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COINCIDENTAL DOOR LOCKING SYSTEM

Original Filed Sept. 11, 1959

5 Sheets-Sheet 1

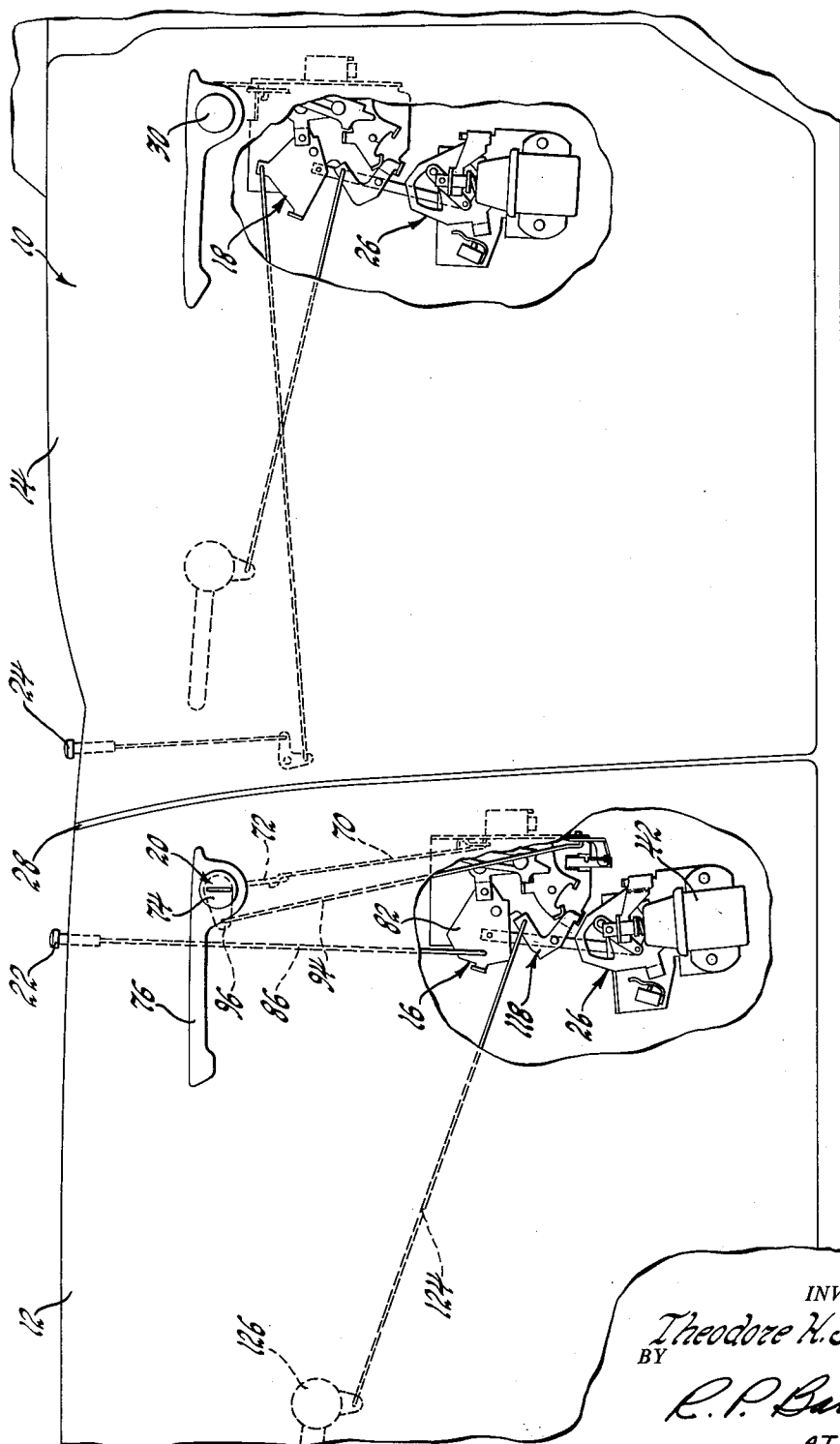


Fig. 1

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5 Sheets-Sheet 2

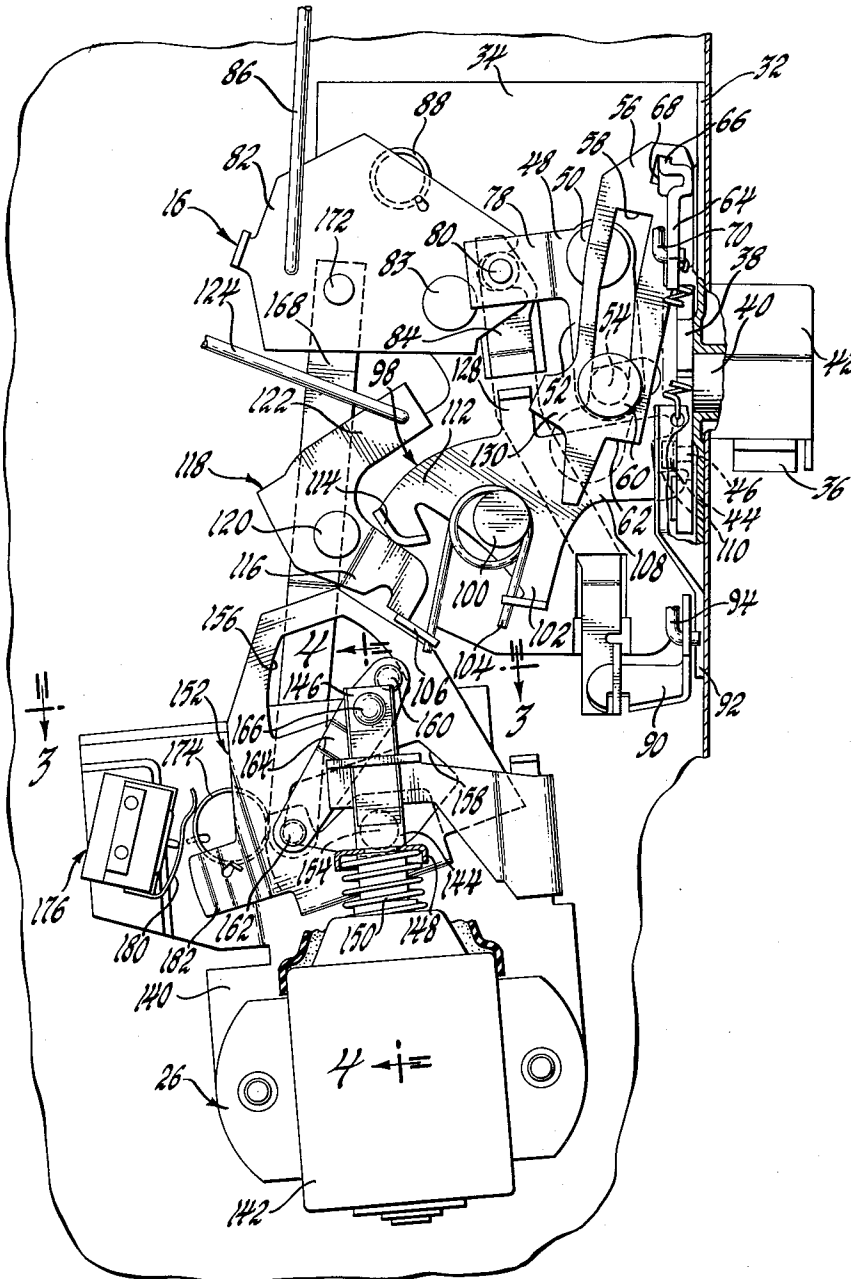


Fig. 2

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5 Sheets-Sheet 3

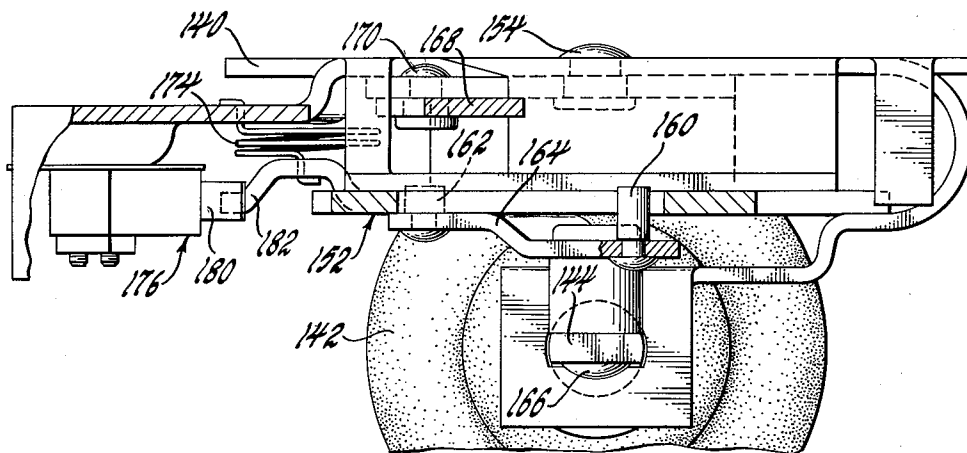


Fig. 3

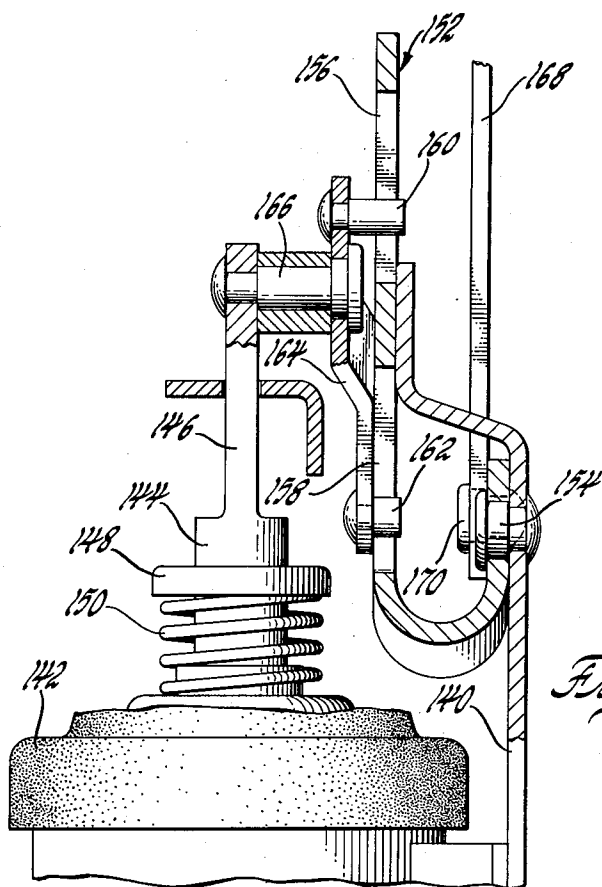


Fig. 4

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5 Sheets-Sheet 5

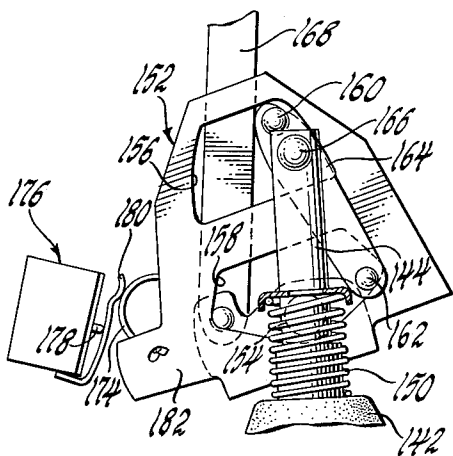


Fig. 7

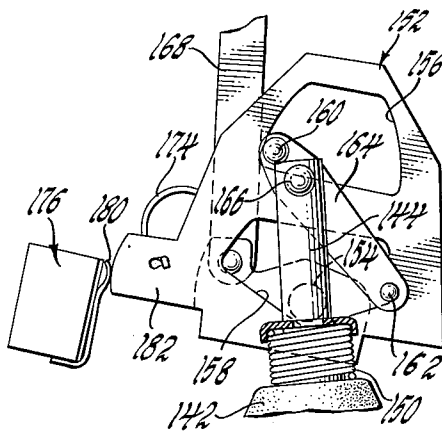


Fig. 8

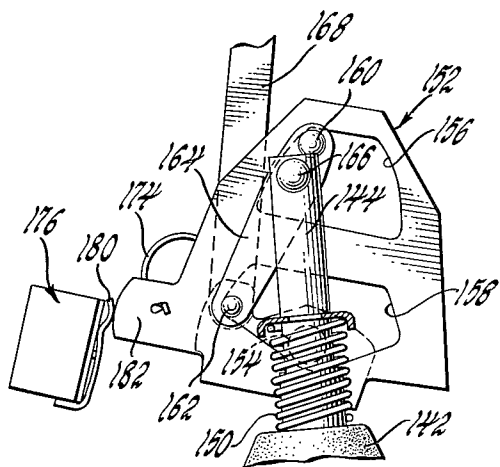


Fig. 9

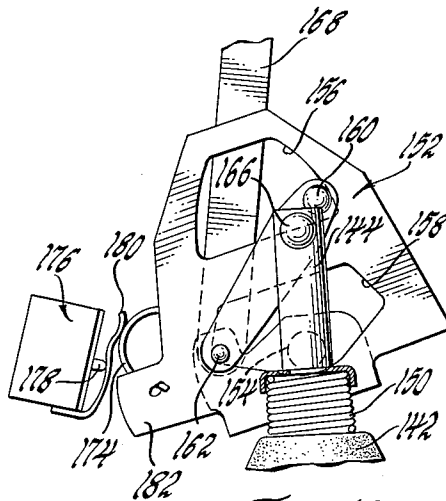


Fig. 10

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COINCIDENTAL DOOR LOCKING SYSTEM

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Continuation of abandoned application Ser. No. 839,394, Sept. 11, 1959. This application July 11, 1960, Ser. No. 42,012

8 Claims. (Cl. 70—264)

The present invention relates to an improved door locking mechanism and more particularly one in which it is possible to automatically lock all vehicle doors from a single position within the vehicle. This is a continuation of Serial No. 839,394, Coincidental Door Locking System, Johnstone, filed September 11, 1959, now abandoned.

Under many vehicle operating conditions it is advantageous for the operator or another person in the front seat of the vehicle to be able to automatically lock or unlock the remaining doors of the vehicle. This is particularly true where the vehicle includes rear doors. Such coincidental door locking systems have long been desired and many have been built. However, in general, these systems have been costly to build and subject to considerable operating difficulties. One of the major factors resulting in unduly high costs for such system has been the necessity, heretofore, of using a pair of solenoids on each door locking mechanism, one solenoid for locking and another for unlocking.

In the present invention a unique operating linkage system has been developed which enables a single solenoid to be utilized on each door locking mechanism to achieve both locking and unlocking. Another difficulty realized in the past with such coincidental door locking systems has been the possibility of the various door locks getting out of phase with the master control disposed in the front passenger compartment. In the present invention an electrical control system has been developed which insures that the various individual door locks cannot get out of phase with the master control system.

The details as well as other objects and advantages of the present invention will be apparent from a perusal of the detailed description which follows.

In the drawings:

FIGURE 1 illustrates a vehicle embodying the subject invention;

FIGURE 2 is an enlarged view of one of the door locking mechanisms;

FIGURE 3 is a view along line 3—3 of FIGURE 2;

FIGURE 4 is a view along line 4—4 of FIGURE 2;

FIGURE 5 is an enlarged view of the solenoid powered rocking member actuator mechanism in a slightly different position than that shown in FIGURE 2;

FIGURE 6 is a diagrammatic representation of the electrical control system utilized with the subject system; and

FIGURES 7—10 show the solenoid controlled rocking lever in various stages of operation.

A vehicle is indicated generally at 10 and includes front and rear doors 12 and 14. The actual door latching mechanisms 16 and 18 are substantially identical differing only in the fact that a key lock mechanism 20 is provided for the front door mechanism 16 in addition to the normal garnish molding locking devices 22 and 24. Door latching mechanisms 16 and 18 are shown and described in Leslie Patent 2,877,043, entitled "Rotary Bolt Door Latch," and do not, per se, constitute a part of the present invention.

The coincidental door latching mechanism includes solenoid controlled devices 26 mounted on each door and operatively connected with the door latching mechanisms 16 and 18. It is solenoid devices 26 in combination with the door latch mechanisms which constitute the subject

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matter of the present invention. The coincidental door locking devices 26 are identical, and, therefore, it will only be necessary to describe one of them.

Before describing the coincidental door locking devices, a brief description of the door latching mechanisms 16 and 18 will be undertaken.

Referring now more particularly to the drawings, FIGURE 1 shows front door 12 hingedly mounted at its front edge in conventional manner, and a rear door 14 hingedly mounted at its front edge on a center body pillar 28 which terminates at the belt line of the car. As will appear in more detail as the description proceeds, these latching mechanisms 16 and 18 are basically identical, but the rear door latch 18 includes some modifications in the means of connecting the release lever to the door outside operator 30. The front door latch is shown in detail in FIGURE 2.

Referring now more particularly to FIGURES 1 and 2, latch mechanism 16 has a right angular frame comprising a body portion 32 which, when the latch is mounted in the door, lies in a plane generally parallel to the jamb face of the door, and a flange portion 34 which lies in a plane generally parallel to the inside panel of the door. Latching means including a bolt 36 and a cam 38 are rotatably mounted on the body 32, the bolt and the cam being rigidly secured to a rotatable stud shaft 40. The outer end of this shaft is journaled in a bolt housing 42 (FIGS. 1 and 4). The arrangement of the bolt housing and the cooperation of the bolt 36 and housing 42 with a striker on the automobile body are shown in detail in the copending application of Stanley D. Cockburn et al., entitled "Rotary Gear Bolt Door Latch," filed November 16, 1953, as Serial No. 392,266, now Patent No. 2,871,049, issued January 27, 1959, and in the copending application of Stanley D. Cockburn et al., entitled "Door Latch Safety Interlock," filed December 30, 1954, as Serial No. 478,766.

A detent 44 is pivotally mounted on the body 32 and has a foot 46 adapted to engage cam 38 to block rotatable movement of the bolt 36 in one direction so that the door will be held latched with the bolt teeth engaging complementary teeth on the striker. In order to open the door, detent 44 is pivoted in a downward direction as the parts appear in FIGURE 2 to move the foot 46 out of blocking relation with the bolt.

A locking bell crank lever 48 is pivotally mounted on a stud 50 on the flange 34, one arm 52 of the bell crank having a guide stud 54 projecting therefrom, and an intermittent or release link 56 is slidably mounted on the stud 54. The stud extends through an elongated longitudinal slot 58 in the link and a collar 60 holds the link on the stud. Adjacent its lower end the link 56 has a shoulder 62 adapted to engage detent 44 so that downwardly slidable movement of the link pivots the detent out of engagement with the cam 38. Mounting the link 56 loosely on the bell crank eliminates the possibility that the link will bind and minimizes friction in the operation of the link.

Outside operating means for sliding link 56 comprises an operating lever 64 pivotally mounted on the body 32 by means of a stud, not shown. Projecting from the inner end of the operating lever is an integral finger 66 which extends through an opening 68 in the link 56. The opening 68 is larger than the finger 66 to provide a loose fit so that the link 56 may swing around the finger 66 when the link is moved to its locked position as will later be described. The outer end of the operating lever 64 is connected to a rod 70 which extends to a lever 72 on the door shown in FIGURE 1. A push button 74 of conventional construction in a fixed gripping handle 76 on front door 12 is arranged to move lever 72 upon depression of the push button to raise the outer end of the operating lever 64, depressing the finger 66 and sliding the link 56 downwardly so that the shoulder 62 en-

gages detent 44 and pivots the detent out of engagement with the cam 38 to free the bolt for rotation in either direction.

In order to lock the door, the link 56 is swung about the axis formed by the finger 66 to the position shown in FIGURE 2. When in this position, shoulder 62 on the intermittent link bypasses detent 44 when the push button 74 is depressed. In order to swing the intermittent link 56 to locked position, the bell crank 48 is pivoted in a clockwise direction as the parts appear in FIGURE 2. An arm 78 of bell crank 48 is connected by a stud 80 to a pivoted inside locking lever 82 and also to a link 84 which forms a part of the outside locking means.

The inside locking lever 82 is connected by a rod 86 to a conventional garnish molding push button 22 (FIGURE 1) which, when depressed, pivots the lever 82 in a counterclockwise direction, causing the bell crank 48 to pivot in a clockwise direction and the link 56 to swing about the axis of finger 66 to its locked position where the shoulder 62 bypasses the detent 44 upon sliding movement of the link. Under these conditions, the outside push button 74 merely "free wheels" without releasing the latch. An overcenter spring 88 yieldably holds the inside locking lever 82 in either its locked or unlocked position.

As shown in FIGURE 2, the link 84 projects through an opening in the frame and extends down to the lower edge of the frame where it makes pivotal connection with an outside locking lever 90 pivoted at 92 on body portion 32 of the frame. The outer end of locking lever 90 is connected by a rod 94 and a lever 96 (FIGURE 1) to conventional key locking cylinder device 20.

The inside release means for the door latch includes a multi-armed lever 98 pivoted on the flange on a stud 100. One arm 102 of the lever 98 is connected to one end of a coil spring 104 which is wrapped around stud 100 and which has its other end anchored in a tab 106 bent from the lower edge of the lock frame portion 34. This spring biases the lever 90 in a counterclockwise direction and, by virtue of a connection between lever 98 and the detent 44, releasably holds the detent in engagement with the cam 38. Another arm 108 has a notch 110 in its end through which detent 44 projects. A third arm 112 of the lever 98 terminates in a turned flange 114 which lies adjacent the end of one arm 116 of a bell crank 118 pivoted on flange 34 at 120, the other arm 122 of the bell crank 118 is connected to a rod 124 which extends to a conventional inside turn handle 126 on the door (see FIGURE 1). Still another arm 128 of the multi-armed lever 98 terminates in a flange which lies adjacent a projection 130 extending from the intermittent link 56.

Operation

As described above, the latch may be released from outside the automobile by depressing the push button 74, which pulls up on rod 70 and causes link 56 to slide downwardly so that its shoulder 62 picks up detent 44 and pivots the detent foot 46 out of engagement with the cam 38.

The latch may be released from inside the car by turning the handle 126 to pull on bell crank 118 through the rod 124, pivoting the bell crank in a counterclockwise direction. Arm 116 of the bell crank picks up flange 114 of the multi-armed lever 98 and pivots this lever in a clockwise direction, swinging the detent out of engagement with the cam.

In order to lock the door from outside, a proper key is inserted in lock 20 and rotated to push down on rod 94, pivoting lever 90 in a downwardly direction and raising link 84. Since the upper end of link 84 is connected to bell crank 48, this bell crank pivots in a clockwise direction and swings the link 56 to its locked position about the pivot formed by finger 66, as shown in FIGURE 2.

Locking from inside is accomplished by depressing

push button 22 and rod 86 to pivot lever 82 in a counterclockwise direction, pivoting bell crank 48 and swinging link 56 to locked position.

The latch illustrated incorporates the features of automatic undogging and keyless locking. The term automatic undogging means that when the latch is in locked position and the inside handle is turned or the door is slammed shut, the latch is automatically undogged or moved back to unlocked position so that if the door is slammed shut when the link 56 is in its locked position the operator will not lock himself out of the car. Assuming the link 56 to be swung to its locked position, FIGURE 2, operation of the inside handle 126 will pivot the multi-armed lever 98 in a clockwise direction so that the flange on the arm 128 will pick up projection 130 and move the intermittent link 56 back to its unlocked position. Also, if the door is slammed shut when the link 56 is in its locked position detent 44 will cam over the teeth of member 38 pivoting lever 98 to pick up the intermittent link and swing it to unlocked position.

While under normal circumstances of operation, the door will not be locked when slammed shut, it is possible to accomplish keyless locking by locking the door either by means of the key or by means of the garnish molding button 22 while the door is open and then depressing the outside push button 74 when the door is slammed shut. Operation of the key or the garnish molding button 22 will swing the intermittent link 56 to its locked position. Now if the door is slammed shut, the lock will be automatically undogged in the manner described above; however, if the outside push button 74 is depressed while the door is being shut, the intermittent link 56 will be slid downwardly so that the projection 130 on this link is out of the path of movement of the flange on the arm 128, and when the door is shut the arm 128 will merely free wheel and will not swing the link back to unlocked position.

Referring now to FIGURES 2 through 10, it will be seen that automatic door lock device 26 includes a bracket member 140 suitably secured to the inner wall of the door. A solenoid 142 is mounted on bracket 140 and includes an armature 144 which extends exteriorly thereof and terminates in a reduced end portion 146. A collar 148 is formed on armature 144 and provides a seat for one end of a spring 150, the other end of which seats against the solenoid casing urging the armature to an extended position as shown in FIGURES 5, 7 and 9. A rocking lever 152 is pivotally supported upon bracket 140 through a pin 154 proximate solenoid 142. Lever 152 includes a pair of openings defining cam surfaces 156 and 158. A pair of pin or follower members 160 and 162 mounted at the ends of a lever 164 respectively coast with cam surfaces 156 and 158. Lever 164 is articulated intermediate its ends to reduced portion 146 of armature 144 through a pin 166 such that as the armature is retracted and extended the pin members 160 and 162 will variously position lever 164 with respect to rocking lever 152 for purposes to be considered in greater detail subsequently.

A link 168 is articulated at one end to rocking lever 152 through a pin 170 and at its other end similarly articulated to inside locking lever 82 through a pin 172. Thus by rocking lever 152 about its pivot 154 the door latch mechanism 16 may be either locked, as indicated in FIGURES 2, 5, 7 and 10, or unlocked when rocked to the other position, as shown in FIGURES 8 and 9. The means whereby this rocking action is achieved will subsequently be considered in detail.

A coiled overcenter spring 174 is secured at one end to bracket 140 and at the other end to rocking lever 152 such that as the rocking lever is rotated between its locked and unlocked position by solenoid 142, the overcenter spring will assist in completing the movement of the rocker lever as the same passes overcenter. The assistance of overcenter spring 174 is necessary since, as will be better

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understood subsequently, the solenoid is adapted to be de-energized by a switch mechanism 176 prior to the completion of the rotating movement of the rocker lever 152.

Switch mechanism 176 is of any conventional single pole-double throw type and includes a plunger 178 adapted to be actuated through a spring member 180 which in turn is periodically engaged by an extension 182 formed on rocking lever 152. Thus whenever solenoid 142 is energized to actuate rocking lever 152 and move it overcenter, extension 182 engages spring 180 actuating plunger 178 to de-energize the solenoid. At this time overcenter spring 174 completes the rotating or pivoting movement of the rocking lever notwithstanding the de-energization of the solenoid.

Referring now to FIGURES 7 through 10, the manner in which locking device 26 operates will now be described. Assuming all the door lock mechanisms 26 are in a locked condition, the individual door switch devices 176 will each be in the position shown in FIGURE 5 and the rocking lever 152 as positioned in FIGURE 7. In this condition, pin 162 is disposed in the lower right corner of cam surface 158 while pin 160 is disposed in the upper right corner of cam surface 156 of the rocking lever. If it is now desired to unlock all of the vehicle doors, a person in the front passenger compartment may actuate either of the switches 184, disposed at one side or the other of the front passenger compartment and move the same to the "unlock" position thereby energizing solenoid 142 from a power source 185. This causes solenoid armature 144 to move downwardly causing pin 162 to exert a downward pressure on rocking lever 152 and thereby rotating the latter in a clockwise direction. As this movement of the rocking lever continues lever extension 182 operates switch 176 as the lever passes overcenter and thereby de-energizes solenoid 142. Overcenter spring 174 causes the lever 152 to complete its clockwise movement to position the lever as shown in FIGURE 8. The downward movement of armature 144 leaves spring 150 compressed so that upon the de-energization of the solenoid the spring returns the armature to an extended position. In so doing pin 160 cams up the left portion of surface 156 rotating lever 164 in a clockwise direction moving pin 162 to the lower left corner of cam surface 158 as shown in FIGURE 9. In this cycle then the inside door lever 82 has been moved upwardly or in a clockwise direction about its pivot point 83 to unlock, supra, the door latch mechanism 16. At the same time, lever 164 is repositioned whereby device 26 is conditioned for locking door latch mechanism 16 when solenoid 142 is again energized. Thus with the parts shown in FIGURE 9, and assuming the operator now wishes to lock the vehicle doors, switch 184 is moved to the "lock" position. At this point it should be recalled that in rotating rocking lever 152 from the position shown in FIGURE 7 to that of FIGURE 8, switch 176 has been actuated and plunger 178 has repositioned the switch so as to be in the "unlock" position of FIGURE 6. Therefore, movement of switch 184 to the "lock" position will cause the solenoid 142 to be energized retracting armature 144 causing pin 162 to impart a counterclockwise rotation to the lever 152. Once again as rocking lever 152 goes overcenter switch 176 is de-energized with overcenter spring 174 completing the movement of the lever to the position of FIGURE 10. At the same time, spring 150 expands repositioning the lever 164 and pins 160 and 162 to the position shown in FIGURE 7 whereby the mechanism is once again cycled and conditioned for unlocking operation.

Thus by virtue of the unique rocking lever 152, a single solenoid 142 may be utilized to both lock and unlock door locking mechanism 16.

Switches 176 insure that none of the individual locking devices 26 gets out of phase with the overall coincidental locking system. Thus, should the doors be locked with the various parts shown in the position of FIGURES 6 and 7 and thereafter should one of the doors be manually

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unlocked by raising the garnish molding button, lever 82 would cause rocking lever 152 to move overcenter to the position of FIGURE 9. In so doing, switch 176 would be moved to the unlocked position. Thereafter, actuation of coincidental locking switch 184 to "unlock" all doors would not affect the "manually unlocked" door solenoid since the associated switch 176 has broken the unlocking circuit putting all devices 26 back in phase.

Referring again to FIGURE 6, a switch 188 may be provided and suitably connected to the switches 184 so that when either of the latter switches is moved to the "lock" position, switch 188 may be closed to light a dash-light 190 indicating that the doors are in a locked condition.

I claim:

1. A door lock mechanism comprising a bolt member, a linkage mechanism for operating said bolt member, an operative connection between said linkage mechanism and said bolt member, a first lever for disconnecting the operative connection between said linkage mechanism and said bolt member, an electrical operating mechanism for operating said lever, said last mentioned mechanism comprising a rocking lever pivotally mounted on a fixed pivot, a link articulated between said rocking lever and said first lever, a pair of cam surfaces formed on said rocking lever, a third lever, a pair of pin members respectively disposed at the opposite ends of said third lever and adapted to coact with the cam surfaces formed on said rocking lever, a solenoid including an armature articulated at one end to said third lever intermediate said pins, spring means normally biasing said armature in an extended position in which said pins are positioned upon said cam surfaces so as to pivot the rocking lever about its pivot upon energization of said solenoid, a switch device adapted to be engaged by said rocking lever when the latter passes overcenter to de-energize said solenoid, and an overcenter spring operatively connected to said rocking lever to complete the rotative movement of said lever after the de-energization of said solenoid.

2. A door lock mechanism as set forth in claim 1 in which one of the rocking lever cam surfaces is radially spaced from the other relative to the fixed pivot.

3. A door lock mechanism comprising a bolt member, a linkage mechanism for operating said bolt member, an operative connection between said linkage mechanism and said bolt member, a first lever for disconnecting the operative connection between said linkage mechanism and said bolt member, an electrical operating mechanism for operating said lever, said last mentioned mechanism comprising a rocking lever pivotally mounted on a fixed pivot, a link articulated between said rocking lever and said first lever, a pair of cam surfaces formed on said rocking lever, a third lever, a pair of pin members respectively disposed at the opposite ends of said third lever and adapted to coact with the cam surfaces formed on said rocking lever, a solenoid including an armature articulated at one end to said third lever intermediate said pins, spring means normally biasing said armature in an extended position in which said pins are positioned upon said cam surfaces so as to pivot the rocking lever about its pivot upon energization of said solenoid, a switch device adapted to be engaged by said rocking lever when the latter passes overcenter to de-energize said solenoid, and an overcenter spring operatively connected to said rocking lever to complete the rotative movement of said lever after the de-energization of said solenoid, said pins always being disposed on opposite sides of a line-of-centers through the fixed pivot and the point of articulation of the armature to the third lever.

4. A door lock mechanism as set forth in claim 3 in which one of said pins coacts with one of the rocking lever cam surfaces to rotate the rocking lever when the solenoid is energized, the other pin coacting with the other cam surface to rotate the third lever and shift the one pin to the other side of the line-of-centers when the solenoid spring means extends said armature.

5. A door lock mechanism as set forth in claim 3 in which said cam surfaces are so disposed that energization of the solenoid will cause one of said pins to rotate the rocking lever with the one pin remaining on the same side of the line-of-centers, de-energization of the solenoid permitting the solenoid spring means to cause the other pin to cam against its cam surface to move said one pin to be shifted to the other side of the line-of-centers.

6. A door lock mechanism comprising a bolt member, a linkage mechanism for operating said bolt member, an operative connection between said linkage mechanism and said bolt member, a first lever for disconnecting the operative connection between said linkage mechanism and said bolt member, an electrical operating mechanism for operating said lever, said last mentioned mechanism comprising a rocking lever pivotally mounted on a fixed pivot, a link articulated between said rocking lever and said first lever, a pair of cam surfaces formed on said rocking lever and radially spaced relative to the fixed pivot, a third lever, a pair of pin members respectively disposed at the opposite ends of said third lever and adapted to respectively coast with the cam surfaces formed on said rocking lever, a solenoid including an armature articulated at one end to said third lever intermediate said pins, said pins always being disposed on opposite sides of a line-of-centers between the fixed pivot and the point of articulation of the third lever and armature, energization of the solenoid retracting the armature causing one of said pins to rotate the rocking lever, spring means adapted to bias said armature in an extended position when the solenoid is de-energized causing the other pin to rotate the third lever and shift the said one pin to the other side of the line-of-centers, a switch device adapted to be engaged by said rocking lever when the latter passes over-center to de-energize said solenoid, and an overcenter spring operatively connected to said rocking lever to complete the rotative movement of said lever after the de-energization of said solenoid.

7. A door lock mechanism comprising a bolt member, a linkage mechanism for operating said bolt member, an operative connection between said linkage mechanism and said bolt member, a first lever for disconnecting the operative connection between said linkage mechanism and said bolt member, an electrical operating mechanism for operating said lever, said last mentioned mechanism comprising rocking lever means pivotally mounted on a fixed pivot, a link articulated between said rocking lever means and said first lever, a solenoid including an armature articulated to said rocking lever means, spring means

normally biasing the armature in an extended position, said solenoid coacting with the rocking lever means to move the first lever between lock and unlock positions relative to said bolt, a source of electrical power, first switch means remote from the rocking lever means and operable to energize the solenoid to move said first lever to its lock or unlock position, and second switch means connected in series with the power source, first switch means and the solenoid and operable by the rocking lever means to maintain said electrical operating mechanism in phase with the operative condition of said first lever.

8. A door lock mechanism comprising a bolt member, a linkage mechanism for operating said bolt member, an operative connection between said linkage mechanism and said bolt member, a first lever for disconnecting the operative connection between said linkage mechanism and said bolt member, an electrical operating mechanism for operating said lever, said last mentioned mechanism comprising a rocking lever pivotally mounted on a fixed pivot, a link articulated between said rocking lever and said first lever, a pair of cam surfaces formed on said rocking lever, a third lever, a pair of pin members respectively disposed at the opposite ends of said third lever and adapted to coast with the cam surfaces formed on said rocking lever, a solenoid including an armature articulated at one end to said third lever intermediate said pins, spring means normally biasing said armature in an extended position in which said pins are positioned upon said cam surfaces so as to pivot the rocking lever about its pivot upon energization of said solenoid, a source of electrical power, a first single pole-double throw switch remote from the rocking lever and having lock and unlock positions, a second single pole-double throw switch connected in series with the first switch, said power source and said solenoid, said second switch being operable by the rocking lever when the latter passes over-center to de-energize the solenoid, and an overcenter spring operatively connected to said rocking lever to complete the rotative movement of the lever after de-energization of the solenoid and to condition the second switch for the next operative cycle of the door lock mechanism.

References Cited in the file of this patent

UNITED STATES PATENTS

809,693	Johnson	Jan. 9, 1906
2,799,154	Beal	July 16, 1957
2,922,672	Van Voorhees	Jan. 26, 1960