June 6, 1972 KENICHI KAZAOKA ETAL 3,667,791

DOOR LOCK MECHANISM

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FIG. 1

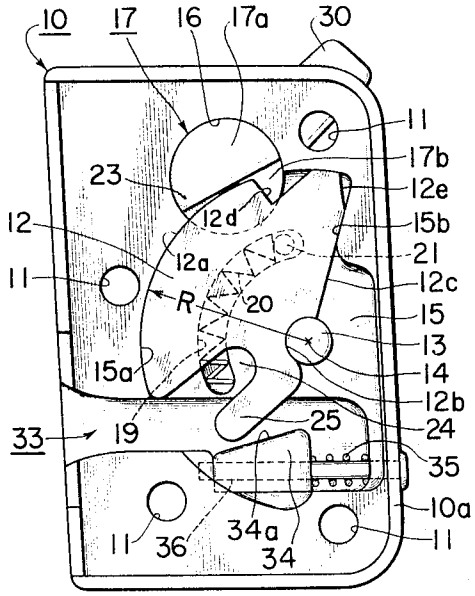


FIG. 2

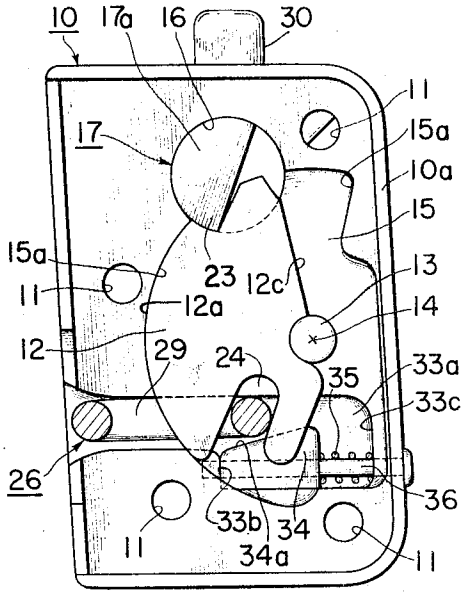


FIG. 3

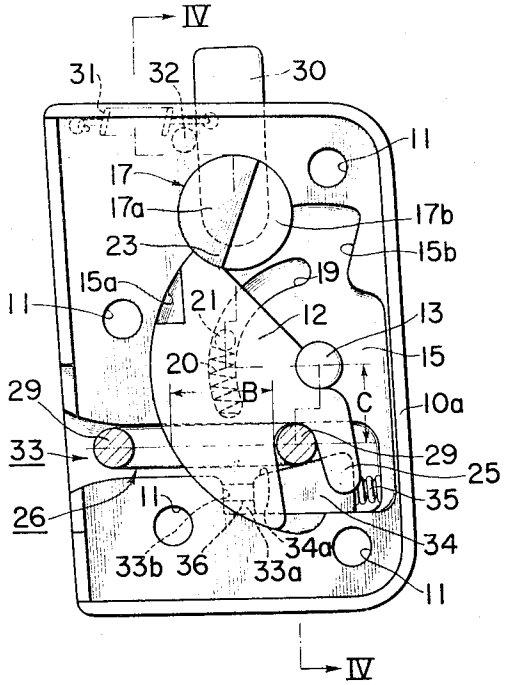


FIG. 4

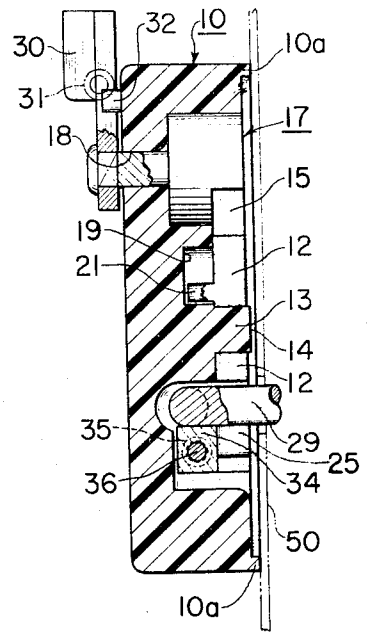


FIG. 7

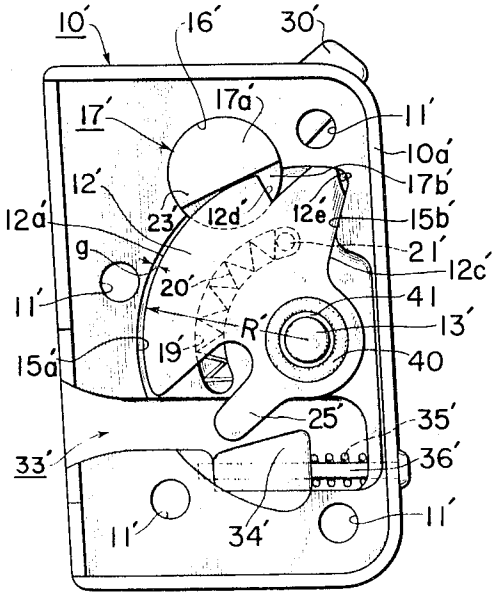


FIG. 5

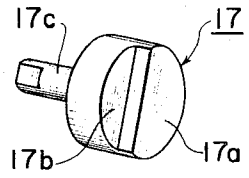


FIG. 6

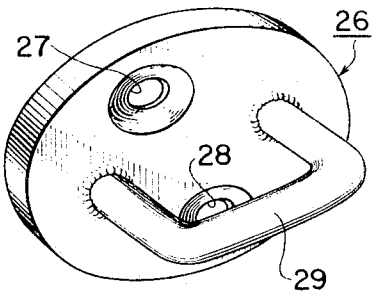


FIG. 8

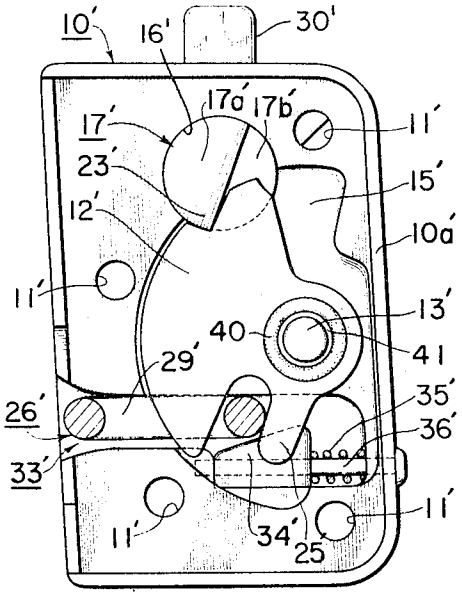
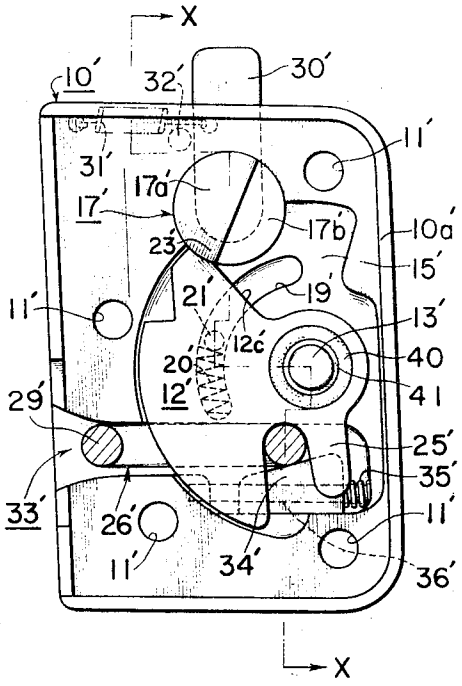


FIG. 9



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DOOR LOCK MECHANISM

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FIG. 10

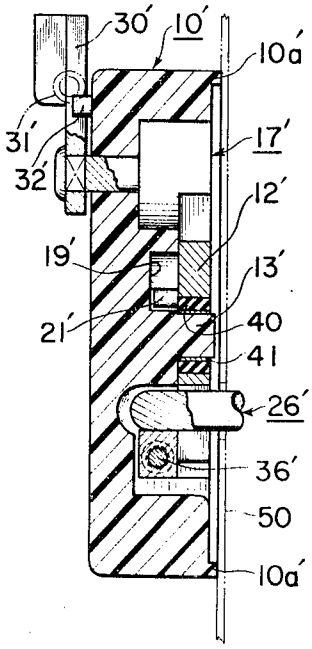
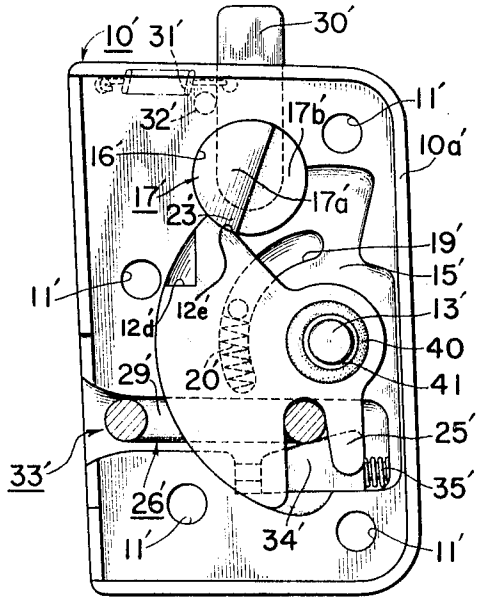


FIG. 11



United States Patent Office 3,667,791
Patented June 6, 1972

3,667,791

DOOR LOCK MECHANISM

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Claims priority, application Japan, Feb. 13, 1969, 44/10,870
Int. Cl. E05c 3/24
U.S. Cl. 292—216 9 Claims

ABSTRACT OF THE DISCLOSURE

A door lock mechanism comprising a base member fixedly mounted on a door of an automotive vehicle; a recess formed on the base member and having an arc-shaped periphery defining part of the configuration of the recess; a sector latch member pivotably mounted in the recess, the latch member formed with an arc-shaped peripheral part having the same radius as that of the arc-shaped periphery of the recess. A spring urging the latch member to rotate in one direction with a checker rotatably mounted on the base; a second spring urging the checker to rotate in a direction opposite to the one direction. A first and a second tooth is formed on the latch member for cooperating in succession with the first and second tooth to keep the latch member in its safety latch and full latch position; and a second and substantially radially directing recess for cooperatingly receiving a striker is mounted on a stationary part of the vehicle when the door is operated in its closing direction.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to improvements in and relating to door lock mechanisms for use with automotive vehicle doors.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a rigid, compact and efficient door lock mechanism adapted for bearing every directional outside forces of substantial magnitudes acting on the door lock mechanism, especially in the axial, lateral and vertical directions, even in an emergency.

It is a further object of the invention to provide a door lock mechanism of the above kind, capable of functioning in a more stabilized and efficient manner than the conventional comparative mechanisms, although the door lock mechanism according to this invention has only a limited space requirement.

BRIEF DESCRIPTION OF THE DRAWINGS

These and further objects, features and advantages of the invention will become more apparent when read in the following detailed description of the invention by reference to the accompanying drawings illustrative by way of example two preferred embodiments of the invention.

In the drawings:

FIG. 1 is a front view of a preferred first embodiment of the door latch mechanism in its normal or off-service position with the automotive door, not shown, being kept open.

FIG. 2 is a similar view to FIG. 1, wherein, however, the door lock mechanism is shown in its safety latch position, as met with the door positioned in its almost closed state.

FIG. 3 is a similar view to FIG. 1, wherein, however, the door lock mechanism is shown in its full latch position, as met with the door positioned in its closed position.

FIG. 4 is a sectional view taken along a sectional line IV—IV shown in FIG. 3.

FIGS. 5 and 6 are respective perspective views of a checker and a striker.

FIGS. 7–10 are similar views to FIGS. 1, 2, 3 and 4, yet showing a second embodiment of the invention.

FIG. 11 is a similar view to FIG. 10, wherein, however, a substantial external force is being applied to the mechanism.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the accompanying drawings, several preferred embodiments of the invention will be described in detail.

In FIGS. 1–4, the numeral **10** denotes a base member, preferably made of a rigid plastic material such as polycarbonate, phenolic or the like resin, and having substantially a rectangular configuration when seen in each of FIGS. 1–3.

The base member **10** is made substantially into a plate having a thickness of several millimeters and provided with a peripheral reinforcing rib **10***a*. The base **10** is further formed with a plurality of, four in this preferred embodiment, bolt holes **11** adapted for attachment to a door of an automotive vehicle, not shown.

A substantially segmental latch member **12** is pivotably mounted around a projection or pin **13** having its center at **14** and made integral with said base **10** which is formed with a recess **15** having substantially the form of a half moon. The latch member **12** is formed with an arc-shaped peripheral edge **12***a* having a radius R measured from the center **14** of the pin **13**, said peripheral edge **12***a* being kept in slidable engagement with a correspondingly formed arc-shaped peripheral edge **15***a* defining part of said recess **15** and having the same radius R measured from said center **14**. The peripheral edge **15***a* is interrupted at its intermediate point by the provision of a round recess **16** formed in the base member **10** and receiving rotatably the enlarged head **17***a* of a checker **17**. The pin head **17***a* is recessed at **17***b* as most clearly seen from FIG. 5 and the checker **17** has a concentric stem **17***c* which passes rotatably and projectingly through a bore **18** drilled through the body of base member **10**. As seen from FIG. 4, the bore **18** is provided concentrically with the round recess **16**.

For allowing the latch **12** to perform pivotal movement, the latch is formed with a rounded recess **12***b* which is concentric with the arc-shaped outer periphery **12***a* and kept in slidable contact with pivot pin **13**.

The recess **15** is formed with an arc-shaped groove **19** in which an urging coil spring **20** is positioned. With one end of this spring **20**, a pin **21** is kept in engagement. As seen from FIG. 4, this pin **21** is made integral with the body of latch **12**, the latter being therefore resiliently urged to turn in clockwise direction when seen in FIGS. 1–3. The spring **20** is naturally mounted in position with a certain predetermined precompression.

The latch **12** is provided with a straight edge **12***c* which is kept in pressure engagement with a straight edge portion **15***b* forming a part of the overall wall part defining the general configuration of the recess **15** when seen in FIGS. 1–3. The design and arrangement of said groove **19**, latch **12**, recess **15** and pin **21** are so selected that with the latch **12** positioned in its off-service position shown in FIG. 1, there is a small idle gap between the pin **21** and the neighboring end wall of said groove **19**.

The latch **12** is formed with a first tooth surface **12***d* and a second tooth surface **12***e* at a small mutual distance as shown. These tooth surfaces are so designed and arranged that when the latch is rotated counterclockwise from the position shown in FIG. 1, they are brought into

successive engagement with tooth-like portion **23** which is formed on the recessed head **17***a* of the rotatably mounted checker **17**, as will be easily understood when observing FIGS. 2 and 3, respectively.

The latch **12** is formed with a substantially radially directing recess or notch **24** so as to provide a projecting arm **25**, said notch being cooperatable with a conventional striker **26**, as will be more fully described hereinafter. The striker **26** is shown specifically in FIG. 6.

In FIG. 6, the striker **26** comprises a disk-like main body **26***a* which is formed in turn with two bolt holes **27** and **28** for the fixed attachment to the main body, preferably pillar means thereof, not shown, of a vehicle. Although conventional striker is provided with a striker pin, the door latch mechanism according to this invention, as exemplified, is fitted rigidly with a modified striker proper into a U-shaped member **29** as shown.

As shown in FIG. 4, a latch-release lever **30** is rigidly fixed at its one end with the projecting stem **17***c* of checker member **17** by conventional fixing means such as riveting as shown. A tension spring **31** is tensioned between a stop pin **32** rigidly mounted on base member **10**, and the latch-release lever **30**, thus urging the assembly comprising said lever **30** and the checker **17** to turn counter-clockwise in FIG. 3.

With the lever **30** turned in the clockwise direction in FIG. 3, the tension of the spring **31** is correspondingly increased so that the counterclockwise turning effort being applied on the lever will become correspondingly increased. It should be however noted that a certain initial tension is applied and thus, even when the lever **30** is positioned at its rest position shown in FIG. 3, where the lever abuts against a stop pin **32** rigidly attached on the back surface of the base member **10**, with the spring **31** kept in its least tensioned state, the lever is being subjected to a certain amount of counterclockwise turning effort when seen in FIG. 3.

The base member **10** is further formed with an elongated passage recess, generally shown at **33**, which has an enlarged part **33***a* as shown, a guide pin **36** bridges the left and right hand end wall parts **33***b* and **33***c*. A slide block **34** is mounted slidably on the guide pin **36**, said slide being urged resiliently to move along the pin from right to left in FIGS. 1–3 by virtue of the provision of an urging coil spring **35** which is mounted around the guide pin and inserted between the slide block **34** and the wall part **33***c*. As will become more clear hereinafter, the passage recess **33** is arranged to receive the striker per se and the slide block **34** functions to assure more positively the latched position of the latch mechanism when operated. In the off-service position or so of the latch mechanism, the slide block **34** is kept in its left-hand extreme position shown in FIGS. **1** and **2**, where the slide abuts against the left-hand side wall **33***b* defining a part of the enlarged recess part **33***a*. Any turning movement of the slide block **34** around guide pin **36** is positively prevented by forming the rear surface of said slide into a plane surface kept in slidable contact with a correspondingly plane surface formed on the base member **10**.

The door plate to which the main parts of the door latch mechanism comprising said base member **10** fixedly attached is shown only schematically in FIG. 4 by two parallel chain-dotted lines **50**.

The operation of the first embodiment of the door latch mechanism so far shown and described is as follows:

As referred to hereinbefore, the position of the door latch mechanism shown in FIG. 1 is the unlatched or latch-release one, thus the door being kept in its open position. When a driver or the like person operates the open door in its closing direction, the striker **26** fixedly attached to the automotive body and together with its latching member **29** will relatively approach towards the advance into passage recess **33**. The member **29** will then be brought into collision with arm **25**, thereby the latch member **12** being rotated in the counter clockwise direction around the pivot pin **13** against the urging force exerted by the compression spring **20** through the intermediary of motion-receiving pin **21** upon the latch with its outer peripheral edge **12***a* performing a sliding motion on the arc-shaped wall **15***a* of recess **15**.

Since checker **17** is always urged resiliently by tension spring **31** to turn counterclockwise in FIGS. 1–3, the tooth-like portion **23** on the checker is brought into engagement with first tooth surface **12***d*, after the latch **12** has been rotated a predetermined angle from the position shown in FIG. 1 to that shown in FIG. 2. In FIG. 2, this engaged position between the both is clearly demonstrated, which corresponds to the "safety latch" position so-called by those skilled in the art.

With further door-closing operation and thus with further advancing movement of the latching member **29** from left to right, from the position shown in FIG. 2 to that shown in FIG. 3, the latch **12** is further rotated in the counter-clockwise direction as before, and the provisionally established engagement between **12***b* and **23** is released and a new engagement is brought about between **12***e* and **23**, as shown in FIG. 3. At the same time, the lever **30** is urged into engagement with stop pin **32** by the spring **31** and therefore, any further counterclockwise rotation of the checker **17** and clockwise rotation of the latch **12** is positively prevented. During straight invading movement of the latching member **29** along the passage recess **33**, more specifically its enlarged inner end part **33***a*, the member **29** will be brought into pressure contact with the inclined, motion-receiving surface at **34***a* of the slide block **34** and ride therealong so that the latter is moved forcibly towards right in FIG. 2, against the urging force exerted by compression spring **35**. At the almost final stage, the mutual position of latch **12**, latching member **29** and slide block **34** will be that shown in FIG. 3, this engaged position being called the "full latch" position.

The automotive door can be operated to a certain small degree in its closing direction. With this movement, the latching member **29** can advance only a small distance in the right-hand direction from the position shown in FIG. 3. But, the base member **10** is so designed and arranged that it is kept in contact with a conventional weather strip, not shown, provided on the vehicle body, for limiting this kind of excess movement of the door or latching member **29** to only a small distance.

When any unintentional outside or inside force is applied to the thus latched door, and thus the latching member **29** is subjected to a force for moving leftwards in FIG. 3 from the position shown therein, the latch **12** is exerted upon by a corresponding force directing in the same sense by virtue of the latched engagement between the both. In this case, however, the thus urged latch **12** is prevented from its moving in that direction by virtue of the broad contact between the arc-shaped outer periphery **12***a* and the correspondingly shaped recess-defining wall surface at **15***a*. A clockwise rotation of the latch **12** urged at the same time by the door-opening force is also prevented in a positive manner, because in this position the tooth-like portions **23** on checker **17** is kept in engagement with the second tooth **12***e* of the latch **12**.

As commonly known, a hinged door such as the automotive door has disadvantageously a tendency of hanging-down by its own weight. A positive prevention of such hanging-down of the door is brought about by use of the door latch mechanism according to this invention wherein with the door closed, the channel-shaped striker proper **29** is brought into positive engagement with the upper wall **33***b* defining the upper limit of the groove **33**, thus the door being definitely supported through the base member **10** by the striker as will be clearly seen from FIG. 3.

When, as an example, a vehicle should come into collision in the lateral direction and against the body

of the vehicle fitted with the present door latch mechanism a substantial force will act in the longitudinal direction of the vehicle body, thus tending the latch member **12** being forcibly moved in the axial direction of pivot pin **13**, or more specifically in the perpendicular direction to the drawing paper surface of FIG. 3 and towards the viewer by the striker proper **29**. In this case, the engagement of the second tooth **12***e* with the checker tooth **23** will be released and the latch **12** will move in the aforementioned direction, but, in the mechanism so far shown and described, an excess displacement of the latch would be positively prevented by contact with the rear surface of the door plate **50**, to which the base member **10** of the door latch mechanism is fixedly attached by bolts, not shown, which are screwed in position after passage through the bolt holes **11**, as was briefly hinted hereinbefore. Therefore, it will be easily understood that the latch member is not removed from position in this case, should the door latch not be subjected to destruction.

When it is desired to open the door from its closed position with the constituent parts of the latch mechanism positioned as shown in FIG. 3, lever **30** is turned in the clockwise direction in FIG. 3 against the urging force exerted by the spring **31**, so as to rotate the checker **17** in the same direction and in unison with the lever and to release the engagement between **23** and **12***e*. Thus, the latch **12** is rotated automatically in the clockwise direction in FIG. 3 under the action of the biasing spring **20**. Therefore, the latch **12** will be returned from the position shown in FIG. 3 to that shown in FIG. 2, or directly to the position shown in FIG. 1.

The first embodiment shown and described so far has the following several advantages.

Since the latch **12** has been formed into substantially a sector shape, the radius R extending from the center **14** of pivot pin **13** to the arc-shaped outer periphery **12***a* of the latch can be selected to a considerably large value in comparison with that adopted in a comparatively compact design of the door lock mechanism. In effect, the distance shown at B in FIG. 3 can be increased considerably when compared with the similar part in the conventional mechanism, even with such assumption that the thickness of the latch be identical with each other. By adopting this measure, the durable performance of the latch **12** against the forced shift of the striker leftwards in FIG. 3 by virtue of an unintentional application of a sudden and substantial door-opening force, as may be met in an emergency.

By the adoption of a larger value of the radius R, the contact area of the arc-shaped outer periphery of the latch with the similarly shaped recess-defining wall part of the base plate **10**, providing a broader pressure transmitting area of the latch member acting against possible movement of the striker urged unintentionally and forcedly in the door-opening direction, as may be encountered in an emergency, thereby constituting a substantially rigid door latch mechanism. In a preferred embodiment as the present one, the ratio: R/C shown in FIG. 3, wherein the distance C is that measured from the center **14** of pivot pin **13** to the central axis of the locus of the striker per se **29** when the striker **26** moves relative to the base member **10** in the aforementioned way, is selected to be substantially equal to that employed in the conventional comparative mechanism, even for a larger value of said distance C, the acting pressure between the both teeth **12***e* and **23** which appears when the latch member **12** is rotated in the aforementioned way, will be substantially equal to that conventionally adopted. Therefore, the dimensional requirement for the checker **17** and its related parts serving for returning the latch from the position shown in FIG. 3 to that in FIG. 1 may not be unchanged for attaining equal strength as conventional.

Next, referring to FIGS. 7–11, a preferred second embodiment of the invention will be described in detail.

The reference symbol **10'** is a similar base member to that shown at **10** in the foregoing, said base being formed equally with a peripheral reinforcing rib **10***a'* as well as four bolt holes **11'** as before.

A segmental latch member **12'** is also provided which is rotatably mounted around a fixed pivot pin **13'**, yet through the intermediary of a first bushing **40** made of a resilient material, such as hard rubber or the like, and a second concentric smaller diameter bushing **41** made of metal or metal alloy having a small frictional coefficient. The first bushing **40** is fixed to the latch **12'**, while the second bushing **41** is rotatable relative to the first bushing and the pivot pin **13'**, said pin **13'** being equal design as that shown at **13** in the foregoing embodiment. As before, the latch **12'** has an arc-shaped peripheral edge **12***a'* having a radius R' measured from the center **14'** of the pivot pin **13'**. The latch **12'** is rotatably and slidably mounted on the bottom of a mounting recess **15'** having an arc-shaped peripheral wall **15***a'* having an equal radius as R', but its center is offset a small distance from the said center **14'**, said offset distance being naturally equal to the gap at *g* between the latch peripheral edge **12***a'* and the recess-defining peripheral wall **15***a'*. The gap *g* is maintained normally, so far as the first bushing **40** keeps its regular cylindrical shape as shown in FIGS. 7–9. As seen, the wall thickness of the first or elastic bushing **40** is substantially larger than the dimension of said gap *g*. The material of the elastic bushing **40** has a rather substantial rigidity so that the bushing may be elastically deformed only when a substantial lateral force, when seen in FIGS. 7–9, as met in a vehicle collision or the like emergency accident, should be applied to the latch mechanism, as will be more fully described hereinafter by reference to FIG. 11.

Several other parts, such as shown at **12***b'*, **12***c'*, **12***d'*, **12***e'*, **15***b'*, **16'**, **17'**, **17***a'*, **17***b'*, **17***c'*, **18'**, **19'**, **20'**, **21'**, **22'**, **23'**, **24'**, **25'**, **26'**, **29'**, **30'**, **31'**, **32'**, **33'**, **33***a'*, **33***b'*, **33***c'*, **34'**, **35'**, **36'**, **50'** have substantially same design and function as those denoted with same reference numerals without attaching no prime, shown and described in the foregoing first embodiment. Therefore, no further analysis of the second embodiment would be necessary for the understanding thereof.

In the normal operation of the door lock mechanism, the latch **12'** rotates in one or the other direction as before, but, without sliding contact of its arc-shaped outer peripheral edge **12***a'* with the correspondingly arc-shaped wall part **15***a'* of the mounting recess **15**, thus the gap *g* being maintained for smooth rotation of the latch.

On the contrary, if a sudden and considerable door-opening force should act in the door-opening direction, by way of example, in an emergency, and thus the striker proper **29'** is moved suddenly from right to left in FIG. 9 with the latch mechanism kept in its full latch position shown therein, the latch **12'** is pushed leftwards and the elastic bushing **40** will be subjected to deformation as shown in FIG. 11 and the latch **12'** will be brought into direct contact with the arc-shaped peripheral wall part **15***a'* of the recess **15'**, thus the gap *g* disappearing and the door-opening force being borne by the direct abutment between the latch and the base member. Therefore, in this case, the broad engagement surface of said arc-shaped wall part **15***a'* serves for bearing the intensive door-opening force. In this case, even when the latch **12'** is subjected to clockwise rotation, the already established engagement between the tooth parts **12***e'* and **23'**, will effectively prevent such latch rotation, if not the door-opening force should be so large that the door latch mechanism may be destroyed.

In the present embodiment, the pivot pin **13'** may be of slender design than that employed in the foregoing embodiment, because a severe door-opening force can not be borne by the pivot pin, thanks to the provision of the elastic bushing **40**.

Other functions of this second embodiment are substantially similar to those in the first embodiment, so that

no further analysis thereof would be necessary for better understanding of the invention.

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

1. In a door lock mechanism for a vehicle door comprising a base member fixedly mounted on said vehicle door and having a curved wall recess along one side thereof;

a latch member pivotably mounted in said recess and having a second recess;

a striker mounted rigidly on a stationary part of said vehicle, and adapted to enter on said same side as said recess of said base member, said second recess capable of engagingly receiving said striker;

a checker means pivotably mounted on said base member for locking said door by engagement with said latch member, said latch member having a generally sector-shaped configuration with an arc shaped outer peripheral surface, said curved wall recess having an arc shaped wall surface complementary to said latch member peripheral surface so that their radii are substantially the same dimension, whereby said two surfaces can engage along a major portion of their surfaces upon the transmission of a large force from said striker to said latch member during and after a door locking operation and while said door is in its closed position, and

a pivot pin rigidly mounted on said base member, said latch member being pivotably mounted on said pivot pin and supported against a door closing force transmitted from said striker to said latch member when said door is being closed, said arc shaped wall surface of said base member supporting said latch member against a door opening force transmitted from said striker to said latch member.

2. The door lock mechanism as claimed in claim 1, further comprising:

a groove formed on said base member, and

a spring inserted in said groove, one end of said spring being kept in pressure engagement with said latch member so as to urge the latter to move in the door-opening direction.

3. The door lock mechanism as claimed in claim 2, further comprising a second spring mounted on said base member and acting upon said checker means which is thereby urged to move in a direction for engaging with said latch member.

4. In a door lock mechanism for a vehicle door comprising a base member fixedly mounted on said vehicle door and having a curved wall recess along one side thereof;

a latch member pivotably mounted in said recess and having a second recess;

a striker mounted rigidly on a stationary part of said vehicle, said second recess capable of engagingly receiving said striker;

a checker means pivotably mounted on said base member for locking said door by engagement with said latch member, said latch member having a generally

sector-shaped configuration with an arc shaped outer peripheral surface, said curved wall recess having an arc shaped wall surface complementary to said latch member peripheral surface, with the radius of said curved wall recess being slightly larger than the radius of said latch member peripheral surface, whereby the two surfaces will engage only upon the transmission of a large force form said striker to said latch member after a door locking operation and while said door is in its closed position;

a pivot pin rigidly mounted on said base member, and

elastic bushing means connecting said pivot pin to said latch member for absorbing the normal forces transmitted between said latch member and said base member during a normal door locking operation.

5. The door locking mechanism as claimed in claim 4, where said elastic bushing means further includes a first elastic bushing fixedly mounted on said latch member and a second bushing rotatably mounted on said pivot pin and connected to said first elastic bushing.

6. The door lock mechanism as claimed in claim 5, further comprising a spring biased camming member directly engaging said striker in a closed door position to help support said striker.

7. The door lock mechanism as claimed in claim 5, where the first elastic bushing has a thickness capable of resiliently being deformed to absorb normal door locking operation forces between said base member and said latch member without said curved wall recess surface contacting said latch member peripheral surface, the resilient thickness, however, not preventing the engagement of said surfaces upon the occurrence of extraordinary forces beyond normal door locking operation forces.

8. The door lock mechanism as claimed in claim 4, further comprising:

a groove formed on said base member, and

a spring inserted in said groove, one end of said spring being kept in pressure engagement with said latch member so as to urge the latter to move in the door-opening direction.

9. The door lock mechanism as claimed in claim 4, further comprising a second spring mounted on said base member and acting upon said checker means which is thereby urged to move in a direction for engaging with said latch member.

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