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DOOR CHECKING AND HOLDING DEVICE

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1 Claim. (Cl. 16—82)

This invention relates generally to door checking and holding devices for motor vehicle doors.

An object of the present invention is to provide a door checking and holding device comprising a pair of toggle links pivotally connected to each other and to the vehicle body and door respectively in such manner as to hold the door in its fully opened position and to assist the intermediate opening movement of the door while at the same time permitting the door to be in a neutral unbiased position when fully closed. This neutral condition in the closed position of the door is made possible with the present construction even though spring means are employed to assist in the intermediate opening movement of the door and in holding the door in its fully opened position. The device comprises a pair of interconnected toggle links, one pivotally connected to the body and the other pivotally connected to the door, in combination with spring means acting upon the toggle and urging the links from their closed to their open position. The toggle links and their pivotal connections with the body and the door are so arranged that the hinge axis of the door is substantially in alignment with a line between the pivotal connections of the toggle links to the body and door respectively. With this geometrical arrangement, the line of force of the spring means passes through the hinge axis of the door and is ineffective to swing the door in either direction from its closed position. Thus there is no force between the door and the body when the door is closed nor any force to interfere with the initial opening movement or final closing movement of the door.

Still another object of the present invention is to provide a door checking and holding device of the toggle link type mentioned above in which the links and their pivotal connections are so arranged that the door hinge axis is offset in a predetermined amount from a line interconnecting the pivotal connections of the toggle linkage, the offset being of sufficient amount to counterbalance the inherent tendency of the door to swing inwardly toward its closed position. In many present day motor vehicles the hinge axis between the vehicle body and door is inclined laterally inwardly of the vehicle body in an upward direction causing the door to have an inherent tendency to swing inwardly. This tendency can be counterbalanced and compensated for by the arrangement of the present invention so that a door of this type will be in a neutral unbiased position when closed.

Other objects and advantages of this invention will be made more apparent as this description proceeds, particularly when considered in connection with the accompanied drawing, wherein:

Figure 1 is a horizontal cross-sectional view of a portion of a vehicle door and the adjacent body structure, and showing the door checking and holding mechanism in its closed door relationship.

Figure 2 is a cross-sectional view similar to Figure 1 but showing the door in its fully opened position.

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Figure 3 is a cross-sectional view similar to Figure 1 but showing a slightly different arrangement in which the door is counterbalanced.

Referring now to the drawing, and particularly to Figures 1 and 2, the reference character 11 indicates a motor vehicle door hinged to the adjacent body pillar 12 for pivotal movement about a generally vertical hinge axis 13. Conventional hinge means can be used and are not shown in this drawing. A bracket 14 is secured to the body pillar 12 by means of bolts 16 and a reinforcing tapped plate 17. The bracket 14 extends through an opening 18 formed in the jamb face 19 of the door 11.

Located inside the door 11 and suitably secured to the inner panel 21 thereof is a bracket 22. A toggle comprising a pair of toggle links 23 and 24 interconnects the two brackets. The toggle links 23 and 24 are pivotally interconnected by means of a pivot pin 26, and the opposite ends of the toggle links are pivotally connected to the brackets 14 and 22 respectively by pivot pins 27 and 28 respectively.

The pin 26 between the two toggle links is mounted upon and non-rotatably connected to the link 24 and freely passes through an opening in the link 23. The end of the pin is slotted at 29 to receive the inner end of a spring 30. The spring is coiled around the pin and its outer end is hooked over an ear 31 bent up from the side of link 23. The spring thus applies a force between the links 23 and 24 tending to swing them away from each other around the pivot pin 26.

It will be noted from Figure 1 that the toggle links are so arranged that their pivotal connections with the brackets carried by the body and the door are substantially in alignment with the hinge axis of the door in the closed position of the latter. Specifically, a line 33 joining the pivotal connections 27 and 28 of the toggle links to their respective brackets passes through the hinge axis 13 of the door. Thus, although the spring 30 exerts a force tending to separate the toggle links 23 and 24, this force is ineffective to swing the door from its closed position or to cause any force to be exerted between the vehicle body and the door when the latter is closed, since this force is along the line 33 and passes through the hinge axis 13. Consequently, the door 11 in its closed position is in a neutral unbiased condition, and the door checking and holding device does not interfere with nor affect the manual movement of the door during its initial opening movement or during its final closing movement.

As the door 11 is swung from its closed position shown in Figure 1 about the hinge axis 13 to its open position shown in Figure 2, the line 33 joining the pivotal connections of the toggle links to the door and body brackets swings out of alignment with the door hinge axis so that the toggle spring 30 is effective through the toggle links to apply an opening torque to the door. This torque is measured by the spring force applied along the line 33 and the lever arm or normal from the line 33 to the hinge axis 13. In the fully opened position of the door as shown in Figure 2, this torque is at a maximum since the lever arm is the longest. Although the spring force diminishes slightly as the door is opened, due to the unwinding of the spring 30 as the toggle opens, the increased lever arm more than offsets this and results in an ever increasing opening force. In addition, the toggle links 23 and 24 swing relative to each other from an acute angle relationship when the door is closed to an obtuse angle relationship when the door is opened and the toggle holds the door in its open position until the latter is manually closed. Link 24 has a portion 32 extending beyond the pivot pin 26 and terminating in a bent flange 33a adapted to engage one side of the link 23 when the door has been fully opened to the

position shown in Figure 2. The flange thus forms a stop determining the fully open position of the door.

While the construction shown in Figures 1 and 2 and described above provides a construction in which the door is unbiased in its closed position when the hinge axis 13 of the door is substantially vertical, in many present day motor vehicles the body construction is such that the door hinge axis is inclined laterally inwardly in an upward direction. This results in a natural tendency for the door to swing inwardly due to the fact that its weight is gradually raised as the door is opened. The construction shown in Figure 3 counterbalances this tendency of the door to close so that the door is in a neutral unbiased condition when closed even though its hinge axis is inclined. It will be noted that in this arrangement the pivotal connection 40 between the toggle link 41 and the bracket 42 carried by the door 43 is shifted slightly so that the line of spring force 44 between the pivotal connections 40 and 45 of the two toggle links is not exactly in alignment with the hinge axis 46 of the door but is slightly offset therefrom. The spring force along the line 44 is then effective through the lever arm extending from the hinge axis 46 to the line 44 to exert an opening torque upon the door, and the amount of offset is predetermined of such amount that this torque counterbalances the tendency of the door to swing closed. Thus, this arrangement applies the principles of the construction shown in Figures 1 and 2 to a door having an inclined hinge axis so that the door may be in a neutral unbiased condition when closed with zero body to door force.

From the foregoing it will be seen that a toggle linkage is provided which is effective to hold the door in its fully open position with sufficient strength to prevent the closing of the door inadvertently and with increased assistance being given to the opening of the door as well as decreasing resistance to the closing of the door. These results are achieved with a construction in which there is no body to door force in the closed position of the door, the latter being completely counterbalanced and unbiased.

It will be understood that the invention is not to be limited to the exact construction shown and described, but that various changes and modifications may be made without departing from the spirit and scope of the invention, as defined in the appended claim.

What is claimed is:

In a motor vehicle having a body pillar and a door hinged thereon upon a vertical axis, said door having inner and outer panels joined by a jamb face with the latter being positioned adjacent the body pillar in the closed position of the door, a toggle door checking device comprising a supporting bracket mounted upon the body pillar and projecting through an opening in the jamb face of the door into the interior of the latter, a second supporting bracket within said door mounted upon the inner panel of said door, a toggle link pivotally connected at one end to said first bracket, a second toggle link pivotally connected at one end to said second bracket, the pivotal connections between said toggle links and said brackets being positioned closely adjacent each other in the closed position of the door and arranged so that a line through said pivotal connections in the closed position of the door passes through the hinge axis of the door, said toggle links converging toward each other from their pivotal connections with said brackets, a pivot pin fixedly carried by one of said toggle links near the end thereof remote from its pivotal connection to one of said brackets and passing through an aperture in the adjacent end of the other of said toggle links to pivotally connect the two toggle links together, a spiral spring having one end anchored to said pivot pin and its other end anchored to an intermediate portion of the other of said toggle links between said pivot pin and the pivotal connection of said other toggle link to its supporting bracket, said spiral spring constantly exerting a force tending to swing said toggle links apart about said pivot pin but inoperative in the closed position of the door to exert an opening or closing force on the door since the line of force through the said pivotal connections of said toggle links to said brackets passes through the hinge axis of the door.

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