June 6, 1972 NOZOMU TORII 3,667,792

DOOR LOCK MECHANISM

Filed March 17, 1970 2 Sheets-Sheet 1

FIG. 1

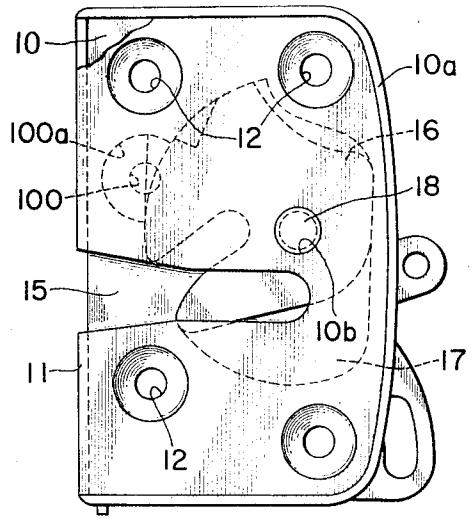


FIG. 2

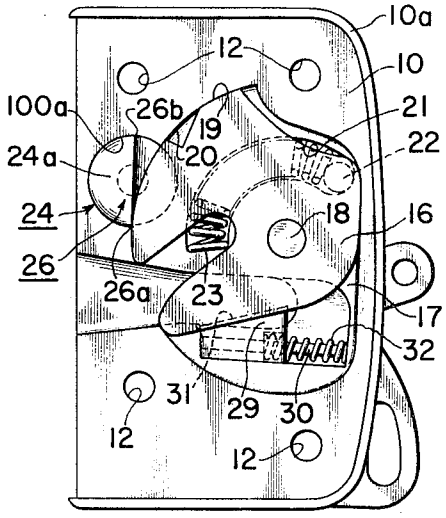


FIG. 3

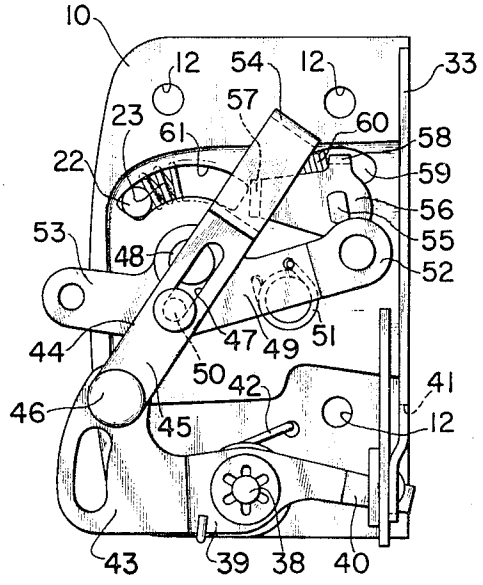
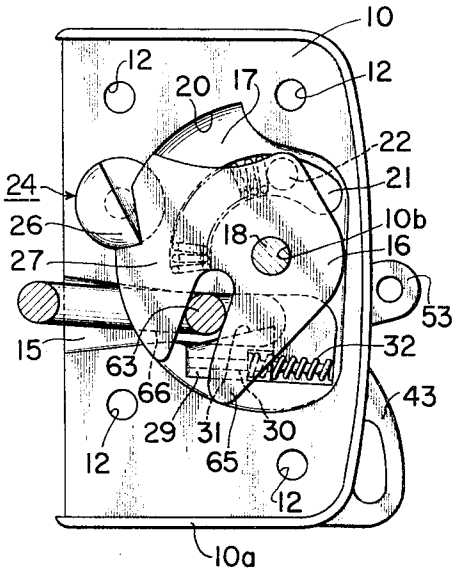


FIG. 4



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DOOR LOCK MECHANISM

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FIG. 5

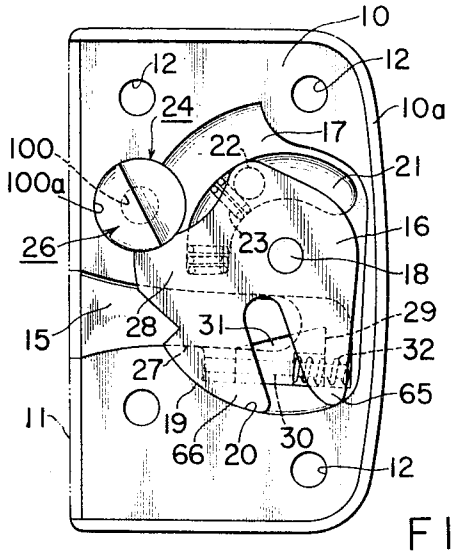


FIG. 6

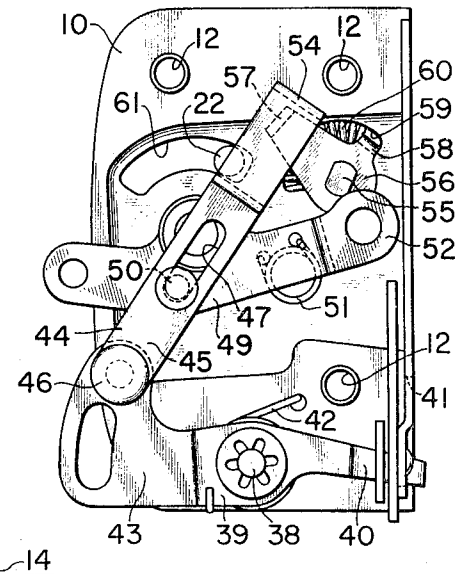


FIG. 9

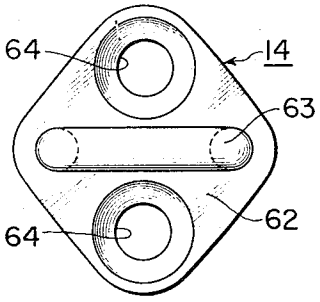


FIG. 7

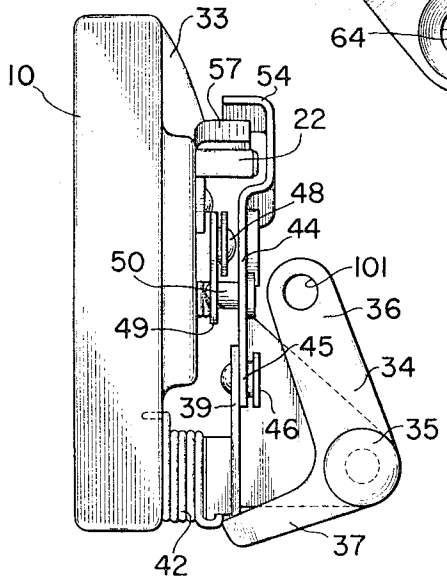


FIG. 8

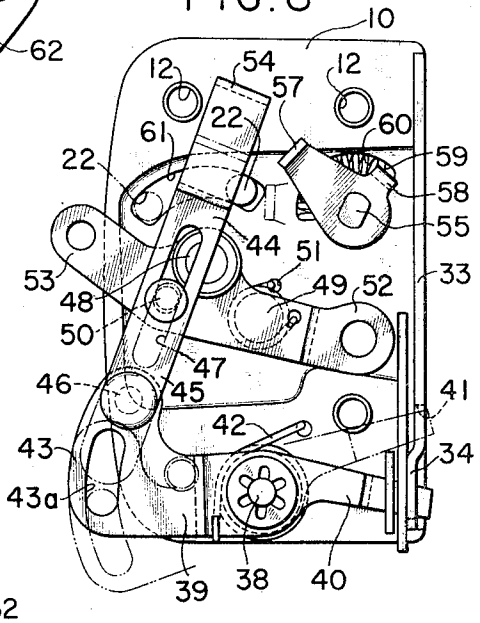
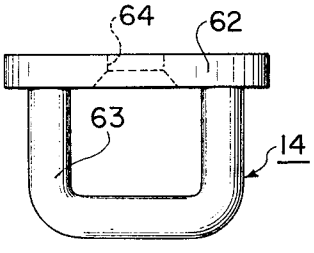


FIG. 10



United States Patent Office 3,667,792 Patented June 6, 1972

3,667,792

DOOR LOCK MECHANISM

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Claims priority, application Japan, Mar. 18, 1969, 44/20,618
Int. Cl. E05c 3/26
U.S. Cl. 292—216 3 Claims

ABSTRACT OF THE DISCLOSURE

An improved door lock mechanism which provides fulfilment of the door lock function to be manipulated from inside of the vehicle; door lock function by key operation from outside of the vehicle; automatic release function in the case that the door should be closed following the erroneous locking of the door from inside; and keyless lock operation from outside without use of a manual key.

This invention relates to door lock mechanisms, especially adapted for use in automotive vehicles.

The main object of the invention is to provide an improved door lock mechanism which provides fulfilment of the following several desirous functional requirements of the door lock mechanism in combination:

The door lock mechanism of the kind above referred to must perform, in combination, the following several functional requirements:

(1) Maintenance of the closed position of a door when the latter has been operated to its closed position (unlocked).

(2) Allowability of opening of the door which has been closed as described in the above item (1) the opening operation being carried into effect either from inside or outside of the vehicle as desired.

(3) Door lock function to be manipulated from inside of the vehicle and for the purpose of preventing an invasion of unauthorized person into the vehicle.

(4) Door lock function by key operation to be carried out from outside of the vehicle and for preventing an invasion of unauthorized person into the vehicle.

(5) Unlock operation which means an automatic lock release function such that when a door is erroneously locked from inside and then the door is closed.

(6) Keyless lock operation which means such that the door can be locked from outside without use of a manual key. This possibility is highly valuable when it is desired to lock the door without use of the door key, for instance, in the case of rainy weather.

These and further objects of the invention will appear more apparent when read in the following detailed description of the invention by reference to several accompanying drawings illustrative of substantially a preferred embodiment of the invention.

In the drawings:

FIG. 1 is substantially a front view of the door lock mechanism of the invention under such conditions that the door has been opened.

FIG. 2 is a similar view to FIG. 1, wherein the cover plate has been removed for the demonstration of inner working parts of the mechanism.

FIG. 3 is a rear review of the mechanism shown in FIG. 1.

FIGS. 4 and 5 are similar views of FIG. 2, wherein the door is being closed in two stages of operation of the door lock mechanism.

FIG. 6 is a similar view to FIG. 3, wherein, however, the door has been closed.

FIG. 7 is a side view of the mechanism when seen from left-hand side of FIG. 6.

FIG. 8 is a rear view of the mechanism when it is in its latched position.

FIG. 9 is a front view of the striker which cooperates with the door lock mechanism.

FIG. 10 is a plan view of a striker.

Referring now to the accompanying drawings, the numeral **10** denotes a plate-like main body of the door latch mechanism according to this invention, said main body being reinforced by a peripheral strengthening rib or flange **10***a*. The main body **10** is provided with a cover plate **11** made integral therewith and formed with a plurality of, herein four, bolt holes **12** for insertion of fixing bolts, not shown. The cover plate **11** is also formed with a plurality of similar bolt holes, not shown, for insertion of fixing bolts, again not shown. By the provision of these bolt holes, the door latch is detachably fixed to the conventional edge panel, not shown, of an automotive vehicle door by means of screw bolts, not shown.

The latch is formed with a lateral recess **15** which is adapted for cooperation with a conventional striker, only schematically shown at **14**, when the door is being closed. This striker **14** is fixed to a stationary pillar or the like member, not shown, which constitutes a part of the chassis, not shown, of the vehicle. The latch mechanism is further formed with a broader recess **17** which is kept in physical communication with the first recess **15** and receiving a latch member **16**, the latter being rotatable about its pivot pin **18** made integral therewith. This pin **18** is rotatably mounted in a round opening **10***b* formed through the body of main body **10** within the area of said recess **17**, and the corresponding part of cover plate **11**.

The latch member **16** is formed with an arc-shaped peripheral surface **19**, the radius of center of which is situated at the central axis of said pin **18**. The second recess **17** is partially defined by a correspondingly arc-shaped peripheral wall **20**. The arc-shaped peripheral surface **19** is kept in slidable contact with the peripheral wall **20**, as shown. It will be seen thus the surface **19** and the peripheral wall **20** are both concentric with the pivot pin **18**.

The latch member **16** is further formed with an arc-shaped groove **21** within the area of said second recess **17**, a coil spring **23**, only schematically shown, being inserted within said groove **21** under tension and a pin **22** rigid with the latch member being kept in pressure contact with one end of said spring **23**. In this way, the latch member is resiliently urged to turn in the clockwise direction in FIG. 2.

The numeral **24** is a rotatable checker which is really a kind of headed pin received in a stepped opening **100** bore through the material of the main body **10**, said opening **100** having an upper enlarged concentric recess **100***a* rotatably receiving the head **24***a* of said checker which has a semi-moon head part **26** having a pair of substantially diametrally opposite points **26***a* and **26***b* adapted for acting as checker pawl means. For this purpose, the enlarged recess **100***a* is partially broken, so as to physically communicate with the second recess **17**. Although not shown, the stem of the checker is rotatably received in the reduced opening part **100**.

During the door-opening operation, as will be more fully described hereinafter, the concentric arc-shaped peripheral surface **19** of latch member **16** influences upon the checker so that the checker pawl means are receded from the area of the second recess **17**, thus the checker being kept in its off-service position. On the other hand, during the door-closing operation, the latch member **16** being turned resiliently under the action of the urging coil spring **23** is brought to such a position wherein a

first latch tooth **27** or a second latch tooth **28** is brought into registration with the checker, thus the checker pawl means **26***a* or **26***b* being protruded into the area of the second recess **17** and brought into engagement with said pawl means, as shown in FIG. 4, or 5, respectively.

The numeral **29** represents a slide block having substantially a key shape when seen in FIGS. 2, 4 and 5 and being mounted slidable along a pin **30** which directs substantially in the same direction as the striker **14** comes in when the door is being closed. An urging coil **32** is mounted around said pin **30** and abuts with its one end for urging the slide block to move in the leftwards in FIG. 2. The slide block **29** and its mounting pin **30** are arranged in the area of said second recess **17**. The upper surface **31**, when seen in FIG. 2, of the slide block **29** is considerably tapered in such a way that the striker reception recess **15** provides a gradually smaller effective space, as the striker **14** invades inwardly along the first recess **15**.

Next, referring to FIGS. 3, 6, 7–8, the operating mechanism will be now described in detail.

Cover plate **11** comprises an elongated side wall **33** extending vertically in FIG. 1 and cooperates with the back side part of the main body **10** when assembled into a unit. The said side wall **33** is formed with a substantially triangular projection plate **34**, an L-shaped bell crank lever **34** serving as a conventional inside open lever being pivotably mounted at its substantially middle point on the inside surface of said plate **34** by means of a pivot pin **35**, as most clearly seen from FIG. 7.

The lever **34** has one arm **36** which is perforated at **101** for link connection with a conventional inside door-opening handle, not shown. When this handle is operated in its door-opening direction, the lever **34** is turned clockwise in FIG. 7. The second arm at **37** of the lever **34** is kept in engagement with one arm **40** of an outside open lever **39** in such a way that when said handle is operated in the door-opening direction, the lever **39** is turned counter-clockwise in FIG. 3.

As seen, the lever **39** is rotatably pivoted by means of a pivot pin **38** on the backside surface of main body **10**, said arm **40** of the lever passing loosely through a slot **41** formed in the side wall **33** of cover plate **11** for allowing a pivotal movement of the lever around its pivot pin **38**. An urging spring **42** is tensioned between the lever **39** and the main body **10** so that the lever is urged resiliently to turn in the clockwise direction in FIG. 3. Under normal conditions, the lever arm **40** abuts against an end extremity **41***a* of said slot **41** so that the lever is positioned as shown in FIG. 3. The lever **39** comprises a second arm **43** which is formed with a slot **43***a* for linkedly connecting with an outside door handle, not shown. When this handle is operated in its door-opening direction, the outside open lever **39** is pivotally moved in the counter-clockwise direction in FIG. 3.

A connecting bar **44** is formed at its intermediate area between the both end extremities with an axially elongated slot **47** and pivotably connected at its lowermost end **45** with the lever arm **43** by a pivot pin **46**. Through the slot **47**, a pin **50** is slidably passed and studded on a rocker plate **49** which is pivoted in turn at **48** on the back surface of main body **10**. A turn-over spring **51** is tensioned between said rocker **49** and main body **10**, thereby the rocker being kept in position either in its unlatched one shown in FIG. 3, or in its latched one shown in FIG. 8.

The rocker plate **49** is linked at its one end **53** with a conventional inside locking button or the like door-locking means, although not shown. This locking arrangement is so designed and arranged that when the locking means is operated in its door-locking direction, the rocker **49** is turned clockwise from the unlock position shown in FIG. 3 to the lock position shown in FIG. 8.

On the other hand, the rocker **49** is further linked at its opposite end **53** with a further door-locking means having a conventional design of the key-operated type, although not shown on account of its very popularity. This arrangement is so designed and arranged that when the locking means is key-operated in its door-opening direction, the rocker is turned clockwise again from the position shown in FIG. 3 to that shown in FIG. 8. All the related parts of the connecting bar **44** is so designed and arranged that when the outside open lever **39** is rotated counterclockwise in FIG. 6 with the rocker plate **49** positioned in its unlatched position shown therein, the inwardly turned-down end at **54** of the connector **44** is brought into engagement with one end **57** of open plate **56** rigid with a shaft **55** united with a rotatably checker **24**, for turning the plate **56** counter-clockwise in FIG. 6.

The outside open lever **39** and its related parts are so designed and arranged that even when this lever is turned counterclockwise in FIG. 8 with the rocker plate **49** positioned in its latch position as shown therein, the connecting bar **44** does not touch by its end **54** with the related end of said lever **56**. One end **58** of open lever **56** is turned down inwardly towards the main body **10** in the form of a kind of a hook, this hooked end extending into a curved slot **59** formed in the main body **10** and kept in pressure contact with one end of a compression coil spring **60** positioned within said slot **59**, thereby the open plate being urged to rotate in the clockwise direction in FIG. 6 (or counter-clockwise in FIG. 2), together with the checker **24**.

The opposite or upper end part of the connecting bar **44** is once turned up remote from main body **10** and then extends a certain distance substantially in parallel to the back surface of the body **10**, the spacing between this parallel bar end and the back surface of said body **10** being selected to be larger than the exposed projecting part of pin **22** from within slot **21**.

In the unlatched position shown in FIGS. 3 and 6, the upper end of the connecting bar **44**, when seen in these figures, is so positioned that it covers only partially said slot **61**, and thus, movement of pin **22** along the groove or slot **61** does not conflict with the connector bar **44**. While, in the position shown in FIG. 8, the related end part of the bar **44** extends fully across substantially middle of the slot so that by movement of the pin **22** therealong, the pin would be brought into physical contact with the bar **44**.

As seen from FIGS. 9 and 10, the striker **14** comprises a base plate **62** and a U-shaped arm **63** made rigid therewith. The base plate **62** is formed with a pair of bolt holes **64** for insertion of respective bolts or rivets, not shown, so as to attach fixedly the striker to the pillar or the like rigid part of the vehicle chassis.

The operation of the door lock mechanism shown and described so far is as follows:

In the stage of a door-opening operation, the latching parts of the mechanisms are positioned as shown in FIG. 2 and the operating parts are maintained in the position shown in FIG. 3.

When the vehicle door is being closed, the striker **14** approaches relatively to the main body **10** and the U-shaped arm **63** of the striker will invade into the guide groove **15** formed in both main body **10** and cover plate **11**. In this way, the arm **63** will be brought into pressure contact with feed pawl **65** formed on latch member **16** so that the latter is rotated in the counterclockwise direaction in FIG. 2 and around the pivot pin **18** against the action of spring **23**.

By this rotating movement of latch member **16**, checking pawl **66** formed on the latch member in opposition to the feed pawl **65** advancing rotatingly in the clockwise direction in FIG. 2 for establishing a positive engagement with the incoming striker **14**. When the latch member **16** has been rotated from its position shown in FIG. 2 to that in FIG. 4, the checker **24** which has been rotated in the counterclockwise direction in FIG. 2 under the influence of spring **60** and on account of a provisional release of the normally established locked condition of the checker by

being contacting with the arc-shaped peripheral surface **19** of latch member **16**, will rotate in the counterclockwise direction in FIG. 2, thereby the checking pawl means, in this case **26***a*, advancing into the area of the second recess **17** and brought into checking engagement with the first tooth **27** on the latch member so as to bring about a provisional or safety latch position of the mechanism, as shown in FIG. 4. In this position, the latch member is checked naturally against further counterclockwise rotation.

When, however, the arm **63** of striker **14** advances further inwardly along the first recess **15**, the latch member **16** will be rotated further in the counterclockwise direction and the provisionally established latching engagement of checker **24** with the first pawl is released thereby. Then, a checking engagement of checker pawl means **26***b* with a second tooth **28** formed on the periphery of latch member **16** will be invited, so as to a final or complete latch condition of the mechanism. In this way, the striker is brought into its final and completely latched position as shown in FIG. 5. During this final invading action of striker **14** along the guide recess **14**, the striker will be brought into contact with the inclined upper surface **31** of slide block **29**, thereby the latter being moved inwards against the action of spring **32**. In the final and completely latched position of the striker **14**, the arm **63** of the latter is subjected to an upward pressure by the pressure contact thereof with the inclined upper surface **31** of the slide block backed up by spring **32**, thus the arm being brought into abutting engagement with the upper side wall **67** of the guide recess for removing occasional and normally unavoidable idle plays between the striker and the recess wall.

During the final and completely latching operation of the striker, the operating section of the door lock mechanism will act in the following way.

In this case, pin **22** rotates in unison with latch member **16** and open plate **56** will rotate in unison with the checker, the working parts of said section will be transferred in their position from that in FIG. 3 to that shown in FIG. 6.

When the driver or the like authorized person desires to open the closed door by manipulating the door handle, not shown, from outside of the vehicle in its door-opening direction, the outside open lever **39** is turned clockwise around the pivot pin **38**, thereby the connecting bar **44** being shifted downwards in FIG. 6, until the lever end **54** is brought into engagemen with the end **57** of open plate **56**, thereby the latter being rotated counterclockwise in FIG. 6 against the action of spring **60**. With rotational movement of the plate **56**, the checker **24** will rotate clockwise in FIGS. 4 and 5 and the pawl means **26** is receded thereby from the area of recess **17**. In this way, the hitherto established engagement of checking pawl means **26** of checker **24** with the second tooth **28** on latching member **16** is released so that the latch member is turned clockwise under the influence of spring action at **23**. The latch member **16** is then returned to the position shown in FIG. 2 upon receding of the locking tooth projection **66** from the defined area of the arm **63** of striker **14**. In this position, the door is ready for opening by application of a manual or the like door-opening effort in that sense.

When the inside door handle, not shown, is operated in its door-opening direction with the door closed, inside open lever **34** will be rotated clockwise in FIG. 6 about pivot pin **35**, until the end **37** of lever **34** is brought into engagement with the related end of outside open lever **39**, thereby the latter being rotated counterclockwise in FIG. 6. Thus, the door can be opened as in the case of the outside door-opening operation.

When the driver or the like person manipulate with a key from outside or the inside door lock push button from inside of the vehicle, as the case may be, in the direction for door locking, rocking plate **49** is rotated clockwise about pivot pin **48** so that the plate is transferred from the position shown in FIG. 6 to that illustrated in FIG. 8. With this rocking motion of the rocking plate, a positional shift of pin **50** rigid with the plate **49**, along the slot **47** of connecting bar **44**, the bar is rotated counterclockwise in FIG. 6 around the pivot pin **46** rigid with lever end **45**, into the position shown in FIG. 8. With the rocking plate **49** brought to its position shown in FIG. 8, then the turn-over spring **51** will urge the rocking plate clockwise which means the opposite urging direction relative to the plate **49**, the latter being thus kept in the position shown in FIG. 8.

With the rocking plate **49** and the connecting bar **44** kept in position shown in FIG. 8, a counterclockwise turning movement of outside open lever **48** and the downward movement of connecting bar **44** thereby caused, which has been brought about by a door-opening operation either from inside or outside of the vehicle, will not bring lever end **54** into engagement of the end **57** of open plate **56**, thus any counterclockwise rotation of open plate **56**, when seen in FIG. 8 being not invited. Therefore, in this case, the latch member **16** is kept in engagement with checker means **24** and thus locked in the completely latched position shown in FIG. 5. Under these conditions, the door cannot be opened.

If the operator or the like person should perform a door lock operation from inside of the vehicle under these conditions and then the door is operated in the closing direction, the latch member **16** for engagement with the striker **14** is correspondingly rotated and the projecting end of pin **22** from the back side of main body **10** and made rigid with the latch member will shift from left to right in FIG. 8 and along the slot or groove **61**. At an intermediate point of this shifting movement of pin **22**, the latter will collide against a portion near the end of connecting bar **44**, the latter being rotated thereby clockwise about the pivot pin **46**. In this way, the bar **44** will act through the pin **50** on the rocking plate **49** for counterclockwise turning of this plate and the latter will be brought to the position shown in FIG. 6, being assisted by the urging action of turn-over spring **51**. At the same time, the bar **44** will occupy the position shown again in FIG. 6.

Under these conditions, when the driver performs a door opening operation from outside of the vehicle, for turning the outside open lever **39** in the clockwise direction in FIG. 6, the door will be opened, since in this case, the connecting bar **44** is kept in such a position where the bar end **54** may be brought into engagement with the plate end **57** upon downward shift of the bar **44**. This means the "unlock" condition.

When it is desired to bring about a "keyless lock" operation, the door is kept in its open position and the lock push button is operated from inside into its locking position, for bringing the rocking lever **49** into its position shown in FIG. 8. Then, it will suffice to close the door with the door handle kept in its door-opening position. In this way, the rotational movement of outside open lever **39** will bring the bar **44** into a downward movement and the related or upper end part of the bar will cover partially the slot or groove **61**, and thus, as was referred to hereinbefore, even a movement of pin **22** from left to right along the groove **61**, being caused by the rotational movement of latch member **16**, does not invite a cooperative engagement of the pin **22** with the connecting bar **44**. In this way, the bar **44** and the plate **49** are kept in their locking position, even after a door-closing operation has been performed. It will be seen that a door-opening operation performed either from outside or inside of the vehicle after realization of a door-closing operation will not invite a door-opening.

The embodiments of the invention in which an exclusive property or privilege is claimed are as follows:

1. A door lock mechanism comprising in combination:

a striker fixedly attached to a motor vehicle chassis adjacent an edge panel of a door of said vehicle;

a base plate fixed to said edge panel;

a latch member pivotally mounted on one side of said

base plate, said latch member being adapted for engagement with said striker when said door is being closed, said latch member being rotated in a first rotational direction upon the closing of said door;

a checker member pivotally mounted on one side of said base plate and adapted for engagement with said latch member, said checker member being engaged with said latch member upon engagement of said latch member with said striker to prevent rotation of said latch member in the opposite direction;

a pin having one end thereof secured to said latch member, the remaining end of said pin extending through a slot formed in said base plate to the opposite side thereof biasing means bearing against said pin;

an opening lever pivotally mounted on said opposite side of said base plate, said opening lever operatively connected with a door opening means for selective operation from inside and outside of said vehicle;

a locking lever pivotally mounted on said opposite side of said base plate and pivotable between a locking and an unlocking position;

means for moving said locking lever between said locking and unlocking positions, said means selectively operable from inside and outside of said vehicle;

an opening plate fixedly attached to one end of said checker member, said opening plate positioned on said opposite side of said base plate; and

a connecting bar having one end pivotally attached to said opening lever, an intermediate portion of said connecting bar being slidably connected with said locking lever, the remaining end of said connecting bar being engageable with said opening plate when said locking lever is in its unlocking position for rotating said checker member to release said latch member upon rotation of said opening lever, said connecting bar being moved away from said opening plate when said locking lever is in its locked position to prevent engagement of the remaining end of said connecting bar with said opening plate.

2. A door lock mechanism as claimed in claim **1**, further comprising means provided on said connecting bar adapted for engagement with said pin upon the rotation of said latch member in said first rotational direction upon the closing of said door when said locking lever is in its locking position, whereby the engagement of said pin with said means provided on said connecting bar will move said locking lever to its unlocking position.

3. A door lock mechanism as claimed in claim **2**, wherein said means provided on said connecting bar for engagement with said pin is positioned a predetermined distance from the remaining end of said connecting bar to prevent engagement with said pin when said locking lever is in its locking position and said opening lever is operated, whereby said locking lever is maintained in its locking position upon the closing of the vehicle door with said opening lever being operated.

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RICHARD E. MOORE, Primary Examiner

U.S. Cl. X.R.

292—DIG 25, DIG 26