(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 884 610 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
06.02.2008 Bulletin 2008/06

(51) Int Cl.:
E05B 65/20 *(2006.01)*

(21) Application number: **07252625.4**

(22) Date of filing: **28.06.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(30) Priority: **28.06.2006 JP 2006177782**

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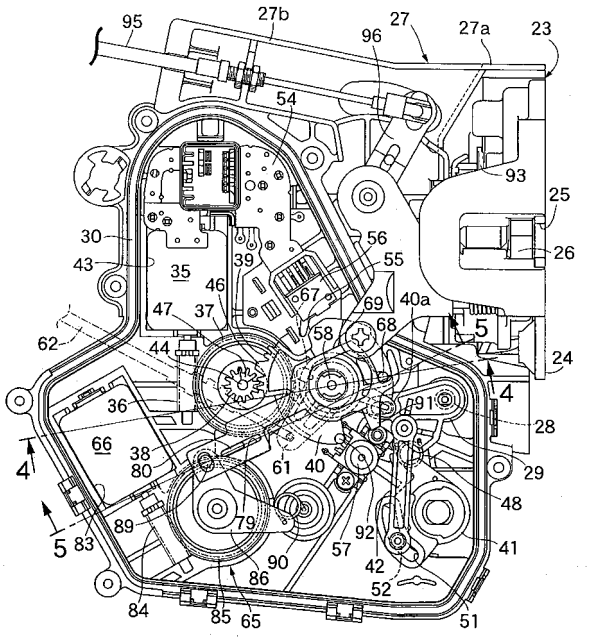
(54) Door opening and closing device for vehicle

(57) A door opening and closing device for a vehicle, includes a superlocking mechanism capable of switching over connection and disconnection between a knob lever and a locking lever. In this device, the knob lever (61) is relatively non-turnably connected to a turning shaft (58) which relatively turnably supports a driving member (40). The driving member (40) is turned by a door-locking motor (35) to drive the locking lever (29) to turn. The superlocking mechanism (65) includes a joint lever (67) which is capable of sliding and which is relatively non-turnably connected to the turning shaft (58) which is capable of sliding, a connection shaft (68) which is provided on the joint lever (67) so as to be switched over between a connected state and a disconnected state in response to the sliding of the joint lever (67), and a superlocking link (69) which is operated to slide so as to switch over the connected state and the disconnected state between the connection shaft (68) and the driving member (40). Thus, assembling and manufacture of the device are facilitated without particularly improving dimensional accuracy of parts of the superlocking mechanism (65).

FIG.3



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Description

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

[0001] The present invention relates to a door opening and closing device for a vehicle. Particularly, the present invention relates to a door opening and closing device for a vehicle, comprising a superlocking mechanism capable of switching over connection and disconnection between a knob lever which is turned in response to operation of a locking knob disposed on a door on a side facing a vehicle compartment and a locking lever which switches over a locking state and unlocking state.

DESCRIPTION OF THE RELATED ART

[0002] Such a door opening and closing device for a vehicle is already known from Japanese Patent Application Laid-open No. 2004-251052. This device includes an actuator housing, a driving member turnably driven by a door-locking motor, and a guide lever connected to a knob lever which turns in response to operation of a locking operation knob, the driving member and the guide lever being supported in the actuator housing so that they relatively turn on the same axis. This device further includes : a link whose one end is turnably connected to a superlocking lever which turns about an axis parallel to the turning axis of the driving member and the guide lever upon operation of a superlocking motor; and an engagement pin which is provided at the other end of the link so as to pass through a guide bore provided in the guide lever and which can be switched over between connection and disconnection to the driving member. The position of the engagement pin in the guide bore is displaced by the turning of the superlocking lever, thereby switching over the connection and disconnection between the guide lever and the driving member.

[0003] However, in the conventionally known device, improved dimensional accuracy and mounting accuracy are required for each part in order to prevent looseness from being generated in an end portion of a link connected to a superlocking lever and a portion of a guide bore through which an engagement pin is passed. Further, because the link is moved within the guide bore in the guide lever while being supported in a cantilevered manner by the superlocking lever, consideration and strength of the link are required for smooth movement of the link.

SUMMARY OF THE INVENTION

[0004] Accordingly, it is an object of the present invention to provide a door opening and closing device for a vehicle, including a simply structured superlocking mechanism, wherein assembling and manufacture of the device are facilitated without particularly improving dimensional accuracy of parts of the superlocking mechanism.

[0005] In order to achieve the above object, according to a first feature of the present invention, there is provided a door opening and closing device for a vehicle, comprising: a door-locking device; an actuator housing; a knob lever; and a superlocking mechanism. The door-locking device includes: a locking lever which is turnable between a locking position and an unlocking position so as to switch over a locking state and unlocking state; and a casing which is attached to a door. The actuator housing is connected to the casing and houses a door-locking motor and a driving member, the driving member turning in response to operation of a door-locking motor to drive the locking lever to turn. The knob lever is turnably supported on the actuator housing so as to turn in response to operation of a locking knob disposed on the door on a side facing a vehicle compartment. The superlocking mechanism is housed in the actuator housing, and switches over connection and disconnection between the knob lever and the locking lever in response to operation of a superlocking motor. The knob lever is relatively non-turnably connected to a turning shaft which is turnably supported in the actuator housing so as to relatively turnably support the driving member. The superlocking mechanism further includes: a joint lever which is relatively non-turnably connected to the turning shaft and which is capable of sliding in a direction perpendicular to an axis of the turning shaft, a connection shaft which is provided on the joint lever so as to be switched over between a connected state and a disconnected state in response to the sliding of the joint lever, and a superlocking link. In the connected state, the connection shaft is connected to the driving member so as to relatively non-turnably connect the joint lever and the driving member to each other. In the disconnected state, the connection shaft is disconnected from the driving member so as to enable relative turning of the joint lever and the driving member. The superlocking link is capable of engaging the connection shaft, and is operated to slide on a plane parallel to a direction of sliding of the joint lever so as to switch over the connected state and the disconnected state of the connection shaft. The superlocking link is operated to slide to switch over the connected state and the disconnected state of the connection shaft in response to the operation of the superlocking motor in a state in which the locking lever is in the locking position. The superlocking link is operated to slide in a direction to bring the connection shaft into the connected state in response to the turning of the driving member for driving the locking lever to turn toward the unlocking position, when the locking lever is in the locking position and the connection shaft is in the disconnected state.

[0006] According to a second feature of the present invention, in addition to the first feature, a guide portion may be provided in the actuator housing in order to guide the sliding of the superlocking link.

[0007] According to a third feature of the present invention, in addition to the first or second feature, a sliding contact plate made of a metal may be fixed to the actuator

housing so as to come into sliding contact with the joint lever; and a passage may be formed between the sliding contact plate and the actuator housing so that electric wires pass through the passage.

[0008] With the first feature of the present invention, when the superlocking motor is operated in a state in which the locking lever is in the locking position to drive the superlocking link to slide, the connection shaft is displaced to a position of the disconnected state in which the driving member and the joint lever are disconnected from each other. Thus, even if the locking knob is operated for unlocking to turn the knob lever and the joint lever together, the turning force is not transmitted to the driving member, and the locking position of the locking lever is maintained. Further, the knob lever is relatively non-turnably connected to the turning shaft which relatively turnably supports the driving member; the joint lever is relatively non-turnably connected to the turning shaft while being capable of sliding in the direction perpendicular to the axis of the turning shaft; and the superlocking link is operated to slide in the direction parallel to the direction of sliding of the joint lever to engage the connection shaft. That is, because the main functions of the superlocking mechanism are concentrated on a region about the axis of the turning shaft, the number of link connected portions is reduced, the superlocking mechanism can be constructed by a simple structure without needing a particularly improved dimensional accuracy of parts or a particularly improved inter-axis dimensional accuracy, and the assembling and manufacture of the device are facilitated.

[0009] With the second feature of the present invention, the sliding of the superlocking link can be guided and smoothened.

[0010] With the third feature of the present invention, the turning and sliding of the joint lever can be smoothened by the sliding contact with the sliding contact plate, and the sliding contact plate can be used for guiding the distribution of the electric wires.

[0011] A preferred embodiment of the invention will now be described by way of example and with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Fig.1 is a front view of a door taken from the side of a vehicle compartment.

[0013] Fig.2 is a perspective view of a connected state between a door-locking device and a cylinder lock.

[0014] Fig.3 is a view of a door-locking device in a locking state with a lid plate omitted, taken in a direction of an arrow 3 in Fig.2.

[0015] Fig.4 is an enlarged sectional view taken along a line 4-4 in Fig.3.

[0016] Fig. 5 is an enlarged sectional view taken along a line 5-5 in Fig.3.

[0017] Fig.6 is an enlarged sectional view taken along a line 6-6 in Fig.4.

[0018] Fig.7 is an enlarged sectional view taken along a line 7-7 in Fig. 4.

[0019] Fig.8 is an enlarged view of essential portions of Fig.3 showing a locking state during superlocking-off;

[0020] Fig.9 is a view similar to Fig.8, but showing an unlocking state during superlocking-off.

[0021] Fig. 10 is a view similar to Fig.8, but showing the locking state during superlocking-on.

[0022] Fig. 11 is a view similar to Fig.8, but showing a locking knob operated for unlocking during superlocking-on.

[0023] Fig.12 is a view similar to Fig.8, but showing a cylinder lock operated for unlocking during superlocking-on.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0024] Referring first to Fig.1, a right-side door D includes a door-locking device 15, a cylinder lock 16, a locking knob 17, an outside handle 18, and an inside handle 19. The door-locking device 15 is capable of switching over locked state and an unlocked state of the door D. The cylinder lock 16 is adapted to switch over the locking state and the unlocking state of the door-locking device 15 by locking and unlocking operations from outside the vehicle. The locking knob 17 is adapted to switch over the locking state and the unlocking state of the door-locking device 15 by operations on the side of a vehicle compartment. The outside handle 18 is adapted to perform a door-opening operation outside the vehicle when the door-locking device 15 is in the unlocking state. The inside handle 19 is adapted to perform a door-opening operation on the side of the vehicle compartment when the door-locking device 15 is in the unlocking state.

[0025] Referring also to Fig. 2, an external handle case 20 is attached to an outer surface of the door D. The outside handle 18 is vertically turnably attached to the external handle case 20. The cylinder lock 16 is attached to the door D such that its one end faces an outer surface of the external handle case 20. An internal handle case 21 is attached to an inner surface of the door D. The inside handle 19 is leftward/rightward turnably mounted in the internal handle case 21. The locking knob 17 is also leftward/rightward turnably mounted in the internal handle case 21.

[0026] Referring also to Fig.3, a casing 23 for the door-locking device 15 is constructed by coupling a plurality of members made of metal and synthetic resin, and is attached to the door D. The casing 23 has a reception recess 25 into which a striker (not shown) provided on a vehicle body can proceed. A latch 26 is turnably supported on the casing 23 such that the latch 26 is turned upon engagement with the striker which has entered the reception recess 25 when the door D is closed. Thus, the door D is locked in the closed state by inhibiting the turning of the latch 26, and the locked state of the door D is cancelled by permitting the turning of the latch 26 to bring

the door D into the unlocked state where the door D can be opened.

[0027] The casing 23 includes a metal plate 24 facing the vehicle body, and a synthetic resin cover 27 covering the metal plate 24. The cover 27 is formed into a substantially L-shape, integrally including a box-shaped cover main portion 27a with a face on the side of the metal plate 24 being opened, and a support wall 27b rising from the cover main portion 27a.

[0028] A locking lever shaft 28 is turnably supported on the support wall 27b, and has an axis parallel to a direction of extension of the reception recess 25 in the casing 23. A locking lever 29 is fixed to the locking lever shaft 28. Thus, the locking state and the unlocking state of the door-locking device 15 are switched over by turning of the locking lever 29, i.e., the locking lever shaft 28 between a locking position and an unlocking position.

[0029] Referring also to Figs.4 and 5, an endless seal groove 30 is provided in the support wall 27b of the cover 27 on a striker entering side of the reception recess 25, and a synthetic resin lid plate 32 is fastened to the support wall 27b such that an endless gasket 31 mounted in the seal groove 30 is sandwiched between the lid plate 32 and the support wall 27b. Thus, an actuator housing 33 connected to the casing 23 is constituted by the support wall 27b and the lid plate 32.

[0030] The actuator housing 33 houses a door-locking motor 35, a worm 36, a worm wheel 37, a pinion 38, a driving member 40, the locking lever 29, a key-operation input lever 41, and a connection link 42. The door-locking motor 35 has a rotational axis parallel to a plane perpendicular to the axis of the locking lever shaft 28. The worm 36 is coaxially connected to an output shaft of the door-locking motor 35. A worm wheel 37 is meshed with the worm 36 and has an axis parallel to the locking lever shaft 28. The pinion 38 is coaxially connected to the worm wheel 37 so as to be turnable in a limited range relative to the worm wheel 37. The driving member 40 is turnable about an axis in parallel with the locking lever shaft 28, and integrally has a sector gear 39 meshed with the pinion 38. The locking lever 29 is fixed to one end of the locking lever shaft 28, and connected at one end to the driving member 40. The key-operation input lever 41 has an axis parallel to the locking lever shaft 28. The connection link 42 is mounted between the other end of the locking lever 29 and the key-operation input lever 41.

[0031] The door-locking motor 35 is rotatable in normal and reverse directions, and clamped between the support wall 27b and the lid plate 32 such that a portion thereof is received in a recess 43 provided in the support wall 27b of the cover 27. The worm wheel 37 and the pinion 38 are turnably supported on a support shaft 44 which is supported between the support wall 27b and the lid plate 32. Moreover, a spring 45 (see Fig.4) is mounted between the worm wheel 37 and the support wall 27b, and serves to return the worm wheel 37 into a position where the worm wheel 37 has situated prior to its turning in the normal or reverse direction, when the operation of the door-locking motor 35 is stopped.

[0032] In order to fix the relative positions of the sector gear 39 and the pinion 38 when assembling these parts, a positioning projection 46 is provided on the sector gear 39 to protrude toward the pinion 38, and a positioning recess 47 is provided in the pinion 38 so that the positioning projection 46 can be fitted into the positioning recess 47.

[0033] An arm portion 40a is integrally provided on the driving member 40 so as to extend toward one end of the locking lever 29. The tip end of the arm portion 40a is turnably connected to the locking lever 29 at a position offset from the locking lever shaft 28. The connection link 42 is also turnably connected at one end to the locking lever 29 at a position offset from the locking lever shaft 28 and a portion of the arm portion 40a connected to the locking lever 29. A click spring 48 is mounted between the locking lever 29 and the support wall 27b of the actuator housing 33 so as to moderately turn the locking lever 29 between a locking position shown in Fig.3 and an unlocking position in which the locking lever 29 is turned in a clockwise direction in Fig.3 from the locking position.

[0034] The key-operation input lever 41 is turnably supported on the support wall 27b of the actuator housing 33. An elongated bore 51 arcuate about a turning axis of the key-operation input lever 41 is provided in the key-operation input lever 41. An engagement pin 52 is embedded in the other end of the connection link 42, and is inserted through the elongated bore 51. Operational forces provided by the locking and unlocking operations of the cylinder lock 16 are transmitted to the key-operation input lever 41 by the twisting motion of a turning-transmitting member 53 (see Figs. 1 and 2), for example, comprising an outer cable and an inner cable inserted through the outer cable.

[0035] Thus, when the cylinder lock 16 is key-operated to an unlocking direction, the key-operation input lever 41 is turned in a clockwise direction in Fig.3 to engage the engagement pin 52 on the side of one end of the elongated bore 51, thereby turning the locking lever 29 in the clockwise direction in Fig. 3 through the connection link 42. Then, the turning-transmitting member 53 is turned in a twist-releasing direction in response to the releasing of the operating force toward the unlocking position in the cylinder lock 16, whereby the key-operation input lever 41 is also returned to a neutral position as shown in Fig.3. In this process, the key-operation input lever 41 does not exert a force to the connection link 42 on the other side of the elongated bore 51, and the locking lever shaft 28 and the locking lever 29 remain in the unlocking position. In addition, the driving member 40, i.e., the sector gear 39 and the pinion 38 are also turned in response to the turning of the locking lever 29, but at this time, the pinion 38 is turned without exerting a turning force to the worm wheel 37.

[0036] When the cylinder lock 16 is then key-operated toward the locking position, the key-operation input lever

41 is turned in a counterclockwise direction from the neutral position in Fig.3 to engage the engagement pin 52 on the side of the other end of the elongated bore 51, thereby causing the locking lever 29 to turn in the counterclockwise direction in Fig.3 through the connectionlink42. Also in this process, the turning-transmitting member 53 is turned to a twist-releasing direction in response to the releasing of the operating force toward the locking position in the cylinder lock 16, whereby the key-operation input lever 41 is also returned to the neutral position shown in Fig.3, and the locking lever shaft 28 remains in the locking position.

[0037] In switching over the locking state and the unlocking state of the door-locking device 15 by the operation of the door-locking motor 35, a power from the door-locking motor 35 is transmitted through the worm 36, the worm wheel 37, the pinion 38 and the sector gear 39 of the driving member 40 to the locking lever 29, whereby the locking lever 29 is turned between the unlocking position and the locking position. In this process, the engagement pin 52 at the other end of the connection link 42 is only moved within the elongated bore 51 in the key-operation input lever 41, and the power cannot be transmitted from the locking lever 29 through the connection link 42 to the key-operation input lever 41.

[0038] A synthetic resin base plate 54 having a bus bar (not shown) embedded therein is attached to the support wall 27b above the driving member 40. A first switch 56 is attached to the base plate 54 so that the first switch 56 engages an abutment corner 55 provided at an upper portion of the driving member 40 to change the switching mode. That is, the first switch 56 changes the switching mode between a state in which the driving member 40 brings the locking lever 29 into the locking position shown in Fig.3, and a state in which the driving member 40 turned in the counterclockwise direction from the position shown in Fig.3 to bring the locking lever 29 into the unlocking position.

[0039] A second switch 57 is attached to the support wall 27b between the key-operation input lever 41 and the driving member 40, in order to detect that the key-operation input lever 41 has been turned to the locking position or the unlocking position, i.e., the locking or unlocking operation has been performed by the cylinder lock 16.

[0040] The driving member 40 is relatively turnably supported by a turning shaft 58 which is turnably supported by the actuator housing 33. The turning shaft 58 is turnably supported at one end by a support projection 59 which is integrally projectingly provided on the support wall 27b of the actuator housing 33 and which is coaxially fitted into the turning shaft 58. The other end of the turning shaft 58 protrudes from the lid plate 32 of the actuator housing 33, while being fitted into and turnably supported in a support tube 60 mounted on the lid plate 32 of the actuator housing 33.

[0041] A knob lever 61 having a turning axis coaxial with the turning shaft 58, i.e., the driving member 40 is disposed outward of the lid plate 32. The knob lever 61 is relatively non-turnably fitted and connected to the other end of the turning shaft 58. An operational force provided by the operation of the locking knob 17 performed on the side of the vehicle compartment in order to switch over the locking and unlocking states of the door-locking device 15 is input to the knob lever 61 through a push/pull cable 62. When the locking knob 17 is operated in an unlocking direction, the knob lever 61 is turned in the counterclockwise direction in Fig.3. When the locking knob 17 is operated in the locking direction, the knob lever 61 is turned in the opposite direction into a position shown in Fig.3.

[0042] The connection and disconnection between the knob lever 61 and the locking lever 2 9 are switched over by a superlocking mechanism 65 housed in the actuator housing 33. The superlocking mechanism 65 includes a superlocking motor 66, a joint lever 67, a connection shaft 68, and a superlocking link 69. The joint lever 67 is relatively non-turnably connected to the turning shaft 58, while being capable of sliding in a direction perpendicular to the axis of the turning shaft 58. The connection shaft 68 is provided on the joint lever 67 so as to be switched over the connected state where the connection shaft 68 is connected to the driving member 40 and the disconnected state where the connection shaft 68 is disconnected from the driving member 40, in response to the sliding of the joint lever 67. The superlocking link 69 is engagable with the connection shaft 68, and switches over the connected and disconnected states of the connection shaft 68 by its sliding along a plane parallel to the sliding direction of the joint lever 67.

[0043] Referring to Fig. 6, a guide support portion 70 is integrally provided at one end of the turning shaft 58. The guide support portion 70 is formed into an oval shape extending in a direction along a diameter line of the turning shaft 58, and has a pair of guide walls 70a, 70a parallel to each other on opposite sides. The joint lever 67 is turnably supported on the guide support portion 70, and disposed between the support wall 27b of the actuator housing 33 and the driving member 40 such that its sliding is guided by the guide support portion 70.

[0044] The joint lever 67 extends over a long distance along a first straight line L1 established on the above-described diameter line of the turning shaft 58. A support bore 71 is provided in the joint lever 67 so that the guide support portion 70 is inserted through the support bore 71. The support bore 71 is formed into an oval shape longer in a direction along the first straight line L1, and has a pair of sidewalls 71a, 71a on opposite sides such that they are closely opposed to the guide walls 70a of the guide support portion 70. Thus, the joint lever 67 is slid such that it is moved relative to the turning shaft 58 and the driving member 40 in the direction along the first straight line L1 within a range where its opposite ends in the longitudinal direction abut on the guide support portion 70. When the turning shaft 58 is turned, the joint lever 67 is turned along with the turning shaft 58.

[0045] Referring also to Fig. 7, the connection shaft 68 is integrally provided on a surface of the joint lever 67 on the side of the driving member 40 such that it is positioned on the first straight line L1. The driving member 40 is provided with a connecting bore 72 through which the connection shaft 68 is inserted. The connecting bore 72 has a substantially L-shape, comprising a radial bore portion 72a extending radially of the driving member 40, and a circumferential bore portion 72b connected to an inner end of the radial bore portion 72a and extending circumferentially of the driving member 40. In a state in which the connection shaft 68 is positioned at an outer end of the radial bore portion 72a of the connecting bore 72, the connection shaft 68 is in a connected state in which it is connected to the driving member 40 so as to prevent relative turning between the joint lever 67, the knob lever 61 and the driving member 40. In a state in which the connection shaft 68 is positioned at the inner end of the radial bore portion 72a of the connecting bore 72, the driving member 40 and the joint lever 67 are relatively turnable so as to displace the connection shaft 68 within the circumferential bore portion 72b, whereby the connection shaft 68 is brought into a disconnected state in which it is disconnected from the driving member 40 to enable the relative turning of the joint lever 67 and the driving member 40.

[0046] A sliding contact plate 73 made of a metal is fitted and fixed to an inner surface of the support wall 27b of the actuator housing 33, and comes into sliding contact with the joint lever 67. A passage 74 is formed between the sliding contact plate 73 and the support wall 27b, and for example, three electric wires 75 connected to the second switch 57 and extended toward the base plate 54 are disposed to pass through the passage 74.

[0047] The superlocking link 69 is disposed between the lid plate 32 of the actuator housing 33 and the driving member 40. The superlocking link 69 is formed to extend over a long distance along a second straight line L2 passing through the center of the turning shaft 58 on a plane parallel to a direction of sliding of the joint lever 67 so that it can be slid in a direction along the second straight line L2. The second straight line L2 is established so as to pass through an intermediate point between the position of the connection shaft 68 when the knob lever 61 is in the locking position and the position of the connection shaft 68 when the knob lever 61 is in the unlocking position.

[0048] A substantially U-shaped engagement recess 77 is provided at one end of the superlocking link 69 so that it is opened on one side in the circumferential direction of the driving member 40. The engagement recess 77 has, on opposite sides, an engagement/abutment portion 77a capable of being brought into engagement and abutment against the connection shaft 68 from radially outside the driving member 40, and an engagement/abutment portion 77b capable of being brought into engagement and abutment against the connection shaft 68 from radially inside the driving member 40. The superlocking link 69 has an opening 78 through which the support tube 60 mounted on the lid plate 32 of the actuator housing 33 is inserted so as to permit the sliding of the superlocking link 69.

[0049] An elongated bore 79 is provided at the lengthwise other end of the superlocking link 69 so as to extend over a long distance in the direction along the second straight line L2. A guide portion 80 is integrally provided on the support wall 27b of the actuator housing 33, and fitted in the elongated bore 79 to guide the sliding of the superlocking link 69. The superlocking link 69 is made of a metal. In order to suppress wear of the guide portion 80, metallic members forming the guide portion 80 may be mold-coupled to the synthetic resin support wall 27b.

[0050] Referring again to Fig.3, the superlocking motor 66 is rotatable in the normal and reverse directions, and is clamped between the support wall 27b and the lid plate 32 such that a part thereof is received in a recess 83 provided in the support wall 27b of the actuator housing 33. A worm 84 is coaxially connected to the output shaft of the superlocking motor 66; a worm wheel 85 having an axis parallel to the rotational axis of the driving member 40 is meshed with the worm 84; and a superlocking lever 86 is coaxially connected to the worm wheel 85 so as to be turnable relative to the worm wheel 85 within a limited range. Moreover, a spring (not shown) is mounted between the worm wheel 85 and the support wall 27b, and serves to return the worm wheel 85 to the original position upon termination of the operation of the superlocking motor 66.

[0051] A connecting pin 89 is integrally provided in the superlocking lever 86 so as to be engaged and connected to an engagement bore 88 provided at the other end of the superlocking link 69. The engagement bore 88 is formed slightly longer in a direction perpendicular to the second straight line L2. The superlocking motor 66 is operated in a direction to cancel the connection between the knob lever 61 and the driving member 40, for example, by performing the locking operation of the cylinder lock 16 twice within a set time. A click spring 90 is mounted between the super locking lever 86 and the support wall 27b of the actuator housing 33 so as tomoderately turn the superlocking lever 86 between a superlocking-off position (a position shown in Fig.3) where the superlocking lever 86 connects the knob lever 61 and the driving member 40 to each other and a superlocking-on position where the superlocking lever 86 is turned in the counterclockwise direction in Fig. 3 from the superlocking-off position to disconnect the knob lever 61 and the driving member 40 from each other.

[0052] The superlocking lever 86 causes the superlocking link 69 to slide along the second straight line L2 upon operation of the superlocking motor 66. When the engagement/abutment portion 77a or 77b at one end of the superlocking link 69 abuts on and engages the connection shaft 68, the connected state and the disconnected state of the connection shaft 68 are switched over from one to the other.

[0053] An abutment projection 91 is integrally projectingly provided on a side portion of the superlocking link 69 in a position near one end of the superlocking link 69. An urging shaft 92 is embedded in the driving member 40. The urging shaft 92 pushes the superlocking link 69 in the direction to abut on the abutment projection 91 and brings the connection shaft 68 into a connected state, when the driving member 40 is turned by the operation of the door-locking motor 35 in the direction to turn the locking lever 29 toward the unlocking position in a state in which the superlocking mechanism 65 is in a superlocking-on state and the superlocking link 69 has operated the connection shaft 68 toward the disconnected position.

[0054] An opening lever 93 is supported on the casing 23 of the door-locking device 15 so as to be turned in response to the input of a door-opening force. Lengthwise one end of the opening lever 93 protrudes from the casing 23. Input into such one end of the opening lever 93 through a rod 94 (see Fig.1), is an operational force corresponding to the operation of the outside handle 18 mounted on the outer surface of the door D. An input lever 96 is turnably supported on the cover 27 of the door-locking device 15. The input lever 96 is turned by the pulling operation of a cable 95 corresponding to the operation of the inside handle 19 mounted on the inner surface of the door D. A power in a door-opening direction is transmitted from the input lever 96 and the opening lever 93.

[0055] The operation of this embodiment will be described below. When the superlocking mechanism 65 is in the superlocking-off state and the door-locking motor 35 is operated by the locking lever 29 in an unlocking direction from a state shown in Fig.8, the driving member 40 is turned in the clockwise direction as shown in Fig. 9, thereby causing the locking lever 29 in the locking position to turn in the counterclockwise direction into the unlocking position. In this process, the connection link 42 connected at one end to the locking lever 29 is also moved upward in Fig. 9, but the engagement pin 52 at the other end of the connection link 42 is merely moved within the elongated bore 51 provided in the key-operation input lever 41, without any influence exerted from the connection link 42 to the key-operation input lever 41. Further, when the driving member 40 is turned from the locking position and the unlocking position, any urging force cannot be exerted from the urging shaft 92 of the driving member 40 to the abutment projection 91 of the superlocking link 69. Furthermore, the knob lever 61 is also turned to the unlocking position along with the joint lever 67 by a force applied from the driving member 40 through the connection shaft 68 to the joint lever 67 due to turning of the driving member 40 from the locking position to the unlocking position.

[0056] In the locking state shown in Fig. 8, when the superlocking motor 66 is operated, for example, by performing the locking operation of the cylinder lock 16 twice within the set time, the superlocking lever 86 is turned in the counterclockwise direction, as shown in Fig. 10. This causes the superlocking link 69 to slide so as to shift the connection shaft 68 from the connected state to the disconnected state, whereby the superlocking mechanism 65 enters the superlocking-on state. In this superlocking-on state provided by the superlocking mechanism 65, when a turning force in an unlocking direction is applied from the locking knob 17 through the push/pull cable 62 to the knob lever 61, the knob lever 61 and the joint lever 67 are turned in the counterclockwise direction as shown in Fig.11, but the connection shaft 68 inserted through the connection bore 72 in the driving member 40 is merely moved within the circumferential bore portion 72b of the connection bore 72, without any turning force exerted from the knob lever 61 to the driving member 40. That is, the knob lever 61 and the driving member 40 are brought into the disconnected state by the operation of the superlocking mechanism 65.

[0057] In the superlocking-on state provided by the superlocking mechanism 65 shown in Fig. 10, when the door-locking motor 35 is operated in the unlocking direction, the driving member 40 is turned in the counterclockwise direction, whereby the locking lever 29 in the locking position is turned in the clockwise direction into the unlocking position. In this process, the connection link 42 connected at one end to the locking lever 29 is also moved upward in Fig. 10, but the engagement pin 52 at the other end of the connection link 42 is merely moved within the elongated bore 51 in the key-operation input lever 41, without any influence exerted from the connection link 42 to the key-operation input lever 41. Further, when the driving member 40 is turned from the locking position to the unlocking position, the urging shaft 92 mounted in the driving member 40 abuts against the abutment projection 91 of the superlocking link 69 to cause the superlocking link 69 to slide, and the connection shaft 68 is pushed by the engagement/abutment portion 77b of the superlocking link 69 to enter the connected state where the connection shaft 68 is connected to the driving member 40. That is, when the knob lever 61 and the driving member 40 are brought into the disconnected state by the operation of the door-locking motor 35, the driving member 40 is turned in the unlocking direction by the operation of the door-locking motor 35, thereby bringing the knob lever 61 and the driving member 40 into the connected state.

[0058] Furthermore, in the superlocking-on state provided by the superlocking mechanism 65, when the cylinder lock 16 is operated to be unlocked, the key-operation input lever 41 is turned in a clockwise direction in Fig.12, and the engagement pin 52 is engaged with the key-operation input lever 41 on the side of one end of the elongated bore 15 provided in the key-operation input lever 41, as shown in Fig. 12. Therefore, the locking lever 29 is turned in the clockwise direction through the connection link 42, thereby shifting the locking lever 29 from the locking position to the unlocking position. Upon the turning of the locking lever 29 toward the unlocking po-

sition, the urging shaft 92 of the driving member 40 abut against the abutment projection 91 of the superlocking link 69, the superlocking link 69 pushes the connection shaft 68 into the connected state, and the knob lever 61 is also turned into the unlocking position. This process also brings the knob lever 61 and the driving member 40 into the mutually connected state such that the turning of one of them toward the locking position is followed by the other.

[0059] Specifically, when the knob lever 61 and the driving member 40 are brought into the disconnected state by the operation of the superlocking mechanism 65, the cylinder lock 16 is operated to be unlocked to turn the driving member 40 toward the unlocking direction, thereby bringing the knob lever 61 and the driving member 40 into the connected state.

[0060] In this way, even if the locking knob 17 disposed on the door D on the side facing the vehicle compartment is illicitly operated in the locking state of the door-locking device 15, the door-locking device 15 cannot be brought into the unlocking state in the superlocking-on state of the superlocking mechanism 65.

[0061] Moreover, the knob lever 61 is relatively non-turnably connected to the turning shaft 58 which relatively turnably supports the driving member 40; the joint lever 67 is relatively non-turnably connected to the turning shaft 58, while being capable of sliding in the direction perpendicular to the axis of the turning shaft 58; and the superlocking link 69 slides in the direction parallel to the direction of sliding of the joint lever 67 to engage the connection shaft 68. That is, because the main functions of the superlocking mechanism 65 are concentrated on a region about the axis of the turning shaft 58, the number of link connected portions is reduced, the superlocking mechanism 65 can be constructed by a simple structure without needing a particularly improved dimensional accuracy of parts or a particularly improved inter-axis dimensional accuracy, and the assembling and manufacture of the device are facilitated.

[0062] Further, the guide portion 80 for guiding the sliding of the superlocking link 69 is provided in the actuator housing 33, so that the sliding of the superlocking link 69 can be guided by the guide portion 80 and thus smoothened.

[0063] Furthermore, the metallic sliding contact plate 73 is fixed to actuator housing 33 to come into sliding contact with the joint lever 67, and the passage 74 is formed between the sliding contact plate 73 and the actuator housing 33 so that the electric wires 75 are passed through the passage 74. Therefore, the turning and sliding of the joint lever 67 can be smoothened by the sliding contact with the sliding contact plate 73, and the sliding contact plate 73 can be used for guiding the distribution of the electric wires 75.

[0064] Although the embodiment of the present invention has been described in detail, the present invention is not limited to the above-described embodiment, and various modifications in design may be made without departing from the subject matter of the invention.

Claims

1. A door opening and closing device for a vehicle, comprising:

a door-locking device (15) including:

a locking lever (29) which is turnable between a locking position and an unlocking position so as to switch over a locking state and unlocking state; and
a casing (23) which is attached to a door (D);

an actuator housing (33) which is connected to the casing (23) and which houses a door-locking motor (35) and a driving member (40), the driving member (40) turning in response to operation of the door-locking motor (35) to drive the locking lever (29) to turn;
a knob lever (61) which is turnably supported on the actuator housing (33) so as to turn in response to operation of a locking knob (17) disposed on the door (D) on a side facing a vehicle compartment; and
a superlocking mechanism (65) which is housed in the actuator housing (33) and switches over connection and disconnection between the knob lever (61) and the locking lever (29) in response to operation of a superlocking motor (66),

characterized in that the knob lever (61) is relatively non-turnably connected to a turning shaft (58) which is turnably supported in the actuator housing (33) so as to relatively turnably support the driving member (40);

the superlocking mechanism (65) further includes:

a joint lever (67) which is relatively non-turnably connected to the turning shaft (58) and which is capable of sliding in a direction perpendicular to an axis of the turning shaft (58) ;
a connection shaft (68) which is provided on the joint lever (67) so as to be switched over between a connected state and a disconnected state in response to the sliding of the joint lever (67),

wherein, in the connected state, the connection shaft (68) is connected to the driving member (40) so as to relatively non-turnably connect the joint lever (67) and the driving member (40) to each other, and in the disconnected state, the connection shaft (68) is

disconnected from the driving member (40) so as to enable relative turning of the joint lever (67) and the driving member (40); and

a superlocking link (69) which is capable of engaging the connection shaft (68) and which is operated to slide on a plane parallel to a direction of sliding of the joint lever (67) so as to switch over the connected state and the disconnected state of the connection shaft (68); and
the superlocking link (69) is operated to slide to switch over the connected state and the disconnected state of the connection shaft (68) in response to the operation of the superlocking motor (66) in a state in which the locking lever (29) is in the locking position; and
the superlocking link (69) is operated to slide in a direction to bring the connection shaft (68) into the connected state in response to the turning of the driving member (40) for driving the locking lever (29) to turn toward the unlocking position, when the locking lever (29) is in the locking position and the connection shaft (68) is in the disconnected state.

2. A door opening and closing device for a vehicle according to claim 1, **characterized in that** a guide portion (80) is provided in the actuator housing (33) in order to guide the sliding of the superlocking link (69)

3. A door opening and closing device for a vehicle according to claim 1 or 2, **characterized in that** a sliding contact plate (73) made of a metal is fixed to the actuator housing (33) so as to come into sliding contact with the joint lever (67); and a passage (74) is formed between the sliding contact plate (73) and the actuator housing (33) so that electric wires (75) pass through the passage (74).

FIG.1

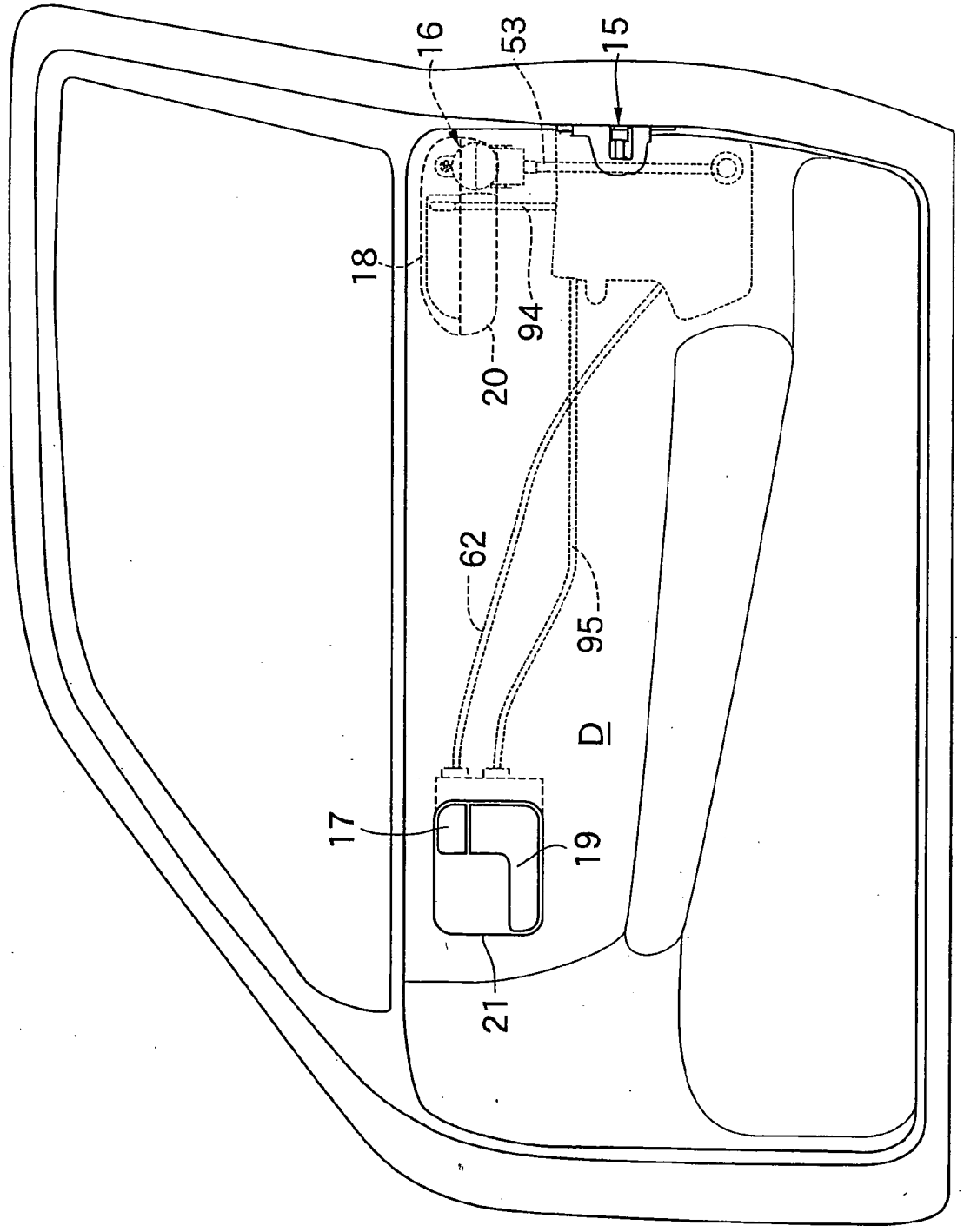
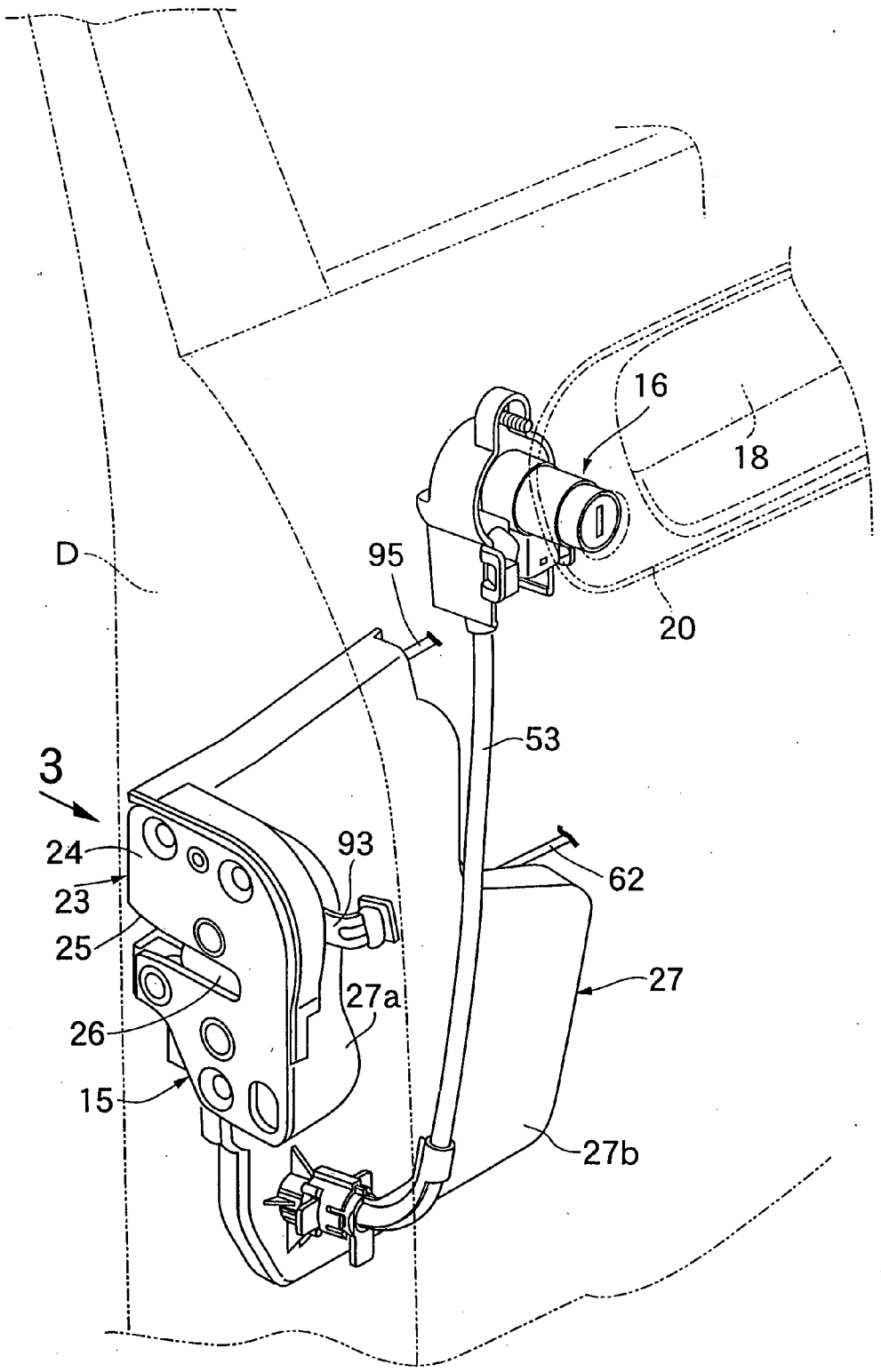


FIG.2



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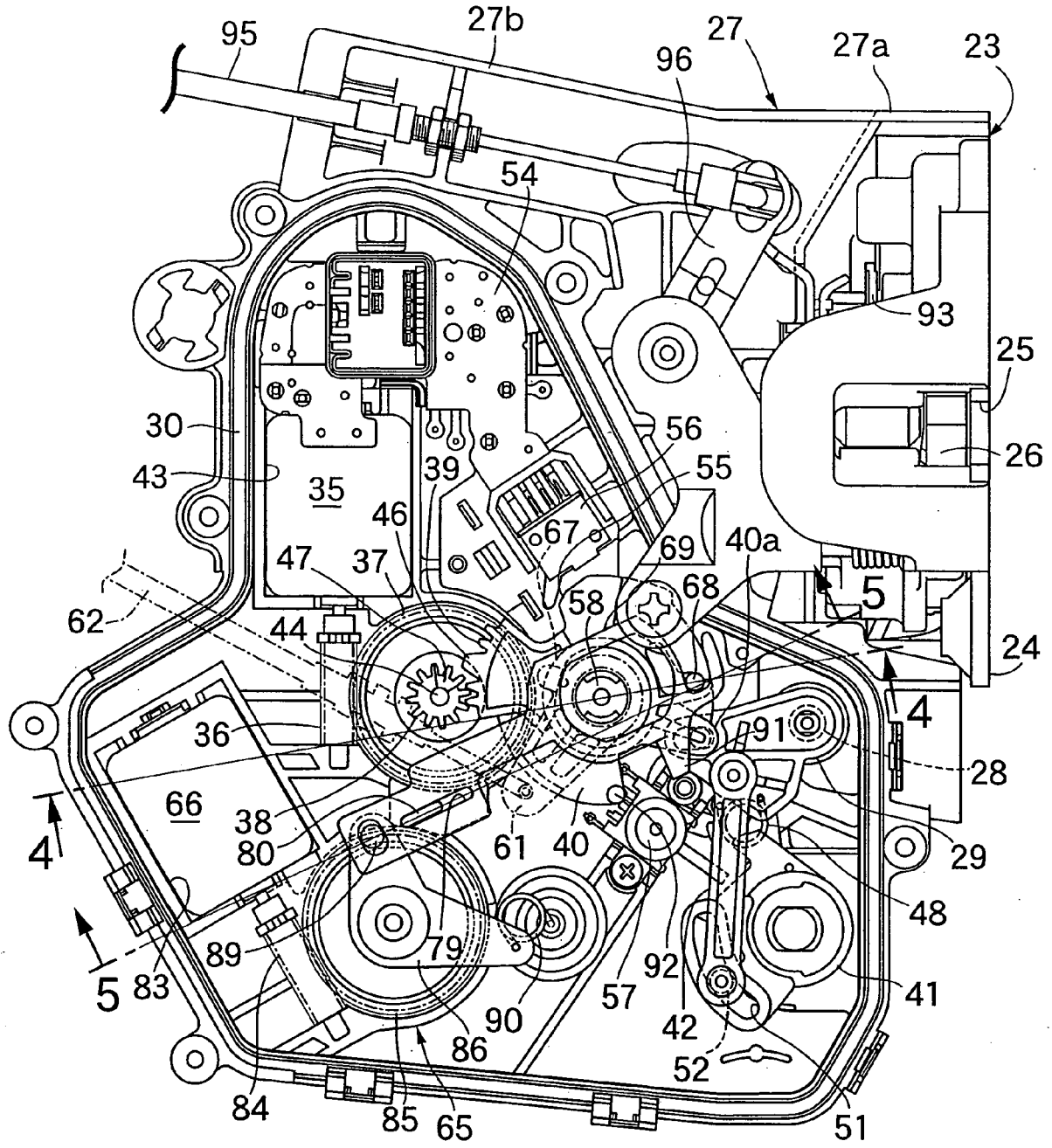
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FIG.4

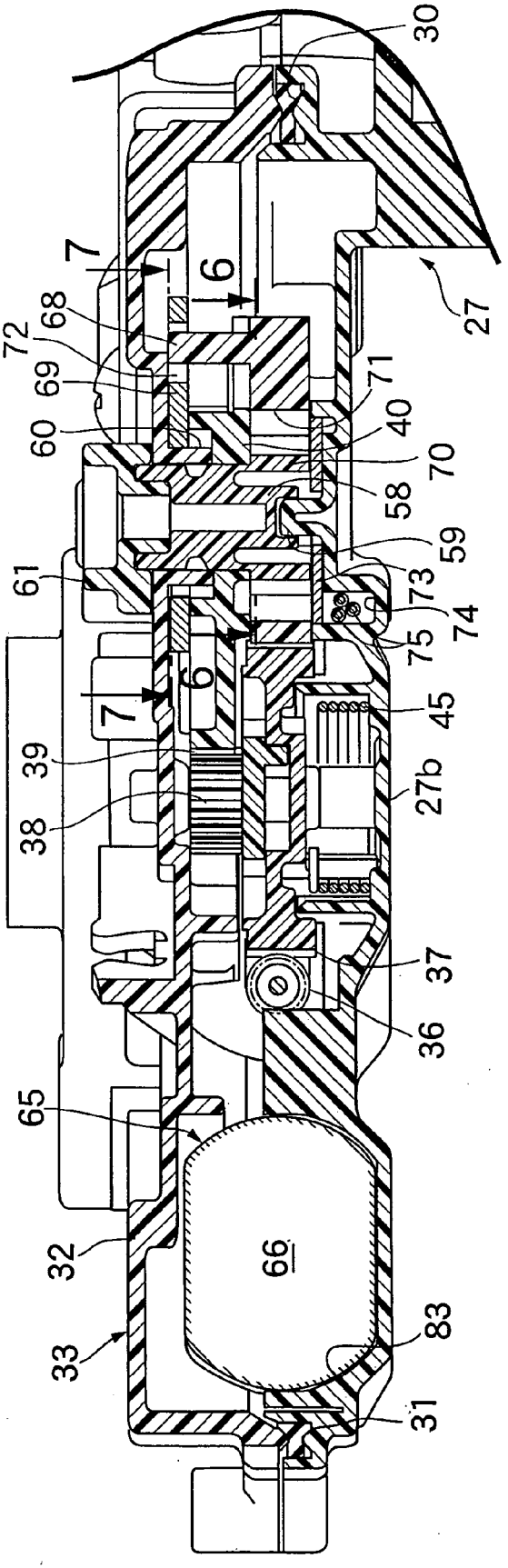
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FIG.5

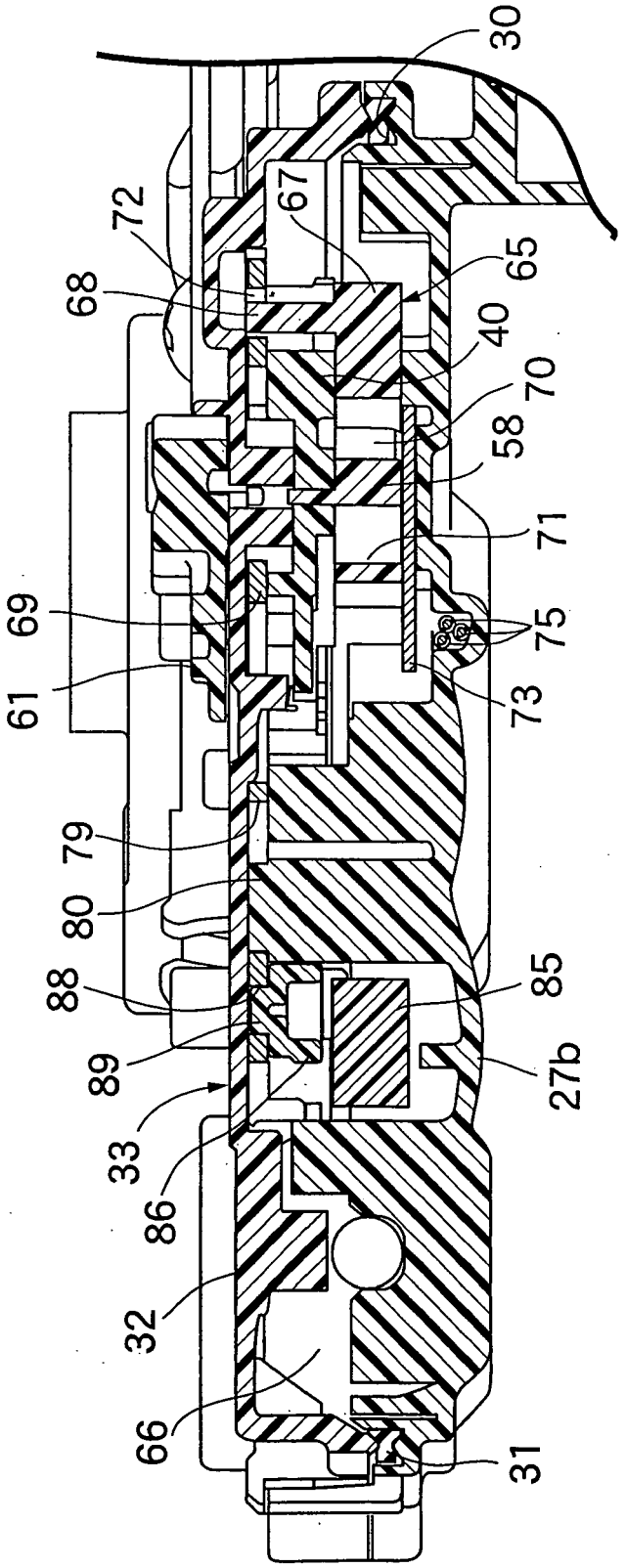

FIG.6

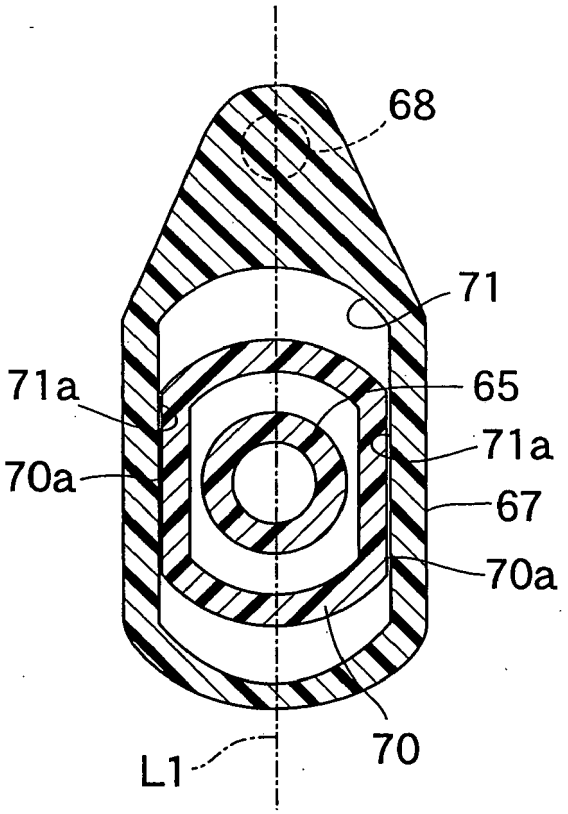

FIG.7

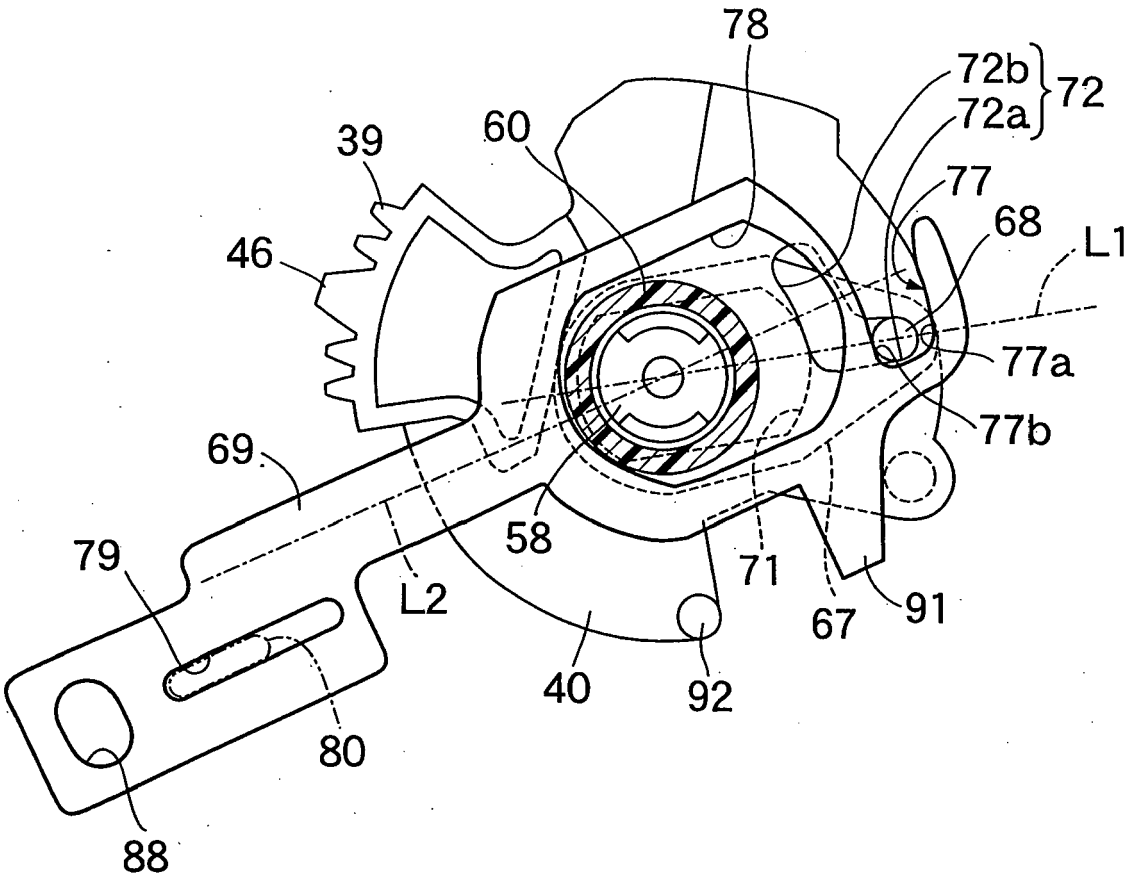
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FIG.8

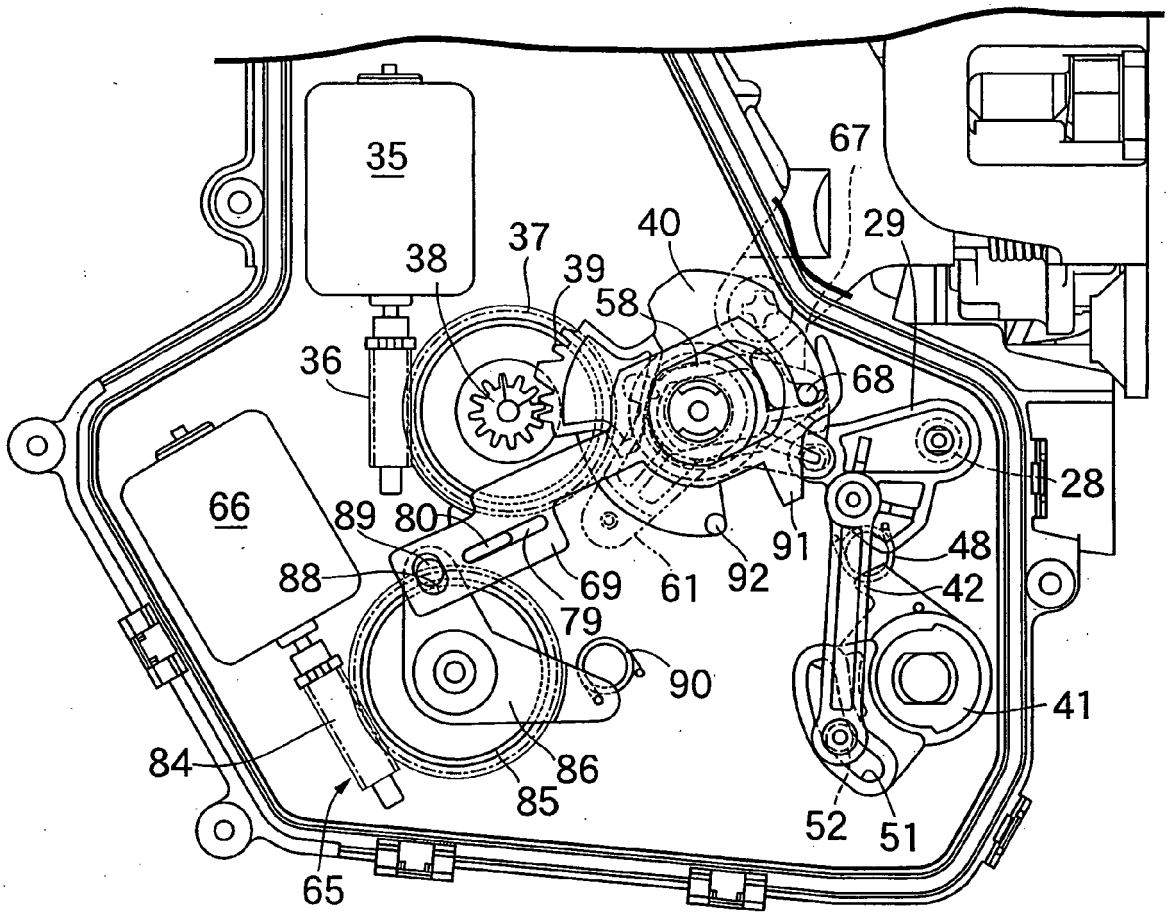
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FIG.9

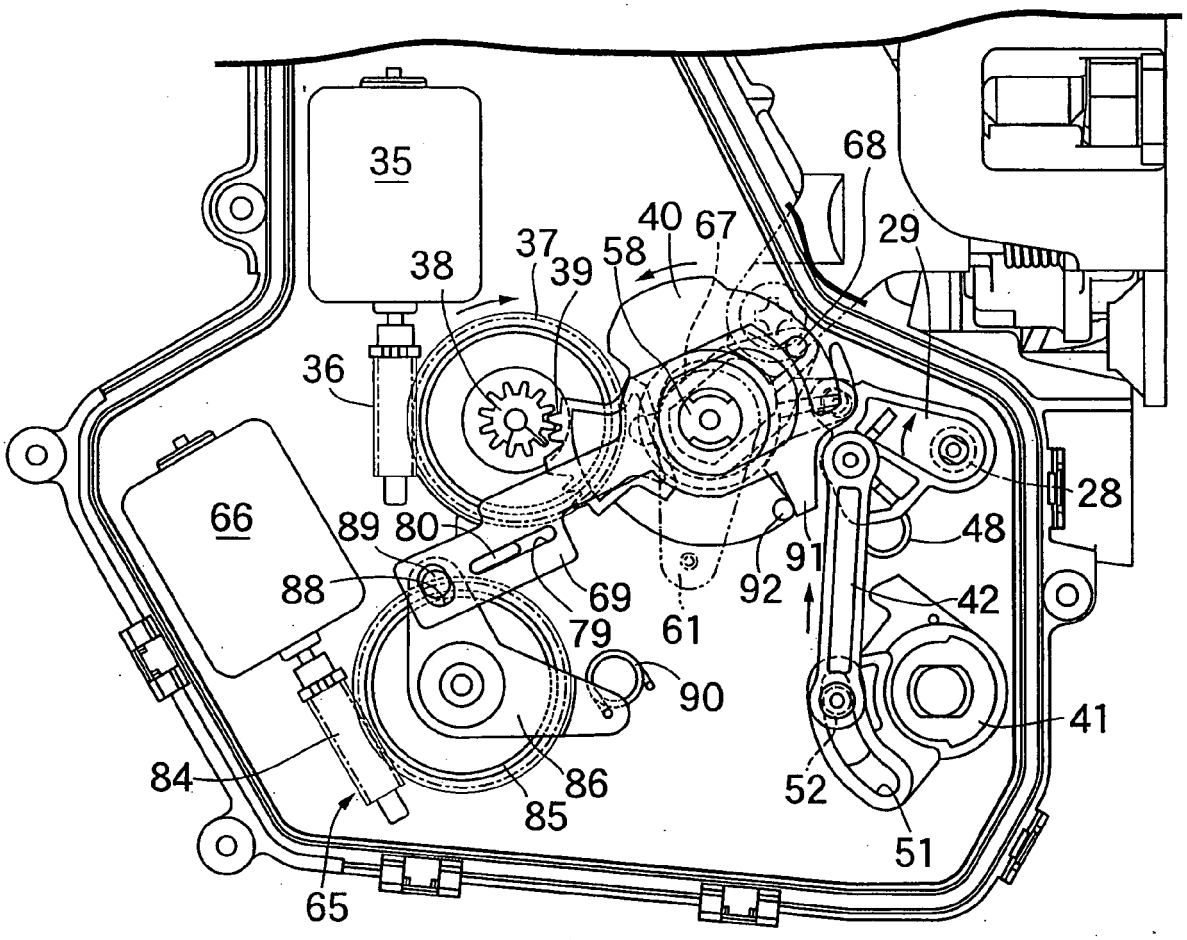
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FIG.10

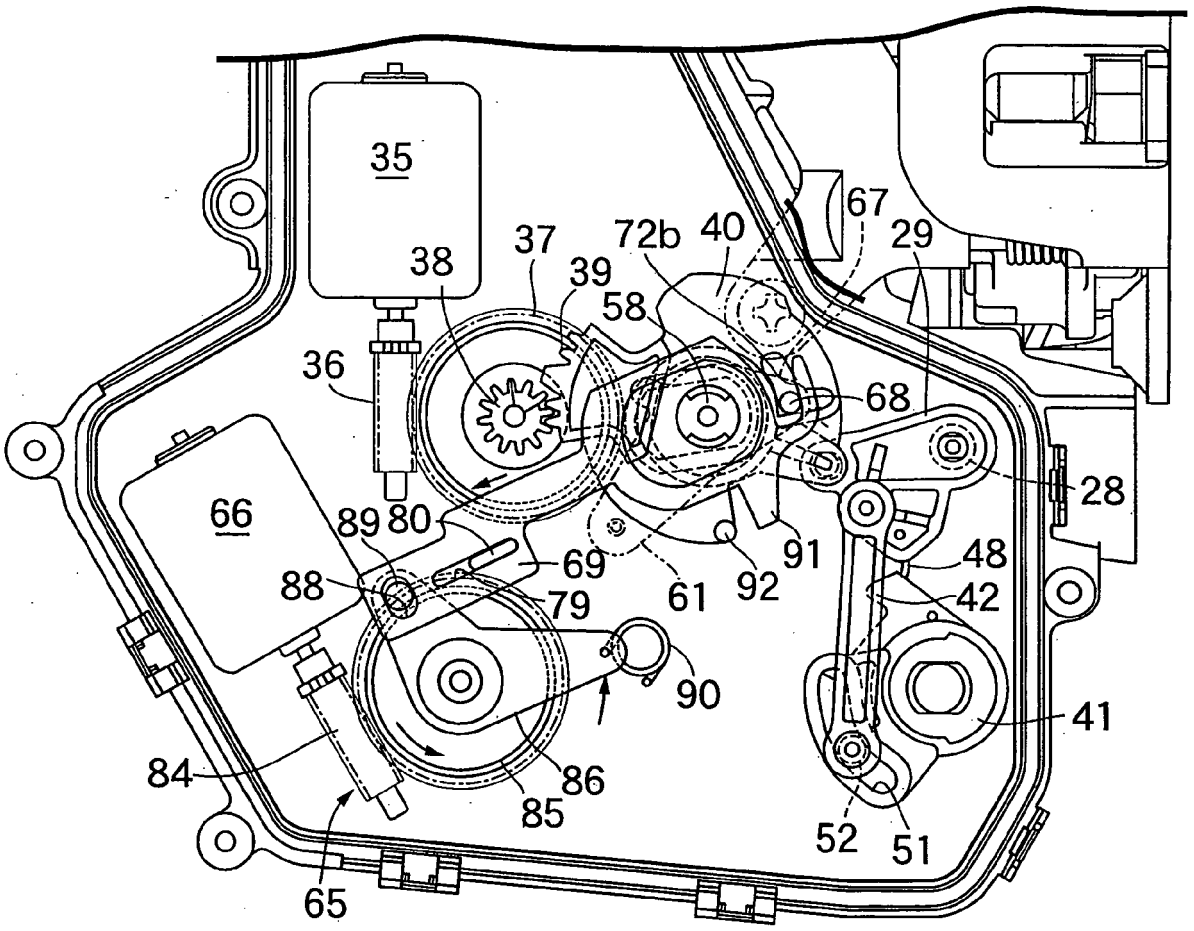
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FIG.11

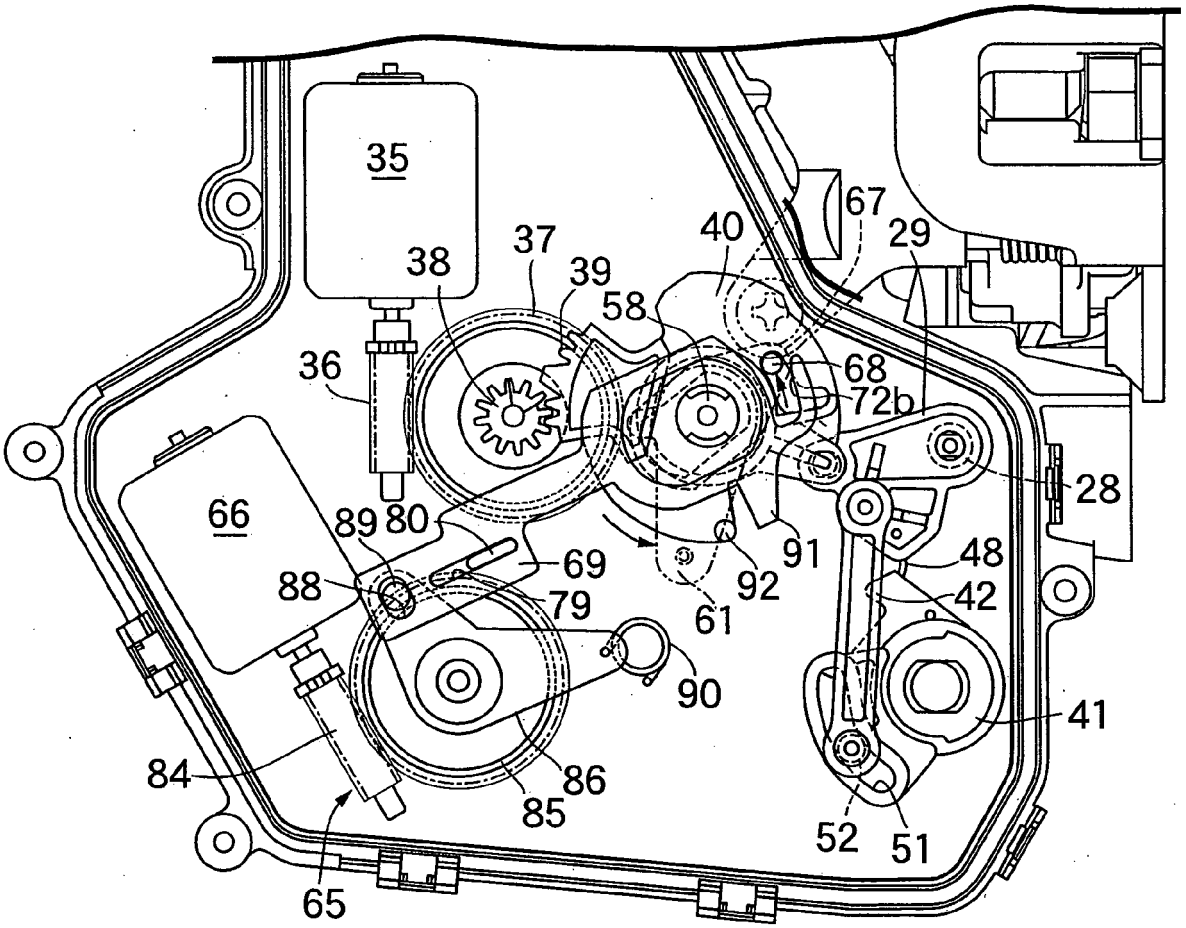
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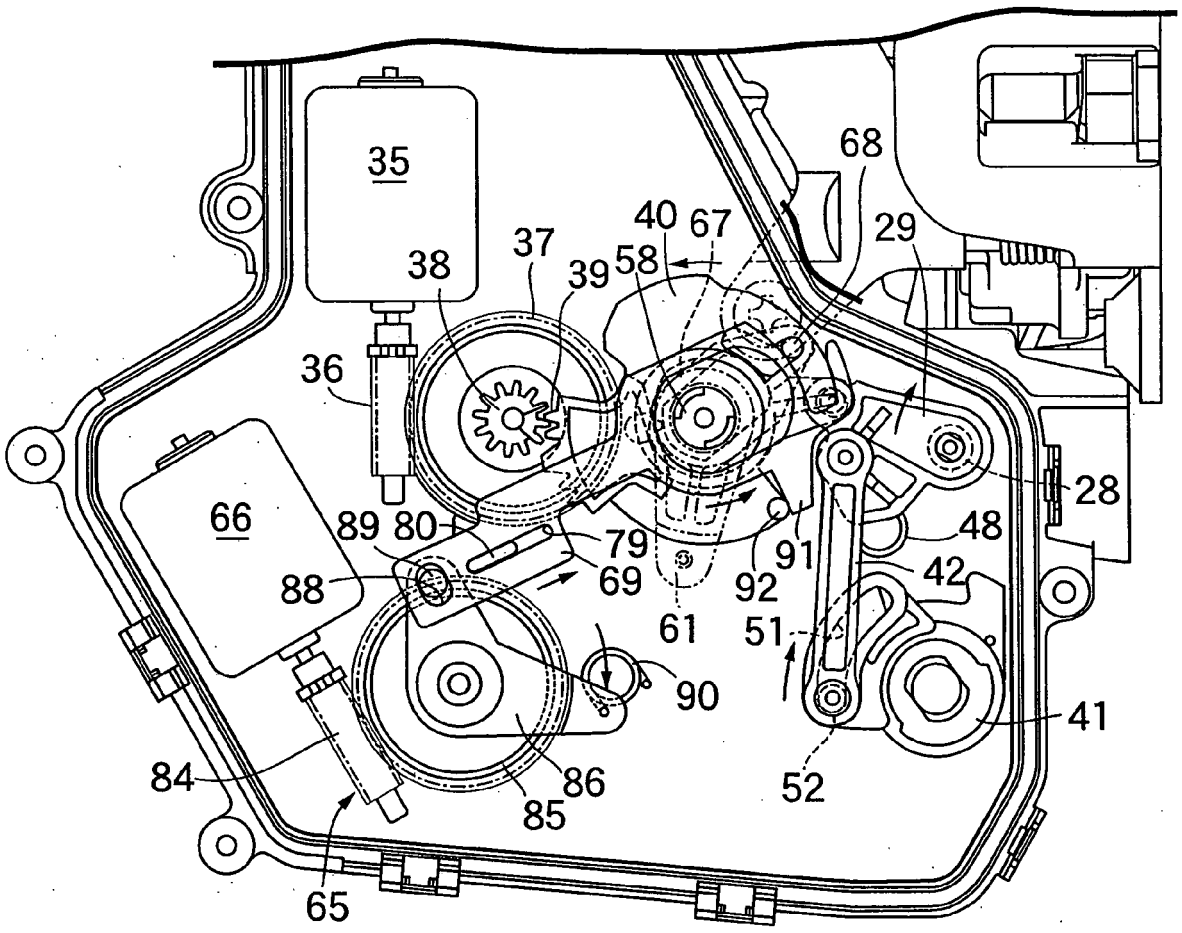
FIG.12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