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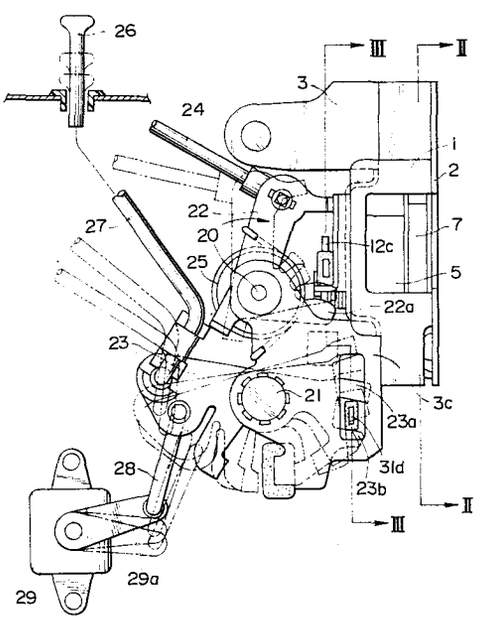
(54) Door lock system.

(57) A door lock assembly has a lock lever (19) for locking a door, and a control lever (31) connected with the lock lever for swinging the lock lever between a lock position and an unlock position. The control lever is connected with an lock knob or a key lock unit of the door. The control lever is swingable between a lock control position for holding the lock lever in the lock position and an unlock control position for holding the lock lever in the unlock position. The control lever can swing beyond the lock control position to a lock over position. The door lock assembly further has a positioning means (32) which enable the control lever to stop in the lock control position and the unlock control position. When the control lever is moved to the lock over position by the lock knob or the key lock unit, a position sensor (29) connected with the control lever produces a lock signal, which is sent to an actuator. The actuator is connected with a second door lock assembly for locking a second door. In response to the lock signal, the actuator puts the second door lock assembly into a lock position for locking the second door.



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DOOR LOCK SYSTEM

The present invention relates to a door lock system applicable to doors of a vehicle such as an automobile, and more specifically to a door lock system arranged to lock and unlock a plurality of doors all together.

Japanese Patent publication Sho 46-15882 discloses one example of such a door lock system. In this door lock system, a lock lever for locking and unlocking a door is resiliently connected, though a compression spring, with a control lever which is moved by a key lock device and an inside lock knob of the door. The control lever is arranged to swing beyond a range in which the lock lever can swing. A position sensor is connected with the control lever, and commands another door lock unit to lock or unlock another door when the control lever is moved beyond the range of the lock lever. However, this door lock system is disadvantageous in that its construction is complicated. Furthermore, in order to actuate the position sensor, the key lock device or the inside lock knob must be moved with a force strong enough to move the control lever against the force

of the compression spring. This feature significantly deteriorates a feeling of operating the key lock device and the inside lock knob. Besides, this door lock system is easily affected by rust. When the lock lever becomes stiff because of rust, this door lock system tends to falls into a condition in which the control lever can only deflects the compression spring but cannot move the lock lever to the lock position, so that this door lock system is incapable of locking the door.

It is an object of the present invention to provide a door lock system which is light in handling and resistant to rust.

According to the present invention, the door lock system comprises a first assembly and actuating means. The first assembly comprises lock means, control means, positioning means and position sensing means. The lock means locks a first door when the lock means is in a lock position, and unlocks the first door when the lock means is in an unlock position. The control means is connected with the lock means for moving the lock means between the lock position and the unlock position. The control means is capable of moving between a lock control position and an

unlock control position. The control means holds the lock means in the lock position when the control means is in the lock control position, and in the unlock position when the control means is in the unlock control position. The control means is capable of moving beyond the lock control position to a lock over position. The positioning means enables the control means to stop in the lock control position and the unlock control position. The position sensing means is connected with the control means for producing a lock signal when the control means is moved beyond the lock control position to the lock over position. The actuating means is connected with the position sensing means to receive the lock signal.

The door lock system may be further arranged so that the control means is capable of moving beyond the unlock control position to an unlock over position, and that the position sensing means produces an unlock signal when the control means is moved beyond the unlock control position to the unlock over position.

Preferably, the actuating means is connected with a second assembly which is capable of locking and unlocking a second door. The actuating means actuates the second assembly to lock the second door in response to the lock signal produced by

the position sensing means of the first assembly, and to unlock the second door in response to the unlock signal.

Fig. 1 is a side view of a door lock assembly of the present invention;

Fig. 2 is a sectional view taken along a line II-II of Fig. 1;

Fig. 3 is a sectional view taken along a line III-III of Fig. 1;

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

Fig. 5 is a sectional view similar to Fig. 3 but showing the lock state;

Fig. 6 is a sectional view similar to Fig. 4 but showing the lock state;

Fig. 7 is a circuit diagram of the door lock system of the present invention, applied to a four-door automobile;

Fig. 8 is a sectional view similar to Fig. 4 but showing another design.

One embodiment of the present invention is shown in Figs. 1 to 7. In Figs. 1 to 3, an unlatch state is shown by solid lines. This door lock system

has a hollow door lock case 1 of a synthetic resin, and a cover plate 2 and a base plate 3 between which the case 1 is sandwitched and fastened as a single unit. The case 1 and the cover plate 2 are formed with an opening 5 for receiving a striker 4 shown in Fig. 2. The striker 4 is fixed to a pillar (not shown).

A forked latch 7 has a first furcation 7a and a second furcation 7b which both extend from a base portion. The forked latch 7 is rotatably mounted, at the base portion, on a shaft 6 in the case 1. The shaft 6 is positioned above the opening 5. A spring 8 is disposed between a projection 2a of the cover plate 2 and the forked latch 7. The spring 8 rotates or tends to rotate the latch 7 in an unlatch direction which is a counterclockwise direction as viewed in Fig. 2. The furcations 7a and 7b of the latch 7 can receive the striker 4 therebetween.

A pawl 10 is disposed below the opening 5. The pawl 10 is rotatable from a detaining position shown by a solid line in Fig. 2 to a releasing position shown by a two-dot chain line in Fig. 2, and vice versa. In the detaining position, the pawl 10 lies within the extent of the rotational movement of the furcations 7a and 7b of the latch 7. In the

releasing position, the pawl 10 lies outside the extent. When the pawl 10 is in the detaining position, the latch 7 can occupy a half latch position (shown by a one-dot chain line in Fig. 2) in which the first furcation 7a is engaged with the pawl 10, and a full latch position (shown by a two-dot chain line in Fig. 2) in which the second furcation 7b is engaged with the pawl 10. When the pawl 10 is in the detaining position, the pawl 10 prevents the latch 7 from returning from the half latch position or the full latch position to an unlatch position shown by a solid line in Fig. 2. When the pawl 10 is moved to the releasing position shown by the two-dot chain line in Fig. 2, the spring 8 returns the latch 7 to the unlatch position. The pawl 10 is normally held in the detaining position by a spring 13 shown in Fig. 3.

A rotary plate 12 shown in Fig. 3 is fixed to the pawl 10. The pawl 10 is fixedly mounted on a shaft 10a which passes through the base plate 3 and has, at an end, the rotary plate 12 fixed thereto. The above-mentioned spring 13 is disposed between the rotary plate 12 and a projection 3b of the base plate 3. The spring 13 rotates or tends to rotate the rotary plate 12, the shaft 10a and

the pawl 10 in the clockwise direction as viewed in Fig. 3. The rotary plate 12 has a bent portion 12a which is bent toward the base plate 3, and a projecting portion 12b.

An outside handle lever 15 is mounted at the upper part of the base plate 3. The outside handle lever 15 is swingable on a shaft 14. A spring 16 applies, on the outside handle lever 15, a force tending to rotate the outside handle lever 15 in the clockwise direction in Fig. 3. One end of the outside handle lever 15 is connected with an outside handle rod 17 which is connected with an outside handle of the door (not shown). The outside handle lever 15 is formed with a support hole 18 lying between the shaft 14 and the swingable end connected with the outside handle rod 17.

An inside handle lever 22 shown in Fig. 1 is rotatably mounted on a shaft 20. The base plate 3 has a portion 3c which is bent perpendicularly. The shaft 20 is supported by this portion 3c of the base plate 3. The inside handle lever 22 is connected with an inside handle of the door (not shown) by an inside handle rod 24. A spring 25 is disposed between the portion 3c of the base plate 3 and the inside handle lever 22. The spring 25

applies a force tending to rotate the inside handle lever 22 in the clockwise direction as viewed in Fig. 1. The inside handle lever 22 has an operating portion 22a. The operating portion 22a lies under a follower portion 12c of the rotary plate 12. When the inside handle is operated by hand, the inside handle lever 22 swings from a position shown by a solid line in Fig. 1 to a position shown by a two-dot chain line in Fig. 1. During this swing motion, the operating portion 22a of the inside handle lever 22 pushes up the follower portion 12c of the rotary plate 12.

A lock knob lever 23 shown in Fig. 1 is rotatably mounted on a shaft 21, which is supported by the portion 3c of the base plate 3. The lock knob lever 23 is connected with an inside lock knob 26 by a lock knob rod 27. The lock knob lever 23 is swingable on the shaft 21 between an unlock position shown by a solid line and a lock position shown by a two-dot chain line in Fig. 1.

A position sensor 29 is connected with the lock knob lever 23. The position sensor 29 has a lever 29a. The lever 29a is connected with one arm of the lock knob lever 23 by a rod 28, as shown in Fig. 1. The position sensor 29 is connected

with actuators M_1, M_2 and M_3, as shown in Fig. 7.

A key lever 31 shown in Fig. 3 is disposed at the lower part of the base plate 3. The key lever 31 is rotatably supported, at a middle portion, on a shaft 30. The key lever has a first end 31d which is sandwitched between furcations 23a and 23b of a forked end of the lock knob lever 23. Accordingly, the end 31d of the key lever 31 and the forked end of the lock knob lever 23 move up and down together. The key lever 31 has a second end 31e which is connected with a key lock unit (not shown) of the door by a key rod 33. The key lever 31 has an extended portion 31f, which has a pin 34 fixed thereto.

A lock lever 19 shown in Fig. 3 has a first end 19a received in the above-mentioned support hole 18 of the outside handle lever 15, and a second end portion 19b having a slot 35 which receives the above-mentioned pin 34 of the key lever 31. The support hole 18 of the outside handle lever 15 swingably supports the first end 19a of the lock lever 19. The lock lever 19 is swingable about the first end 19a. The slot 35 is in the shape of a circular arc. The pin 34 is slidable in the slot 35. The lock lever 19 has an unlocking projection

19c and a bent edge 19d. The unlocking projection 19c lies near the bent portion 12a of the rotary plate 12. The bent edge 19d of the lock lever 19 lies near the projecting portion 12b of the rotary plate 12. When the lock lever 19 is in a position shown by a solid line in Fig. 3, the unlocking projection 19c of the lock lever 19 can push down the bent portion 12a of the rotary plate 12. When the lock lever 19 is in a position shown by a solid line in Fig. 5, the unlocking projection 19c is so apart from the bent portion 12a of the rotary plate 12 that the unlocking projection 19c cannot push down the bent portion 12a. In this position, the bent edge 19d of the lock lever 19 stands close to the projecting portion 12b of the rotary plate 12, and prevents the movement of the rotary plate 12.

A positioning mechanism 32 shown in Fig. 4 is provided between the key lever 31 and the stationary base plate 3. The positioning mechanism 32 has a compression spring 32b retained in a case 32a fixed to the base plate 3. The compression spring 32b pushes a push member 32c against the key lever 31. The key lever 31 is formed with two recesses, an unlock recess 31a and a lock recess 31b. The recesses 31a and 31b are adjacent to each other,

and lie on a circle along which a point fixed to the key lever 31 travels when the key lever 31 swings. The key lever 31 is further formed with a guide slope 31c adjacent to the lock recess 31b.

The thus constructed door lock system can be put in three positions, an unlock position, a lock position and a lock over position.

The unlock position is shown by solid line in Figs. 1, 3 and 4. When the lock knob lever 23 and the key lever 31 are moved to the unlock position, the unlock recess 31a of the key lever 31 receives the push member 32c of the positioning mechanism 32, and the lock lever 19 is held in the position shown by the solid line in Fig. 3. If the outside handle is operated by hand in this condition, the arm of the outside handle lever 15 pushes down the lock lever 19 to an unlatch position shown by a two-dot chain line in Fig. 3. During this movement, the unlocking projection 19c of the lock lever 19 pushes down the bent portion 12a of the rotary plate 12, and by so doing, rotates the pawl 10 from the detaining position to the releasing position. Therefore, the latch 7 is released, and the door is put in an openable state.

The lock position is shown by a two-dot chain

line in Fig. 1, and solid lines in Figs. 5 and 6. When the key lever 31 and the lock knob lever 23 are moved to the lock position, the lock recess 31b of the key lever 31 receives the push member 32c, and the lock lever 19 is held in the position shown by the solid line in Fig. 5. In this position, the unlocking projection 19c of the lock lever 19 is away from the bent portion 12a of the rotary plate 12, so that one cannot move the pawl 10 by operating the outside handle. The bent edge 19d of the lock lever 19 prevents the rotary plate 12 from rotating in the counterclockwise direction as viewed in Fig. 5, by engaging with the projecting portion 12b of the rotary plate 12. Therefore, one cannot move the pawl 10 by operating the inside handle. Thus, the door is locked in this lock position.

The lock over position is shown by one-dot chain lines in Figs. 1 and 5. The lock knob lever 23 and the key lever 31 can swing beyond the lock position to the lock over position. In this lock over position, the push member 32c of the positioning mechanism 32 lies on the guide slope 31c of the key lever 31. When the lock knob lever 23 and the key lever 31 are moved to the lock over position, the position sensor 29 is actuated, and causes the

actuators M_1, M_2 and M_3 to lock doors which are, respectively, connected with the actuators. The guide slope 31c produces a restoring force which returns or tends to return the lock knob lever 23 and the key lever 31 to the lock position. Therefore, the lock knob lever 23, the key lever 31 and the lock lever 19 return to the lock position when the inside lock knob or the key lock unit are set free.

Fig. 8 shows another design of the positioning mechanism 32. In this design, the key lever 31 is further formed with a second guide slope 31g adjacent to the unlock recess 31a. The position sensor 29 is arranged to command the actuators M_1, M_2 and M_3 to unlock the associated doors when the lock knob lever 23 and the key lever 31 are moved beyond the unlock position to an unlock over position in which the push member 32c lies on the second guide slope 31g. In this case, actuators of a type capable of moving in two opposite directions can be used as the actuators M_1, M_2 and M_3.

In this embodiment, the lock knob lever 23 and the key lever 31 are returned to the lock position or the unlock position by the action of the guide slope 31c or 31g and the spring 32b. This design can be modified by using a spring which is disposed

between the base plate 3 and the lock knob lever 23 or the key lever 31 for returning the lock knob lever 23 and the key lever 31 to the lock position or the unlock position. The feature of automatically returning the lock knob lever 23 and the key lever 31 to the lock position or the unlock position is not essential. The lock knob lever 23 and the key lever 31 may be held in the lock over position or the unlock over position.

The door lock system according to the present invention does not use a spring means used in the conventional design, and is so arranged that the control lever (the lock knob lever 23 and the key lever 31) can remain in the predetermined positions by the aid of the positioning means 32, and move beyond the predetermined positions. Accordingly, this system is very light in handling the inside lock knob and the key lock, and very reliable in that this system is not easily affected by rust. Besides, this system can be constructed by slightly modifying a conventional design, without changing its basic construction, in such a manner as to widen the extent of the movement of each lever.

CLAIMS

1. A door lock system comprising:

a first assembly which comprises

lock means (19) for locking a first door when said lock means is in a lock position and unlocking the first door when said lock means is in an unlock position,

control means (23, 31), connected with said lock means, for moving said lock means between the lock position and the unlock position, said control means being capable of moving between a lock control position and an unlock control position, said control means holding said lock means in the lock position when said control means is in the lock control position, and in the unlock position when said control means is in the unlock control position, said control means being capable of moving beyond the lock control position to a lock over position,

positioning means (32) for enabling said control means to stop in the lock control position and in the unlock control position, and

position sensing means (29), connected with said control means, for producing a lock signal when said control means is moved beyond the lock control position to the lock over position, and

actuating means connected with said position sensing means to receive the lock signal.

2. A door lock system according to Claim 1, wherein said control means is capable of moving beyond the unlock control position to an unlock over position, and said position sensing means produces an unlock signal when said control means is moved beyond the unlock control position to the unlock over position.

3. A door lock system according to Claim 2, further comprising a stationary casing (1, 2, 3) supporting said lock means and said control means, and wherein said positioning means is disposed between said control means and said casing, said positioning means comprising a spring (32b) which is retained by said casing, and a push member (32c) which is pushed by said spring against said control means, said control means being formed with a lock recess (31b) which receives said push member when said control means is in the lock control position, and an unlock recess (31a) which receives said push member when said control means is in the unlock control position.

4. A door lock system according to Claim 3, wherein said control means comprises a control lever (31) swingable in a swing plane, said lock and unlock recesses being formed in a surface of said control lever which is substantially parallel to the swing plane, said spring of said positioning means pushing said push member in a direction substantially normal to the swing plane.

5. A door lock system according to Claim 4, wherein said control lever is further formed with a first guide slope (31c) adjacent to said lock recess, said lock recess lying between said first guide slope and said unlock recess, said first guide slope being so inclined as to push said push member and compress said spring more and more as said control means is moved away from the lock control position toward the lock over position.

6. A door lock system according to Claim 5, wherein said control lever is further formed with a second guide slope (31g) adjacent to said unlock recess, said unlock recess lying between said second guide slope and said lock recess, said second guide slope being so inclined as to push said push member and

compress said spring more and more as said control means is moved beyond the unlock control position to the unlock over position.

7. A door lock system according to Claim 6, wherein said lock means comprises a lock lever (19) swingable in a plane substantially parallel to the swing plane of said control lever, said lock lever having a first end (19a) about which said lock lever is swingable, and a swingable second end which is formed with a slot (35), said control lever having a first arm having a pin (34) which is fixed thereto and slidably received in the slot of said lock lever.

8. A door lock system according to Claim 7, further comprising a second assembly capable of locking and unlocking a second door, and wherein said actuating means is connected with said second assembly for actuating said second assembly to lock the second door in response to the lock signal and to unlock the second door in response to the unlock signal.

9. A door lock system according to Claim 8, wherein said lock means remains in the lock position for holding the first door locked when said control

means is moved beyond the lock control position to the lock over position, and in the unlock position for holding the first door unlocked when said control means is moved beyond the unlock control position to the unlock over position.

10. A door lock assembly according to Claim 9, wherein said first assembly further comprises latch means which comprises a latch member (7) for latching the first door when said latch member is in a latch position, and unlatching the first door when said latch member is in an unlatch position, and pawl means (10, 12) movable between a detaining position and a releasing position, said pawl means preventing said latch member from moving from the latch position to the unlatch position when said pawl means is in the detaining position, and allowing said latch member to move freely when said pawl means is in the releasing position, said pawl means having a spring which normally holds said pawl means in the detaining position, said lock means preventing said pawl means from moving from the detaining position to the releasing position when said lock means is in the lock position.

11. A door lock system according to Claim 10, wherein said door lock system is adapted to be mounted on a vehicle for locking and unlocking doors of the vehicle, the first and second doors being doors of the vehicle, the first door having an inside handle, an outside handle, an inside lock knob and a key lock unit, and wherein said first assembly further comprises a swingable inside handle lever (22) which is so connected with the inside handle of the first door as to be swung by the movement of the inside handle, and capable of moving said pawl means from the detaining position to the releasing position by swinging and pushing a first portion (12c) of said pawl means, and a swingable outside handle lever (15) which is so connected with the outside handle of the first door as to be swung by the movement of the outside handle, and capable of moving said pawl means from the detaining position to the releasing position by swinging, said control means further comprising a swingable lock knob lever (23) which is connected with the inside lock knob of the first door to be swung by the movement of the inside lock knob, said lock knob lever having a swingable end connected with a swingable end of said control lever so that the swingable end of

the lock knob lever swings together with the swingable end of said control lever, said control lever being connected with the key lock unit of the first door to be swung by the movement of the key lock unit.

12. A door lock system according to Claim 11, wherein the first end of said lock lever is pivotally supported by a swingable arm of said outside handle lever, said lock lever being capable of moving longitudinally in a reciprocating manner with the swing motion of said outside handle lever, said lock lever being capable of swinging between the lock position and the unlock position about the first end supported by said outside handle lever with the swing motion of said control lever, said lock lever having a third portion (19c) which lies close to a second portion (12a) of said pawl means when said lock lever is in the unlock position and apart from the second portion of said pawl means when said lock lever is in the lock position, said lock lever further having a fourth portion (19d) which lies close to a third portion (12b) of said pawl means when said lock lever is in the lock position and apart from the third portion of said pawl means when said lock lever is in the unlock position, said third portion

of said lock lever pushing said second portion of said pawl means when said lock lever moves longitudinally in the unlock position, said fourth portion of said lock lever preventing said pawl means from moving from the detaining position to the releasing position when said lock lever is in the lock position.

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FIG.1

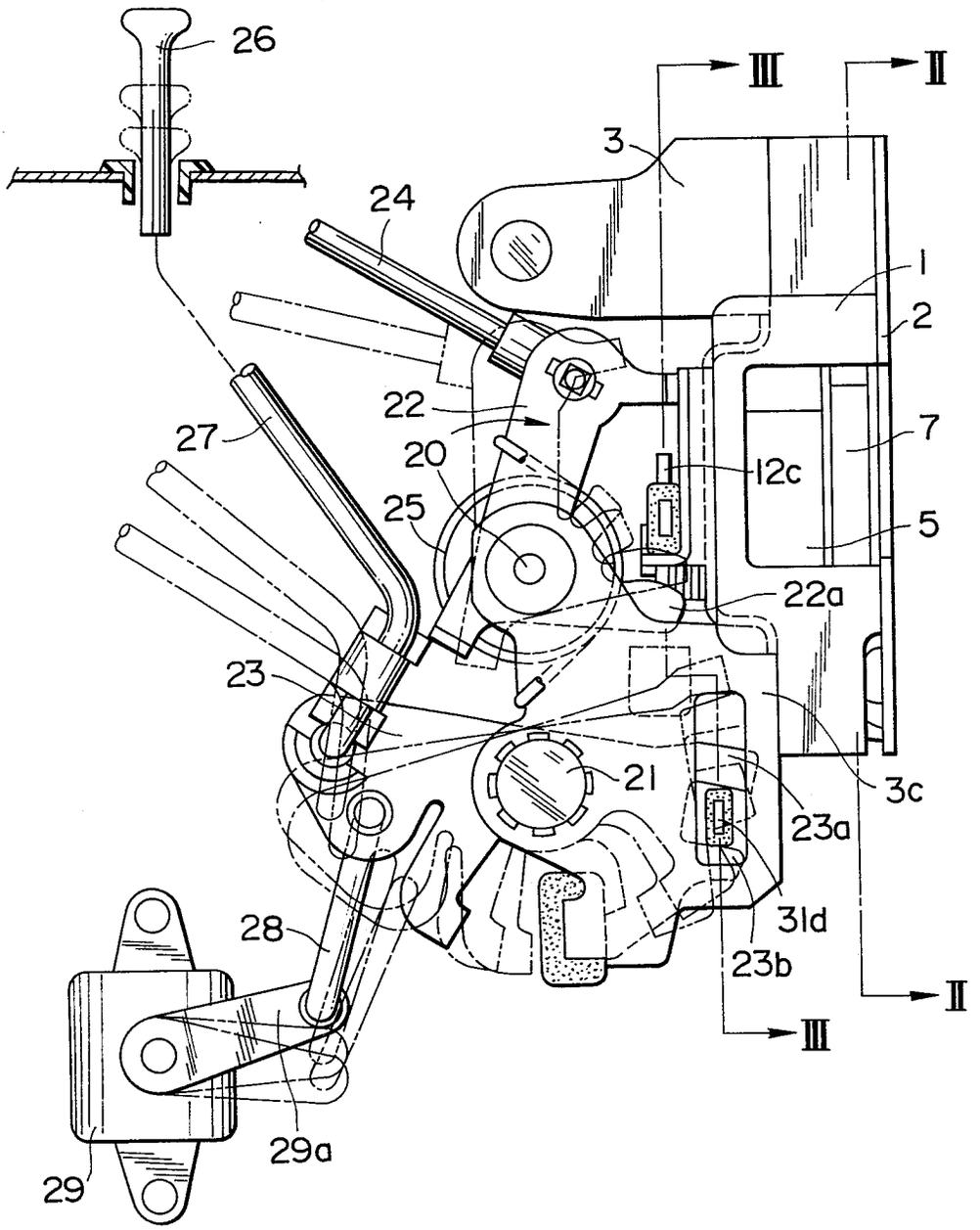

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FIG.2

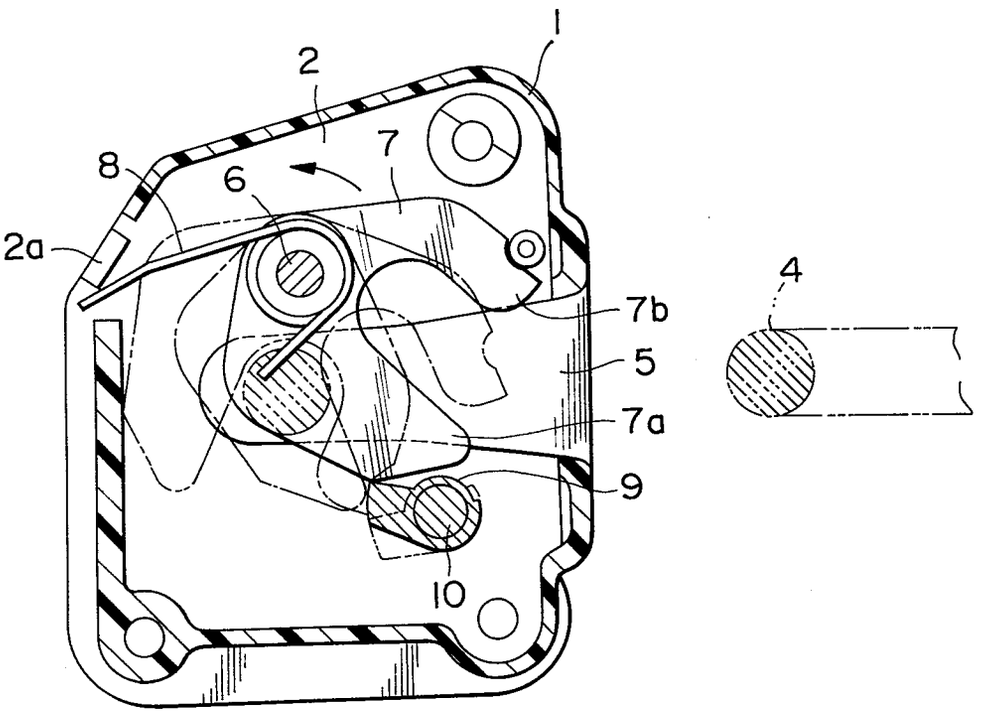

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FIG.3

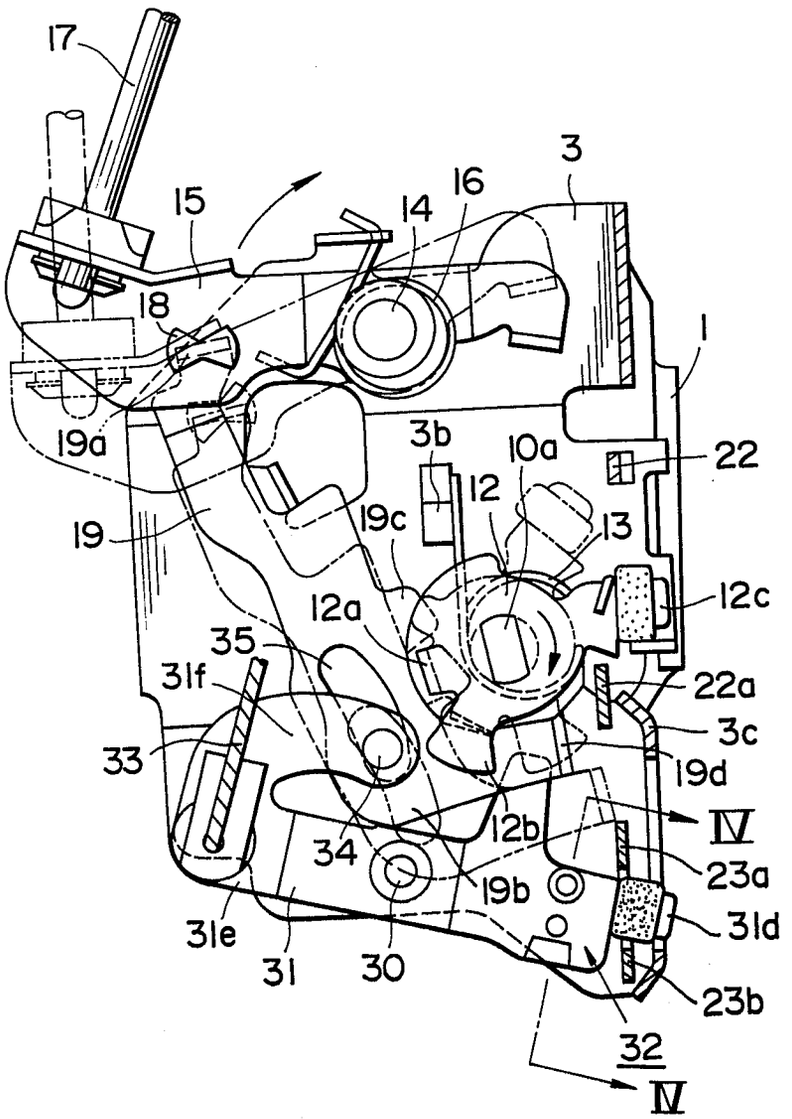

FIG.4

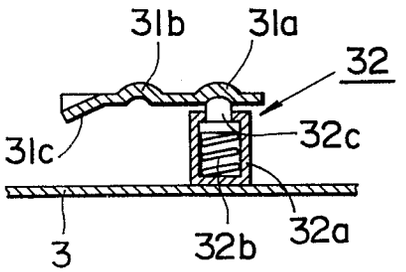

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FIG.5

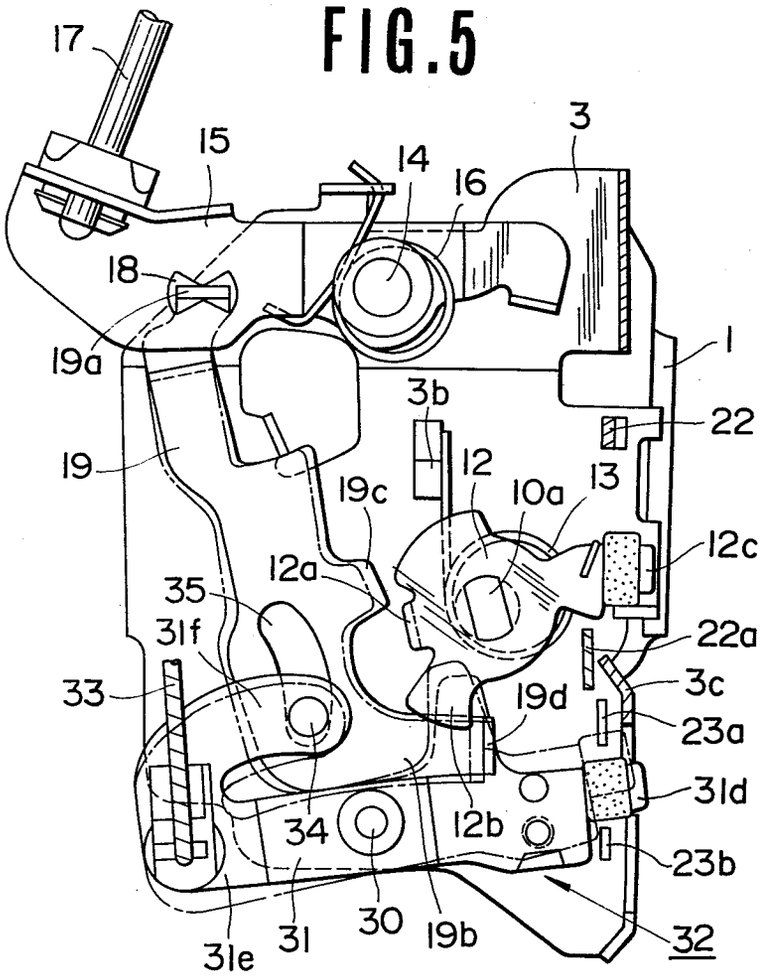

FIG.6

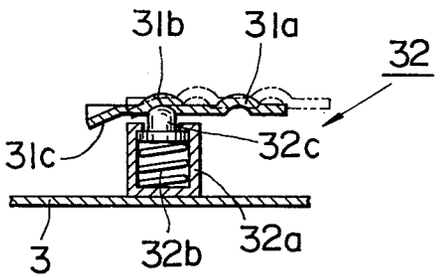

FIG.7

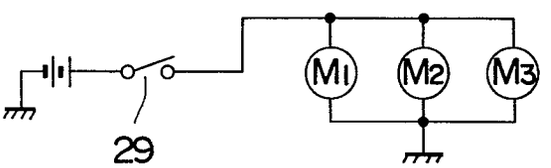

FIG.8