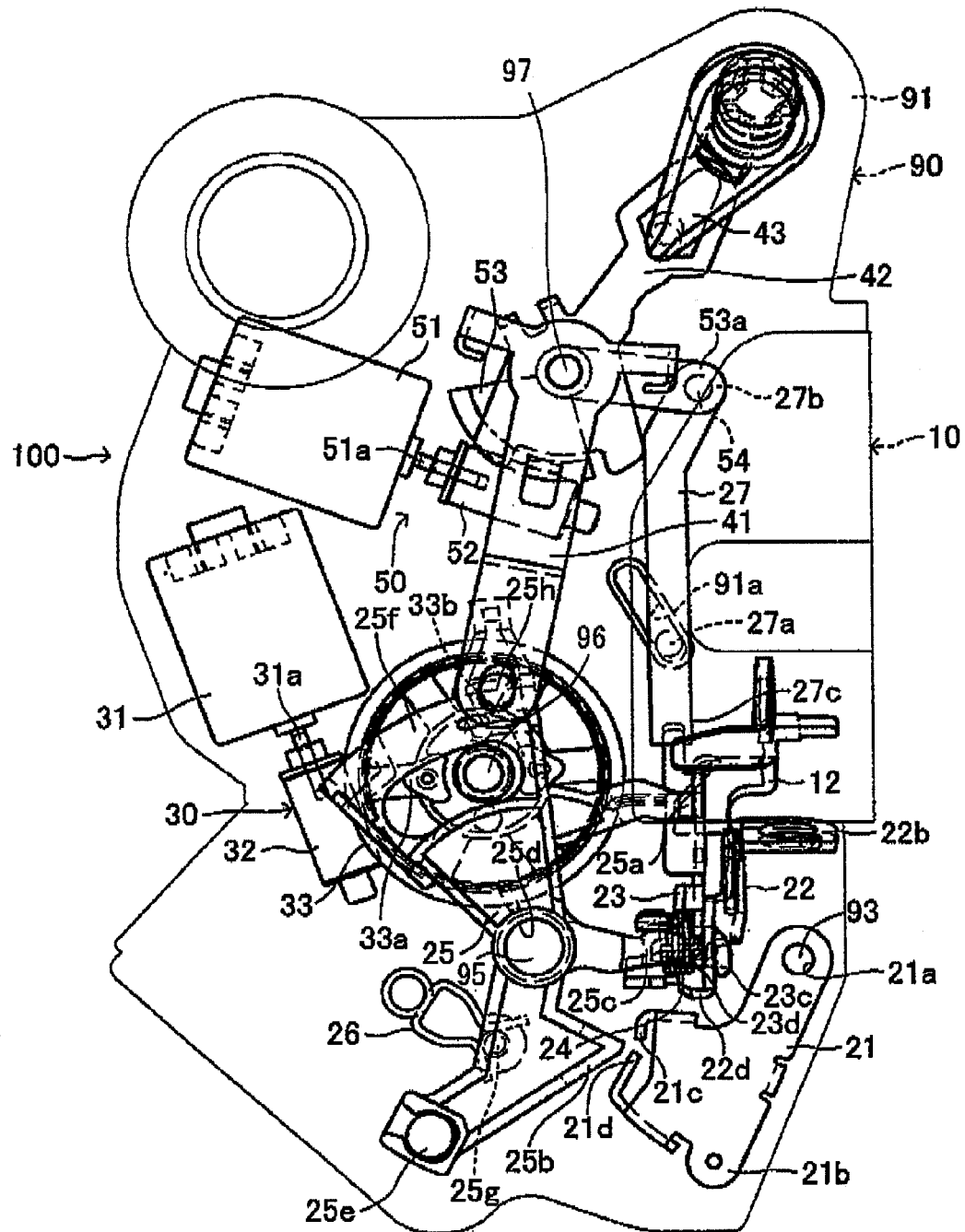


FIG. 14

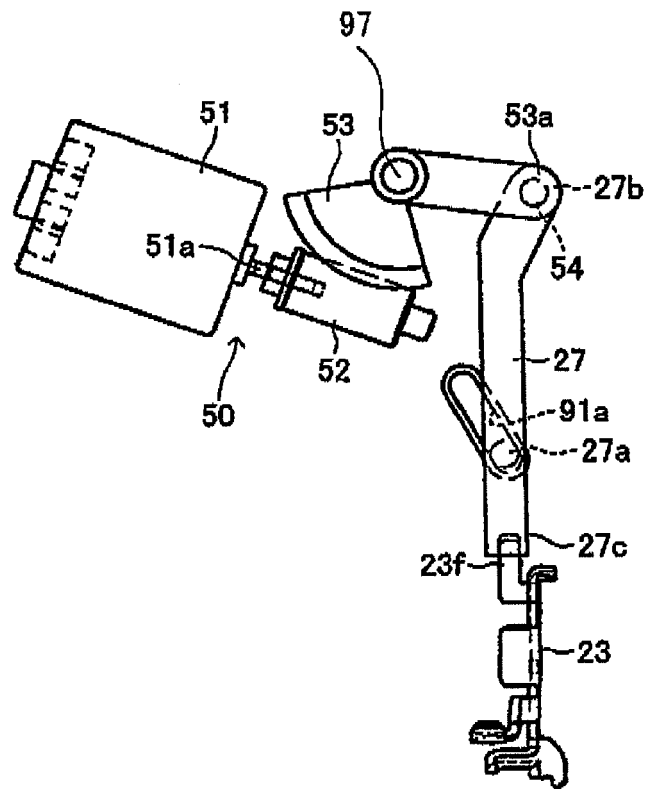
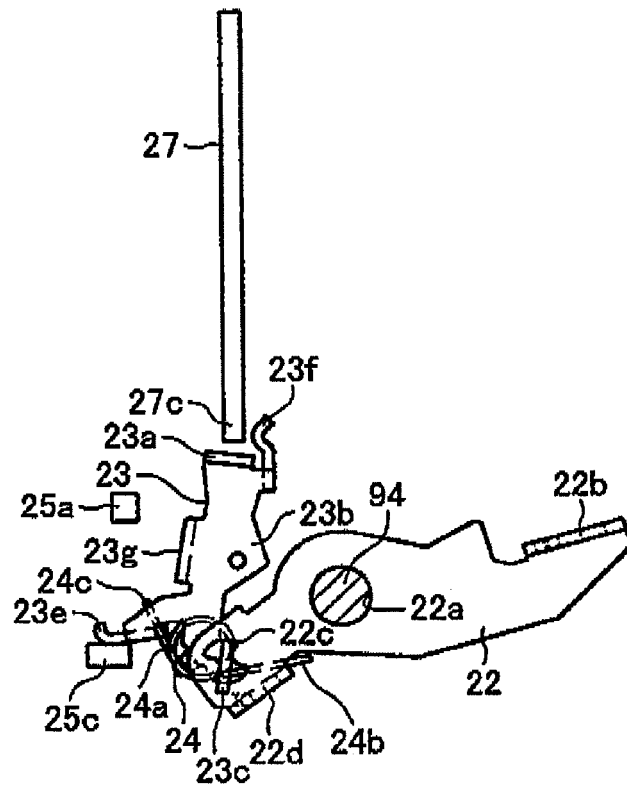


FIG. 15



REFERENCES CITED IN THE DESCRIPTION

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