

Oct. 26, 1965

P. C. EPPLE

3,213,484

DOOR HOLD-OPEN HINGE

Filed Aug. 19, 1963

4 Sheets-Sheet 1

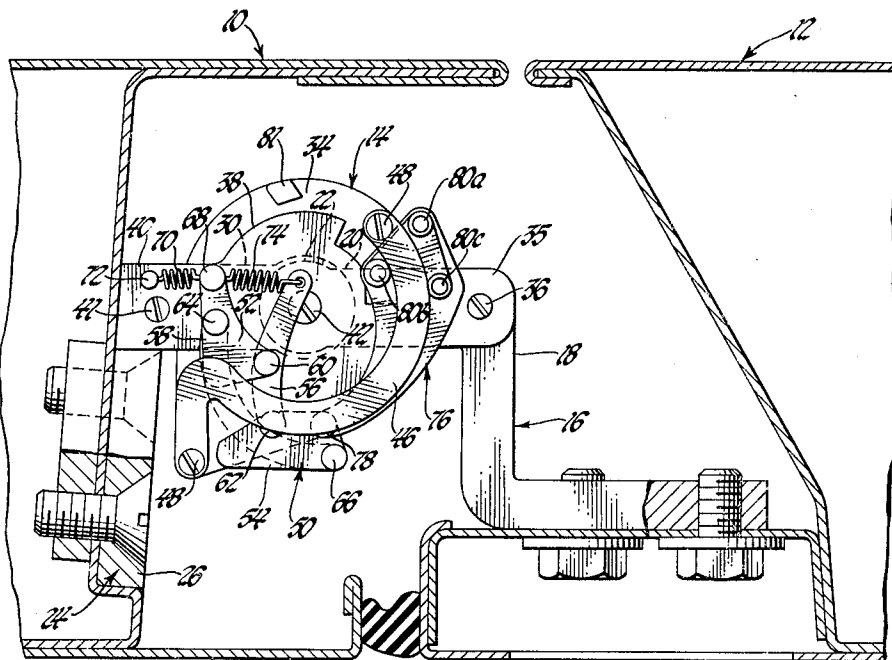


Fig. 1

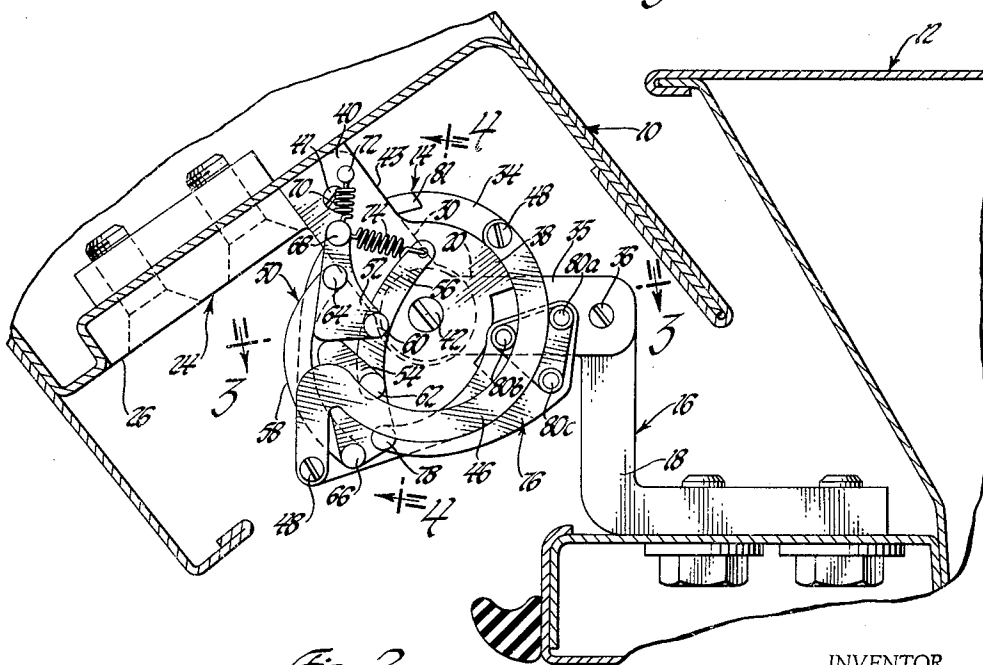


Fig. 2

INVENTOR.
Peter C. Epple
BY
W. S. Pettigraw
ATTORNEY

Oct. 26, 1965

P. C. EPPLE

3,213,484

DOOR HOLD-OPEN HINGE

Filed Aug. 19, 1963

4 Sheets-Sheet 2

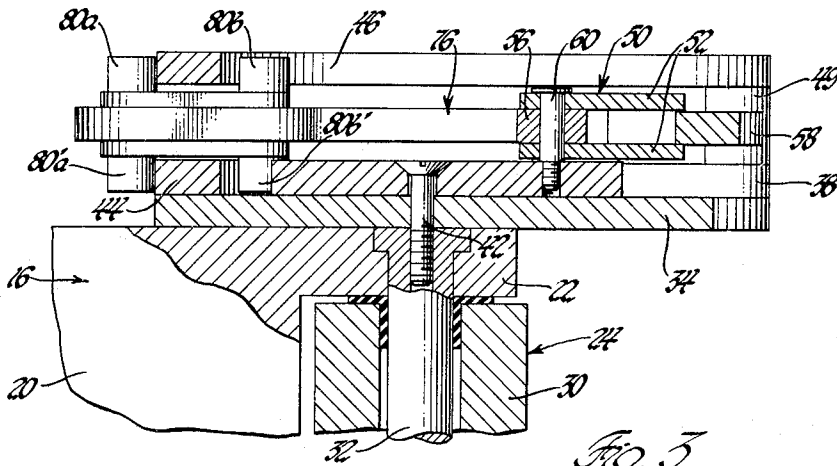


Fig. 3

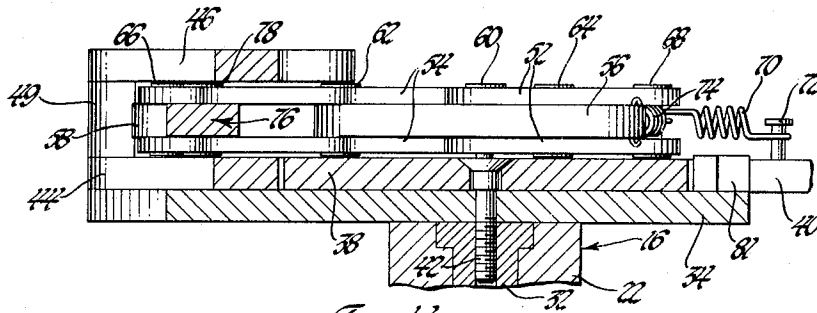


Fig. 4

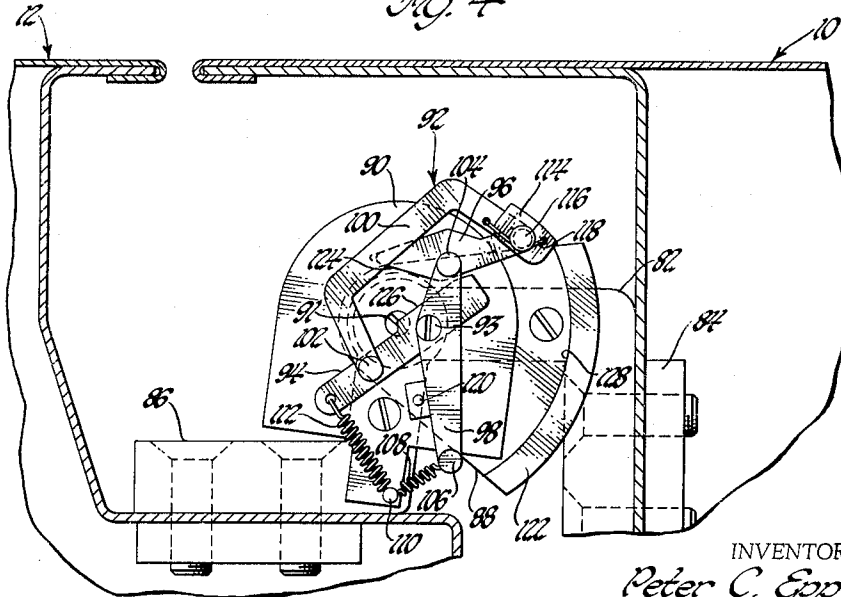


Fig. 5

INVENTOR.
Peter C. Epple
BY
W. S. Pettigrew
ATTORNEY

Oct. 26, 1965

P. C. EPPLE

3,213,484

DOOR HOLD-OPEN HINGE

Filed Aug. 19, 1963

4 Sheets-Sheet 3

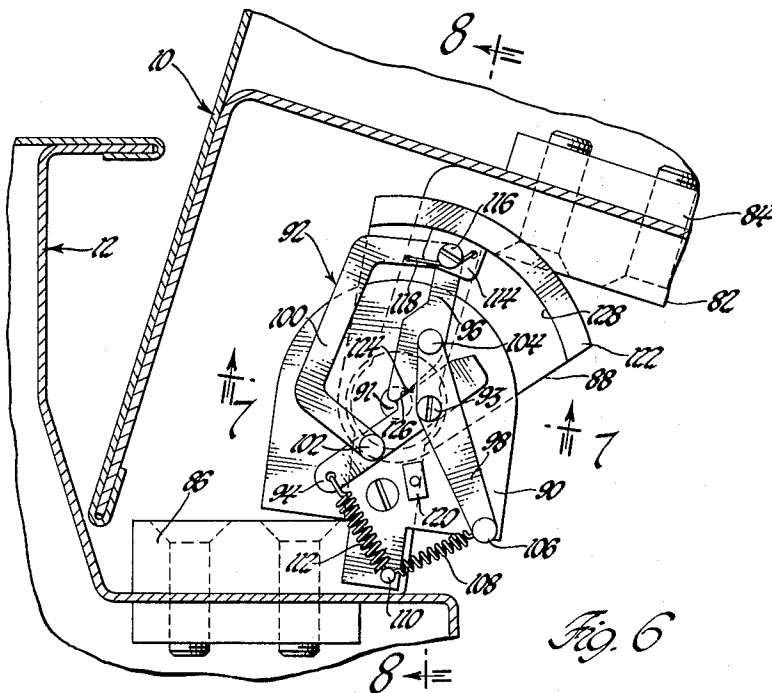


Fig. 6

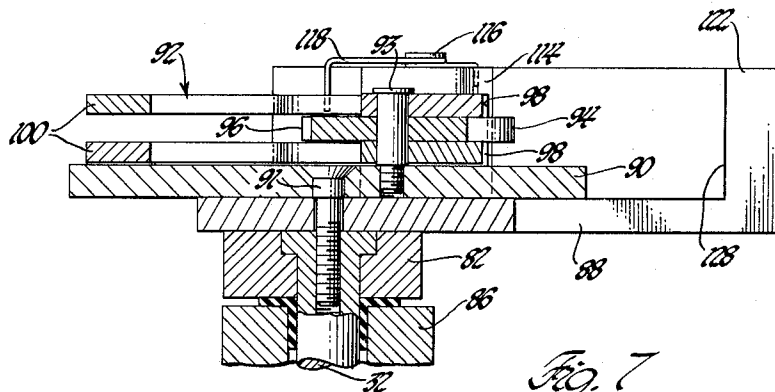


Fig. 7

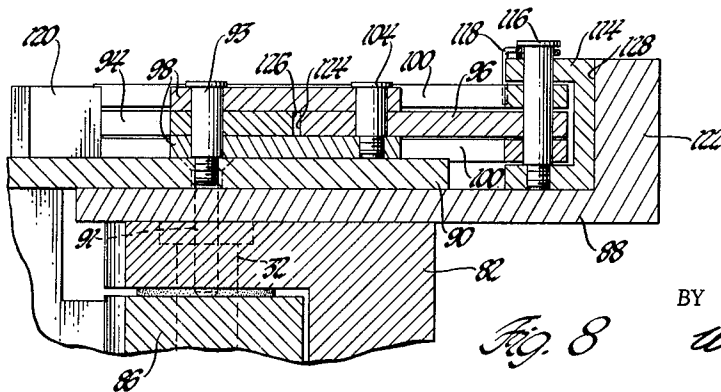


Fig. 8

INVENTOR.
Peter C. Epple
BY
W. S. Pettigrew
ATTORNEY

Oct. 26, 1965

P. C. EPPLE

3,213,484

DOOR HOLD-OPEN HINGE

Filed Aug. 19, 1963

4 Sheets-Sheet 4

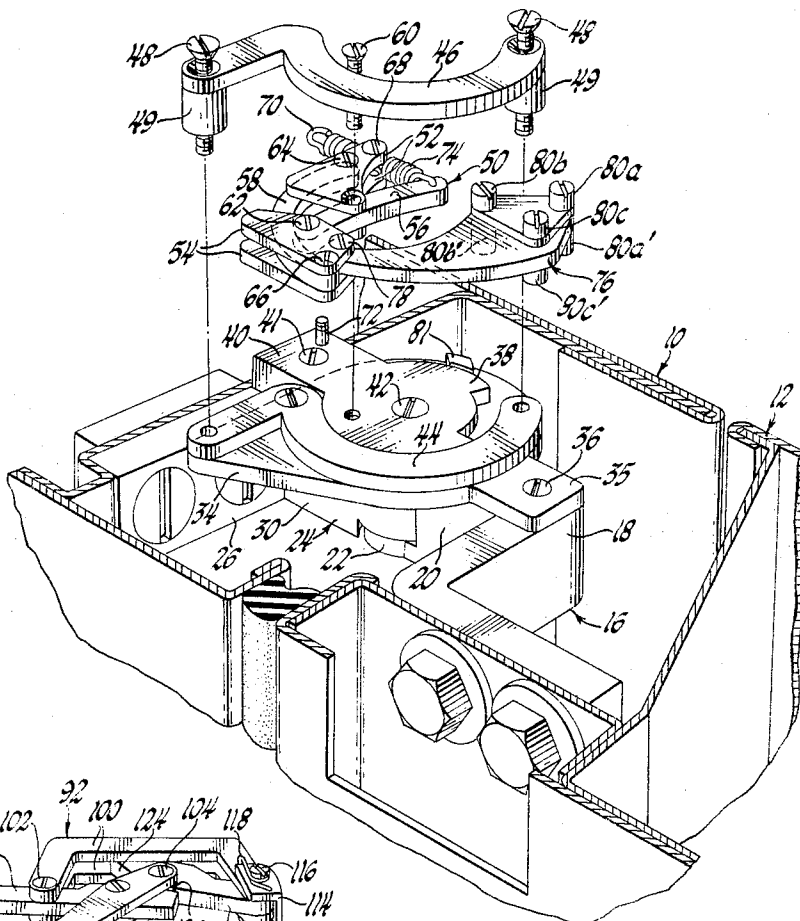


Fig. 9

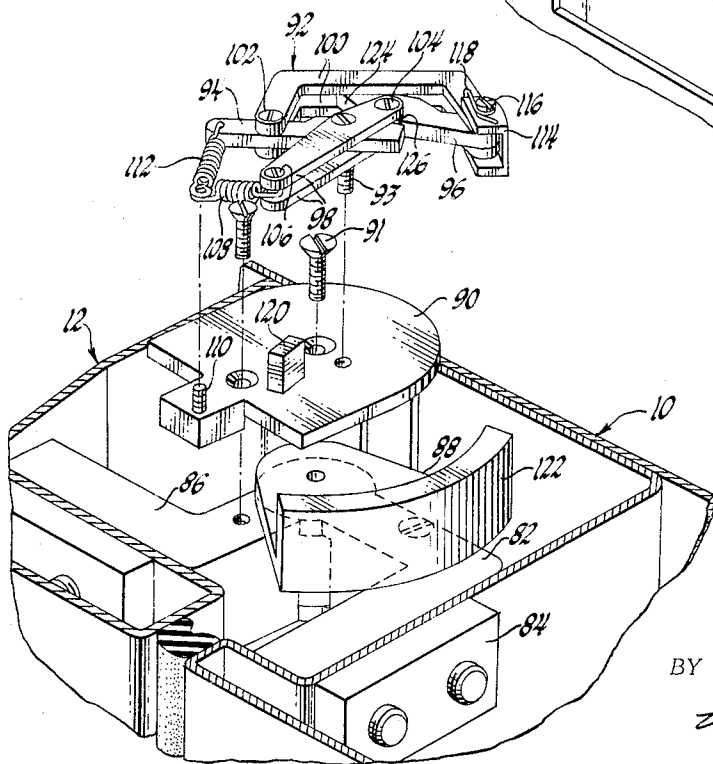


Fig. 10

INVENTOR.

Peter C. Epple

BY

W. S. Pettigrew
ATTORNEY

1

3,213,484

DOOR HOLD-OPEN HINGE

Peter C. Epple, Detroit, Mich., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Filed Aug. 19, 1963, Ser. No. 302,781
8 Claims. (Cl. 16—141)

This invention relates to a vehicle body door hinge, check and hold-open and more particularly to a vehicle body door hinge, check and infinite position hold-open.

The primary object of this invention is to provide a new and improved vehicle body door hinge, check and hold-open. Another object of this invention is to provide a new and improved vehicle body door hinge and hold-open effective to releasably hold the vehicle door in any selected one of an infinite number of positions relative to the vehicle body.

Generally, the door hinge and hold-open of this invention includes a pair of interconnected hinge members, a toggle linkage pivotally mounted on one of the hinge members for movement between folded and unfolded positions, and a holding member secured to the toggle linkage and engageable with the other hinge member to releasably hold the hinge members against movement relative to each other.

In one embodiment of the invention, a sliding shoe holding member on the toggle linkage is engageable with an arcuate bearing surface on the other hinge member to provide the releasable hold-open. Initial movement of the one hinge member in a door opening direction moves the toggle linkage into an unfolded or generally straightened position, with the sliding shoe being freely slidable along the bearing surface to permit unimpeded movement of the one hinge member to any selected one of an infinite number of positions relative to the other hinge member. However, initial incremental movement of the one hinge member in a door closing direction from the selected position thereof causes the sliding shoe to engage the bearing surface with sufficient force to hold the one hinge member against further movement in the door closing direction. Upon the application of a predetermined force to the one hinge member in a door closing direction, the toggle linkage collapses to a folded position to withdraw the sliding shoe from the bearing surface and allow free movement of the hinge member in a door closing direction.

In another embodiment, a clamping lever holding member is mounted on the toggle linkage and includes a set of clamping elements freely movable with respect to the other hinge member in the straightened position of the toggle linkage during door opening movement of the one hinge member to any selected one of an infinite number of positions. However, initial incremental movement of the one hinge member in a door closing direction from the selected position thereof causes the clamping elements to clamp the other hinge member and hold the one hinge member against further movement in the door closing direction. Again, a predetermined force applied to the one hinge member in a door closing direction collapses the toggle linkage and releases the clamping elements to allow free movement of the one hinge member in a door closing direction.

The foregoing and other objects, features and advantages of this invention will be readily apparent from the following specification and drawings wherein:

FIGURE 1 is a sectional view of a vehicle body having a door mounted thereon for movement between open and closed positions by a door hinge and hold-open according to this invention, with the door being shown in closed position;

2

FIGURE 2 is a view similar to FIGURE 1 showing the door in an open position;

FIGURE 3 is an enlarged sectional view taken generally along the plane indicated by line 3—3 of FIGURE 2;

FIGURE 4 is an enlarged sectional view taken generally along the plane indicated by line 4—4 of FIGURE 2;

FIGURE 5 is a view similar to FIGURE 1 showing another embodiment of a door hinge and hold-open according to this invention;

FIGURE 6 is a view similar to FIGURE 5 showing the door in an open position;

FIGURE 7 is an enlarged sectional view taken generally along the plane indicated by line 7—7 of FIGURE 6;

FIGURE 8 is an enlarged sectional view taken generally along the plane indicated by line 8—8 of FIGURE 6;

FIGURE 9 is an exploded perspective view of the door hinge and hold-open shown in FIGURES 1 through 4; and

FIGURE 10 is an exploded perspective view of the door hinge and hold-open shown in FIGURES 5 through 8.

Referring now to FIGURES 1 through 4 and 9 of the drawings, a vehicle body door 10 of conventional construction is adapted to be swingably mounted on a vehicle body pillar 12 by a door hinge and hold-open 14 according to this invention. A female hinge strap or member 16 has one leg 18 thereof bolted to pillar 12, and the other leg 20 thereof terminating in a bifurcated end 22, FIGURES 3 and 9. A male hinge strap or member 24 of generally L-shaped configuration has one leg thereof 26 bolted to door 10 and the other leg 30 thereof received within the bifurcated end 22 of strap 16. A hinge pin 32 pivotally interconnects hinge straps 16 and 24 to swingably mount door 10 on pillar 12. As is conventional, pin 32 is arranged with a slight tilt relative to vertical so that door 10 will fall back from opened to closed position.

A flat bearing plate 34 seats on the upper surface of leg 20 and includes a leg 35 secured thereto at 36. A second flat bearing plate 38 seats on plate 34 and includes a leg 40 secured at 41 to leg 26. A stud 42 extends through aligned apertures of plates 34 and 38 into the hinge pin 32 and guides rotational movement of the plates relative to each other upon movement of the hinge straps 16 and 24 relative to each other.

As seen best in FIGURES 2, 3 and 9, a pair of identical sectors or bearing members 44 and 46 are secured to plate 34 immediately radially outward of the edge of plate 38 by studs 48, with sector 44 being located on the surface of plate 34, and sector 46 being located thereabove by spacers 49, FIGURES 3 and 4, surrounding studs 48. A multiple-articulated toggle linkage 50, comprising a pair of link members 52 and 54, and a pair of carrier or connecting members 56 and 58, is pivotally mounted on plate 38 by a stud 60. This type of linkage is particularly well-suited to its present application, presently to be described, in that the link members 52 and 54 thereof are not only movable between folded and straightened positions, but are free of any direct pivotal interconnection therebetween so as to be translationally or bodily movable relative to each other.

As indicated in FIGURES 3 and 4, in the linkage 50, each of the link members 52 and 54 is formed of a pair of identical upper and lower portions spaced to receive members 56 and 58. The stud 60 secures both portions of link member 52 to member 56 and to plate 38, and a like stud 62 pivotally interconnects the portions of link member 54 and an end of member 56. A stud 64 pivotally interconnects the spaced portions of link member 52 and one end of member 58, and a stud 66 pivotally interconnects the portions of link member 54 and the other end of member 58. A stud 68 further secures the portions of link member 52 together. A tension spring 70 ex-

tends between stud 68 and a pin 72 on plate 38, and a tension spring 74 extends between the other end of member 56 and stud 68.

A lever or holding member 76 is pivotally connected to link member 54 intermediate the spaced portions thereof by stud 78 and lies intermediate sectors 44 and 46 so that opposite sets of triangularly arranged pins or clamping elements 80a, 80b and 80c and 80a', 80b' and 80c' extend respectively from the upper and lower surfaces of the lever and embrace the edges of both sectors.

Referring now to FIGURE 1, when door 10 is in closed position, lever 76 is located relative to sectors 44 and 46 such that clamping elements 80b and 80c engage the sectors, and toggle linkage 50 is in a folded position. Opening movement of door 10 moves plate 38 and stud 60 clockwise tending to move the folded toggle linkage 50 and the linkage-connected end of lever 76 upwardly and to the left. Due to the engagement of elements 80b and 80c, 80b' and 80c' and 80b' with the sectors, a counterclockwise reactive clamping couple is created resisting such movement of lever 76. Thus, any forced clockwise movement of plate 38 and stud 60 against the clamping couple creates a toggle straightening force between stud 60 and stud 78 tending to draw the two studs apart. To accommodate this drawing apart, toggle member 54 pivots clockwise about stud 78. Concurrently, the continued upward movement of stud 60 tends to carry link member 52 bodily upwardly therewith, but this tendency is resisted by member 58 which is restrained against any substantial bodily movement by lever 76. Link member 52 is thus forced to rotate counterclockwise about stud 60 and relative to member 56 against the action of spring 74. The link members rotate until studs 60, 62 and 78 are finally generally aligned, whereupon a cam surface on the upper end of link member 54 engages link member 52 and the toggle linkage assumes its straightened position of FIGURE 2, wherein springs 70 and 74 have relaxed. Prior to reaching this position, the clockwise rotation of toggle member 54 about stud 66 has carried the connection of lever 76 at stud 78 downward and to the right so as to reorient the clamping elements 80b, 80c and 80b', 80c' out of clamping engagement with sectors 44 and 46. In addition, the counterclockwise rotation of link member 52 has extended spring 70 such that when the clamping elements are initially reoriented, spring 70 rotates the toggle linkage 50 and lever 76 clockwise about mounting stud 60 to a position relative to plate 38 as indicated in FIGURE 2. This rotation further reorients the clamping elements relative to the sectors such that all three elements in each set will move concentrically of hinge pin 32, thus precluding any clamping on the sectors and permitting unimpeded swinging of the door to the fully open position of FIGURE 2.

Hinge check means are provided in the form of a block 81 on plate 38 located to be engaged by the outer edge 43 of leg 40 to prevent movement of door 10 past fully open position.

Assuming now that door 10 is moved to fully opened position, and has been released such that, due to the tilt of hinge axis 32 or otherwise, it falls back an incremental distance toward closed position, such incremental rotation of the door and plate 38 causes a generally downward movement of linkage 50 and the linkage-connected end of lever 76, as viewed in FIGURE 2. The lever thus reorients the clamping elements out of concentric relation with hinge pin 32 such that the individual clamping elements 80a, 80b and 80a', 80b' engage the sectors and exert a counterclockwise clamping couple resisting further rotation of lever 76, linkage 50 and plate 38 relative to plate 34. Door 10 is thus held against further movement in a closing direction.

From the foregoing, it will be obvious that the hold-open sequence just described may be caused to occur in any selected one of an infinite number of positions of the door between closed and fully open positions, since, once

toggle linkage 50 is in straightened position, the clamping couple of lever 76 produced by initial closing movement of the door may be applied to sectors 44 and 46 at any desired point along the lengths thereof.

Considering now that it is desired to move door 10 from the held position of FIGURE 2, a predetermined closing force is applied to the door against the reactive couple of lever 76. A toggle breaking force is thus created between studs 60 and 78 tending to move the studs closed together. As stud 62 must move laterally to accommodate such movement, the predetermined force required is that force having a lateral component sufficient to overcome the resistance of spring 74 against clockwise rotation of member 56 and stud 62 about stud 60. This forced rotation of member 56 moves link member 54 counterclockwise about stud 78 and moves the end of lever 76 at stud 78 upwardly to reorient the clamping elements to generally concentric relation with hinge pin 32. With the clamping couple thus released, the stretched spring 74 acts about member 56 to rotate link member 52 and member 58 clockwise, and the stretched spring 70 moves toggle linkage 50 and lever 76 to the folded position of FIGURE 1. The hinge assembly is thus freed for movement to the closed position of FIGURE 1.

As will be obvious from the foregoing, it is not necessary that door 10 be returned to fully closed position before again opening the door to again move toggle linkage 50 into straightened position so as to hold the door in a selected position, since once the toggle linkage is folded, opening movement of door 10 from any position will reorient the clamping elements of lever 76 into clamping engagement with sectors 44 and 46 to create the toggle-straightening force previously described.

Referring now to FIGURES 5 through 8 and 10 of the drawings, another embodiment of the door hinge and infinite position hold-open of this invention is illustrated, with like numerals referring to like parts. A vehicle body door 10 is swingably mounted on a body pillar structure 12 by a bifurcated hinge member 82 bolted to a transverse wall of door 10 and an inner reinforcing plate 84, and pivotally interconnected by a hinge pin 32 to a male hinge strap or member 86 which is bolted to a wall of pillar 12. A bearing plate or member 88 seats on the upper surface of hinge member 82 and includes a flat wedge-shaped portion which rotatably supports a plate 90 secured to hinge 86. A stud 91 extends through aligned apertures of plates 88 and 90 into hinge pin 32, and guides rotation of plate 88 relative to plate 90.

A multiple articulated toggle linkage 92 is mounted on plate 90 by a stud 93 and includes a pair of link members 94 and 96 and a pair of carrier or connecting members 98 and 100. Members 98 and 100 are each formed of a pair of identical upper and lower portions spaced to receive link members 94 and 96. A stud 102 pivotally interconnects the portions of member 100 and link member 94, a stud 104 pivotally interconnects the portions of member 98 and link member 96 and a stud 106 further secures the portions of member 98 together. A tension spring 108 extends between stud 106 and a pin 110 on plate 90, and a tension spring 112 extends pin 110 and link member 94.

A generally U-shaped in vertical section sliding shoe 114 is mounted on linkage 92 by a stud 116 which pivotally interconnects shoe 114, the portions of member 100, and link member 96. A torsion spring 118 surrounds stud 116 and is hooked at one end thereof to member 100 and at the other end thereof to shoe 114 to bias the shoe counterclockwise relative to member 100, as viewed in FIGURE 5.

When door 10 is in closed position, toggle linkage 92 is in folded position and is so located relative to plate 90 that member 98 engages a vertical stop 120 on plate 90, and an edge of shoe 114 engages a vertically extending arcuate bearing portion 122 on plate 88. Due to this later engagement, initial rotation of door 10 and plate 88

5

from the closed position of FIGURE 5 causes toggle linkage 92 to rotate relative to plate 90 about stud 93 against the action of spring 108 until link member 94 engages stop 120. Further forced counterclockwise rotation of shoe 114 then rotates member 100 about stud 102, which rotation tends to move link member 96 to the left to thereby rotate member 98 counterclockwise about stud 93 against the action of spring 108. When sufficient resistance is built-up in spring 108 to hold member 98, the continued movement of shoe 114 results in a counterclockwise rotation of link member 96 about pin 104 relative to member 98 until a cam surface 124 on link member 96 engages a flat edge 126 of link member 94. The link members thus assume a straightened position, as indicated in FIGURE 7, and are resiliently held therein by the resistance of springs 108 and 112 to folding movement of member 98 and link member 94.

With the toggle linkage thus straightened, further rotation of door 10 and plate 88 acts against the sliding shoe to rotate the toggle linkage counterclockwise about stud 93 against spring 108 until, due to the eccentricity of movement of bearing portion 122 relative to pin 93, the edge of the bearing portion engaging the sliding shoe moves upwardly relative to the sliding shoe a sufficient distance to permit spring 108 to rotate linkage 92 about stud 93, so as to move shoe 114 into the vertical bearing surface 128 on portion 122. The shoe then slides along the bearing surface until the door is located in a desired position, such as the fully open position as indicated generally in FIGURE 8.

Assuming now that a slight tilting of hinge axis 32 has caused the door to fall back an incremental distance toward closed position from the selected position thereof, the resulting incremental eccentric movement of portion 122 relative to stud 93 causes portion 122 to engage shoe 114 with a force between stud 116 and stud 102 creating a sliding friction preventing further movement of portion 122 relative to the shoe. Door 10 is thus held against movement to closed position.

To release the hold-open, a predetermined closing force is applied to door 10 to create a force between stud 116 and stud 93 having a lateral component sufficient to overcome spring 108 and move stud 104 to the left, so as to rotate link member 94 and member 98 thereabout, and thus draw studs 93 and 116 together to break the toggle linkage into the folded position of FIGURE 5. Shoe 114 is thus withdrawn from portion 122 to permit unimpeded closing movement of door 10.

Thus a new and improved door hinge and infinite hold-open is provided.

I claim:

1. A door hinge and hold-open comprising, in combination, a pair of pivotally interconnected hinge members, holding means mounted on one of said members for movement relative thereto between inoperative and operative positions and movement therewith relative to the other of said members, said holding means permitting movement of said members relative to each other when in the inoperative position thereof and being engageable with said other member in the operative position thereof to releasably hold said members against movement relative to each other, and means on said members moving said holding means from the inoperative to the operative position thereof upon initial movement of said one member in one direction relative to said other member, said holding means permitting further movement of said one member in said one direction relative to said other member, and means moving said holding means into engagement with said other member upon movement of said one member in the opposite direction relative to said other member to releasably hold said members against movement relative to each other.

2. The combination recited in claim 1 and further including means moving said holding means from the opera-

6

tive to the inoperative position thereof upon the application of a predetermined force moving said one member in said opposite direction relative to said other member to thereby release said members for movement relative to each other.

3. A door hinge and hold-open comprising, in combination, a pair of pivotally interconnected hinge members, holding means mounted on one of said members for movement relative thereto between inoperative and operative positions and movement therewith relative to the other of said members, said holding means permitting movement of said members relative to each other when in the inoperative position thereof and being engageable with said other member in the operative position thereof to releasably hold said members against movement relative to each other, toggle linkage means associated with said holding means and being movable between a folded position to locate said holding means in the inoperative position thereof and an unfolded position to locate said holding means in the operative position thereof, and means on said members for moving said toggle linkage means from the folded position thereof to the unfolded position thereof upon movement of said one member relative to said other member to thereby move said holding means into the operative position thereof to releasably hold said members against movement relative to each other.

4. A door hinge and hold-open comprising, in combination, a pair of pivotally interconnected hinge members, holding means mounted on one of said members for movement relative thereto between inoperative and operative positions and movement therewith relative to the other of said members, said holding means permitting movement of said members relative to each other when in the inoperative position thereof and being engageable with said other member in the operative position thereof to releasably hold said members against movement relative to each other in one direction, toggle linkage means associated with said holding means and being movable between a folded position to locate said holding means in the inoperative position thereof and a straightened position to locate said holding means in the operative position thereof, and means on said members for moving said toggle linkage means from the folded position thereof to the straightened position thereof upon initial movement of said one member relative to said other member in a direction opposite to said one direction to thereby move said holding means into the operative position thereof, said holding means permitting further movement of said one member in said opposite direction relative to said other member to any selected one of an infinite number of positions relative to said other member, and means moving said holding means into engagement with said other member upon initial incremental movement of said one member from said selected position thereof in said one direction to releasably hold said one member against further movement in said one direction relative to said other member.

5. Apparatus as recited in claim 3 and further including means for moving said toggle linkage means to the folded position thereof to move said holding means to the inoperative position thereof upon the application of a predetermined force moving said one member in said opposite direction from said selected position thereof relative to said other member.

6. Apparatus as recited in claim 1 wherein said holding means includes a sliding shoe engageable with a bearing surface on the other of said members in the operative position of said holding means.

7. Apparatus as recited in claim 1 wherein said holding means includes a member pivotally mounted on said toggle linkage means and having a clamping member engageable with said other hinge member in the operative position of said holding means.

7

8. Means interconnecting a pair of relatively movable members comprising, in combination, holding means mounted on one of said members for movement relative thereto between an inoperative position permitting movement of said members relative to each other and an operative position wherein said holding means is engageable with the other of said members to releasably hold said members against movement relative to each other, toggle linkage means associated with said holding means and including a pair of link members and means pivotally connected to each of said link members for permitting combined pivotal movement of said link members relative to said connected means and bodily movement relative to each other between folded and unfolded positions, said link members being operative in the folded position thereof to locate said holding means in the inoperative position thereof and being operative in the unfolded position thereof to locate said folding means in the operative position thereof, and means on said members for moving

5

10

15

20

8

said link members from the folded to the unfolded position thereof upon movement of said one member relative to said other member to thereby move said holding means into the operative position thereof to releasably hold said members against movement relative to each other.

References Cited by the Examiner

UNITED STATES PATENTS

2,674,761	4/54	Weiss	16—164
2,985,908	5/61	Allen et al.	16—141
2,992,451	7/61	Schonitzer et al.	16—141
2,992,452	7/61	Schonitzer et al.	16—141

FOREIGN PATENTS

260,631	3/27	Great Britain.
---------	------	----------------

DONLEY J. STOCKING, *Primary Examiner.*

M. HENSON WOOD, JR, *Examiner.*

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,213,484

October 26, 1965

Peter C. Epple

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 46, for "the hinge" read -- the one hinge --; column 3, line 17, for "lvere" read -- lever --; line 19, strike out "and 80b^c"; column 4, line 10, for "closed" read -- closer --; line 60, for "extends pin" read -- extends between pin --.

Signed and sealed this 5th day of July 1966.

SEAL)

Attest:

ERNEST W. SWIDER

Attesting Officer

EDWARD J. BRENNER

Commissioner of Patents