Dec. 30, 1969 P. BOUTHORS ET AL 3,486,352

AUTOMOTIVE ELECTRIC DOOR LOCK SYSTEMS

Filed May 17, 1968 2 Sheets-Sheet 1

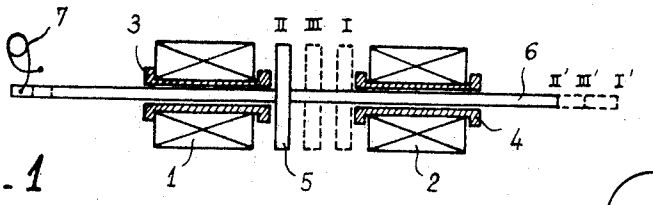

Fig. 1

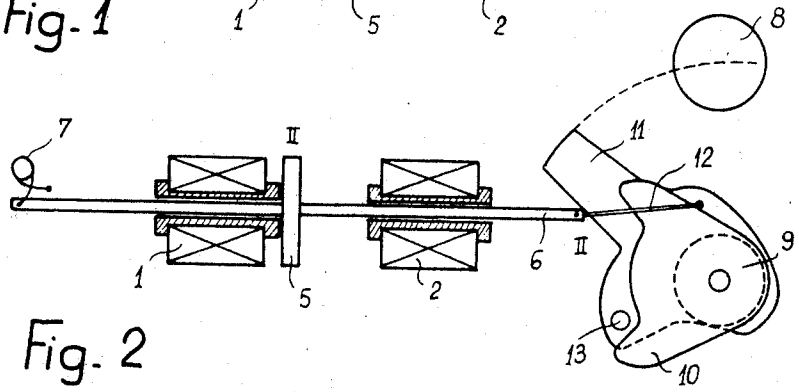

Fig. 2

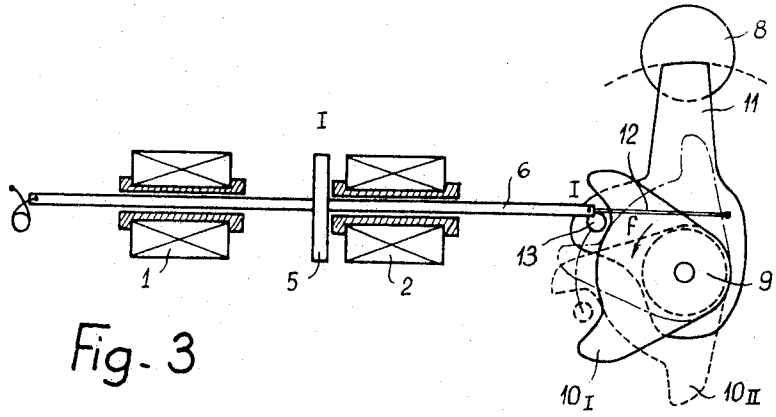

Fig. 3

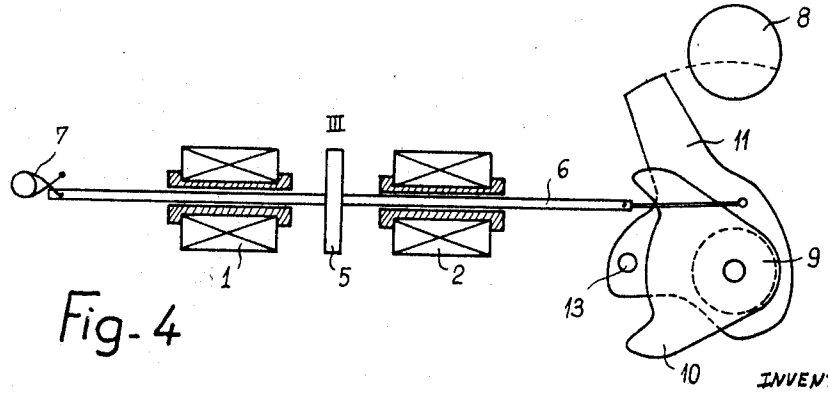

Fig. 4

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AUTOMOTIVE ELECTRIC DOOR LOCK SYSTEMS

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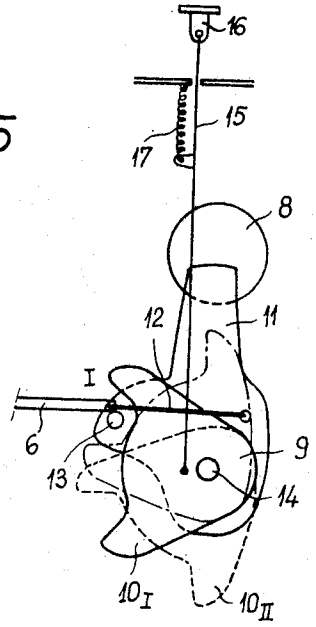
Fig-5



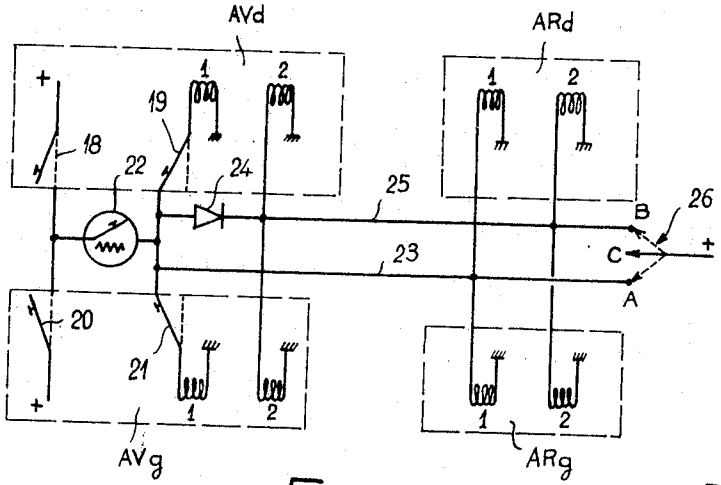


Fig-6

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AUTOMOTIVE ELECTRIC DOOR LOCK SYSTEMS

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U.S. Cl. 70—264 11 Claims

ABSTRACT OF THE DISCLOSURE

An electric device for simultaneously locking the doors of an automotive vehicle, each door being provided with an electromagnetic system each system having a movable member which is rigid with a ferrite type permanent magnet and is connected to a pivoting member adapted to lock the member controlling the opening of the door, and the electromagnetic systems of the front doors are associated with electric switches actuated by the relevant doors so as to constitute electric barrel locks adapted, when either one of the front doors is opened, to put all the other doors in a "temporarily unlocked" condition, and to lock said other doors when said front door is closed and remains unlocked.

The present invention relates to door lock systems of automobiles and has specific reference to an electric device for simultaneously locking and unlocking the doors of an automobile. Its purpose is to avoid the unpleasant contortions necessary for locking or unlocking the doors of an automobile when the driver or a passenger is alone in the front compartment of the vehicle.

It is already known to provide to this end on the front doors or in the vicinity thereof small barrels constituting electrical switches, and, in the doors themselves, coils adapted, according to their energization, to lock or unlock the doors by attracting an iron core or a permanent magnet. It may be more advantageous to control the locking and unlocking of the automobile doors by closing or opening the front doors by means of a door switch. However, if it is required, for instance, to have the possibility of stepping out of or into the vehicle indifferently from the off-side or near-side thereof, for example in narrow parking spaces and garages, of prohibiting the locking of the doors in case the lock keys are inadvertently left inside of the vehicle, of driving at will with the doors locked or unlocked, of avoiding the continuous energization of the lock coils when driving to avoid coil overheating, it is frequently necessary to use complicated electric circuits and/or locks.

It is the object of the present invention to provide a simple device capable of meeting the above-mentioned requirements by creating between the "locked" and "unlocked" positions a third position referred to hereinafter as the "temporarily unlocked position," so that even the most complicated requirements can be met.

The electric device according to this invention for simultaneously locking the doors of an automotive vehicle, in which each door comprises an electromagnetic system of the coil and permanent magnet type, is characterised in that the movable member of said electromagnetic system of each door is rigid with a ferrite permanent magnet and connected to a pivoting member adapted to lock the door opening control member, and that the electromagnetic systems of the front doors are associated with door-operated electric switches with a view to constitute electric barrels adapted, when either of the front doors is open, to put all the other doors in a state of "temporarily unlocked" condition and lock these other doors when said front door is closed, the latter remaining unlocked.

The advantages resulting from this arrangement may be summarized as follows:

Under normal driving conditions the coils remain de-energized;

The use of ferrite magnets provides a simple locking action by magnetic attraction exerted on the cores;

The other doors can be unlocked by simply opening a front door, so that the driver for instance can enable other persons to open another door by simply opening "his" door;

The "temporarily locked" position is useful in that it simplifies the electric circuit while meeting many otherwise contradictory requirements;

The entire movable assembly can be operated by conventional means such as barrels and push-buttons mounted on the edge of the doors, so that in case of failure in the supply of energizing current the locks can be released in the usual manner.

In order to afford a better understanding of the invention and of the manner in which the same may be carried out in practice, reference will now be made to the accompanying drawing illustrating diagrammatically by way of example a typical form of embodiment of the control device of this invention. In the drawing:

FIGURE 1 illustrates the basic principles of the electromagnetic system of this invention;

FIGURES 2, 3 and 4 illustrate a typical application of this system to a front door lock, shown respectively in the unlocked position, in the locked position and in the temporarily locked position;

FIGURE 5 illustrates by way of example the application of this system to a rear door lock, and

FIGURE 6 is the wiring diagram of the device.

Referring first to FIGURE 1, it will be seen that the electromagnetic system incorporated in each door comprises two coils **1** and **2** advantageously reinforced by tubular ferromagnetic cores **3** and **4** and of a ferrite permanent magnet **5** secured to a rod **6** of non-magnetic material, which is adapted to slide through said cores. According to the energization applied to the coils, the ferrite magnet **5** is in position I, II or III as shown in the drawing.

If coil **1** alone is energized, so as to repel the **30** ferrite magnet **5**, the latter will be moved to position I and when the energizing current is cut off the ferrite magnet **5** will remain "locked" by adhering to core **4**.

If coil **2** alone is energized, so as to repel the ferrite magnet **5**, the latter will be moved to position II and when the energizing current is cut off the ferrite magnet **5** will remain "locked" by adhering to core **3**.

If both coils are energized so as to repel the ferrite magnet **5**, the latter will be maintained in an intermediate or balance position III between I and II, a suitable spring being provided for returning the ferrite magnet to position I when the energization of the two coils is discontinued. This spring may consist for example of a horn-shaped spring **7** having one end secured to the supporting plate carrying the coils **1** and **2**, and the other end attached to the sliding rod **6**.

Thus, the end of rod **6** is in position I', II' or III', positions I' and II' being stable even when the coil energizing current is cut off, but position II' is unstable since rod **6** is urged to position I' by the return spring **7**. These positions I', II' and III' are used for locking or unlocking a door by preventing the control push-button from actuating the corresponding door lock.

As shown in FIGURES 2 and 4, the front doors comprice an external push-button **8** and a separate barrel lock **9** adapted to actuate a two-horned lever **10**. A member **11**

adapted to rotate about the barrel axis can prevent or not the push-button **8** from actuating the door lock (not shown). This member **11** is actuatable by means of a link **12** pivoted to the adjacent end of sliding rod **6** and to member **11**, as shown. The position II of rod **6** (FIGURE 2) corresponds to the unlocked position since member **11** does not engage the push-button **8**. This is a stable position because when the energizing current is cut off in coil **2**, the ferrite magnet **5** and therefore member **11** remain stationary. Similarly, position I of FIGURE 3 is a locked position for member **11** prevents the push-button **8** from controlling the lock **9**, thus providing a stable position. Position III (FIGURE 4) corresponds to an unlocked position for member **11** is disengaged from push-button **8**, but nevertheless this is an unstable position for the movable assembly is returned to the locked position I of FIGURE 3 when the supply of energizing current is discontinued.

The passage from position I to position II and vice versa may also be controlled manually by turning the lever **10**, i.e. by turning a key in the barrel lock **9**; thus, for instance, the change from position I to position II is obtained by turning the barrel in the counter-clockwise direction *f* (FIGURE 3); as lever **10** engages the finger **13** of member **11**, the latter is moved from its position 10_I shown in thick lines to its position 10_{II} shown in dash lines. To extract the key from the barrel the key must be restored to its vertical position, thus moving the lever **10** back to position 10_I after taking up the lost motion.

In a rear door (FIGURE 5) instead of a barrel the same lever **10** pivoted on a pin **14** is controlled for example by a rod **15** carrying a lock button **16** emerging from the edge of the door, and providing position I or position II according as it is pulled or pushed. A spring **17** restores the push-button **16** to its intermediate position in order to reset the lever **10** rotating about the pin **14** and take up the lost motion.

Referring now to the wiring diagram of FIGURE 6 it will be seen that each front door comprises two edge or door switches, namely **18**, **19** for the right-hand front door AV_d and **20**, **21** for the left-hand front door AV_g. Switches **18** and **20** are connected in parallel on one side to the positive terminal of the power source, and on other side through a thermal switch **22** to switches **19** and **21** inserted in the circuit of coils **1** of the front-door magnetic system. Switches **18** and **20** are open when the corresponding door is closed, and switches **19** and **21** are then closed. The thermal switch **22** serves the purpose of avoiding any undue overheating of the coils when it is desired to keep the doors open during a relatively long time.

The energizing switches **18** and **20** are adapted to energize through a first circuit **23** the coils **1** of all the doors, and through a diode **24** and another circuit **25** all the coils **2**. All these coils **1** and **2** have one end grounded by being connected to the negative terminal of the power source.

A reversing switch **26** having two instable positions A and B is connected to the positive terminal of the power source and permits of supplying current either to circuit **23** or to circuit **25**; it is urged to its neutral position C by a spring (not shown) when released.

The above-described device operates as follows:

When a front door is opened, energizing current is caused to flow through all the coils except the coil **1** of this door, since switch **19** (or **21**) is open. All the other doors are then in the above-defined "temporarily unlocked" condition, while the thus open front door is in its "unlocked" condition. When the door is closed, the other three doors resume their "locked" condition and the just closed door remains "unlocked." It is clear that with this system the only door to be locked by using the lock key is the front door having been closed last. Switch **26** in position A permits supplying energizing current through all the coils and to obtain the "temporary unlocking" condition, and therefore to lock all the doors when said switch is released; in the switch position B current flows only through coils **2** due to the presence of diode **24**, and therefore the doors can be "unlocked."

This reversing switch **26** may be of any suitable and known type, for example a control button mounted on the instrument panel, or a device connected to the starting or ignition system of the vehicle. In this last case, when the vehicle is started all the doors are unlocked to permit the access to the inside in case of a crash.

It may also be contemplated to lock the doors from inside the vehicle, in order to protect the passengers against wrong maneuvers. In this case the reversing switch **26** may consist of a device adapted automatically to lock the doors when the vehicle exceeds a predetermined speed, and to unlock them when the vehicle speed is low.

Of course, various modifications and variations may be brought to the specific form of embodiment of the present invention which is shown and described herein, without inasmuch departing from the spirit and scope of the invention.

We claim:

1. An electric device for simultaneously locking the doors of an automotive vehicle, having at each door an electromagnetic locking system provided with two fixed tandem coils energized by a power source and with a movable member with an attached resilient member, said movable member being actuated by said coils and connected to a pivoting member adapted to lock and unlock a member of the door lock controlling the opening of this door, said movable member being rigid with a ferrite type permanent magnet disposed between said tandem coils to be repelled by either coil when energized, each front door locking system comprising a first door-switch and a second door-switch, both switches being actuated by the relevant door, said first switch being adapted to energize at least one coil for each of the doors, said second switch being inserted in the energizing circuit of a first of said tandem coils locking said relevant door when said second switch is closed, said front door electromagnetic system associated with said two switches comprising an electric barrel lock adapted, when either one of the front doors is opened, to put all the other doors of the vehicle in a temporarily unlocked position, and to lock said other doors when said one front door is closed, said one front door remaining unlocked.

2. An electric device according to claim **1**, wherein each coil has an inner fixed tubular ferromagnetic core and said movable member is a non-magnetic rod sliding in said tubular cores of said tandem coils.

3. An electric device according to claim **2**, wherein the size of said ferrite magnet and said coils are so dimensioned and connected, that the magnetic field of an energized coil repels said ferrite magnet until to such position that it remains stuck to the core of the non-energized coil even after the energizing current supply to said one coil has been discontinued.

4. An electric device according to claim **1**, wherein in said temporarily unlocked condition said magnet is maintained equally spaced from said tandem coils by simultaneous energization of said tandem coils, said movable member being then in a mechanically unstable position and urged by said resilient member to a locking position if current supply is simultaneously discontinued to both said coils.

5. An electric device according to claim **1**, wherein said first switches of the front doors are connected in parallel on the one side directly to one of the terminals of the power source, and on the other side to a first circuit connected to the energizing circuits of said first coils of all the doors for locking said door lock control member, and to another circuit connected to the second coils of all the doors for releasing said member.

6. An electric device according to claim **1**, wherein said first switch of the front doors are in their open contact position when the corresponding front door is closed.

and said second switch in said first coil circuit is then in its closed contact position.

7. An electric device according to claim 5, wherein a diode is inserted in said other coil energizing circuit connected to said second coils.

8. An electric device according to claim 5, wherein a thermal switch is inserted between the first switches controlling the coil energization and said two coil energizing circuits.

9. An electric device according to claim 5, further comprising a reversing switch having two unstable positions and being connected to said two coil energizing circuits in order to, in a first position, permit energizing all the door coils, so as to cause firstly said temporary unlocked position and then, by releasing said reversing switch, the locking of all the doors, and, in a second position permitting energizing only the coils controlling the unlocking of the doors.

10. An electric device according to claim 9, wherein said reversing switch is operatively connected to the starting system of the vehicle and adapted to unlock the doors when the vehicle has been moved from rest.

11. An electric device according to claim 9, wherein said reversing switch is responsive to the vehicle speed,

so as to automatically lock the doors when a predetermined speed is attained.

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