Jan. 27, 1959 S. D. COCKBURN ET AL 2,871,049

ROTARY GEAR BOLT DOOR LATCH

Filed Nov. 16, 1953 3 Sheets-Sheet 1

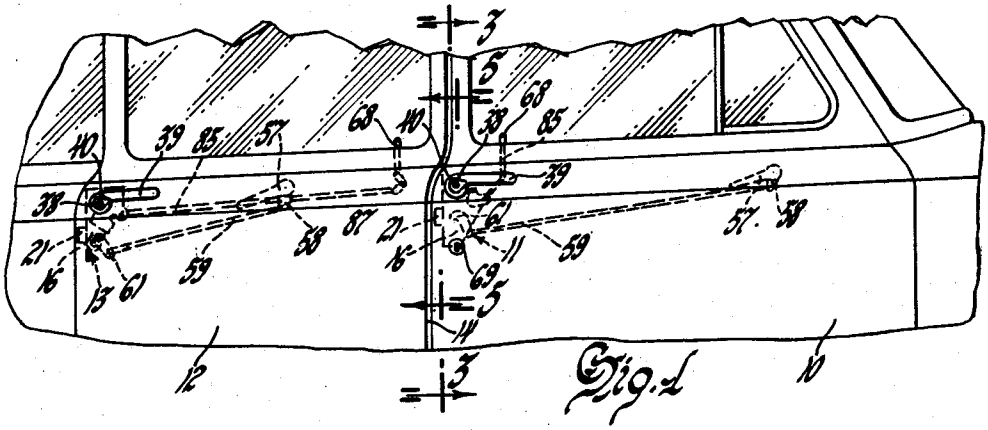


Fig. 1

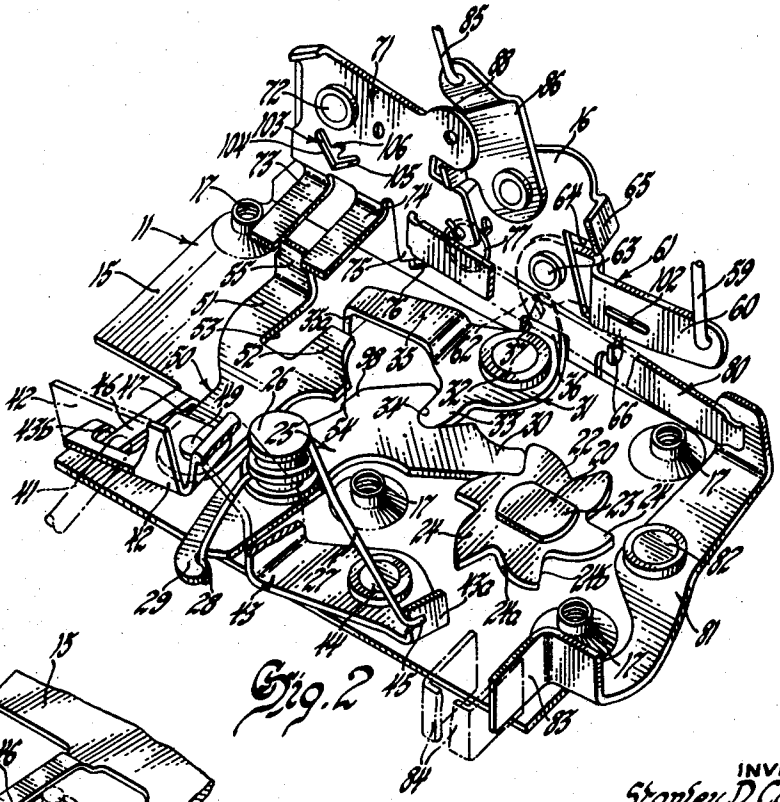


Fig. 2

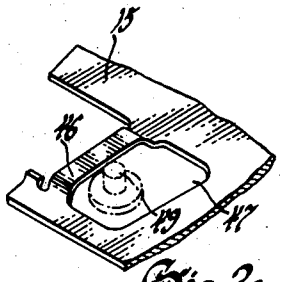


Fig. 2a

INVENTORS
Stanley D. Cockburn,
James D. Leslie,
La Verne B. Ragsdale &
BY Bewley D. Priestman
Paul Fitzpatrick
ATTORNEY

Jan. 27, 1959 S. D. COCKBURN ET AL 2,871,049

ROTARY GEAR BOLT DOOR LATCH

Filed Nov. 16, 1953 3 Sheets-Sheet 2

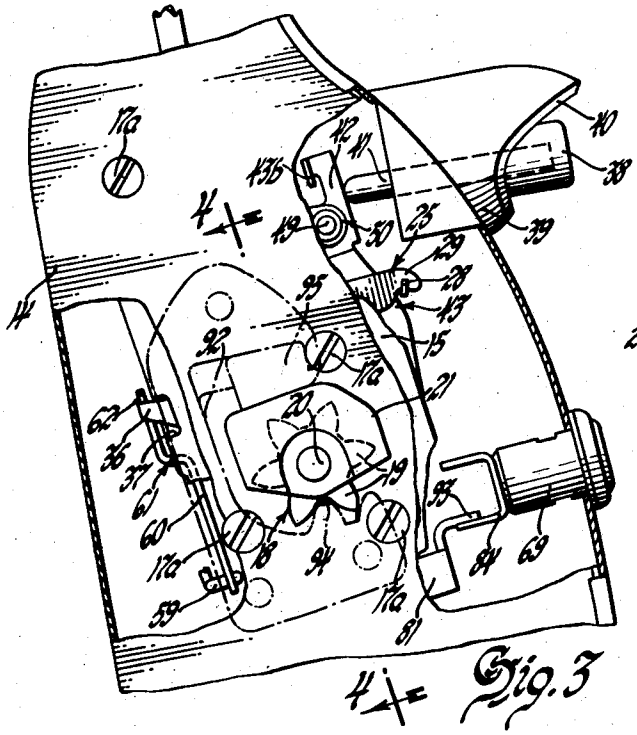


Fig. 3

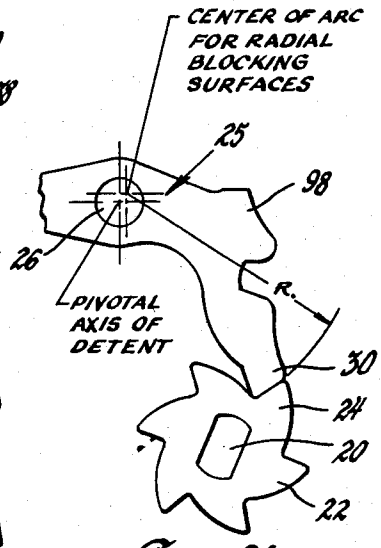


Fig. 2b

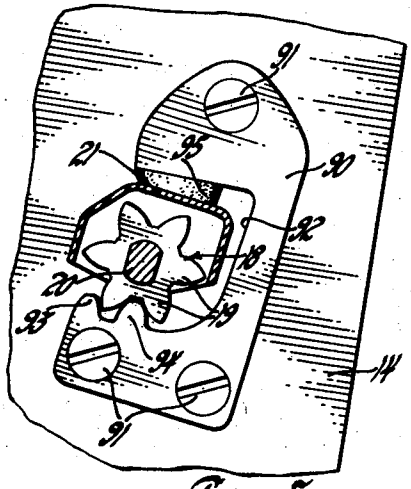


Fig. 5

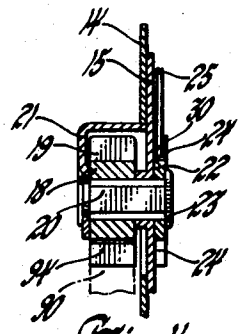


Fig. 4

INVENTORS
Stanley D. Cockburn,
James D. Leslie,
LaVerne B. Ragsdale &
BY Bewley D. Priestman
Paul Fitzpatrick
ATTORNEY

Jan. 27, 1959 S. D. COCKBURN ET AL 2,871,049

ROTARY GEAR BOLT DOOR LATCH

Filed Nov. 16, 1953 3 Sheets-Sheet 3

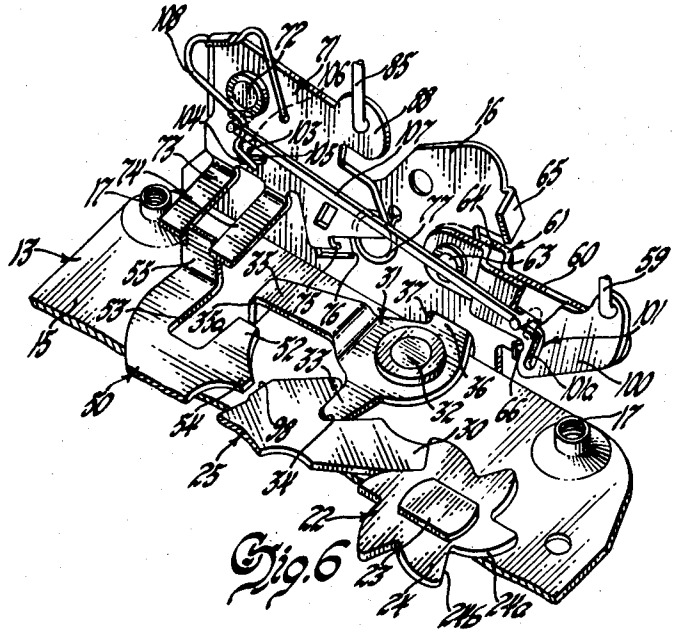


Fig. 6

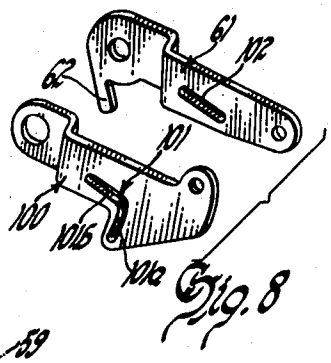


Fig. 8

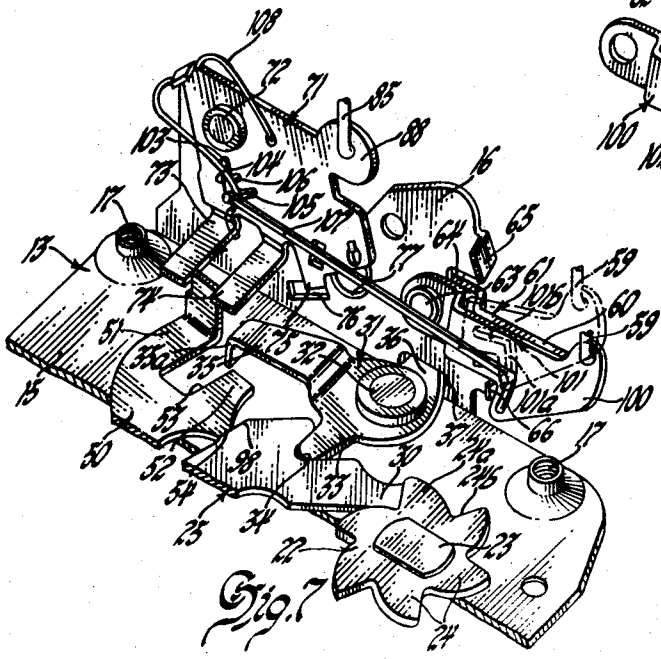


Fig. 7

INVENTORS
Stanley D. Cockburn,
James D. Leslie,
LaVerne B. Ragsdale &
BY Bewley D. Priestman
Paul Fitzpatrick
ATTORNEY

United States Patent Office

2,871,049

Patented Jan. 27, 1959

2,871,049

ROTARY GEAR BOLT DOOR LATCH

Stanley D. Cockburn, Detroit, James D. Leslie, Manchester, Bewley D. Priestman, Livonia, and La Verne B. Ragsdale, Dearborn, Mich., assignors to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application November 16, 1953, Serial No. 392,266

6 Claims. (Cl. 292—280)

This invention relates to a door latch, and more particularly to a rotary gear bolt door latch for an automobile.

One feature of the invention is that it provides an improved door latch; another feature is that it provides a gear type latch having arcuate abutting surfaces on the detent member and the latch member arranged to provide easy opening of the door; still another feature of the invention is that it provides a rotary gear bolt latch particularly adapted for push button operation since only a slight force is required to release the latch despite the fact that the door sealing pressure may be high; yet another feature of the invention is that in one form, it provides a rotary gear bolt door latch which is shifted from locked to unlocked position when the inside handle is operated so that the door may be opened from inside the car whether or not it is locked from outside the car; still a further feature of the invention is that it provides an improved rotary gear bolt latch which is shifted from locked to unlocked condition whenever the car door is closed unless the operator consciously desires to lock the door without a key, in which event, upon a simple manipulation by the operator, the door may be locked without a key; and yet another feature of the invention is that, in a modified form, it provides an improved rotary gear bolt latch having selectively operable protective means which in one condition prevents release of the latch when the inside handle is operated when the latch is locked, and which may readily be shifted to another condition in which the latch is released when the inside handle is operated whether or not the latch is locked.

In addition, in the improved door latch, the key cylinder for the outside locking means is located below the outside handle on the door panel. This is advantageous over an arrangement wherein the key cylinder is located within the push button assembly because it makes it possible to change the handle styling without changing the operating means for the lock, it reduces the push button force necessary to open the door through reducing the spring force necessary to prevent push button bounce, it permits reducing the handle bore and thereby simplifies retention of the handle on the molding, and it facilitates push button operation by removing the lock tumbler from the push button. Furthermore, the improved latch is so constructed that it is secured to the door by screws which extend only through the jamb face of the door and no screws are necessary through the inner door panel. This is advantageous because the inner panel section is too weak to absorb the shock when the door is slammed, and the lock may be distorted if it is secured to the inner door panel.

Other features and advantages of the improved latch will be apparent from the following description and from the drawings, in which:

Fig. 1 is a fragmentary side elevational view of an automobile having the improved door latch therein;

Fig. 2 is an isometric view of the latch;

Fig. 2*a* is a detail view of a portion of Fig. 2;

Fig. 2*b* is a detail view of a portion of the detent and bolt holding cam, showing the relationship between the pivotal axis of the detent and the axis about which the arcuate surfaces of the detent foot and cam teeth are formed;

Fig. 3 is an enlarged section through the body pillar taken along the line 3—3 of Fig. 1;

Fig. 4 is a detail section through the rotary gear bolt taken along the line 4—4 of Fig. 3;

Fig. 5 is a section taken along the line 5—5 of Fig. 1 and showing the bolt and keeper;

Fig. 6 is a fragmentary isometric view similar to a portion of Fig. 1, showing the latch in unlocked position and illustrating a modification wherein a protective feature has been added;

Fig. 7 is a view similar to Fig. 6, but showing the latch in locked condition, parts being shown in solid lines in one position and in broken lines in another position; and

Fig. 8 is an exploded view of certain of the levers of Figs. 6 and 7.

Referring now more particularly to the drawings, in Fig. 1 an automobile is shown having a front door **10** which is hinged at its front edge and which, adjacent its rear edge, carries a front door latch illustrated generally as **11**. The automobile also has a rear door **12** which is hinged at its front edge and which, adjacent its rear edge, mounts a rear door latch **13**. The front door latch **11** is illustrated in Figs. 2–5 and the rear door latch is illustrated in Figs. 6–8. While the front and rear door latches are basically the same, the rear door latch has been modified by the addition of a protective feature as will be hereinafter described. The front door latch bolt engages a keeper on a door pillar **14**, and the rear door is hingedly mounted on this pillar. A similar keeper is provided for the rear door latch.

The latch parts are mounted on a frame having a body or plate portion **15** which, when the latch is mounted on the door, lies in a plane generally parallel to the jamb edge of the door, and a right angle flange portion **16** which lies in a plane generally parallel to the inner door panel. The plate portion **15** has countersunk threaded openings **17** through which screws **17***a* extend for securing the latch frame to the jamb edge of the door.

The latch bolt **18** is in the form of a gear having a plurality of symmetrical and equally spaced teeth **19**, the bolt being mounted on the squared shank of a shaft **20** which is rotatably mounted on the frame plate **15**. A generally C-shaped bolt housing **21** is riveted to the outer surface of the plate **15** and rotatably supports the outer end of shaft **20**. The housing **21** and the bolt **18** project out of the door through an opening provided in the edge thereof, and the bolt and housing engage a keeper structure to be hereinafter described to hold the door latched.

On the inner surface of the plate **15** a cam **22** is rigidly mounted on the shaft **20**, the end of the shaft being staked over at **23** to hold the parts in position. The bolt **18** and cam **22** are rigid with shaft **20**, and the shaft is freely rotatable in the latch frame **15** and bolt housing **21**.

Cam **22** has a plurality of asymmetrical teeth **24** which are adapted to be engaged by a detent lever **25** to hold the bolt against rotation in one direction (counterclockwise as the parts appear in Figs. 2, 6 and 7). The detent lever **25** is pivotally mounted upon a stud **26** which projects from the inner surface of the plate **15**, and a coil spring **27** which is mounted on the stud **26** has one end **28** engaging an ear **29** on the free end of the detent. This spring biases the detent so that a foot **30** at the operating end of the detent is urged into engagement with the cam **22**.

When the detent foot **30** is in engagement with the cam **22**, as illustrated in Figs. 2, 6 and 7, the door is held in

latched position when closed. Of course, if the door is open, it may be closed without releasing the detent since the cam and bolt may rotate in a clockwise direction. Each of the cam teeth 24 is provided with a sloping cam surface 24*a*, and upon rotation of the cam and bolt in a clockwise direction, the detent 25 rides up over the sloping surface 24*a*; however, counterclockwise rotation of the cam and bolt is prevented by the generally radial but arcuate blocking surfaces 24*b* of each cam tooth.

In order to open the door it is necessary to pivot the detent 25 in a counterclockwise direction (Figs. 2, 6 and 7) to free the bolt for counterclockwise rotation. This pivotal movement of the detent is accomplished through a multiplier lever 31 which is pivoted on a stud 32 and which has a detent actuating arm 33 engaged in a recess 34 in the detent lever. The multiplier lever also has a relatively long arm 35 for operation by means of an outside actuator and a relatively short arm 36 which extends through an opening 37 in the flange 16 for operation by an inside actuator.

The multiplier lever has several functions. Because of the restricted available space in which to mount the parts of the lock, the detent pivot 26 is outboard of the cam 22, and, therefore, it is necessary to change the direction of the door opening force. This force is originally exerted on the push button in a direction inboard of the car, and the multiplier lever changes the direction of the force to move the detent out of engagement with the cam tooth. The multiplier lever arm 36 also transmits and reverses the direction of motion of the inside actuator, and the lever is so arranged that it permits "free wheeling" of an intermittent lever which will be hereinafter described.

Operation of the latch from outside the car is accomplished by means of a push button 38 (Figs. 1 and 3) which is slidable in a fixedly mounting handle 39 on the outer door panel. As shown in Fig. 3, the handle has an overhanging or awning portion 40 which extends outwardly beyond the push button and which shields the push button from rain and snow and also provides a safety feature in that it protects the push button against actuation should an object strike the side of the car or should the car turn over on its side. The push button acts through a push rod 41 which abuts a flange 42 turned from a push button lever 43 which is pivoted on the plate 15 on a stud 44. The other end 45 of spring 27 is hooked over a tab 43*a* which is turned from the push button lever 43 so that the spring 27 biases the lever 43 in a counterclockwise direction. A tab 43*b* at the free end of lever 43 is turned under a raised portion 46 of the plate 15 to provide a guide for the lever 43 and also to provide stop means to limit the range of pivotal movement of the lever 43.

An elongated opening 47 in the plate 15 provides space for movement of the head of a rivet 49 which pivotally mounts an intermittent lever 50 on the push button lever 43. The free end of the intermittent link 50 is formed as a fork having spaced arms 51 and 52 separated by a slot 53. On the bottom of the arm 52 is a projection 54 which performs an undogging or unlocking function to be hereinafter described, and on the free end of arm 51 is a bent tab 55 which is part of the locking structure to be hereinafter described.

When the push button 38 is operated to open the door from outside the car, push rod 41, acting against flange 42 on push button lever 43, causes clockwise pivotal movement of lever 43 and consequent longitudinal shifting movement of intermittent lever 50 so that the free end of arm 52 engages a bent tab 35*a* at the end of arm 35 of multiplier lever 31, pivoting the multiplier lever in a clockwise direction and the detent lever 25 in a counterclockwise direction so that detent foot 30 moves out of blocking relation to cam 22 and the bolt 18 is freely rotatable. With the parts in this position the resilient weatherstrip which seals the door will force the door open slightly.

The inside unlatching mechanism includes a remotely located inner turn handle 57 (Fig. 1) connected by a link 58 to a remote actuating rod 59. The rear end of this rod is connected to an arm 60 of a remote lever 61 which is formed as a bell crank and is pivoted intermediate its ends by a stud 63 on the flange 16 of the latch frame. The other arm 62 of the remote lever extends adjacent arm 36 of multiplier lever 31. When the remote handle 57 is turned, lever 61 is pivoted in a counterclockwise direction (Fig. 2) to operate the multiplier lever 31 and the detent 25 and to free bolt 18. The remote lever operates in a recess 64 in the flange 16, and tabs 65 and 66 which are bent from the flange at opposite sides of the recess 64 provide stop means to limit the movement of the remote lever.

The latch may be locked from inside the car by means of a conventional garnish molding push button 68, or from outside the car by means of a key actuated lock cylinder 69 (Fig. 1).

The locking means includes a trip lever 71 which is pivoted on the flange 16 on a rivet 72. The trip lever has spaced prongs 73 and 74 which are bent at right angles to lie in a plane parallel to the plate 15 and which straddle the tab 55 which is bent from intermittent lever arm 51. The trip lever is movable about the axis of rivet 72 between an unlocked position (Figs. 2 and 6) and a locked position (Fig. 7) defined by a stop tab 75 which is bent from lever 71 and extends through a slot 76 in the flange 16. The opposite ends of the slot cooperate with the tab to stop movement of the trip lever, and an overcenter spring 77 holds the lever in either its locked or unlocked position. In Figs. 2 and 6, trip lever 71 is in unlocked position, holding the longitudinally and pivotally movable intermittent lever 50 in a position wherein arm 52 of lever 50 is aligned with tab 35*a* on the multiplier lever arm 35. With the parts in this position, operation of the outside push button will move the detent 25 out of engagement with the cam 22. In Fig. 7, the trip lever 71 has been pivoted in a counterclockwise direction to its locked position, carrying with it intermittent lever 50 so that arm 52 is out of alignment with tab 35*a* and upon operation of the outside push button the intermittent lever merely "free wheels," the tab 35*a* entering the slot 53 in the intermittent lever.

In order to lock the door by means of a key from the outside, a connecting link 80 (Fig. 2) extends downwardly from the trip lever and is connected at its lower end to one end of a rockable locking lever 81 which is pivoted intermediate its ends on the plate 15 by means of a stud 82. The outer end of the locking lever has a flange 83 which is straddled by an actuator 84 connected to the locking cylinder 69. When the door is locked by means of a key, the actuator 84 is turned to rock the locking lever 81 in a clockwise direction, pulling down on the connecting link 80 and moving the trip lever to its locked position.

In order to lock the door from inside the car, the garnish molding push button 68 is pushed down. The push button 68 is connected to the trip lever 71 through an actuating rod 85 and a bell crank 86, so that the trip lever is moved between locked and unlocked positions by means of the garnish molding button.

In the front door lock illustrated in Figs. 1–5, the garnish molding push button is located above the latch, and, therefore, the bell crank 86 is necessary to change the direction of motion to move the trip lever between its two positions. However, in the rear door lock illustrated in Figs. 1, 6 and 7, the garnish molding push button is located forwardly of the latch and a bell crank 87 is inserted between the garnish molding push button 68 and the push button actuator rod 85 to change the direction of motion. The rear end of the actuator rod 85 is connected directly to a tab 88 on the trip lever.

Figs. 3, 4 and 5 show the interengagement between the bolt 18 and the keeper to hold the door latched. As shown in these figures, the keeper comprises a generally C-shaped casting 90 which is secured to the body pillar 14 by means of screws 91. The casting 90 is provided with a recess 92 and two integral teeth 93 and 94 project into the recess 92 along the lower side thereof. On the upper side of the recess 92 there is mounted a conventional spring-pressed sliding shoe which preferably is formed from a block of nylon. When the door is closed, the upper surface of the bolt housing 21 engages the lower surface of the sliding shoe 95 and the gear teeth 19 of the bolt 18 engage the keeper tooth 94. The tooth 93 provides a safety latch, and when the door is in fully latched position, a latch tooth 19 rides over inside the keeper tooth 94 as shown in Figs. 4 and 5.

The latch is particularly well adapted for use in so called narrow pillar constructions wherein the total combined width of the body pillar 14 and the abutting door pillars is small, thereby reducing the blind area between the front and rear windows of the car. In this latch the thickest part which lies in the path of the window channel, exclusive of the lock frame, is a section through the cam 18 and stud 20 and a section through the rockable lever 81 and the stud 82, this latter section being deliberately made at least as thick as the first mentioned section to act as a spacer for the window glass channel.

One feature of the improved lock is that when the door is opened from the outside by actuation of the push button 38 only a relatively light opening push button pressure is necessary despite the fact that the door may be sealed with a pressure of the order of 100 pounds. This easy opening is due in part to the provision of the multiplier lever 31 between the intermittent lever 50 and the detent lever 25, the multiplier lever providing a force multiplication factor of about two. Further, in order to move the detent foot 30 out of blocking relation to the cam 22, the detent is swung through an arc in a direction substantially at right angles to the direction of the force which the cam tooth exerts against the detent foot, and the only force which it is necessary to overcome is the frictional component between the end of the detent foot 30 and the abutting surface of the cam tooth. If it were necessary to operate the detent foot in a direction opposed to the direction of force which the cam tooth exerts, much more door opening pressure would be necessary.

The generally radial blocking surfaces 24*b* of the teeth of cam 24 are formed on an arc, and when cam 24 is in the position of Figs. 3 and 5 the construction is such that the surface of the tooth which abuts the detent foot is formed on an arc having its center adjacent the pivotal axis of the detent 25 (the center of stud 26). The abutting end surface of the detent foot 30 is formed on an arc about the same center. Theoretically, the surfaces might be so formed that the center of the arc is at the pivotal axis of the detent, but if so formed, and if the center of the arc shifted away from the pivotal axis of the detent in one direction because of manufacturing variations in mass production, a wedging action would occur when the detent was pivoted out of blocking engagement with the cam. This would cause reverse pivotal movement of the cam against the heavy door sealing pressure, resulting in hard push button operation. The cam 24 and the detent 25 preferably are sheet metal stampings, and it is very difficult to hold exact tolerances in the mass production of such stampings.

Therefore, instead of locating the center of the arc at the pivotal axis of the detent, the center of the arc is spaced a small fraction of an inch from this pivotal axis, preferably being spaced a distance of the order of .05 inch from the pivotal axis of the detent in a direction away from the axis of the bolt and toward the flange 16. In other words, referring to Fig. 2, the arc formed by the abutting surfaces of the detent foot and the cam tooth has its center spaced from the pivotal axis of the detent

in a direction toward the upper margin of the sheet as the parts appear in Fig. 2. With this construction, pressure of the cam tooth 24 on the detent foot 30 provides a force vector tending to move the detent foot out of blocking abutment with the tooth. This assures easy push button operation because there is no binding between the parts as the detent moves away from the cam even if there is a slight variation in the location of the center of the arc for either the detent or the tooth surface in mass production.

An important feature of the latch is the provision of "automatic undogging" and "remote undogging" combined with keyless locking. Because of the automatic undogging feature, it is impossible for the operator to lock himself out of the car inadvertently because whenever the door is closed the latch is automatically shifted to unlocked condition unless the operator consciously acts to obtain keyless locking. The tab 54 which projects from the bottom of the arm 52 of intermittent lever 50 is adapted to abut a small projection 98 on the detent lever 25. Therefore, if the door is closed with the latch locked, counterclockwise pivotal movement of the detent as the bolt 18 rides over the keeper teeth 93 and 94 will cause interengagement of the tab 54 and projection 98 to shift the intermittent lever 50 and trip lever 71 to unlocked condition.

Similarly, by means of the remote undogging feature the door may be opened through the inside handle regardless of whether the latch is in locked or unlocked condition. Operation of the remote handle moves the detent 25 through the multiplier lever 31 and the remote lever 61, so that the undogging projection 98 engages the tab 54 and shifts the parts to unlocked condition.

Despite the fact that normal closing of the door will automatically undog the latch or shift the parts to unlocked condition, the construction provides for keyless locking whenever the operator consciously desires to lock the door without using a key. In order to lock the door without a key, it is merely necessary to depress the garnish molding button 68 when the door is open, thus shifting the trip lever 71 and intermittent lever 50 to locked condition and then to push in on the outside push button while the door is being closed. Operation of the outside push button shifts the intermittent lever 50 longitudinally so that its undogging tab 54 is out of the path of movement of the projection 98 on the detent 25 and the parts are not shifted to unlocked condition upon counterclockwise pivotal movement of the detent lever.

The lock illustrated in Fig. 2 is particularly adapted for the front door of the automobile, while the lock in Figs. 6 and 7 is modified to adapt it to an automobile rear door. In addition to eliminating the key lock, the rear door lock of Figs. 6 and 7 includes a selective free wheeling feature which permits the lock, when in one condition, to include the above described remote undogging feature, and when in another condition, to eliminate this feature so that the inside handle merely "free wheels" when the latch is locked. The latch is shiftable between these two conditions and may be set for either condition when the car is sold or after the car has been in use.

Instead of connecting the remote actuator rod 59 directly to the remote lever 61 as is illustrated in Fig. 2, in the modification illustrated in Figs. 6 and 7, the rod 59 is connected to a free wheeling lever 100 which overlies remote lever 61 and which is pivoted on the remote lever stud 63. The free wheeling lever 100 is formed with an L-shaped slot 101 having an arcuate transverse arm 101*a* and a longitudinal arm 101*b* and the remote lever 61 is formed with a longitudinal slot 102 (see Fig. 8). The lower end of slot 102 registers with the juncture of the arms of slot 101. Trip lever 71 is formed with L-shaped slot 103 having angularly extending arms 104 and 105 (see Fig. 2), the arm 104 being provided with an additional angular slot 106 which facilitates the assembly of the parts and has no function during operation.

A free wheeling connecting link 107 has its upper end mounted in the L-shaped slot 103, the other end of the link extending through the cross-slots 101 and 102. An overcenter spring 108 holds the upper end of the free wheeling link 107 in arm 104 or in arm 105 of slot 103 as desired. When the upper end of link 107 is in the upwardly extending arm 104 of slot 103, the lower end of this link is always above the arcuate transverse arm 101*a* of slot 101 so that the lower end of the link ties levers 100 and 61 together regardless of whether the trip lever 71 is in locked or unlocked position. With the latch set in this condition, the rear door latch operates in exactly the same manner as does the front door latch and remote undogging is accomplished by turning the inside remote handle 58. However, if desired, a tool may be inserted through the edge of the door to shift the free wheeling connecting link downwardly so that the overcenter spring 108 holds the upper end of this link in the downwardly extending arm 105 of slot 103. With the parts in this position, the lower end of link 103 is above the transverse arm 101*a* when the trip lever is in its upper unlocked position, but the lower end of the link registers with the transverse arm 101*a* of slot 101 when the trip lever is moved downwardly to its locked position. Consequently, when the door is unlocked, the levers 100 and 61 are tied together by the lower end of link 107 and the door may be opened by means of the remote handle; however, when the door is locked, actuation of the remote handle does not operate the remote lever 61 because the lower end of link 107 is now in the transverse arm 101*a* of slot 101 and the inside handle merely free wheels, moving only free wheeling lever 100 which pivots relative to remote lever 61.

While we have shown and described two embodiments of our invention, it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

We claim:

1. A door latch of the character described, including: pivotally mounted latching means having a plurality of detent engaging teeth; a pivotally mounted detent having a foot adapted to abut a surface of one of said teeth to block pivotal movement of the latching means in a door opening direction, said foot being swingable out of abutting relation with the surface of said tooth, and the abutting surfaces of said foot and tooth being curved on an arc having its center adjacent the pivotal axis of said detent but spaced from said pivotal axis in the general direction in which said foot swings when moving out of abutting relation with said tooth, said center being farther from the axis of the latching means than is the pivotal axis of said detent whereby said foot backs off from the surface of said tooth when the detent is swung; and operating means for swinging said detent out of blocking engagement with said latching means.

2. Apparatus of the character claimed in claim 1, wherein the center of said arc is spaced a small fraction of an inch from the pivotal axis of said detent.

3. Apparatus of the character claimed in claim 1, wherein the center of said arc is spaced a distance of the order of .05 inch from the pivotal axis of said detent.

4. An automobile door latch of the character described, including: a latch frame having a body portion lying in a plane generally parallel to the jamb face of the door and a flange portion extending from said body portion and lying in a plane generally parallel to a side panel of the door; latching means pivotally mounted on the body portion of said frame, said latching means including a rotatable bolt and a rotatable ratchet member rigid with said bolt and having a plurality of detent engaging teeth; a detent pivotally mounted on the body portion of said frame, the pivotal axis of the detent being farther from the flange portion of the frame than is the pivotal axis of said latching means, and said detent having a foot adapted to abut a surface of one of said teeth to block pivotal movement of the latching means in a door opening direction, said foot being swingable out of abutting relation with the surface of said tooth, and the abutting surfaces of said foot and tooth being curved on an arc having its center adjacent the pivotal axis of said detent but spaced from said pivotal axis a small fraction of an inch in the general direction in which said foot swings when moving out of abutting relation with said tooth, said center being farther from the axis of the latching means than is the pivotal axis of said detent and being closer to the flange portion of the frame than is the pivotal axis of said detent whereby said foot backs off from the surface of said tooth when the detent is swung; and operating means for moving said detent out of blocking engagement with said latching means.

5. An automobile door latch of the character described, including: a latch frame having a body portion lying in a plane generally parallel to the jamb face of the door and a flange portion extending from said body portion and lying in a plane generally parallel to a side panel of the door; latching means rotatably mounted on the body portion of said frame and including a rotatable bolt and a rotatable ratchet member rigid with said bolt and having a plurality of detent engaging teeth; a detent pivotally mounted on the body portion of said frame, the pivotal axis of the detent being farther from the flange portion of the frame than is the pivotal axis of said latching means and said detent having a foot adapted to abut a surface of one of said teeth to block pivotal movement of the latching means in a door opening direction, said foot being swingable out of abutting relation with the surface of said tooth; an operating lever pivotally mounted adjacent one end on the body portion of said frame, said operating lever having adjacent its other end a flange for engagement with an operating push rod; a coil spring mounted at the pivotal axis of said detent and having one end engaging said detent to urge said detent foot toward said ratchet and the other end engaging said operating lever to urge the flange on said lever toward said push rod; an intermittent link pivotally mounted on said operating lever adjacent the flange thereof, said intermittent link having a bifurcated end forming first and second arms separated by an open-ended slot; a multiplier lever pivotally mounted on the body portion of said frame, said lever having three generally radial arms projecting therefrom, each arm being spaced in the order of 90 degrees from an adjacent arm and the center one of said arms being longer than the other two arms and extending toward the first arm of said intermittent link; means providing a permanent connection between one of said shorter arms and said detent; a flange on said center arm located in the path of movement of the first arm of said intermittent link when the intermittent link is in one pivotal position with reference to said operating lever and when the operating lever is swung, said flange being in position to enter the slot on the intermittent link when the intermittent link is in another pivotal position with reference to said operating lever and when the operating lever is swung; a locking lever pivotally mounted on said flange and having a spaced pair of fingers straddling the second arm of said intermittent link; locking means for swinging said locking lever to pivot said intermittent link between said two pivotal positions; and inside operating means movably mounted on the body portion of said frame and adapted to engage the other shorter arm of said multiplier lever to move said detent out of blocking engagement with said latching means.

6. Apparatus of the character claimed in claim 5, wherein the abutting surfaces of said detent foot and ratchet tooth are curved on an arc having its center adjacent the pivotal axis of said detent but spaced from said pivotal axis in the general direction in which said detent foot swings when moving out of abutting relation

with said ratchet tooth, said center being farther from the axis of the latching means than is the pivotal axis of said detent and being closer to the flange portion of the frame than is the pivotal axis of said detent whereby said detent foot backs off from the surface of said ratchet tooth when the detent is swung.

References Cited in the file of this patent

UNITED STATES PATENTS

2,094,413	Schonitzer	Sept. 28, 1937
2,557,468	Roethel	June 19, 1951
2,581,838	Dingman	Jan. 8, 1952
2,629,618	Roethel	Feb. 24, 1953
2,634,148	Dingman et al.	Apr. 7, 1953
2,641,495	Leslie et al.	June 9, 1953
2,646,300	Roethel	July 21, 1953
2,680,037	Marple	June 1, 1954
2,705,882	Craig	Apr. 12, 1955
2,706,129	Craig	Apr. 12, 1955