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(71) Applicant: **Nabtesco Corporation**
Tokyo 105-0022 (JP)

(72) Inventors:
- **Takahashi, Kazutama**
  Kobe-shi,
  Hyogo 651-2271 (JP)
- **Kawasaki, Katsuji**
  c/o Kobe Plant, Nabtesco Corp.
  Kobe-shi, Hyogo 651-2271 (JP)

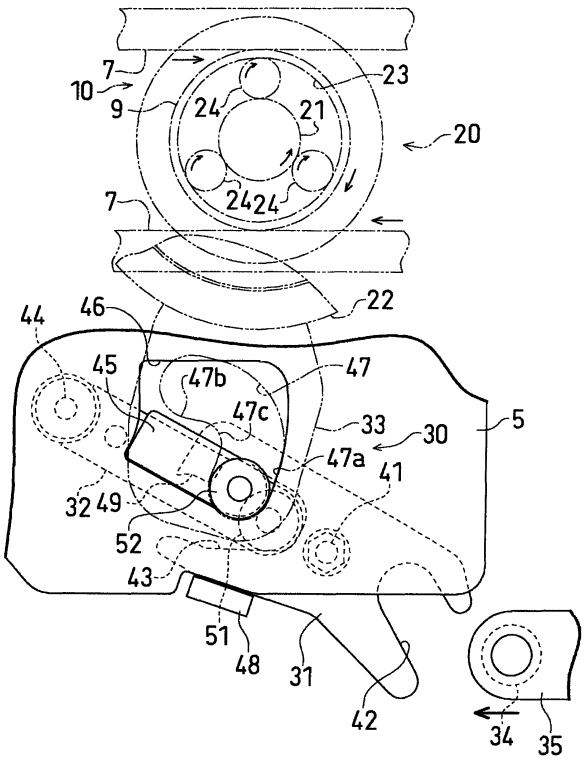
(74) Representative: **Intes, Didier Gérard André et al**
Cabinet Beau de Loménie,
158, rue de l'Université
75340 Paris Cedex 07 (FR)

(54) Opening-closing device with lock

(57) The invention provides a simple and compact construction in an opening-closing device with a lock for also performing a closing lock by power of an actuator for opening and closing a sliding door (11). Further, it is prevented that the lock is performed before reaching a full closing position and the lock is unintentionally released at a breaking time of the actuator.

Therefore, the invention has an unillustrated actuator as an opening-closing driving source of sliding doors able to be reciprocated, a planetary gear mechanism (20) for inputting driving force of this accuator thereto, and a lock mechanism (30) able to lock the sliding doors in a full closing position. When the sliding doors are located in positions except for the full closing position, the power of the actuator is distributed to a pinion of a rack and pinion mechanism through the planetary gear mechanism, and operates the sliding doors. In contrast to this, when the sliding doors are located in the full closing position, the power of the actuator is distributed to a lock plate (33) for switching of locked state/lock releasing state of the lock mechanism. Further, when the sliding doors are located in the positions except for the full closing position, a movement of the lock plate is prevented. In contrast to this, when the sliding doors are located in the full closing position, the movement of the lock plate is allowed.

Fig.2



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Description

BACKGROUND OF THE INVENTION

Technical Field

[0001] The present invention relates to the construction of an opening-closing device with a lock able to open and close a sliding door and lock the sliding door in a full closing position.

Background Art

[0002] For example, the opening-closing device with a lock of this kind is disclosed as a second embodiment mode in patent literature 1 (JP-A-2000-142392 (0040 to 0054, Figs. 6 to 13, rail moving body 3b, needle 6a, buffer body 12, spring (buffer spring) 12b, push-out fitting 14a, slide cam device 13b, spring (return spring) 13c, cam follower 13e, latch lock 13g, hole portion 7e arranged in rack)). In the construction of this patent literature 1, an opening-closing door of a double-leaf shape is set by connecting two sliding doors through a rack and pinion mechanism. A rail moving body for suspending this sliding door and a needle of a linear motor for opening and closing operations of the sliding door are connected through a buffer body including a buffer spring. The sliding door is moved in a closing direction by operating the needle in the linear motor. This needle is operated so as to further extend the spring of the above buffer body even when the sliding door reaches the full closing position. Thus, a push-out fitting arranged at a tip of the needle pushes and moves and slides a slide cam device against a return spring. A cam follower lowered in accordance with this sliding also lowers a latch lock. Accordingly, the latch lock is engaged with a hole portion arranged in the rack of the rack and pinion mechanism. Thus, the lock of the sliding door is realized in the full closing position.

[0003] In this construction, driving force of the linear motor is normally distributed for the opening and closing operations of the sliding door through the buffer spring of the buffer body. On the other hand, when the sliding door reaches the full closing position, the driving force of the linear motor is distributed to the slide cam device, and the lock using the latch lock is performed. Namely, the driving force of the single linear motor (actuator) is constructed so as to be utilized in both the opening and closing operations of the sliding door and the lock operation. Accordingly, there is an advantage able to simplify the construction.

[0004] However, in the construction of the above patent literature 1, the buffer body as a mechanism for switching and distributing the driving force of the linear motor to the opening and closing operations of the sliding door and the pushing movement of the slide cam device is constructed so as to slide and move together with the sliding door. Accordingly, the entire construction becomes complicated, and it is necessary to provide the space for a movable stroke amount of the buffer body. Therefore, a simple and compact construction of the sliding door opening-closing lock device cannot be realized.

[0005] Further, in the construction of patent literature 1, the slide cam device is pushed and moved so as to extend the buffer spring of the buffer body in the full closing position of the sliding door. Therefore, for example, when load (resistance with respect to the closing of the sliding door) due to wind pressure, etc. is applied to the door just before the full closing position, the buffer spring is extended before the sliding door reaches the full closing position. As this result, the push-out fitting of the tip of the needle pushes and moves the slide cam device at an excessive early stage, and the latch lock is lowered although the positions of the latch lock and the hole portion of the rack are not aligned. Therefore, there is a risk that the latch lock and the hole portion are damaged, and the sliding door is restricted (in an opening state) before a stage at which the sliding door reaches the full closing position.

[0006] Further, when the linear motor loses the driving force owing to a certain situation such as breakdown of the linear motor, an electric power source fail due to a stoppage of electric power supply, etc. at the closing lock time of the sliding door, the needle and the push-out fitting are pulled in a direction for releasing the pushing movement of the slide cam device by the buffer spring, and the slide cam device is also returned by the return spring. Accordingly, the latch lock is raised together with the cam follower, and the lock is released. This means that the closing lock is released unintentionally at the time of the breakdown and failure of the electric power source.

[0007] When the above buffer spring is set to be strong so as to prevent the latch lock from being lowered excessively early even when more or less load is applied to the sliding door, force applied in the direction of the lock release is also increased when the driving force of the linear motor is lost, for example as a result of a failure of the electric power source. Accordingly, the risk of an unintentional lock release is increased. Namely, no construction able to solve both of the above issues simultaneously and satisfactorily has been proposed yet, said issues being contradictory.

SUMMARY OF THE INVENTION

[0008] The present invention is made in consideration of the above situation, and its object is to provide a simple and compact construction in the opening-closing device with a lock for opening and closing the sliding door and performing the closing lock by a single actuator. Another object of the present invention is to provide a construction able to prevent the locking from being performed before the sliding door operated in the closing direction reaches the full closing position, and simultaneously prevent the unintentional lock release even if the actuator loses the driving force in a closing lock state.

[0009] The problem of the present invention intended

to be solved is provided as mentioned above, and a means and its effect for solving this problem will next be explained.

[0010] In accordance with a viewpoint of the present invention, an opening-closing device with a lock constructed as follows is provided. The opening-closing device with the lock comprises a rack and pinion mechanism constructed as a rack attached to a sliding door able to slide back and forth, and a pinion engaged with this rack; an actuator as an opening-closing driving source of the sliding door; a planetary gear mechanism for inputting the driving force of this actuator thereto; and a lock mechanism able to lock the sliding door in a full closing position. Power of the actuator is distributed to the pinion through the planetary gear mechanism when the sliding door is located in a position except for the full closing position. The power of the actuator is distributed to a switching lever for switching a locked state and a lock releasing state of the lock mechanism through the planetary gear mechanism when the sliding door is located in the full closing position.

[0011] In this construction, the power of the actuator is distributed through the planetary gear mechanism, and one portion of the power operates the pinion of the rack and pinion mechanism, and the other operates the switching lever. Accordingly, a construction for transmitting (distributing) the power from the actuator is stored into a compact space. Therefore, it is possible to provide a compact opening-closing device with the lock able to be structurally simplified.

[0012] Further, the driving force from the actuator is distributed by using the planetary gear mechanism instead of the buffer spring as in patent literature 1. Accordingly, even when the actuator loses the driving force by breakdown, etc. in a locking state of the sliding door in the closing position, no force in a lock releasing direction is applied to the switching lever, etc., and unintentional lock release is prevented.

[0013] In the above opening-closing device with the lock, the lock mechanism is preferably constructed so as to prevent a movement of the switching lever when the sliding door is located in the position except for the full closing position, and to allow the movement of the switching lever when the sliding door is located in the full closing position.

[0014] In this construction, when the sliding door is in a position other than except for the full closing position, the movement of the switching lever is prevented. Accordingly, the lock operation is performed after the sliding door reliably reaches the full closing position. Namely, when the sliding door is operated in a closing direction, situations where the lock operation is performed too early, the lock mechanism is broken and the sliding door is restricted before the full closing, are prevented.

[0015] The above opening-closing device with the lock is preferably constructed as follows. Namely, the lock mechanism has a cam, and a projection for preventing the switching from the lock releasing state to the locked state is arranged in this cam. It is possible to ride across this projection only when the sliding door operated in a closing direction by the actuator in the lock releasing state reaches the full closing position or its vicinity, and the movement of the switching lever is allowed by riding across this projection.

[0016] Thus, a simple construction able to prevent the excessive early lock in operating the sliding door in the closing direction can be realized.

[0017] The above opening-closing device with the lock is preferably constructed as follows. Namely, the lock mechanism has a rotating member which is engaged with a member of the sliding door side located in the vicinity of the full closing position, and is rotated in accordance with an opening-closing movement of the sliding door; and it also has a moving member connected to the switching lever through the cam, and able to be moved between a lock position for regulating the rotating movement of the rotating member in a position set when the sliding door is located in the full closing position, and a position dislocated from this lock position. The switching lever is constructed so as to realize the locked state by fixing the moving member in the lock position, and realize the lock releasing state by releasing the fixation of the moving member in the lock position. The opening-closing device with the lock is constructed so as to ride across the projection of the cam by the rotating movement of the rotating member based on the movement of the sliding door in the closing direction.

[0018] Thus, a double lock structure of locking the sliding door by locking the rotating movement of the rotating member by the moving member, and further fixing (locking) the moving member is realized. Accordingly, even when the actuator loses the driving force by breakdown, etc. in a state in which the sliding door is closed and locked, the unintentional lock release of the sliding door is very reliably prevented.

[0019] Further, since the riding-across of the projection (i.e., the allowance of the movement of the switching lever) is performed by the rotating movement of the rotating member, it is safe to move the switching lever in the vicinity of the full closing position. Namely, the excessively early locking is further reliably prevented.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

Fig. 1 is an entire front view showing an embodiment mode having an opening-closing lock device in an opening-closing door for a vehicle.

Fig. 2 is a front view of a main portion showing the constructions of a lock mechanism and a planetary gear mechanism in a lock releasing state.

Fig. 3 is a front view of a main portion showing a situation for operating a sun gear in a door closing direction from the state of Fig. 2, and switching the lock mechanism to a locked state.

Fig. 4 is a front view of a main portion showing a situation after the sun gear is further operated in the door closing direction and is switched to the locked state.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0021] An embodiment mode of the present invention will next be explained. Fig. 1 is a front view showing an embodiment mode having an opening-closing device with a lock in an opening-closing door for a vehicle. Fig. 2 is a front view of a main portion showing the constructions of a lock mechanism and a planetary gear mechanism in a lock releasing state.

[0022] The opening-closing door for a vehicle shown in Fig. 1 is constructed as a side door able to open and close an opening portion formed in a side wall of the vehicle such as a railway vehicle, etc., and has a pair of left and right sliding doors 11, 12 of a double leaf type. These two sliding doors 11, 12 are arranged so as to be moved back and forth along a guide rail 2 horizontally arranged above the above opening portion. More concretely, hangers 3 are arranged every two hangers at respective upper edges of the above sliding doors 11, 12. Door rollers 4 are rotatably pivoted in the respective hangers 3. This door roller 4 is constructed so as to be rolled on the above guide rail 2.

[0023] This opening-closing door is opened and closed by the opening-closing device with the lock in accordance with one embodiment mode of the present invention, and can be automatically locked so as not to be unintentionally opened in a closing state. When the door of the vehicle such as a railway vehicle, etc. is opened during running, it is dangerous. Therefore, it is required to reliably lock the door so that it is not unintentionally opened during the running.

[0024] The present invention will next be explained in detail. A base body 5 of a plate shape is fixedly attached to an upper portion (a space above the above opening portion) of the side wall of the vehicle. Two racks 7, 7 are supported by rack supports 6, 6 fixed to this base body 5. These racks 7, 7 are arranged such that these longitudinal directions are horizontal (in parallel with the above guide rail 2). The racks 7, 7 are supported by slide support portions 8 so as to be slid in the longitudinal direction (horizontal direction).

[0025] The two racks 7, 7 are arranged in parallel with each other while these racks 7, 7 form a suitable clearance in the vertical direction. Further, the racks 7, 7 are arranged such that respective tooth portions are opposed to each other. Further, a pinion 9 is rotatably arranged so as to be simultaneously engaged with both the tooth portions of the two racks 7, 7. This pinion 9 is located in a left-right central position above the opening portion of the opening-closing door 1, and is arranged in a position vertically nipped by the two racks 7, 7.

[0026] Respective ends of the two racks 7, 7 are connected to the corresponding sliding doors 11, 12 through arm members 13, 13 fixedly attached to the hanger 3 of a door tip side. A rack and pinion mechanism 10 is constructed by these racks 7, 7 and the pinion 9, and the two sliding doors 11, 12 are operated so as to be opened and closed by the rack and pinion mechanism 10. The rack and pinion mechanism 10 also fulfills a role for realizing symmetrical opening and closing of the sliding doors 11, 12 by connecting the left and right sliding doors 11, 12 to each other.

[0027] A planetary gear mechanism 20 is supported in the above base body 5. As typically shown in Fig. 2, this planetary gear mechanism 20 has a sun gear 21 rotatably pivoted, plural planetary gears 24, a carrier 22 and an internal gear 23. The plural planetary gears 24 are arranged in the outer circumference of this sun gear 21 and can be rotated on their own axes and can be revolved while the planetary gear 24 is engaged with the sun gear 21. The carrier 22 rotatably supports the above planetary gear 24. The internal gear 23 has inner teeth engaged with the above planetary gear 24 outside. Three elements constructed by the sun gear 21, the carrier 22 and the internal gear 23 are arranged on the same axis so as to be relatively freely rotated with respect to each other. The axis of these three elements is the same as the axis of the pinion 9 of the above rack and pinion mechanism 10.

[0028] The output shaft of an electric motor (actuator) of a direct drive system omitted in the drawings and able to be rotated normally and reversely is connected to the above sun gear 21. This output shaft may be also connected to the sun gear 21 through a suitable speed reduction mechanism. Further, the above internal gear 23 is connected to the pinion 9 of the above rack and pinion mechanism 10 through an unillustrated bolt, etc. Further, the above carrier 22 is connected to a lock plate (switching lever) 33 constituting a lock mechanism 30 described later.

[0029] Next, the lock mechanism 30 of the opening-closing door 1 will be explained in detail. As shown in Figs. 1 and 2, this lock mechanism 30 is mainly constructed so as to have a lock link (rotating member) 31 of a flat plate shape rotatably pivoted about the above base body 5, a lock lever (moving member) 32 of a flat plate shape similarly swingably pivoted about the base body 5, the above lock plate 33, and a catch roller 34. This lock mechanism 30 is located below the above planetary gear mechanism 20.

[0030] As shown in Fig. 2, the above lock link 31 is constructed such that its central portion is rotatably pivoted about the base body 5 through a support shaft 41, and an engaging-disengaging portion 42 is arranged on one end side of the lock link 31 and a roller insertion portion 43 is arranged on the other side of the lock link 31. The engaging-disengaging portion 42 is a notch of a concave shape, and is constructed so as to be engaged with the above catch roller 34 attached to one side of the sliding door 11. Further, the roller insertion portion 43 is also set to a notch of a concave shape, and a first roller

51 described later and supported by the lock lever 32 is inserted into the interior of the roller insertion portion 43. A rotating stopper 49 able to be opposed to the first roller 51 is arranged in the roller insertion portion 43 on the side far from its support shaft 41.

[0031] One end of the above lock lever 32 is rotatably pivoted about the above base body 5 through a support shaft 44. Two rollers 51, 52 are arranged on the other end side of the lock lever 32. Concretely, the above first roller 51 is supported on one side (the deep side of the paper face of Fig. 2) of a tip of the lock lever 32, and the second roller 52 is supported on the other side (this side of the paper face of Fig. 2). The first roller 51 is inserted into the above roller insertion portion 43 of the lock link 31.

[0032] A regulating plate 45 is fixedly attached to the above lock lever 32, and is located in the interior of a regulating hole 46 formed in the base body 5 and approximately formed in a fan shape. A swinging angle range of the lock lever 32 is prescribed by this regulating plate 45 and the regulating hole 46. An unillustrated biasing spring of a torsion coil spring shape is arranged on the above support shaft 44. This biasing spring always applies biasing force in the clockwise direction in Fig. 2 to the lock lever 32.

[0033] The above lock plate 33 is a member of a wide lever shape fixed to the carrier 22 of the above planetary gear mechanism 20, and is extended in the downward direction seen from this planetary gear mechanism 20. Further, a curving hole (cam) 47 of a shape curved approximately perpendicularly is formed in this lock plate 33. The second roller 52 of the above lock lever 32 is inserted into this curving hole 47.

[0034] This curving hole 47 is set to a hole of a constant width mutually connecting a rotation preventing portion 47a and a rotation allowing portion 47b. The rotation allowing portion 47b extends in the circumferential direction (approximately the horizontal direction) on a base end side of the lock plate 33. The rotation preventing portion 47a extends approximately below the rotation allowing portion 47b in the radial direction toward the tip side of the lock plate 33. In other words, a projection 47c is formed in a portion (a portion corresponding to the inner circumference of the curving portion) for connecting the rotation preventing portion 47a and the rotation allowing portion 47b. This projection 47c is constructed so as to prevent the above second roller 52 from being moved from the rotation preventing portion 47a to the rotation allowing portion 47b.

[0035] In Figs. 2 to 4, the lock plate 33 and the curving hole 47 are perspectively illustrated by chain lines to easily understand the construction.

[0036] Further, as shown in Fig. 1, a bracket 35 is fixedly attached to one side of an arm member 13 of the sliding door 11, and the tip of this bracket 35 extends on the central side. The above catch roller 34 is rotatably supported at this tip of the bracket 35. This catch roller 34 is moved along the guide rail 2 together with the above sliding door 11. When the sliding doors 11, 12 are located near a closing position, the catch roller 34 is constructed so as to be located near the engaging-disengaging portion 42 of the above lock link 31.

[0037] The sliding door opening-closing lock device is constructed as mentioned above. Opening and closing and locking operations of the sliding doors 11, 12 in this construction will next be explained with reference to Figs. 2 to 4. Fig. 3 is a front view of a main portion showing a situation in which the sun gear is operated in a door closing direction from the state of Fig. 2 and the lock mechanism is switched to a locked state. Fig. 4 is a front view of a main portion showing a situation after the sun gear is further operated in the door closing direction and the lock mechanism is switched to the locked state.

[0038] A lock releasing state of the lock mechanism 30 is shown in Fig. 2. In this state, no engaging-disengaging portion 42 of the lock link 31 is engaged with the catch roller 34. Further, the lock lever 32 is set to a position inclined slightly downward as shown in Fig. 2 by the operation of the above biasing spring. Since a bottom portion of the roller insertion portion 43 is also pushed and moved downward by the first roller 51 of the above lock lever 32, the lock link 31 is also set to an inclined posture as shown in Fig. 2. Reference numeral 48 of Fig. 2 designates a stopper fixedly attached to the base body 5 to regulate one side of the rotating angle range of the lock link 31.

[0039] Further, in this lock releasing state, the second roller 52 of the lock lever 32 is located in an end portion of the rotation preventing portion 47a side of the curving hole 47 in the lock plate 33. As shown in Fig. 2, in this lock releasing state, a line connecting the center of the second roller 52 of the lock lever 32 and the center of the support shaft 44 is set so as to be approximately parallel to a tangential direction of a revolution circle of the planetary gear 24. Namely, a dead point is attained. Accordingly, when the sun gear 21 of the planetary gear mechanism 20 is operated by the above electric motor in the lock releasing state of Fig. 2, the planetary gear 24 is not revolved but is rotated only on its own axis. Accordingly, all the driving force of the sun gear 21 is transmitted (distributed) to the pinion 9 through the internal gear 23, and the sliding doors 11, 12 are opened and closed.

[0040] In particular, even when the sliding doors 11, 12 are operated in the closing direction, no second roller 52 can ride across the projection 47c within the curving hole 47 so that the rotating movement of the lock plate 33 is prevented. As this result, the rotation of the carrier 22 connected to this lock plate 33 is also prevented. Accordingly, at a stage at which no sliding doors 11, 12 reach the vicinity of a full closing position, all the driving force of the sun gear 21 is distributed to the pinion 9. In other words, the switching from the lock releasing state to the locked state is prevented by the projection 47c except when the sliding doors 11, 12 are located in the vicinity of the full closing position. This means that the excessive early lock feared in the construction of the above patent literature 1 can be reliably prevented in the

construction of this embodiment mode.

[0041] Next, the above sun gear 21 is operated in a direction for closing the sliding doors 11, 12. As a result, it is supposed that the sliding doors 11, 12 approach the full closing position, and the above catch roller 34 attached to the sliding door 11 approaches the engaging-disengaging portion 42 of the lock link 31 as shown by the thick line arrow of Fig. 2. When the sun gear 21 (sliding doors 11, 12) is further operated in the closing direction from this state of Fig. 2, the catch roller 34 moved in the direction of the arrow of the thick line pushes this engaging-disengaging portion 42 and rotates the lock link 31 as shown in Fig. 3 while this catch roller 34 is engaged with the engaging-disengaging portion 42 (while the catch roller 34 is caught by the engaging-disengaging portion 42).

[0042] When the lock link 31 is rotated, a bottom face portion of its roller insertion portion 43 pushes up the first roller 51 of the lock lever 32. Accordingly, as shown in Fig. 3, the lock lever 32 is rotated upward against the biasing spring, and approximately attains a horizontal posture. Further, the lock link 31 is also rotated in a rising direction simultaneously with this horizontal posture. When the sliding doors 11, 12 mutually reach the full closing position, the lock link 31 approximately attains a vertical posture, and the rotating stopper 49 arranged in its roller insertion portion 43 faces the first roller 51 of the lock lever 32 (Fig. 3 shows a state just before this facing). After this facing, the rotation of the lock link 31 in the counterclockwise direction is regulated by the above first roller 51 and the above rotating stopper 49. Accordingly, the catch roller 34 of the lower side is fixed by the engaging-disengaging portion 42 such that no catch roller 34 can be moved. Thus, the sliding door 11 and the sliding door 12 of the other side connected to this sliding door 11 through the rack and pinion mechanism 10 are set so as not to be moved while the full closing position is held (first lock).

[0043] Further, as shown in Fig. 3, in accordance with the above upward rotating movement of the lock lever 32, the second roller 52 of the lock lever 32 is moved from the rotation preventing portion 47a to the rotation allowing portion 47b in the above curving hole 47 while the second roller 52 rides across the projection 47c. As this result, the rotating movement around the axis of the planetary gear mechanism 20 is allowed in the lock plate 33, and the rotation (in other words, the revolution of the planetary gear 24) of the carrier 22 connected to this lock plate 33 is also allowed. On the other hand, after the sliding door 11 reaches the full closing position, no movement of the closing direction can be made. Hence, the rotation of the internal gear 23 connected to this sliding door 11 through the rack and pinion mechanism 10 is also prevented. Accordingly, the driving force of the sun gear 21 continuously rotated is transmitted (distributed) to the carrier 22. As shown in Fig. 4, the lock plate 33 is rotated in the counterclockwise direction, and the above second roller 52 reaches the end of the rotation allowing portion 47b side of the curving hole 47. In this state, the downward rotating movement of the lock lever 32 is prevented by locating the second roller 52 in the rotation allowing portion 47b (second lock).

[0044] As mentioned above, the lock mechanism 30 is automatically switched to the locked state after the movement to the full closing position of the sliding doors 11, 12 as in Fig. 2 → Fig. 3 → Fig. 4. The sliding doors 11, 12 are then locked in the closed state as it is. Accordingly, the lock associated with the closing of the sliding doors 11, 12 is realized by merely operating the sun gear 21 of the planetary gear mechanism 20 by a single actuator so that the driving construction can be simply set.

[0045] Further, in this lock state of Fig. 4, the first lock is performed by regulating the rotation of the lock link 31 by the lock lever 32. Further, the second lock is performed by regulating a swinging movement of this lock lever 32 by the lock plate 33. Namely, a double lock can be set. Accordingly, for example, even when an electric power failure is caused in the electric motor by a stoppage of electric power, breakdown of a vehicle, etc. and the rotation of its output shaft (the above sun gear 21) becomes free, the opening of the sliding doors 11, 12 can be very reliably prevented by the above double lock. This means that it is possible to prevent a situation in which the sliding doors 11, 12 are unintentionally opened by wind pressure, etc. even when the stoppage of electric power, etc. happens in the vehicle.

[0046] In the switching from the above lock state to the lock releasing state and the opening of the sliding doors 11, 12, it is sufficient to merely operate the sun gear 21 by the above electric motor in the direction opposed to that at the closing time. Namely, in Fig. 4 showing the lock state, the sliding door 11 is locked by the lock link 31. Therefore, the rotation of the internal gear 23 is prevented. On the other hand, since the second roller 52 is located in the rotation allowing portion 47b, the rotating movement of the lock plate 33, in other words the rotation of the carrier 22, is allowed. Accordingly, when the sun gear 21 is operated in a direction opposite to the arrow from the state of Fig. 4, all the driving force of the sun gear 21 is transmitted (distributed) to the carrier 22. The lock plate 33 is swung in a direction opposite to the arrow, and the second roller 52 of the lock lever 32 is pulled out of the rotation allowing portion 47b. Accordingly, the above second lock is released, and the lock lever 32 is rotated and moved downward by the operation of the biasing spring.

[0047] When the lock lever 32 is rotated and moved downward, the first roller 51 is pulled out of the rotating stopper 49 so that the rotating regulation of the lock link 31 is stopped. This means that the lock (first lock) of the sliding door 11 is released and the rotation of the internal gear 23 is allowed. On the other hand, the second roller 52 enters the rotation preventing portion 47a of the curving hole 47 in accordance with the downward rotating movement of the lock lever 32. Accordingly, the rotations of the lock plate 33 and the carrier 22 are prevented by

the projection 47c of the above curving hole 47. As a result, the driving force of the sun gear 21 in the planetary gear mechanism 20 is transmitted (distributed) to the internal gear 23 side. Accordingly, the sliding doors 11, 12 are operated in an opening direction through the rack and pinion mechanism 10. The catch roller 34 is then moved on the opening side while rotating the lock link 31 to a certain extent. The catch roller 34 is finally pulled out of the engaging-disengaging portion 42, and is further moved to the opening side.

[0048] As shown above, the sliding door opening-closing lock device for a vehicle in this embodiment mode has the rack and pinion mechanism 10, the electric motor as an opening-closing driving source of the above sliding doors 11, 12, the planetary gear mechanism 20, and the lock mechanism 30. The rack and pinion mechanism 10 is made of the racks 7, 7 attached to the sliding doors 11, 12 able to be reciprocated, and the pinion 9 engaged with these racks 7, 7. The driving force of this electric motor is inputted to the planetary gear mechanism 20. The lock mechanism 30 can lock the above sliding doors 11, 12 in the full closing position. When the above sliding doors 11, 12 are located in positions except for the full closing position, the power of the electric motor is distributed from the internal gear 23 of the planetary gear mechanism 20 to the above pinion 9. In contrast to this, when the above sliding doors 11, 12 are located in the full closing position, the power of the electric motor is distributed from the carrier 22 of the planetary gear mechanism 20 to the lock plate 33 for switching the locked state and the lock releasing state of the above lock mechanism 30.

[0049] Thus, the power of the electric motor is distributed through the planetary gear mechanism 20, and one portion of this power operates the pinion 9 of the rack and pinion mechanism 10, and the other operates the lock plate 33. Further, the output (concretely, the output of the internal gear 23) of the planetary gear mechanism 20 is connected to the pinion 9 of the above rack and pinion mechanism 10. Accordingly, a construction for the power distribution is stored into a compact space together with the rack and pinion mechanism 10. Accordingly, it is possible to provide an opening-closing lock device in which a driving force transmitting (distributing) structure from the electric motor can be simplified, and space is saved.

[0050] Further, the driving force from the electric motor is distributed by using the planetary gear mechanism 20 instead of the buffer spring as in patent literature 1. Accordingly, even when the above electric motor loses the driving force owing to breakdown, etc. in a state in which the sliding doors 11, 12 are locked in the closing position, no force of the lock releasing direction is applied to the lock plate 33, etc. so that unintentional lock release is prevented. In accordance with a construction in which the lock plate 33 and an unillustrated lever arranged in a position able to be accessed from the interior or exterior of the vehicle are connected by a connecting member such as an unillustrated wire, etc., an operator operates this lever at an emergency time, and swings the lock plate 33 in a direction for attaining the lock releasing state. After the lock is released, the operator can manually open the sliding doors 11, 12.

[0051] Further, in this embodiment mode, when the above sliding doors 11, 12 are located in positions except for the full closing position (Fig. 2), the above lock mechanism 30 is constructed so as to prevent the rotating movement of the above lock plate 33. In contrast to this, when the above sliding doors 11, 12 are located in the full closing position (Fig. 3 or 4), the lock mechanism 30 is constructed so as to allow the rotating movement of the above lock plate 33.

[0052] Thus, it is safe to perform the lock operation after the sliding doors 11, 12 reliably reach the full closing position. Namely, when the sliding doors 11, 12 are operated in the closing direction, the fact that the lock operation is performed too early, and that the lock mechanism 30 is damaged and that the sliding doors 11, 12 are restricted before the full closing, are prevented.

[0053] Further, in this embodiment mode, the above lock mechanism 30 has a cam constructed by the curving hole 47. The projection 47c for preventing the switching from the lock releasing state to the locked state is arranged in this cam (curving hole 47). The above second roller 52 as a follower of a cam mechanism is constructed so as to ride across the above projection 47c as shown in Fig. 2 only when the sliding door 11 operated in the closing direction by the electric motor in the lock releasing state reaches the vicinity of the full closing position. The rotating movement of the above lock plate 33 is allowed by riding across this projection 47c.

[0054] Accordingly, it is possible to realize a simple construction able to prevent the lock in the above excessive early timing.

[0055] Further, the above lock mechanism 30 has the lock link 31 engaged with the catch roller (member of the sliding door side) 34 arranged in the sliding door 11 located in the vicinity of the full closing position, and rotated in accordance with the opening and closing movement of the sliding door 11. Further, the lock lever 32 is arranged in the lock mechanism 30. This lock lever 32 is connected to the lock plate 33 through the cam constructed by the curving hole 47. Further, this lock lever 32 can be moved between a horizontal position (the position of Fig. 4: corresponding to the lock position) for regulating the rotating movement of the lock link 31 in a position set when the above sliding doors 11, 12 are located in the full closing position, and a position (the position of Fig. 2) slanted from the horizontal position. The above lock plate 33 is constructed so as to realize the above lock state by fixing the above lock lever 32 in a horizontal position (the position of Fig. 4), and realize the above lock releasing state by releasing the fixation in the above horizontal position. As shown in Fig. 2, the lock lever 32 is pushed up by the rotating movement of the above lock link 31 based on the movement of the sliding door 11 in the closing direction (by pushing up the first roller 51 by

the above roller insertion portion 43). The above second roller 52 is constructed so as to ride across the projection 47c in the above curving hole 47.

[0056] Thus, the automatic double lock structure of locking (first lock) the sliding doors 11, 12 by locking the rotating movement of the lock link 31 by the lock lever 32, and further fixing (second lock) the lock lever 32 by the lock plate 33 is realized. Accordingly, even when the electric motor loses the driving force by breakdown, etc. in a state in which the sliding doors 11, 12 are locked in the full closing position, the unintentional lock release of the sliding doors 11, 12 is very reliably prevented.

[0057] Further, the latch lock of the background art is engaged with a hole portion arranged in the rack of the rack and pinion mechanism. Accordingly, this hole portion necessarily becomes larger than a lock pin. Therefore, in a state in which the lock pin is inserted into the hole portion, problems exist in that a clearance is formed and the sliding door is shaken by wind pressure, etc., and an uncomfortable feeling is given to a passenger, and life of the lock device might be influenced. On the other hand, such problems are not caused in the lock system of the present invention since there is no clearance in the lock state.

[0058] Further, the second roller 52 rides across the projection 47c (in other words, the rotating movement of the lock plate 33 is allowed) by rotating the lock link 31. Accordingly, it is safe to rotate the lock plate 33 in the vicinity of the full closing position of the sliding door 11. Namely, a lock operation happening too early is further reliably prevented.

[0059] The preferable embodiment mode of the present invention has been explained as mentioned above, but the above embodiment mode can be changed and executed e.g., as follows.

[0060]

(1) In the above embodiment mode, the sun gear 21 is connected to the output shaft of the electric motor, and the internal gear 23 is connected to the pinion 9, and the carrier 22 is connected to the lock plate 33. However, the present invention is not limited to this construction. For example, various variations such as a construction for connecting the sun gear 21 to the pinion 9 and connecting the internal gear 23 to the electric motor, etc. are considered.

[0061]

(2) In the above embodiment mode, the cam between the lock plate 33 and the lock lever 32 is constructed by using the curving hole 47 and the second roller 52. However, the present invention is not limited to this construction, but cams of various publicly known constructions and forms can be adopted. For example, it is possible to adopt a lock mechanism constructed by a link and a pin. Further, the present invention is also not limited to setting of a lock mechanism for realizing the double lock as in the above embodiment mode.

[0062]

(3) In the above embodiment mode, the sliding doors 11, 12 of the double leaf type are set, but the construction of the present invention can also be applied to the case of a single swing type.

Claims

1. An opening-closing device with a lock comprising:

a rack and pinion mechanism (10) constructed by a rack (7) attached to a sliding door (11) able to move back and forth, and a pinion (9) engaged with this rack;
an actuator as an opening-closing driving source of said sliding door;
a planetary gear mechanism (20) for inputting driving force of this actuator thereto; and
a lock mechanism (30) able to lock said sliding door in a full closing position;
characterized in that the power of said actuator is distributed to said pinion through said planetary gear mechanism when said sliding door is located in a position other than the full closing position; and
the power of said actuator is distributed to a switching lever (32) for switching between a locked state and a lock releasing state of said lock mechanism through said planetary gear mechanism when said sliding door is located in the full closing position.

2. The opening-closing device with the lock according to claim 1, **characterized in that** said lock mechanism is constructed so as to prevent a movement of said switching lever (32) when said sliding door is located in a position other than the full closing position, and allows the movement of said switching lever when said sliding door is located in the full closing position.

3. The opening-closing device with the lock according to claim 2, **characterized in that** said lock mechanism has a cam (47), and a projection (47c) for preventing the switching from said lock releasing state to said locked state is arranged in this cam, and
it is possible to ride across this projection only when said sliding door operated in a closing direction by said actuator in said lock releasing state reaches the full closing position or its vicinity, and the movement of said switching lever (32) is allowed by riding across this projection.

4. The opening-closing device with the lock according to claim 3, **characterized in that** said lock mechanism has:

a rotating member which is engaged with a member of said sliding door side located in the vicinity of the full closing position, and is rotated in accordance with an opening-closing movement of the sliding door; and
a moving member connected to said switching lever through said cam, and able to be moved between a lock position for regulating the rotating movement of said rotating member in a position set when said sliding door is located in the full closing position, and a position dislocated from this lock position; and
said switching lever (32) is constructed so as to realize said locked state by fixing said moving member in said locked position, and realize said lock releasing state by releasing the fixation of said moving member in said lock position; and
the opening-closing device with the lock is constructed so as to ride across the projection of said cam by the rotating movement of said rotating member based on the movement of said sliding door in the closing direction.

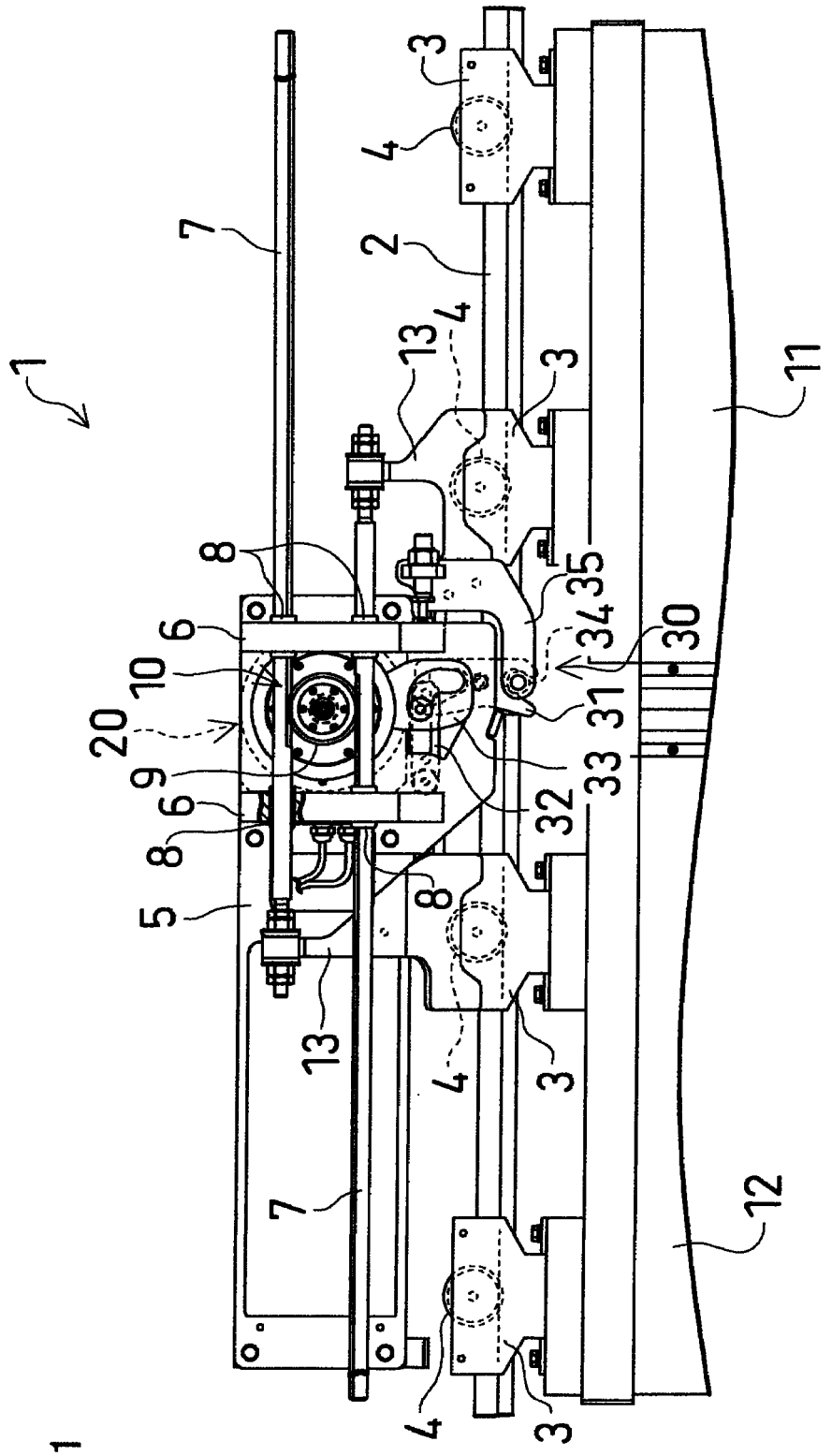

Fig.1

Fig.2

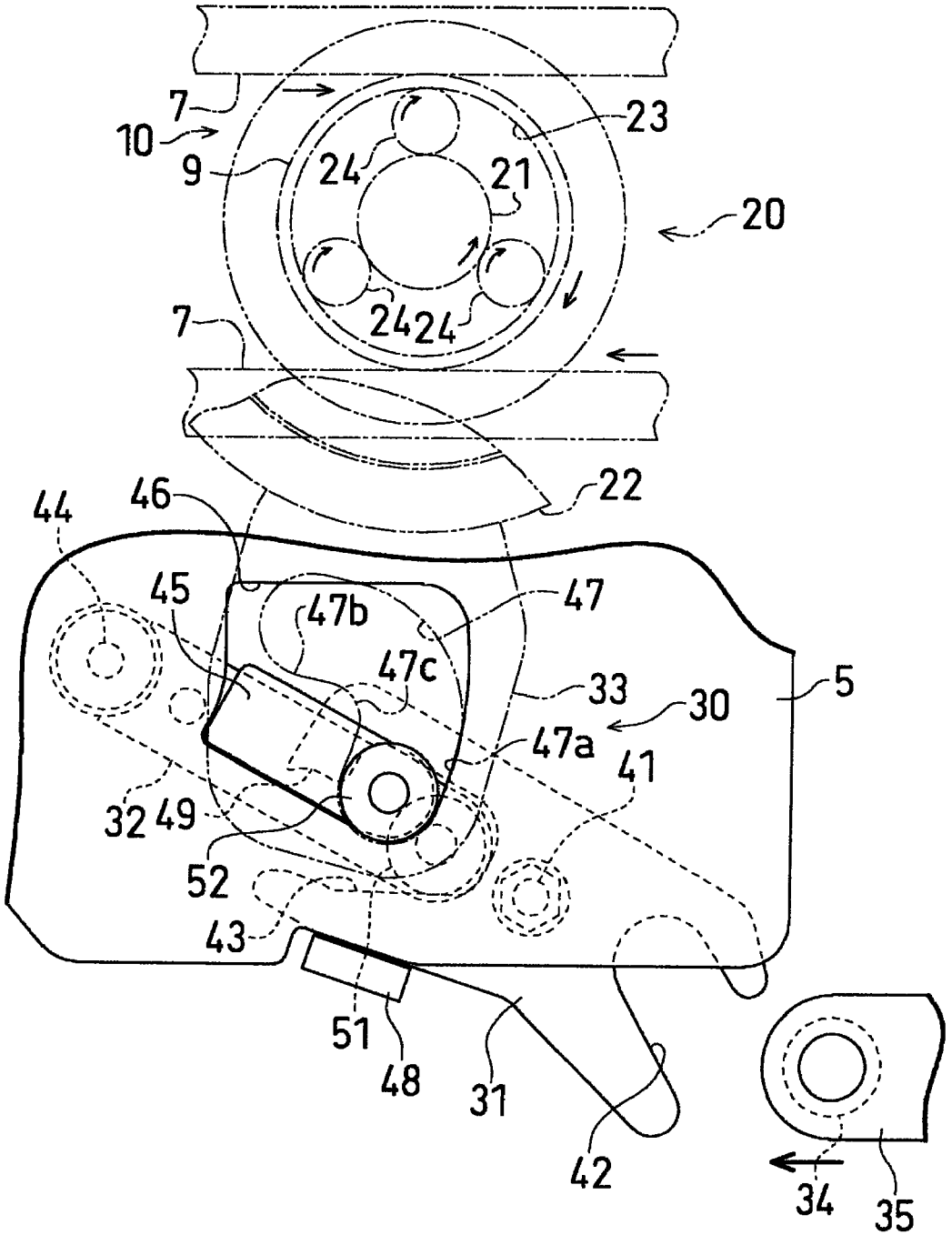
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Fig.3

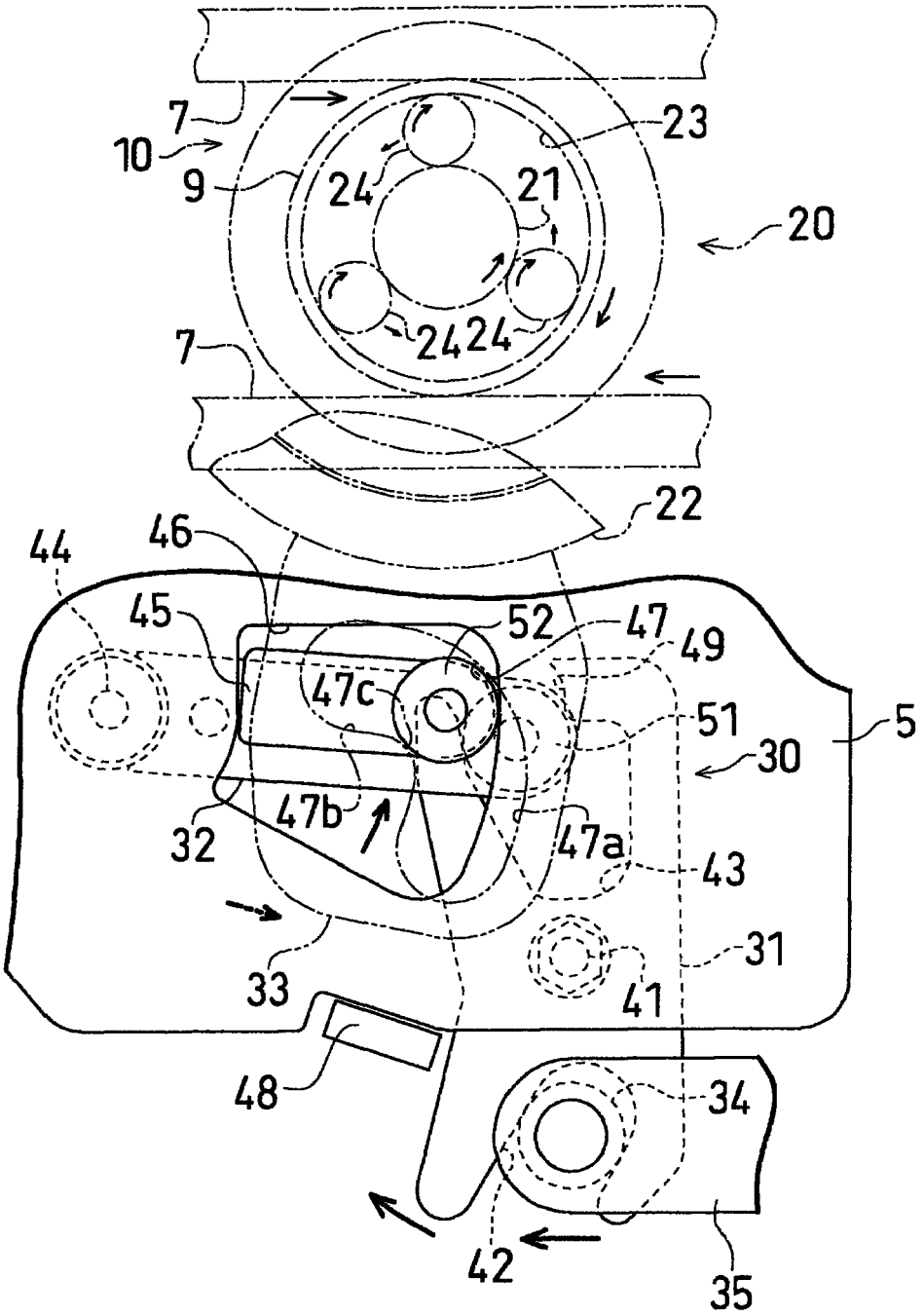
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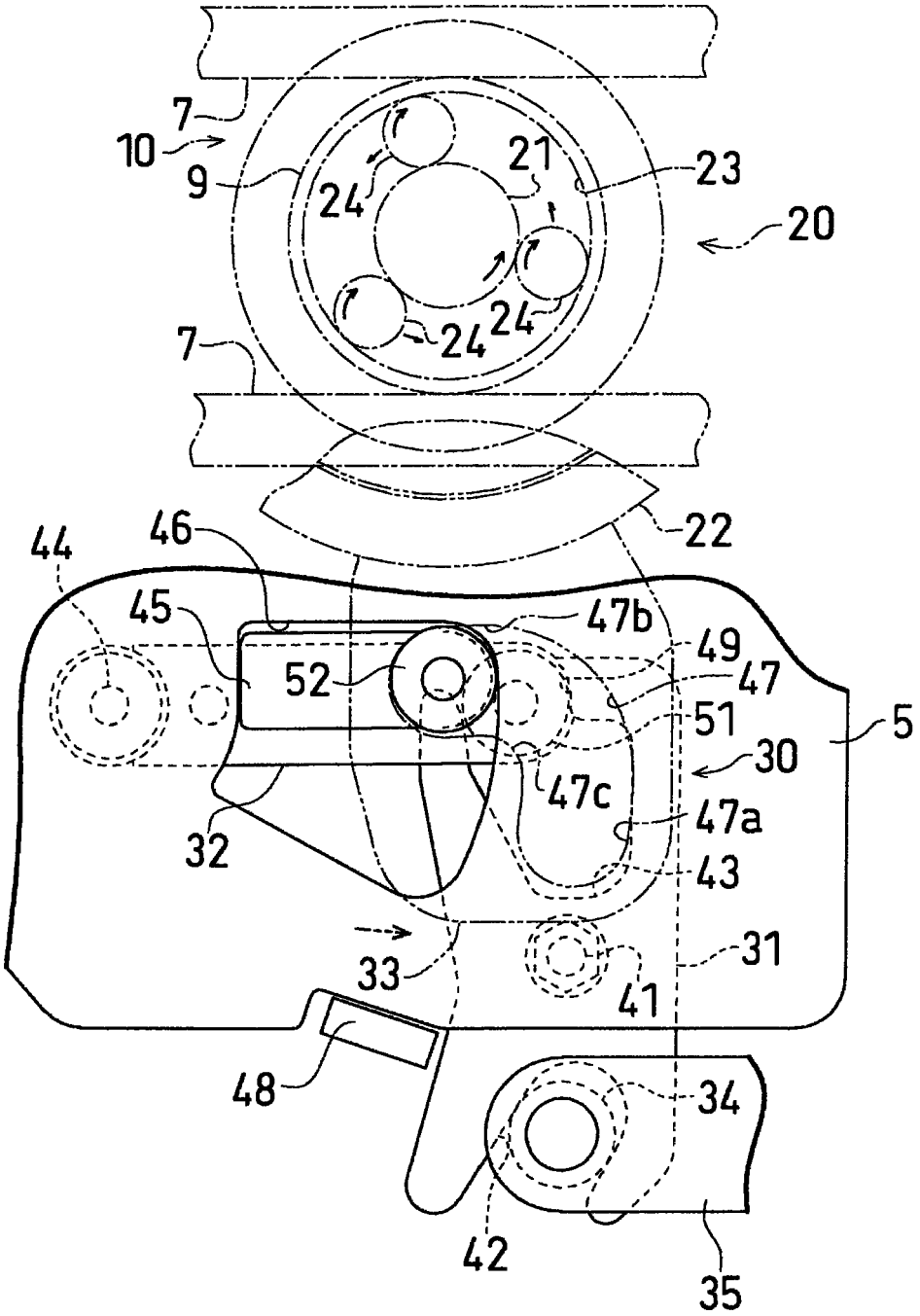
Fig.4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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 11 3884

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 5 483 769 A (ZWEILI ET AL) 16 January 1996 (1996-01-16) * column 3, line 43 - column 5, line 36; figures 1-8 *	1	INV. B61D19/00 E05F15/14
Y		1,2	
A		3	

Y	DE 197 35 181 A1 (WEBASTO TUERSYSTEME GMBH, 82131 STOCKDORF, DE; WEBASTO TUERSYSTEME GMB) 25 February 1999 (1999-02-25) * column 2, line 57 - column 5, line 63; figures 1-5 *	1,2	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 August 2006	Chlosta, P

CATEGORY OF CITED DOCUMENTS

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REFERENCES CITED IN THE DESCRIPTION

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