Sept. 5, 1967 D. E. BROWN 3,339,226

TOGGLE LINKAGE FOR VEHICLE DOOR HINGE

Filed May 27, 1964 3 Sheets-Sheet 1

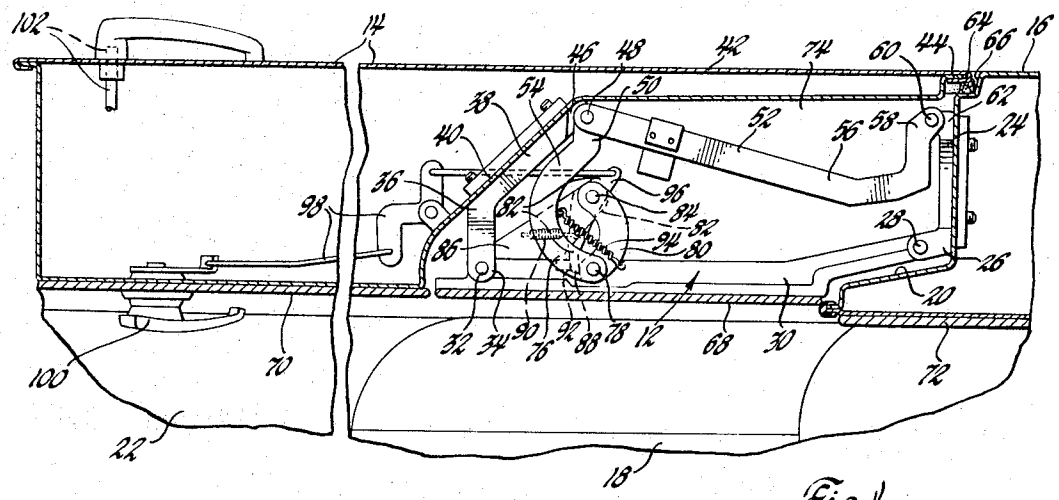


Fig. 1

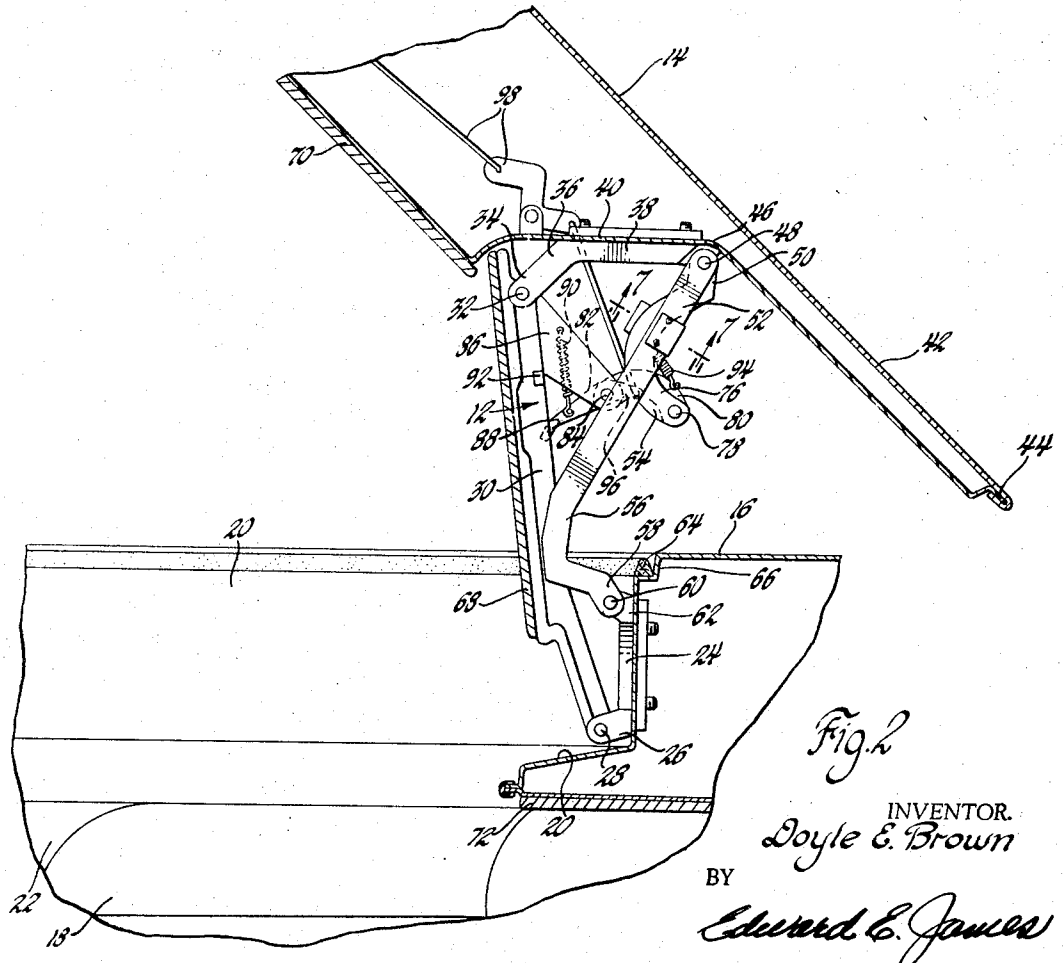


Fig. 2

INVENTOR.
Doyle E. Brown

BY
Edward E. James
ATTORNEY

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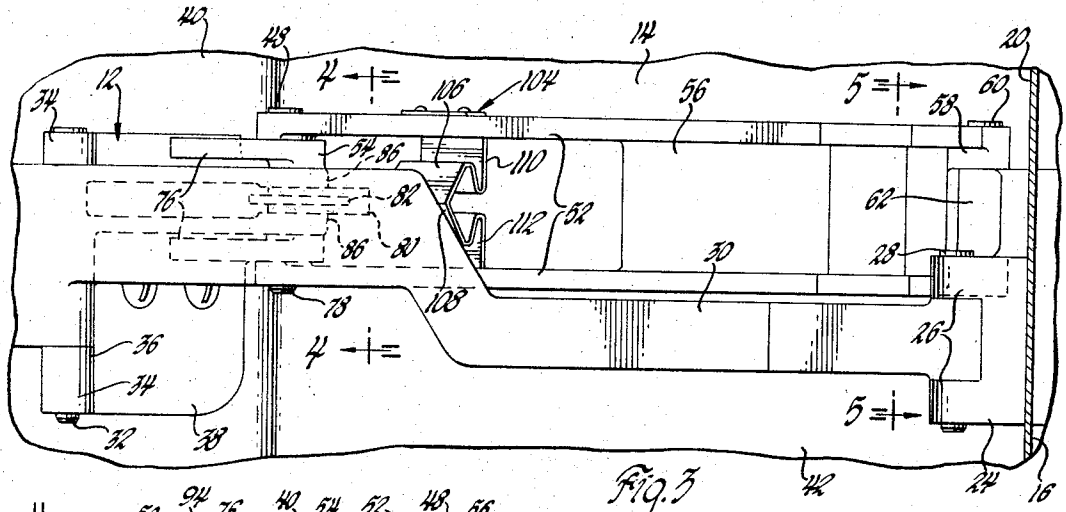


Fig. 3

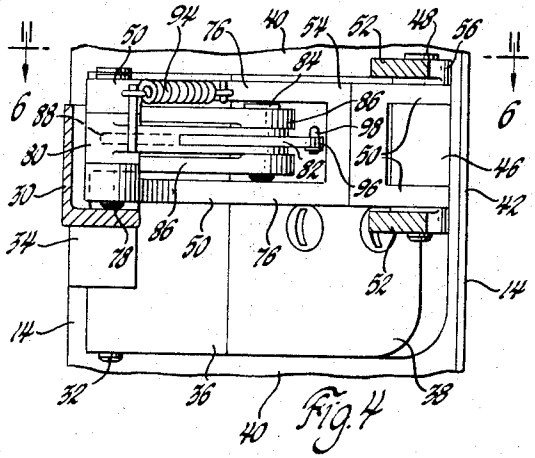


Fig. 4

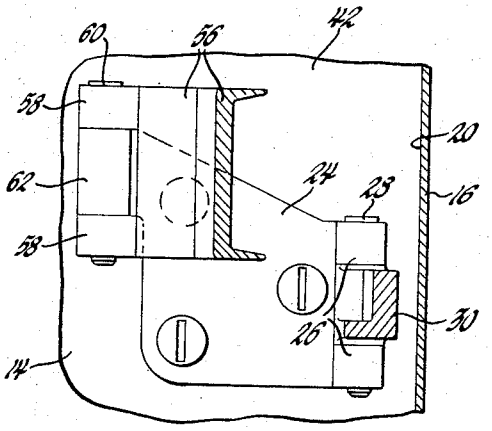


Fig. 5

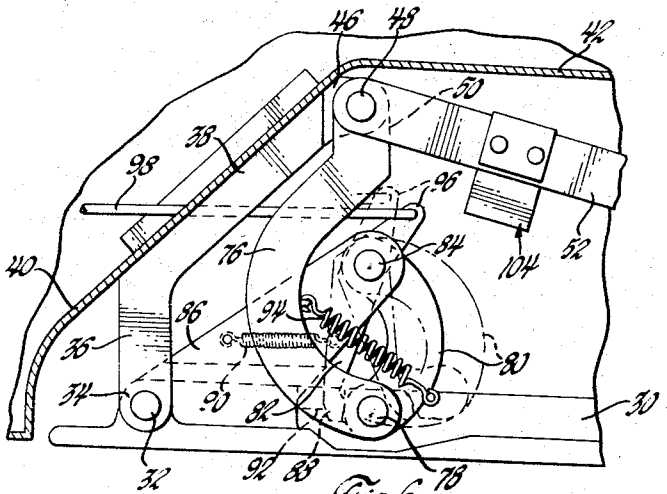


Fig. 6

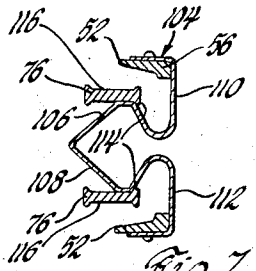


Fig. 7

INVENTOR.
Doyle E. Brown

BY
Edward E. James
ATTORNEY

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TOGGLE LINKAGE FOR VEHICLE DOOR HINGE

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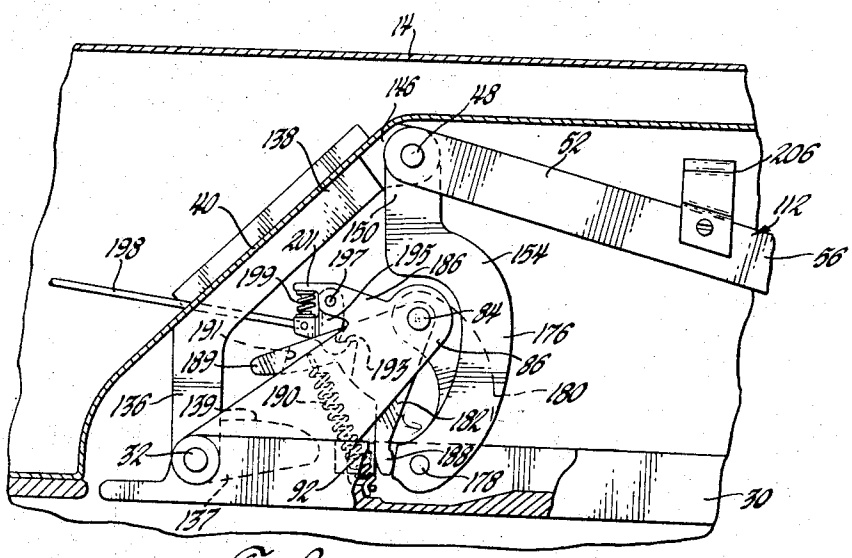


Fig. 8

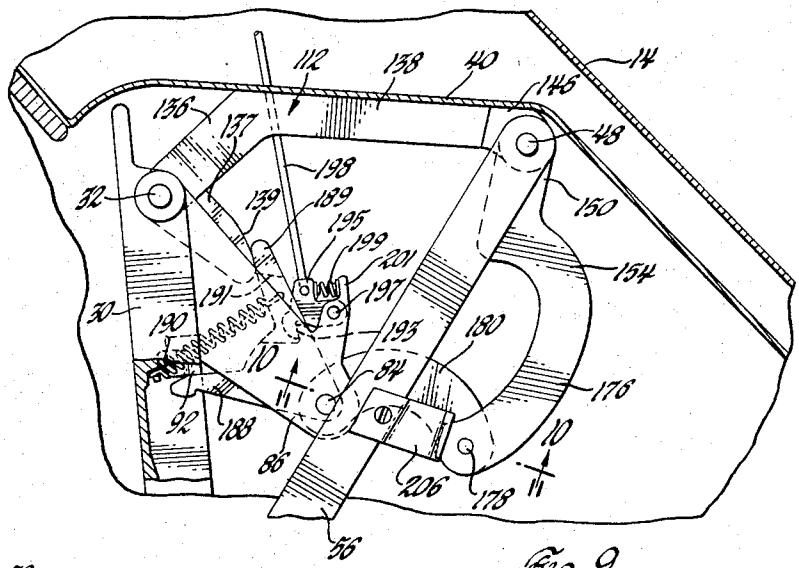


Fig. 9

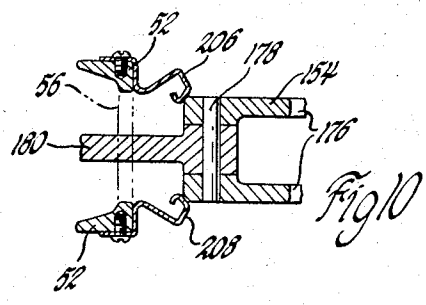


Fig 10

INVENTOR.
Doyle E. Brown

BY

Edward E. Jaucea
ATTORNEY

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3,339,226

TOGGLE LINKAGE FOR VEHICLE DOOR HINGE

Doyle E. Brown, Utica, Mich., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Filed May 27 1964, Ser. No. 370,612
6 Claims. (Cl. 16—163)

This invention relates generally to a hinge mechanism adapted to mount a vehicle door for opening movement with respect to a vehicle body door opening; more particularly to a quadrilateral hinge mechanism for mounting such a vehicle body door for translatory opening and closing movement; and with regard to certain of its more specific aspects, to a toggle linkage for such a hinge mounted vehicle door.

Easier access to a vehicle passenger compartment and greater door opening movement in a restricted space may be provided by mounting the vehicle door on the vehicle body by spaced swinging bar hinge members cooperating to form quadrilateral hinge linkages with the hinge supporting door pillar and the opposing edge of the door. Such hinges translate the hinge mounted side of the door outwardly of the adjacent vehicle body door pillar during door opening with linkage controlled swinging movement of the door. The compound motion provided by such hinges further tends to eliminate any interference between the side body contoured edges of the door and the adjacent door opening and hinge supporting pillars of the vehicle body.

When used with a conventional vehicle door lock or latching mechanism however, quadrilateral swinging bar hinges tend to permit cyclic rebounding of the door relative to the hinge supporting pillar during vehicle operation. This rebounding or cyclic swinging movement of the hinge mounted side of the door results in objectionable noise and in excessive wear and destructive impacting of the interengaged door locking elements and of the resilient weatherseal normally interposed between the door and the door opening portions of the body. Hence, an auxiliary or secondary door stabilizing latching mechanism is usually provided at the hinged side of the door to prevent such rebounding between the hinge supporting pillar and the adjacent side face of the door. In the past, such secondary latching mechanisms have generally been connected to the primary latch mechanism for sequential or simultaneous release by appropriate operation of either an inside or outside button or handle. Such compound latching arrangements have necessarily required relatively complex detent operating linkages and excessive operating effort. More recently, several auxiliary door stabilizing latch mechanisms have been operably connected for door latching actuation and release by closing and opening movement of the door relative to the body opening and independently of latching engagement and detent releasing operation of the primary latch means.

The instant invention broadly contemplates an improved quadrilateral hinge mechanism of relatively simple, inexpensive, rigid construction and particularly adapted to mount vehicle body doors for controlled translatory swinging movement between an extreme door opened position and a locked rebound preventing closed position relative to the vehicle body door opening. The invention further contemplates and provides such a hinge mechanism or similar hinge mounted door with a toggle linkage folded in the closed position of the door to an overcenter door and hinge locking position and swingable therefrom by remote operating means to an intermediate position unlatching the door and hinge for opening movement to an extended position wherein the toggle and hinge members cooperate to define door holding and checking positions.

The foregoing and other objects, advantages and features of the invention will be apparent from the following description of several illustrative embodiments, having reference to the accompanying drawings, in which:

FIGURE 1 is a fragmentary sectional view of a portion of a vehicle body taken substantially in a horizontal plane through a closed door hinged on the body for translatory swinging movement by a quadrilateral hinge mechanism shown in plan elevation, the hinge mechanism being constructed in accordance with the invention and incorporating an illustrative door stabilizing toggle linkage, hold-open and door checking device;

FIGURE 2 is a view similar to FIGURE 1 and shows the door and hinge elements in their toggle maintained hold-open positions;

FIGURE 3 is an enlarged fragmentary view looking outwardly of the vehicle body with portions removed and sectioned to show the illustrative hinge mechanism and toggle linkage in side elevation when in their door closed hinge latching positions with respect to the adjacent door hinge supporting body pillar;

FIGURE 4 is a fragmentary sectional view taken substantially in the plane indicated at 4—4 of FIGURE 3 and shows the hinge and door locking toggle linkage and the hinge mounting on the jamb or pillar facing edge of the closed door in end or side elevation;

FIGURE 5 is a similar sectional view taken substantially in the plane indicated at 5—5 of FIGURE 3 and shows the door pillar mounting of the hinge mechanism opposite side elevation;

FIGURE 6 is an enlarged fragmentary sectional view of a portion of FIGURE 1 and shows the structure and geometry of the hinge locking and hold-open toggle linkage of the illustrative swinging bar quadrilateral hinge mechanism in plan elevation taken substantially in the direction indicated at 6—6 of FIGURE 4;

FIGURE 7 is a fragmentary sectional view taken substantially in the plane indicated at 7—7 of FIGURE 2 and shows the door hold-open detenting engagement effected between a spring member carried by one of the swinging hinge members and spaced arms of one of the door stabilizing toggle links;

FIGURE 8 is an enlarged fragmentary sectional view similar to FIGURE 6 and shows the structure and geometry of an alternative hinge and door locking, hold-open toggle linkage acting between and maintaining the several elements of the illustrative swinging bar quadrilateral hinge mechanism in their door closed position;

FIGURE 9 is a similar enlarged fragmentary sectional view corresponding to a portion of FIGURE 1 and shows the several elements of the alternative toggle linkage and the quadrilateral hinge mechanism of FIGURE 8 in their hold-open maintained door opened position; and

FIGURE 10 is a fragmentary sectional view taken substantially in the plane indicated at 10—10 of FIGURE 9 and shows the door hold-open detenting engagement effected between the swinging hinge members and the several elements of the alternative toggle linkage.

Referring more particularly to FIGURES 1–7 of the drawings, a quadrilateral hinge mechanism constructed in accordance with the invention is indicated generally by the reference numeral 12. In the illustrative embodiment, the quadrilateral hinge mechanism 12 mounts a forwardly opening rear door 14 on a vehicle body door jamb forming pillar 16 located adjacent the back of a rear seat partially shown at 18. As shown in FIGURES 1 and 2, swinging translation of the door is provided by this hinge mechanism between opened and closed positions relative to rear door body opening 20 which provides access to the rear passenger compartment 22 of the vehicle body.

In the illustrative hinge mechanism, a hinge supporting member or bracket 24 is suitably secured as shown to the

jamb face of the body pillar **16**. As best seen in FIGURES 3 and 5, the inner side of this support member forms vertically spaced clevis arms **26** which are coaxially peforated to receive hinge pin **28**. The pin **28** pivotally mounts the adjacent end of an inner hinge bar **30** for swinging movement relative to the pillar supported bracket **24**. The inner bar **30** serves as the primary door supporting member of the illustrative hinge mechanism. The distal end of this inner hinge member is pivotally mounted about a parallel axis by a hinge pin **32**. This hinge pin extends between vertically spaced clevis arms **34** formed by the inner end of flange or leg **36** angled inwardly from a door mounted hinge bracket **38**. The angled bracket **38** is suitably secured to the wall **40** of the door inner panel. An outer panel **42** is hem flanged to wall **40** at **44**.

The outer end of the door secured bracket **38** has a vertically perforated boss **46** of reduced vertical dimension. A hinge pin **48** is vertically inserted through and pivotally secures the vertically internested clevis arm forming ends **50** and **52** of a toggle link member **54** and of an outer hinge bar **56**, respectively, to the supporting boss **46** of the door mounted hinge bracket **38**. As best shown in FIGURE 3, the parallel vertically spaced clevis arm **52** of the hinge member **56** extend rearwardly from their door pivoted ends through approximately half the length of this hinge member. The other end **58** of the outer hinge bar **56** forms vertically spaced clevis arms which are pivotally connected by a hinge pin **60** to a supporting boss **62** formed outwardly of the pillar mounted hinge bracket **24**.

It should be noted that the outer hinge bar is pivotally connected to the door rearwardly of the inner bar pivot pin **32** and is substantially shorter than the inner hinge bar. The outer hinge bar thus serves as a control link and is operable to swing the adjacent outer door flange **40** outwardly and rearwardly closely adjacent to the body side wall during door opening movement. In moving to its closed position, the rear door edge **44** sealingly engages a deflective and/or compressive weatherstrip **64** of suitable resilient material. The weatherstrip is mounted in a recess **66** formed in the hinge mounting pillar adjacent the outer door opening.

A hinge concealing panel **68** is secured to the hinge member **30**. As shown in FIGURE 1, this panel extends between a door mounted interior panel **70** and a similar pillar mounted panel **72** when the door is in its closed position. The hinge panel **68** of the closed door thus conceals the hinge within chamber **74** formed between this panel, the pillar and the adjacent flanges of the door. During door opening movement, the hinge panel **68** similarly cooperates with the rearwardly translated outer door flange **40** and the adjacent side wall of the vehicle body to substantially conceal the hinge mechanism.

In the hinge disclosed in FIGURES 1–7, a toggle linkage device operably interconnects the inner hinge bar **30** and the outer hinge pivot **48**. This toggle device includes the link **54** and cooperates with the adjacent hinge members to form a combined door locking, hold-open and door checking mechanism. The toggle link **54** has vertically spaced arms **76** which extend arcuately from its door pivoted end. The ends of these arms distal from the pivot **48** pivotally support one end of a shorter and thinner arcuate toggle link **80** connected thereto by a pivot pin **78**. The opposite end of the toggle link **80** is bifurcated to form spaced arms which pivotally mount the intermediate portion of a toggle stop and release lever **82**. The link **80** and the lever **82** are coaxially journaled on a pivot pin **84**. This pin is supported by vertically spaced clevis arms or flanges **86** formed integrally of the inner door supporting hinge bar **30**. The lever **82** has a lever arm **88** opposite engageable between a door locking stop flange or abutment shoulder **92** formed on the inner hinge bar **30** and the toggle link **80** adjacent the toggle interconnecting pivot **78**. Such lever arm engagement occurs when the door is moved to its closed position. A second

arm **96** on this lever is connected through a suitable linkage **98** to an inside door latch operating handle **100**. This handle operated linkage is operable through the lever arm **88** to swing the toggle linkage to a door releasing or unlatching position. The linkage **98** may also be operably connected to a push button actuator **102** associated with an outside door handle. The outside push button actuator **102** and the inside handle **100** may be operably interconnected to the linkage **98** for alternative door unlocking actuation through a conventional door latching mechanism, not shown, associated with the adjacent side of the door.

A spring **90** is tensively interposed between the lever arm **88** and the spaced arms **86** of the inner hinge bar. As viewed in FIGURES 1, 2 and 6, the spring **90** biases the lever **82** in a clockwise direction toward toggle limiting, door locking engagement with the stop flange or shoulder **92** on the inner hinge bar. A second tensively extended spring **94** is connected between an eyelet mounted on the toggle link **54** as shown and an upstanding pin or arm suitably secured to the other toggle link **80** at a point slightly spaced from the pivotal connection **78** between the toggle link members.

During door closing movement of the hinge mechanism, the toggle geometry and the biasing action of the spring **94** cooperate to rotate the toggle link **80** and the pivot **78** in a clockwise direction into limiting abutment with the stop flange **92**. This flange together with the interposed lever arm **88** defines an overcenter position for the pivot **78** with respect to the pivots **48** and **84**. Such overcenter abutment causes the toggle linkage to lock the quadrilateral hinge in its door closed position since the door sealing pressures of the weatherstrip **64**, and any other forces acting on the door in an opening direction, tend to rotate the toggle pivot **78** about the control hinge rod pivot **60** in a clockwise, abutment restrained direction.

Thus spring **94** maintains links **54** and **80** in their overcenter position in engagement with lever arm **88** which abuts stop flange **92**. In this position any opening motion by door **14** will only force links **54** and **80** more tightly against stop flange **92** (and lever arm **88**) to prevent opening of door **14**.

The abutment engaging, door locking position of the lever **82** is shown in full and broken hidden lines in FIGURES 1 and 6. Actuation of this lever to the position shown in broken phantom lines in FIGURE 6 by operation of either the inside handle **100** or the outside push button **102** carries the toggle pivot **78** overcenter with respect to the toggle hinge pivotal connections **48** and **84**. Such toggle movement effects an initial door opening movement and permits further door opening movement between the several hinge and toggle members.

A hold-open detenting and door checking spring member **104** is suitably secured to and extends between the vertically spaced arms **52** of the control hinge member **56**. This spring member is bent to form a barb shaped central portion having oppositely inclined spring ramps or arms **106** and **108** connected by laterally extending flanged arms **110** and **112** to the spaced arms of the hinge member **56**. As shown in FIGURE 7, the spaced arms **76** of the link member **54** are of I-section. As the door **14** approaches its hold-open position shown in FIGURE 2, the vertically spaced arms **76** of the link **54** slidably engage and inwardly deflect the opposing arms **106** and **108** of the hold-open spring member **104**. Such spring deflection occurs until these opposing spring arm portions pass or snap over the adjacent flanged edges **114** and slidably engage the opposing central portions **116** of the I-sectioned toggle arms to form a detented hold-open position permitting a limited range of further door opening movement. Subsequent door checking occurs when further door opening causes the toggle link arms **76** to abut the laterally extending arms **110** and **112** of the spring member **104**.

Only the toggle portion of the alternative hinge structure is shown in FIGURES 8–10. The rear door, the pillar, and the pillar attached hinge members are substantially

the same or identical and are identified, where shown, by the same reference numerals used in describing the previous embodiment. The modified hinge and toggle elements of this second embodiment are generally identified by adding 100 to the corresponding reference numerals of the first embodiment. Hence, a door mounted hinge bracket **138** is pivotally connected at **32** to the inner hinge member **30** and has a hold-open and door checking toe **137**. This toe extends from the pivoted inner side of the angled flange **136** of the bracket toward the toggle linkage. The outer or opposite side of the bracket **138** is pivotally connected at **48** to the spaced arms **52** of the swinging hinge member **56** and to the internested clevis arms **150** of a toggle link member **154**.

As in the previous embodiment, a toggle linkage device including link **154** operably interconnects the inner hinge member and the outer door hinge pivot **48** to provide door locking, hold-open and door checking functions. The vertically spaced arms **176** of the toggle link **154** extend arcuately from its door pivoted end but are bowed oppositely of link **54**. An arcuate toggle link **180** is connected by a pivot pin **178** to the arms **176** distal from the pivot **48**. The opposite end of the toggle link **180** has spaced arms pivotally connected by a pin **84** and internested between a toggle stop and release lever **182** and the vertically spaced clevis arms **86** of the inner hinge member **30**. The lever **182** of this embodiment is generally of triangular shape and has a first lever arm **188** engageable between the toggle locking shoulder **92** on the inner hinge member and one of the toggle links **154** or **180** adjacent the pivot **178**. Such lever arm engagement occurs when the door is moved to its toggle locked closed position.

A spring **190** is tensively interposed between the inner hinge arms **86** and a second arm **189** on the lever **182**. During initial toggle releasing door opening movement, this spring rotates the lever **182** and the toggle links **154** and **180** counterclockwise, as viewed in FIGURES 8 and 9, until the lever arm **189** engages an arcuate cam surface **139** formed on the hinge bracket toe **137**. The lever arm **189** is perforated at **191** to form a detent engaging boss or striker **193**. This boss has a relatively flat shoulder engageable to retain a cooperating detent lever **195** pivotally mounted at **197** between lateral extensions **186** of the toggle supporting clevis arms **86** of the inner hinge member. A spring **199** is compressively interposed between the detent lever **195** and a flange **201** extending between the detent supporting clevis arms **186**. The spring **199** normally biases the detent lever toward engagement with the retaining shoulder formed on the striker boss **193** of the lever **182**. Such detenting engagement normally maintains the lever arm **188** in abutment with the stop **92** on the inner hinge member. As before, such lever abutment permits the toggle pivot **178** to be retained in its overcenter toggle and door hinge locking position with respect to the toggle hinge pivotal connections **48** and **84**.

The detent member **195** is operably connected through a suitable linkage **198** to either an inside or outside door actuator for swinging movement out of detenting engagement with the striker **193** on the lever **182**. Such detent releasing movement causes the spring **190** to actuate the lever **182** in a counterclockwise direction carrying the toggle pivot **178** to an overcenter toggle and door hinge releasing position limited by initial engagement between the lever arm **189** and the hinge bracket toe **137**. During subsequent door opening movement, the cam surface **139** on the hinge bracket toe and the lever arm **189** cooperate to swing the toggle stop and release lever **182** against the snubbing action of the spring **190** to an intermediate hold-open position wherein the spring biased detent lever **195** initially engages the outer surface of the striker boss **193** on the lever **182** and further into door checking abutment between the lever arm **188** and the stop flange on the inner hinge member **30**. As shown in FIGURE 9, this door checking lever position permits spring biased return of the pivotal detent lever **195** into retaining engagement with the striker shoulder on the lever **182**. Such cam effected detenting of the lever **182** permits the pivotally connected ends of the toggle link to be freely rotated during door closing movement to their overcenter hinge and door locking positions shown in FIGURE 8.

When the door is only partially opened, cam effected detenting of the lever **182** does not occur. However, door closing movement causes the pivotally interconnected end of the toggle links to carry the lever **182** in a clockwise direction into abutment with the shoulder **92** on the inner hinge member. This lever position permits the spring biased detent member to again engage the retaining shoulder of the striker boss. As previously indicated, such detent maintained lever abutment provides an overcenter toggle and hinge locking position for the toggle pivot **178** which cooperates with the door pillar hinge pivots and the sealing pressures acting between the closed door and the resilient weatherstripping to maintain the toggle linkage in a hinge and door locking position.

In this embodimentfi, two hold-open spring members **206** and **208** are bent to form opposiing spring arms and suitably secured to the vertically spaced arms **52** of the control hinge member **56**. As best shown in FIGURE 10, these spring members are deflectable outwardly and slidably engageable with the vertically spaced arms of the link member **154** adjacent the pivot **178** during door opening movement approaching and passing through its intermediate hold-open position. As the door reaches its fully opened checked position, the opposing spring arms **206** and **208** are deflected or permitted to return inwardly behind the spaced arms of the toggle link member **154** and resiliently cooperate to detent or hold the door in its fully opened checked position.

From the foregoing description, it will be seen that the illustrative embodiments provide improved quadrilateral hinge mechanisms for mounting vehicle body doors for lateral outward swinging translatory movement and novel toggle linkage devices operably connected therebetween capable of providing the several stated objects and advantages of the invention, of locking the door in a closed position, and of establishing several hold-open and door checking positions. It will be further apparent to those skilled in the art that various modifications and changes might be made in and from the hinge and toggle geometry of the disclosed embodiments and in the pivotal interconnection and shape and form of the several hinge and toggle elements without departing from the spirit and scope of the invention as defined in the following claims.

I claim:

1. In combination with a support member, a closure member and hinge means mounting the closure member on the support member for movement between open and closed positions, the hinge means including a connecting link pivotally interconnecting the closure member and the support member, control means for controlling the swinging movement of the closure member including, a toggle linkage having a pair of links pivotally interconnected at a first pivot point, means pivotally connecting one of the toggle links to the connecting link at a second pivot point, means pivotally connecting the other of the toggle links to one of the members at a third pivot point, locating means locating the toggle linkage in an overcenter position in which the first pivot point is moved past a line defined by the second and third pivot points in closure-closed position to prevent opening movement of the closure member, and selectively operable means for moving the toggle linkage out of overcenter position to permit opening movement of the closure member.

2. The combination according to claim **1**, wherein the locating means include biasing means interconnecting the toggle links and being operable in closure-closed position to bias the linkage to overcenter position and means limiting the overcenter movement of the toggle linkage.

3. The combination according to claim **2**, wherein the toggle linkage is movable between a folded position in

closure-closed position and an unfolded position in closure-open position and the biasing means are operable in linkage-unfolded position to maintain the linkage in unfolded position and oppose closing movement of the closure member.

4. The combination according to claim 2, wherein the selectively operable means include a member interposed between one of the toggle links and the limiting means and actuatable to oppose the biasing means to move the toggle linkage out of overcenter position to permit opening of the closure member.

5. The combination recited in claim 1, including means for retaining the closure in open position.

6. In combination with a door hinged for swinging movement between opened and closed positions relative to a vehicle body.

a toggle linkage device interconnecting the door and body and foldable by door closing movement to a closed door locking position and releasable therefrom to permit door opening movement to hold-open and door checking positions established by the device, said device comprising

a swinging support member extending between and pivotally connected at opposite ends to the door and to the body for swinging movement with the door about substantially parallel axes,

two pivotally interconnected toggle link members of different length pivotally interconnected at one end and connected at their opposite ends to said swinging support member and to said door for toggle swinging movement about pivotal axes spaced laterally of the door between a folded door closed position and an extended opened door position,

abutment means engageable to define an overcenter position limiting movement of the folded door closed link members relative to the pivotal axes connecting the opposite ends of said link members to said swinging support member and door thereby locking said link and swinging support members in their closed door positions to prevent door opening movement,

and toggle releasing means including a lever pivotally mounted on the door swinging member and engageable with at least one of said toggle link members to swing the toggle interconnection from its folded door locking overcenter position,

first spring means for biasing and tending to maintain the toggle stop and releasing lever in overcenter door locking engagement with the abutment means,

means operably connected to actuate said toggle stop and releasing lever to swing the toggle interconnection between its overcenter door locking position and its overcenter door opening position,

second spring means for biasing and tending to maintain the folded toggle link members in door locking engagement with said lever and abutment means, said second spring means being operably connected to permit the biasing action thereof to pass over the toggle interconnection during door opening movement and to bias said toggle linkage means thereafter toward its extended door opened position, and

third spring means engageable with one of the toggle link members during door opening movement to establish an intermediate door hold-open position and a fully opened door checking position.

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MARVIN A. CHAMPION, *Primary Examiner.*

EDWARD C. ALLEN, *Examiner.*

D. L. TROUTMAN, *Assistant Examiner.*