March 31, 1959 E. L. ALLEN 2,880,029

DOOR CHECK

Filed Jan. 23, 1957 6 Sheets-Sheet 1

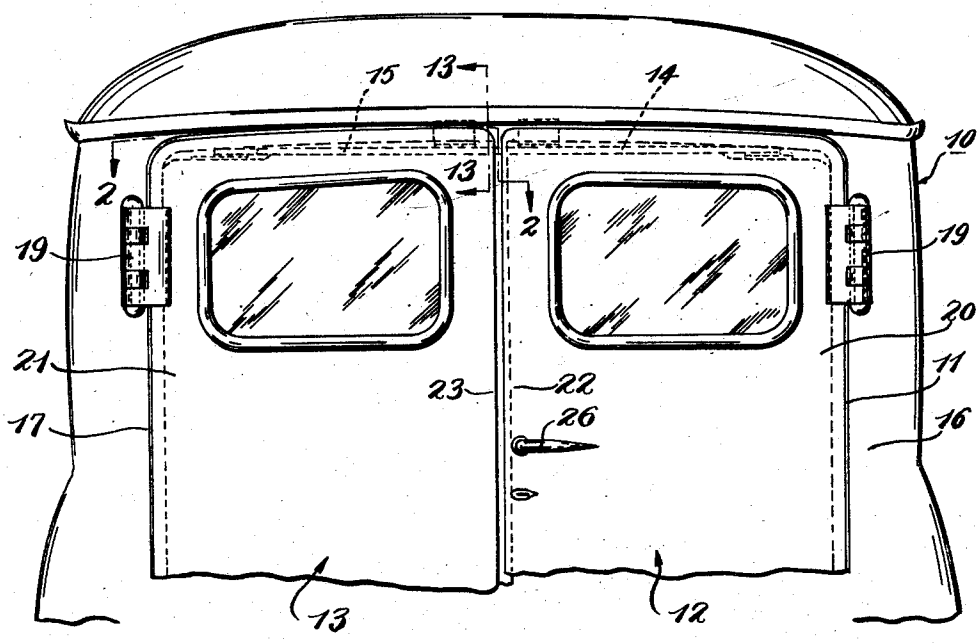


FIG. 1

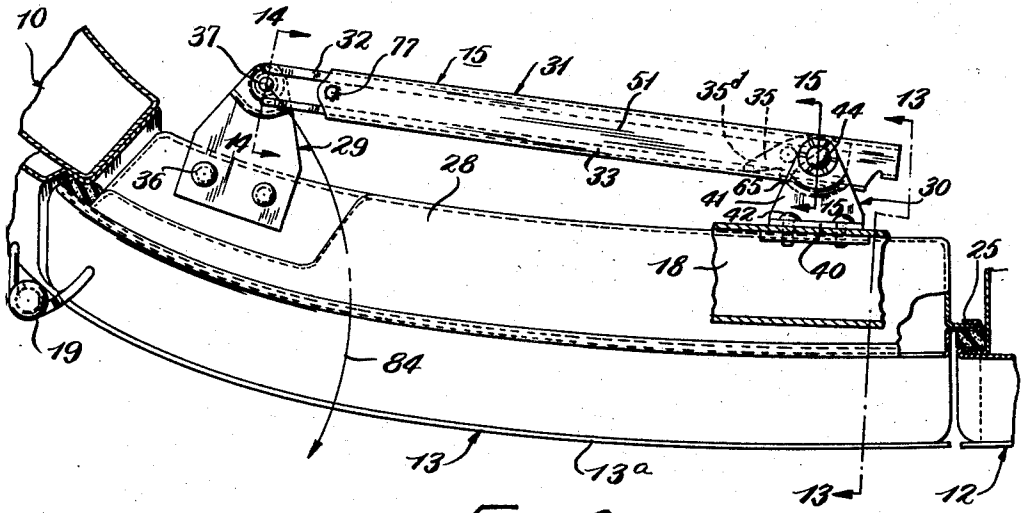


FIG. 2

INVENTOR.
EDWIN L. ALLEN
BY Hudson, Boughton, Williams, David & Hoffmann
ATTORNEYS

March 31, 1959 E. L. ALLEN 2,880,029

DOOR CHECK

Filed Jan. 23, 1957 6 Sheets-Sheet 2

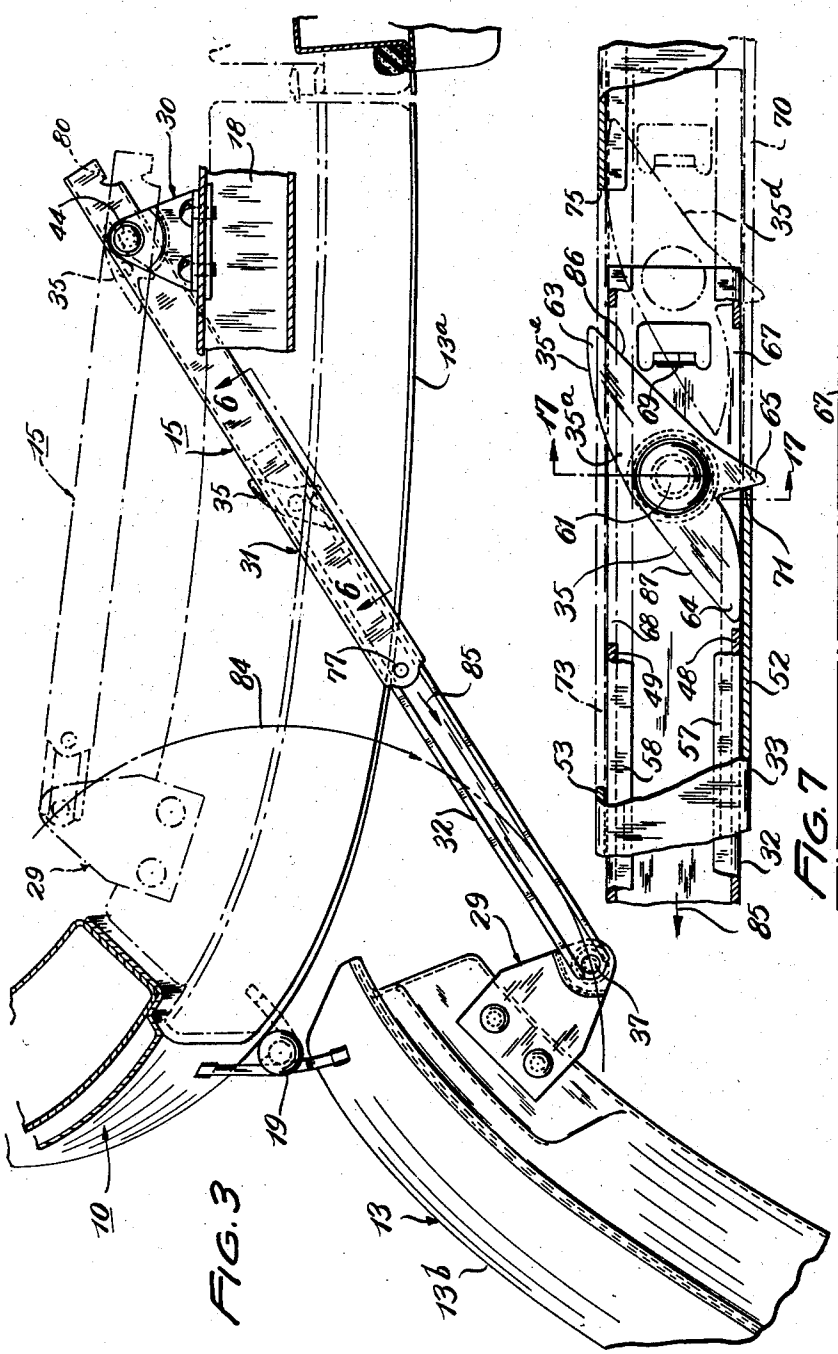


FIG. 3

FIG. 7

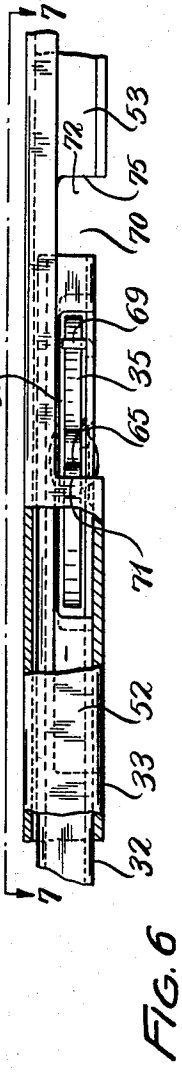


FIG. 6

INVENTOR.
EDWIN L. ALLEN
BY Hudson, Boughton, Williams, David & Hoffmann
ATTORNEYS

March 31, 1959 E. L. ALLEN 2,880,029

DOOR CHECK

Filed Jan. 23, 1957 6 Sheets-Sheet 3

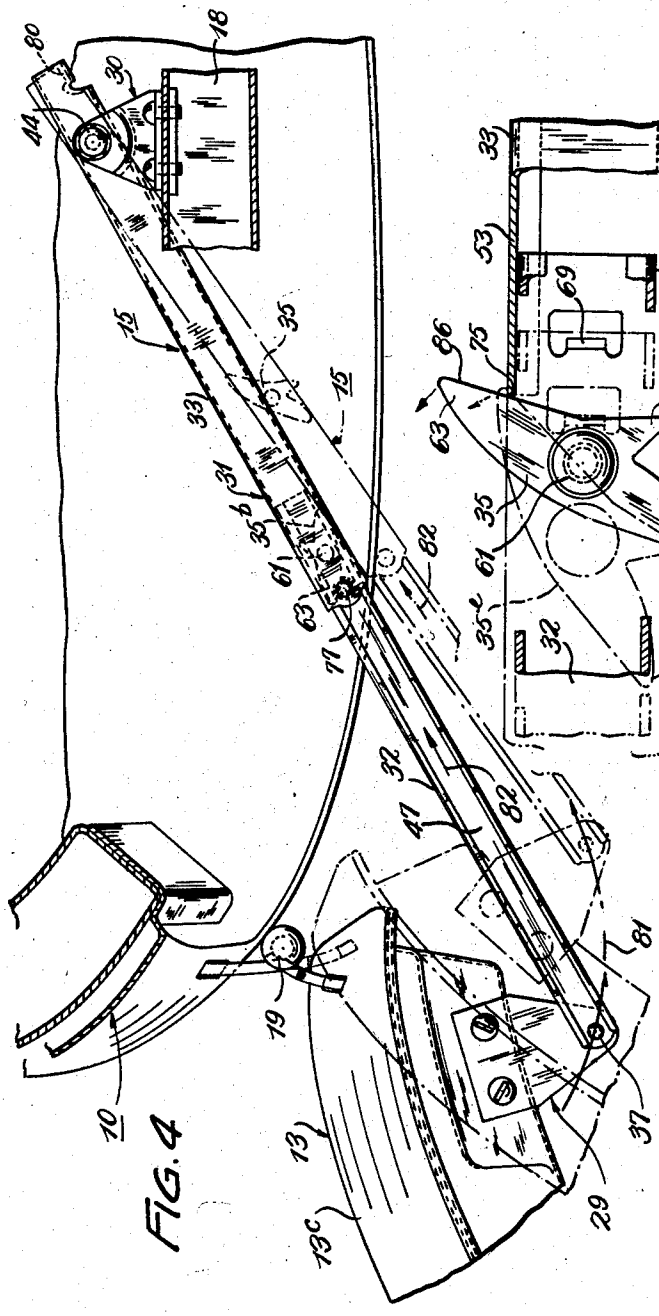


FIG. 4

FIG. 8

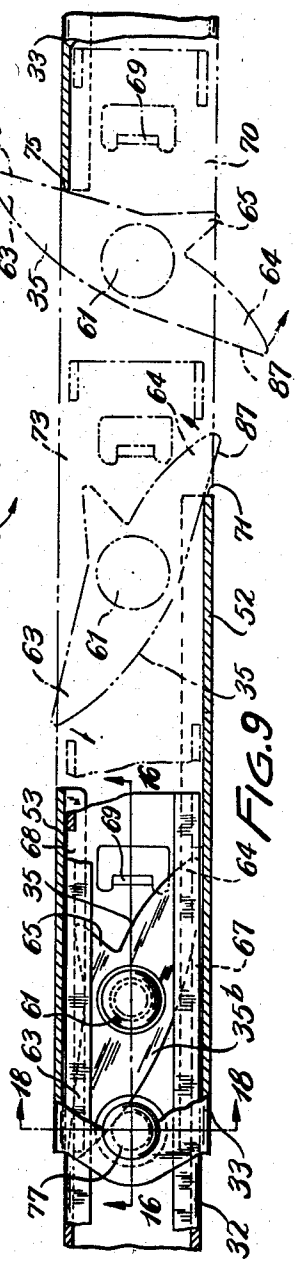


FIG. 9

INVENTOR.
EDWIN L. ALLEN
BY Hudson, Boughton, Williams, David & Hoffmann
ATTORNEYS

March 31, 1959 E. L. ALLEN 2,880,029

DOOR CHECK

Filed Jan. 23, 1957 6 Sheets-Sheet 4

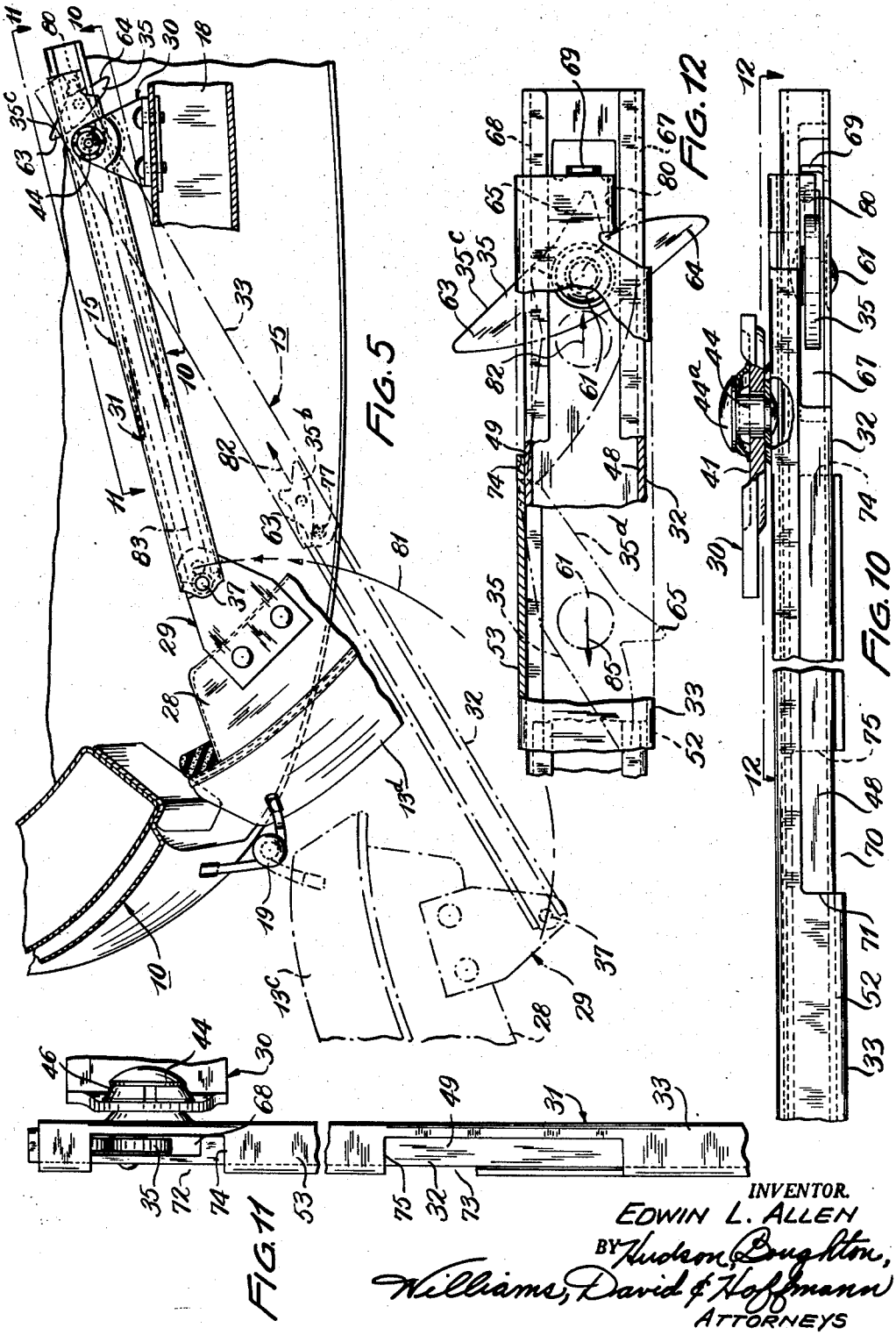


FIG. 5

FIG. 12

FIG. 10

FIG. 11

INVENTOR.
EDWIN L. ALLEN
BY Hudson, Boughton, Williams, David & Hoffmann
ATTORNEYS

March 31, 1959 E. L. ALLEN 2,880,029

DOOR CHECK

Filed Jan. 23, 1957 6 Sheets-Sheet 5

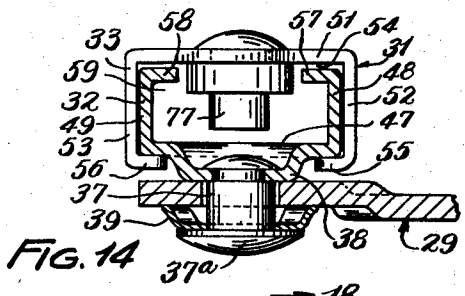


FIG. 14

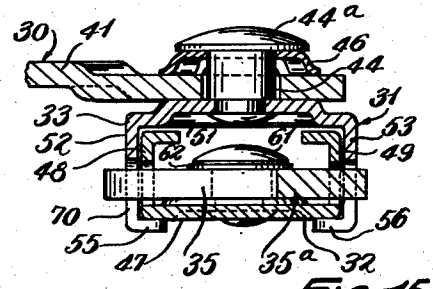


FIG. 15

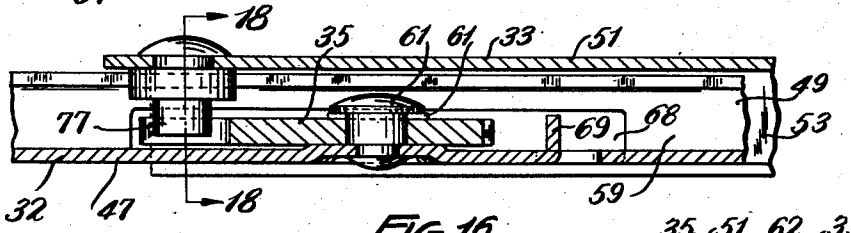


FIG. 16

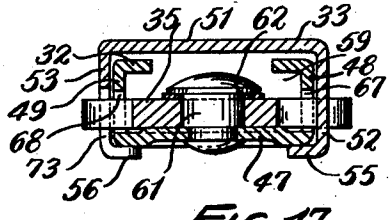


FIG. 17

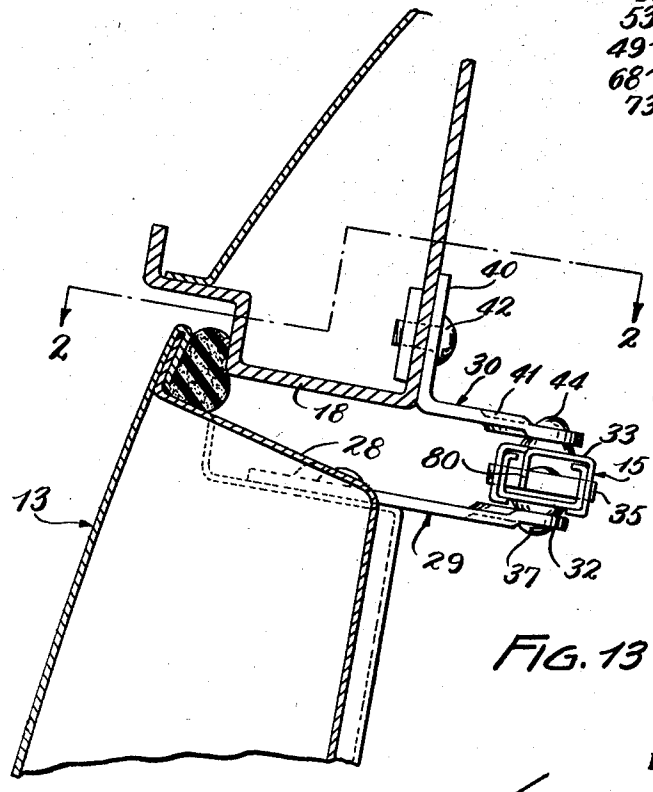


FIG. 13

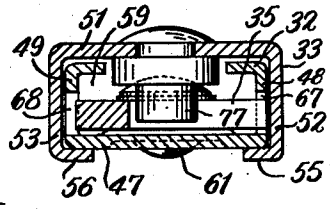


FIG. 18

INVENTOR.
EDWIN L. ALLEN
BY Hudson, Boughton, Williams, David & Hoffmann
ATTORNEYS

March 31, 1959 E. L. ALLEN 2,880,029

DOOR CHECK

Filed Jan. 23, 1957 6 Sheets-Sheet 6

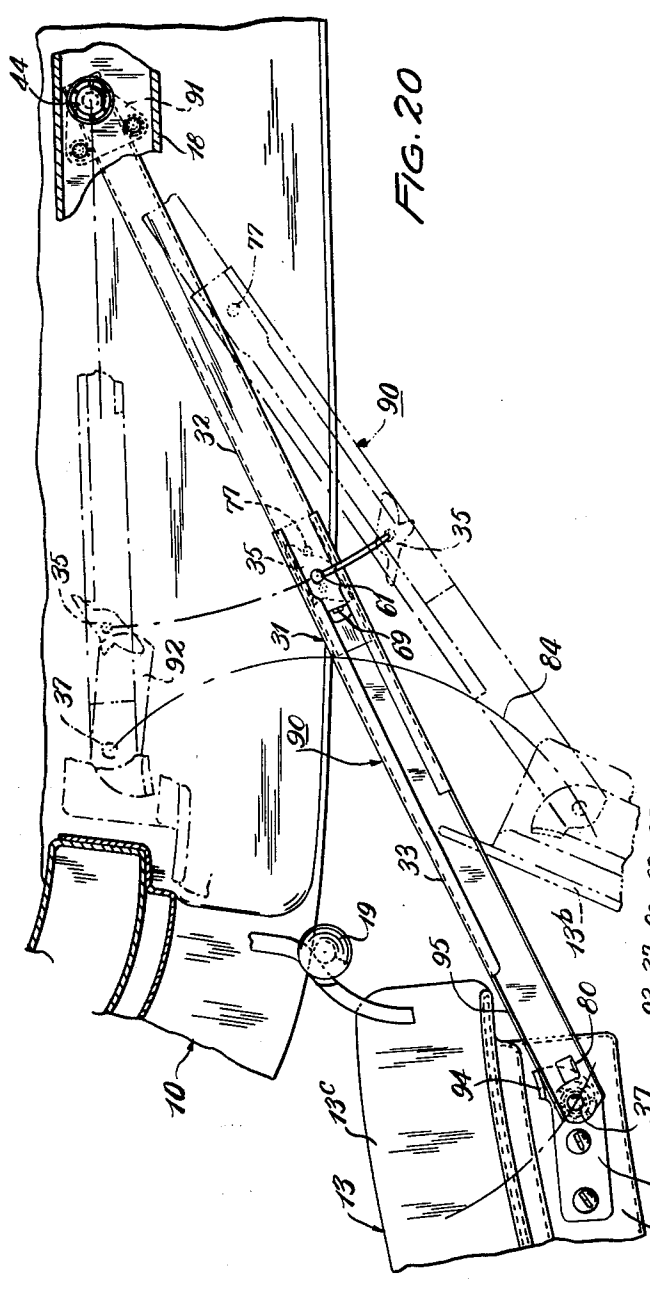


FIG. 20

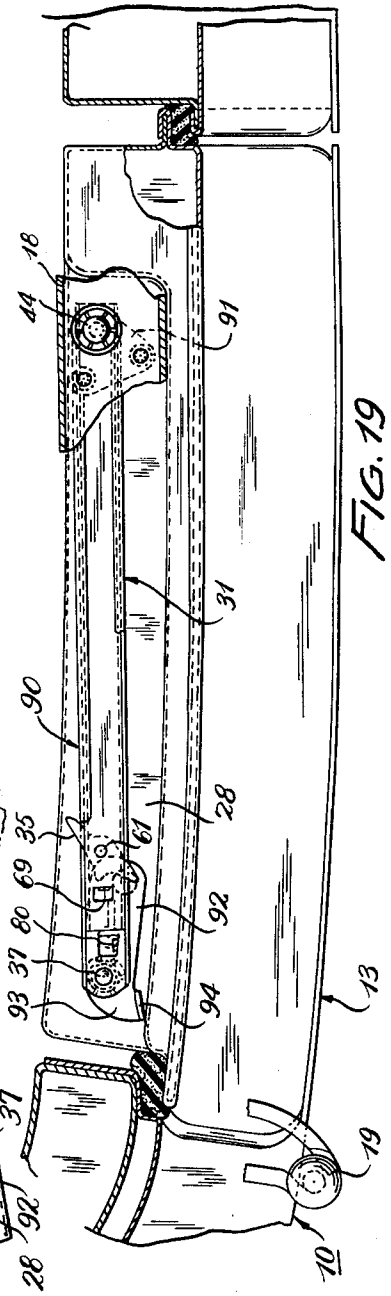


FIG. 19

INVENTOR.
EDWIN L. ALLEN
BY Hudson, Boughton, Williams, David & Hoffmann
ATTORNEYS

United States Patent Office 2,880,029 Patented Mar. 31, 1959

2,880,029

DOOR CHECK

Edwin L. Allen, Cleveland Heights, Ohio, assignor, by mesne assignments, to Lisle W. Menzimer, Rockford, Ill., trustee

Application January 23, 1957, Serial No. 635,754

19 Claims. (Cl. 292—278)

This invention relates to holding devices of the kind used between swingably connected parts for holding the swingable part in different desired positions.

By way of example and without limitation on the use thereof, the holding device of the present invention is herein disclosed as being of the door check type and as being applied to a swingable rear door of a panel delivery truck. In such delivery trucks it is desirable that the door check be capable of holding a rear door at either a substantially 180° full open position or at a substantially 90° partially open position. The hinge arrangement and balance for such a rear door are usually such that when the door is on one side of the 90° position it will tend to fall shut and when the door is at, or on the other side of the 90° position, the door will tend to fall toward the full open or 180° position.

It is also desirable that such a truck door be openable to the 180° position, so as to permit the rear end of the truck to be moved up close to a loading dock or platform without interference from the door. On the other hand, when the truck is standing at a curb or in a roadside position and the rear doors are opened, one of those doors, usually the left hand door, if opened to its 180° position, will extend into the adjacent traffic lane and will create a hazard. It is therefore necessary that the door check be capable of holding the door at the 90° open position so that the door will not extend into the adjacent traffic lane.

It is further desirable that the door check be automatic in its functioning, such that the different desired holding positions for the door will be established merely by manual swinging of the door and without need for any manual operation to be performed on the door check itself.

The present invention accordingly has, as one of its objects, the provision of a novel door check which will efficiently fulfill all of the above mentioned door holding requirements and which is of a relatively simple and practical form, capable of being readily manufactured and easily installed.

Another object is to provide such a door check which will automatically assume an engaged condition for holding the door in an intermediate open position, such as a 90° position, and in which the engaged condition is automatically releasable by a mere manual control swinging movement of the door to thereby permit further movement of the door to another predetermined open position or to its closed position.

Still another object is to provide a novel multiple door-position door check comprising an extensible articulated linkage embodying a linkage unit having relatively movable link members and pawl means effective between such link members for automatically establishing or releasing different holding lengths for the linkage unit in response to manual swinging of the door.

A further object is to provide a door check which will fulfill all of the above requirements and, at the same time, is capable of being installed to lie in a substantially concealed position between the door and the associated doorframe when the door is in its closed position, so that no part of the door check projects into the body space of the vehicle, where such a projecting part might interfere with, or damage, the cargo or might cause injury to a person located in the body space and in the vicinity of the door.

Other objects and advantages of the invention will be apparent in the following detailed description and in the accompanying sheets of drawings forming a part of this specification and in which:

Fig. 1 is a partial rear end elevation of a vehicle having swingable doors equipped with door checks embodying the present invention;

Fig. 2 is a partial transverse horizontal section taken through the vehicle, as indicated by section line 2—2 of Figs. 1 and 13 and showing the closed position of the left hand door and the corresponding collapsed condition of its associated door check;

Fig. 3 is a partial transverse horizontal section similar to Fig. 2, but showing the door as having just been swung in the opening direction to an intermediate or partially open position, and also showing the associated door check in the condition of establishing a corresponding intermediate holding length for retaining the door in such partially open position;

Fig. 4 is a partial tranverse horizontal section similar to Fig. 2, but showing the door as having just been swung to its full open position, and also showing the corresponding fully extended door holding condition of the associated door check;

Fig. 5 is a partial transverse horizontal section similar to Fig. 2, but showing the door as having just been swung from its fully open position toward the enclosed position and presently occupying a partially open position in which the linkage unit of the door check is substantially on a dead center line;

Fig. 6 is a larger scale partial side elevation of the door check when viewed as indicated by the directional line 6—6 of Fig. 3 and with certain portions of the device broken away;

Fig. 7 is a larger scale partial plan view of the door check when viewed as indicated by the directional line 7—7 of Fig. 6 and with certain portions of the device broken away;

Fig. 8 is a partial plan view of the door check with portions thereof broken away, illustrating different positions and movements of the control pawl;

Fig. 9 is another such partial plan view with portions broken away, illustrating different positions and movements of the control pawl;

Fig. 10 is another partial side elevation of the door check when viewed from one side thereof, as indicated by the directional line 10—10 of Fig. 5 and with certain portions of the device broken away;

Fig. 11 is another partial side elevation of the door check when viewed from the other side thereof, as indicated by the directional line 11—11 of Fig. 5;

Fig. 12 is a partial plan view of the door check when viewed as indicated by the directional line 12—12 of Fig. 10 and with certain portions broken away;

Fig. 13 is a vertical section taken on section line 13—13 of Figs. 1 and 2 with the vehicle door in closed position and with the associated door check appearing in end elevation;

Fig. 14 is a larger scale vertical sectional view taken transversely of the door check at the door-attached pivoted end thereof, as indicated by section line 14—14 of Fig. 2;

Fig. 15 is a larger scale vertical sectional view taken transversely of the door check at the vehicle-attached

pivoted end thereof, as indicated by section line 15—15 of Fig. 2;

Fig. 16 is a partial vertical section taken longitudinally of the door check, as indicated by section line 16—16 of Fig. 9;

Fig. 17 is a transverse section taken on section line 17—17 of Fig. 7;

Fig. 18 is a transverse section taken on section line 18—18 of Figs. 9 and 16;

Fig. 19 is a partial transverse horizontal section taken through the vehicle, similarly to that of Fig. 2 but showing a modified form of the door check; and

Fig. 20 is another such transverse horizontal section through the vehicle, but showing the door as having just been swung to its full open position, and also showing the corresponding fully extended door holding condition of the modified door check of Fig. 19.

The drawings show the novel door check of the present invention applied to a delivery truck **10** of the panel body type having a doorway **11** in the rear end thereof and a pair of rear doors **12** and **13** for closing such doorway. Door checks **14** and **15** of the novel construction provided by this invention are applied to the doors **12** and **13** for holding the same in the desired full open, or partially open, positions in the manner to be explained hereinafter. The door checks **14** and **15** are identical in construction, with the exception that they are for right-hand and left-hand installation to suit the right-hand and left-hand doors **12** and **13** to which they are applied.

The doorway **11** of the truck **10** is defined by body portions constituting a doorframe structure which includes upright side edge or pillar portions **16** and **17** and a transverse top wall portion or lintel **18**. The doors **12** and **13** are swingably mounted on the upright doorframe portions **16** and **17** by pairs of suitable hinges **19** which are attached to these doorframe portions and to the adjacent upright edge portions **20** and **21** of the doors. When the doors are in their closed position, as shown in Figs. 1 and 2, their free edges **22** and **23** are in a meeting or engaged relation in or adjacent a common parting plane, and in this instance, the edge portion of the left hand door **13** is provided with a stop flange **25** with which the edge portion of the right-hand door **12** has an abutting engagement in an overlapping relation thereto, as shown in Fig. 2.

The right-hand door **12** is here shown as provided with a suitable handle **26** for swinging the same and, if desired, a similar handle can be provided on the door **13**. The doors **12** and **13** also include an upper edge wall **28** which is located adjacent to but below the transverse doorframe portion **18** when the doors are in their closed position.

For a more detailed description of the invention, reference need be made only to the left-hand door **13** and to the door check **15** associated therewith. As shown in the drawings, the door **13** is swingable from the closed position 13^a of Fig. 2 to the intermediate and full open position 13^b and 13^c of Figs. 3 and 4. The intermediate position 13^b is a substantially 90° open position and the position 13^c is a substantially 180° open position.

The location of the hinges **19** is such that if the door **13** is in its 90° position 13^b and is then released, it will tend to fall open toward its 180° position 13^c, and if the door is somewhat to the right of the 90° position 13^b when it is released, it will tend to fall shut. As will be explained more fully hereinafter, the door check **15** has an engaged condition providing an intermediate door-holding length for holding the door **13** in the 90° position 13^b and also has a second engaged condition, which in this case is its fully extended length, for holding the door in the 180° position 13^c.

The door check **15** is in the form of an extensible articulated linkage which comprises, in general, a pair of anchorage or attaching members **29** and **30** for connecting the opposite ends of the linkage with the door and doorframe structures respectively, and a linkage unit **31** extending between the attaching members and comprising a pair of link members **32** and **33** having their adjacent ends in an overlapping or telescoping relation. The door check **15** also comprises a control pawl **35**, which is effective between the link members **32** and **33** as hereinafter explained in greater detail, for establishing and releasing different door holding lengths for the linkage unit **31**.

The attaching member **29** can be of any appropriate form and is here shown as comprising a substantially flat plate bracket adapted to be secured to the top edge wall **28** of the door **13** by the connecting screws **36**. The outer end of the link member **32** carries a fixed pivot pin **37** which extends through an opening of the bracket **29** and pivotally connects such outer end with this bracket. As shown in Fig. 14, the outer end of the link member **32** is provided with a boss **38** on which the pivot pin **37** is mounted and which bears against the bracket **29**. The pivot pin **37** is provided with a head 37^a located in spaced relation to the link member **32** and a spring washer **39** disposed under the head acts to take up lost motion in the pivotal connection thus established.

The attaching member **30** can likewise be a bracket made of sheet metal or plate material and is here shown as being of a substantially L-shaped form having substantially right-angularly disposed flat upright and horizontal legs **40** and **41**. The bracket **30** can be mounted on the door frame member **18** with the flat upright leg **40** secured thereagainst by the connecting screws **42**.

The outer end of the link member **33** has the upper side thereof in bearing engagement with the leg **41** of the bracket **30** and carries a fixed pivot pin **44** by which such outer end is pivotally connected with this horizontal leg of the bracket. As shown in Fig. 14, the pivot pin **44** has a head 44^a disposed in spaced relation to the link member **33** and a spring washer **46** located between such head and link member acts to take up looseness in the pivotal connection thus established.

As shown in Figs. 14 and 15, the opening of the brackets **29** and **30** through which the pivot pins **37** and **44** extend, are of a size to afford a desired clearance such that there will be flexibility in the pivotal connections between the linkage unit **31** and these brackets. This flexibility is provided, in part, by the spring washers **39** and **46** which also prevent rattling between the adjacent parts. Such flexibility in the pivotal connections allows for misalignment which may occur in the parts of the door check itself but, more particularly, for misalignment occurring between the door and doorframe members to which the door check is to be applied.

The link member **32** can be a substantially straight bar of an appropriate length and is here shown as being a sheet metal member of a channel-shaped cross-section having a substantially flat longitudinal web portion **47** and substantially parallel longitudinal side flanges **48** and **49**. The link member **33** can likewise be a substantially straight bar of an appropriate length and is here shown as being a sheet metal member of a channel-shaped cross-section having a substantially flat longitudinal web portion **51** and substantially parallel longitudinal side flanges **52** and **53**.

The width and depth of the channel recess **54** of the link member **33** are such that the link member **32** is snugly and telescopingly received in such channel recess and is longitudinally slidable therein. The side flanges **52** and **53** of the link member **33** are provided with in-turned longitudinal edges defining a pair of retaining flanges **55** and **56** for retaining the link member **32** in the channel recess **54**. The longitudinal edge flanges **55** and **56** also form a stiffening means for increasing the rigidity of the link member **33**.

The link member **32** preferably also has the longitudinal edge portions of the side flanges **48** and **49** thereof deflected inwardly to form stiffening flanges **57** and **58**. The link member **32** is disposed in the link member **33** with its longitudinal channel recess **59** facing toward the longitudinal web portion **51** of the latter link member.

The pawl **35** is mounted on one of the link members in this case, the link member **32** adjacent the inner end thereof with the body portion **35a** of the pawl housed in the channel recess **59**. As shown in Figs. 15 and 16, the web portion **47** of the link member **32** is provided with a fixed pivot pin **61** on which the pawl **35** is swingably mounted.

As best seen in Figs. 7 and 8, the pawl **35** is provided with substantially oppositely extending first and second control fingers **63** and **64**, and is also provided at an intermediate point thereof with a stop finger **65** located in a substantially radially extending relation to the axis of the pivot pin **61**. The longitudinal side flanges **48** and **49** of the link member **32** are provided with openings **67** and **68** (see Figs. 10, 11 and 12) adjacent the location of the pawl **35** to accommodate the control fingers **63** and **64** and permit movement of those control fingers extended and retracted positions during swinging of the pawl on the pivot pin **61**.

At a point adjacent the pawl **35**, the link member **32** is provided with a projection, in this case, a lug **69** deflected from the web **47** and extending into the channel recess **59**. The lug **69** is engageable by one or the other of the control fingers **63** and **64** and prevents a full rotation of the pawl **35** on the pivot pin **61**.

A retarding washer **62**, disposed between the pawl and the head of the pivot pin **61**, prevents a too-free oscillation of the pawl such as might be caused by inertia effects and might render the pawl positions inaccurate. The washer **62** provides a frictional or drag effect on the pawl and can be a wavy spring washer or a washer made of a suitable friction material.

From the construction of the door check **15** as thus far decribed, it will be seen that the link member **32** is telescopingly slidable in the link member **33** and is confined by the side flanges of the latter to a substantially straight-line relative longitudinal movement between the link members. It will also be seen that since the pawl **35** is pivotally mounted on the link member **32**, it will be movable with the latter along the link member **33** during such relative longitudinal sliding movement.

To accommodate this longitudinal translatory movement of the pawl **35**, one of the side flanges of the link member **33**, in this instance the side flange **52**, is cut away (see Fig. 10) for a substantial portion of its length to provide a clearance opening **70** therein for the pawl. The side flange **52** is provided with a control stop **71** (see Figs. 6, 7 and 9) which, in this instance, is formed by an edge or shoulder carried by this flange and located at the inner end of the clearance opening **70**.

The other side flange of the link member **33**, in this instance the side flange **53**, is provided with longitudinally spaced clearance openings **72** and **73** (see Fig. 11) which accommodate the fingers of the pawl **35** during swinging thereof and thus provide swing locations spaced apart along one link member **33**. The side flange **53** of the link member **33** is also provided with a pair of longitudinally spaced control stops **74** and **75** which, in this instance, are formed by the edge portions or shoulders of the side flange **53** which face toward the respective clearance openings **72** and **73**. The control stops **71**, **74** and **75** are engageable by the fingers of the pawl **35** in a manner and for the purposes explained in detail hereinafter.

As shown in the drawings, one of the link members, in this instance the link member **33**, is provided adjacent the inner end thereof with a control stop **77** which is preferably in the form of a fixed pin mounted on the web portion **51**. The stop **77** projects into the channel recess **59** between the longitudinal edge flanges **57** and **58** of the link member **32** and is engageable by a stop means provided on the latter link member when the door check is in its fully extended condition shown in Fig. 4, to thereby establish an extended holding length for the door check **15**. The stop means of the link member **32** which engages the control stop **77** is, in this case, the finger **63** of the pawl **35** while the latter is held against swinging by one or both of the side flanges **52** and **53** which are then in covering relation to the clearance openings **67** and **68** as shown in Fig. 9. The engagement of the body portion of the pawl with the control stop **77** also prevents a complete axial separation between the overlapped inner ends of the link members **32** and **33**.

The link member **33** is also provided with a control stop **80** adjacent the outer end thereof and which control stop projects into the channel recess **59** so as to be engageable by the pawl **35** when the door check is actuated to its fully contracted or collapsed condition shown in Fig. 5. The control stop **80** is here shown as being an inwardly deflected lug formed by a portion of the web **51** of the link member **33**. In the door check **15** the control stop **80** is located on the link member **33** at a point outwardly of or beyond the pivot pin **44**.

During the translatory movement of the pawl **35** with the link member **32** as just above referred to, the pawl is carried to two different trip locations along the door check **15**, one such trip location being adjacent the bracket **30** and the other being adjacent the mid-point of the link member **33**. When the pawl **35** is carried to or along the first of these trip locations, it is successively actuated to two different trip positions. Likewise, when the pawl **35** is moved to or along the second trip location, it is actuated to two other different trip positions.

The actuation of the door check will now be described in detail with reference to the above-mentioned two trip locations and the above-mentioned different trip positions of the pawl **35** will be pointed out in the drawings. For such detailed description of operation let it be assumed that the door **13** is in its full open or 180° position **13c** shown in Fig. 4 and that the door is about to be swung therefrom in a closing direction, as indicated by the arcuate directional arrow **81**. At this time the pawl **35** occupies a substantially fully retracted position **35b** in the channel recess **59**, as shown in full lines in Fig. 9 and in broken lines in Figs. 4 and 5, and has the finger **63** thereof in engagement with the stop pin **77** of the link member **33**. This engagement of the pawl with the stop pin **77** is at this time retaining the door **13** against opening movement beyond its 180° position and the check device **15** is in its fully extended condition.

The closing movement of the door **13** from such fully open position **13c** advances the link member **32** into the link member **33**, as indicated by the straight directional arrow **82**, and thereby moves the pawl **35** toward the control stop **80** and to the trip location adjacent the bracket **30**. When the door **13** reaches the position **13d** of Fig. 5 in which the door check **15** is substantially on the dead center line **83** and is in its fully collapsed condition, the pawl **35** has come into engagement with the control stop **80** and has been swung by the latter in a clockwise direction to the first trip position **35c** (shown in Figs. 5 and 12), in which the fingers **63** and **64** of the pawl project outwardly from opposite sides of the link member **33**. As the door **13** swings further in the closing direction from the position **13d** the door check **15** moves inwardly of the vehicle body and beyond the dead center

line 83, whereupon the door check is subjected to a lengthening or expanding action by a partial withdrawal of the link member 32 from the link member 33, as represented by the condition of the door check shown in Fig. 2. During this lengthening action, the finger 63 of the pawl 35 engages the control stop 74 causing a further clockwise swinging of the pawl (as seen in Fig. 12) to the position 35^d shown in broken lines in Figs. 2, 7 and 12. The door 13 has now arrived at its fully closed position 13^a of Fig. 2 and the pawl 35 occupies a trip position in which the stop finger 65 projects in an extended relation beyond the side flange 52 of the link member 33.

When the pawl 35 is in the trip position 35^d of Figs. 2, 7 and 12 with the stop finger 65 in an extended relation, the door check 15 is in a condition such that during the next opening movement of the door 13 the stop finger 65 will be in a ready position for engagement with the control stop 71. The arcuate arrow 84 of Figs. 2 and 3 is indicative of this opening movement of the door from its fully closed position and the straight arrow 85 is indicative of the corresponding withdrawal movement of the link member 32. When the door arrives at the 90° open position 13^b shown in full lines in Fig. 3, the pawl 35 will have been carried along the link member 33 to the second trip location and to the point where the stop finger 65 comes into engagement with the control stop 71 and the pawl thereupon assumes the trip position 35^e shown in full lines in Fig. 7. The engagement of the stop finger 65 with the control stop 71 limits further expanding movement of the door check and establishes a holding length for the door check by which the door is restrained against further swinging in the opening direction and is maintained at the 90° open position.

While the pawl 35 is being advanced toward the full-line trip position 35^e of Fig. 7 it lies in the channel recess 59 in the broken line position 35^d and, when the stop finger 65 comes into engagement with the control stop 71, the pawl is swung by the latter in a counter-clockwise direction on the pivot pin 61, thereby moving the pawl to the trip position 35^e. When the pawl is in the trip position 35^e the control finger 63 is in an extended position projecting somewhat from the channel recess 59 through the side flange openings 68 and 73 of the link members 32 and 33. At this time the control finger 64 of the pawl engages the inner surface of the side flange 52 of the link member 33 and which engagement prevents rotation of the pawl in the counter-clockwise direction beyond the full line trip position 35^e shown in Fig. 7.

If the vehicle operator wishes to swing the door 13 from its 90° postion 13^b of Fig. 3 to its closed position, he can readily do so by an immediate and direct swinging of the door to such closed position. If, however, the operator wishes to swing the door from the 90° position 13^b to the fully open position 13^c, he must first cause or initiate a trip actuation of the pawl 35 for retracting the stop finger 65. This is accomplished by imparting to the door a partial closing movement, as a control movement to cause or initiate such trip actuation of the pawl, after which the door can be freely swung to the fully open position 13^c.

This control swinging of the door 13 from the 90° position 13^b in the closing direction need be for only a small arcuate distance for initiating the trip actuation of the pawl 35 for retracting, or partially retracting, the stop finger 65. As shown in Fig. 7, the control finger 63 is at this time already in a partially extended position, and hence, the control swinging movement of the door in the closing direction from the 90° position 13^b will cause this control finger to come into engagement with the control stop 75 of the link member 33 with the inclined side edge 86 of this control finger sliding against and across this control stop 75, thereby causing swinging of the pawl in a counter-clockwise direction from the position 35^e of Figs. 7 and 8 to partially retract the stop finger 65.

This counter-clockwise rotation of the pawl 35 by the engagement of the control finger 63 with the control stop 75, immediately causes the control finger 64 to be partially extended on the opposite side of the linkage unit, whereupon the desired swinging of the door in an opening direction and beyond the intermediate position 13^b, can be accomplished. The retraction of the stop finger 65 is then completed by a further counter-clockwise rotation of the pawl by the engagement of the side edge 87 of the control finger 64 against the control stop 71. As the opening movement of the door continues, the side edge 87 of the control finger 64 wipes across the control stop 71 causing the pawl to be further swung in the counter-clockwise direction, as shown in Figs. 8 and 9, until the pawl has been swung through approximately 180° from the position 35^e of Fig. 7 to the fully retracted position 35^b of Fig. 9.

The control swinging of the door in the closing direction could, of course, be carried through a sufficient arcuate distance to cause substantially all of the 180° counter-clockwise swinging of the pawl 35 from the position 35^e of Fig. 7 to the position 35^b of Fig. 9. In that case, the side edge 86 of the control finger 63 remains in engagement with the control stop 75 for a longer interval and the counter-clockwise swinging of the pawl is produced to a major extent by this control stop.

When the pawl 35 has been thus moved to its substantially fully retracted position 35^b by the above-mentioned control swinging of the door 13 in the closing direction, the door can then be swung freely to its fully open position 13^c, whereupon the control finger 63 comes into engagement with the stop pin 77, as shown in Figs. 4, 5 and 9, to thereby maintain the door in the fully open position by preventing opening movement beyond the 180° position, as previously mentioned above. While the door is left in the fully open position, the pawl 35 remains in its fully retracted position 35^b of Figs. 4 and 9, such that it will be freely movable along the link member 33 during the succeeding closing movement of the door. From the foregoing detailed description of the operation, it will be seen that functioning of the door check 15 has been carried through a full cycle of operation with respect to the closing and opening swinging movements of the door.

Figs. 19 and 20 show a door check 90 which is of a construction very similar to that of the door check 15 but which represents a modification thereof and possesses certain advantages thereover. In general, the door check 90 comprises similar component parts as the door check 15 and which corresponding component parts have been designated by the same reference characters.

One difference between the modified door check 90 and the above described door check 15 is that the door check 90 is installed in the vehicle 10 in a position in which linkage unit 31 of the door check 15 is inverted and is reversed end for end. The term inverted, as here used, means that the linkage unit 31 has been rotated about its longitudinal axis through 180° or to a position which is upside down with respect to the position in which the door check 15 is installed. In this inverted and reversed installation position of the door check 90, the pawl 35 remains in one location inasmuch as the link member 32 on which it is pivotally mounted is now attached to the vehicle by an anchorage member or bracket 91. In the door check 90, the link member 33 is attached to the door 13 by an anchorage member or bracket 92 and is actuated by the door for longitudinal movement relative to the link member 32.

The link members 32 and 33 carry the same control stops for performing the same functions as have already been described above for the door check 15, but in this case, the outer end of the link member 33 is connected with the bracket 92 by the pivot pin 37 and the outer end of the link member 32 is connected with the bracket 91 by the pivot pin 44. Likewise, the pawl 35 is swung on its pivot pin 61 in the same manner and to the various control positions which have been described above for the pawl of the door check 15.

When the door check **90** has been thus installed in the above described relatively reversed and inverted condition, the portions of the link members **32** and **33** which are nearest the bracket **91** will provide a relatively smooth hand grasp means by which the vehicle operator can assist himself in climbing into the open rear end of the vehicle. Since the pawl **35** is on the inner end of the link member **32**, it will be in a spaced relation to the bracket **30** and will not be engaged by the operator's hand when he grasps the linkage unit **31** for climbing into or out of the vehicle, and personal injury to the operator is therefore less likely to occur.

Another advantage of the door check **90** is that in its installed position it lies substantially wholly between the upper edge wall of the door and the adjacent upper edge wall of the doorframe when the door is in its closed position. This is a relatively concealed and housed position for the door check in which no part of the device projects into the cargo or passenger space of the vehicle body to interfere with or damage the cargo or to cause personal injury to a passenger.

A structural difference of the door check **90** is present in the bracket **92** by which the outer end of the link member **33** is pivotally connected with the door **13**. The bracket **92** differs from the bracket **29** of the door check **15** in that it is provided with an extension portion **93** carrying a control stop **94**. The control stop **94** projects upwardly from the arm **93** and is located in an adjacently spaced relation to the pivot pin **37** so as to be engageable by the adjacent side flange of the link member **33** when the door **13** arrives at its fully open position **13c**.

The engagement of the link member **33** with the stop **94** prevents further transverse relative swinging movement between this link member and the bracket **92**, such that the door **13** is powerfully resisted against further swinging in the opening direction. This door checking function of the stop **94** prevents the application of excessive loads to the hinges **19** and thus reduces the likelihood of springing or otherwise damaging such hinges.

From the accompanying drawings and the foregoing detailed description it will now be readily understood that this invention provides a novel holding device for controlling the opening movements of a door, or other swingable member, and in which a control pawl for establishing different holding lengths for the device is actuated automatically to its different extended and retracted positions entirely in response to manual control swinging movements of the door.

Although the novel holding device of the present invention has been illustrated and described herein to a somewhat detailed extent, it will be understood, of course, that the invention is not to be regarded as being limited correspondingly in scope, but includes all changes and modifications coming within the terms of the claims hereof.

Having thus described my invention, I claim:

1. In a check device for use between relatively swingably connected structures, an extensible linkage unit comprising a pair of relatively longitudinally movable link members, attaching means adjacent the ends of said unit and adapted for pivotally connecting said ends with said said structures, stop means on said link members for cooperating engagement when said unit is substantially fully extended, a pawl having a stop finger and a control finger, said pawl being supported by one of said link members for swinging relative thereto for moving said stop finger from an extended position to a retracted position and vice versa, means on the other of said link members and engageable with said control finger for causing such movement of said stop finger to and from its extended position, said link members having a substantially free relative longitudinal movement for lengthening or shortening said unit when said stop finger is in its retracted position, and stop means on the other of said link members and engageable with said stop finger when the latter is in its extended position for preventing extension of said unit beyond an intermediate holding length.

2. In a check device for use between relatively swingably connected structures, an extensible linkage unit comprising a pair of relatively longitudinally movable link members, attaching means adjacent the ends of said unit and adapted for pivotally connecting said ends with said said structures, stop means on said link members for cooperating engagement when said unit is substantially fully extended, a pawl having a stop finger and first and second control fingers, said pawl being supported by one of said link members for swinging relative thereto for moving said stop finger and said first control finger from extended positions to retracted positions and vice versa, means on the other of said link members and engageable with said first control finger when the latter is in its extended position for causing the movement of said stop finger to and from its extended position, means on said other link member and engageable with said second control finger for causing movement of said first control finger to its extended position, and means on said other link member and engageable with said stop finger when the latter is in its extended position for preventing extension of said unit beyond a given holding length.

3. In a check device for use between relatively swingably connected structures, an extensible linkage unit comprising a pair of relatively longitudinally movable link members, attaching means adjacent the ends of said unit and adapted for pivotally connecting said ends with said structures, stop means on said link members for cooperating engagement when said unit is substantially fully extended, a pawl having a stop finger and a control finger, said pawl being supported by one of said link members for swinging relative thereto for moving said stop finger and said control finger from extended positions to retracted positions and vice versa, said control finger having a first extended position and a second extended position, means on the other link member and engageable with said control finger when the latter is in its first extended position for causing movement of said stop finger to its extended position, means on said other link member and engageable with said stop finger when the latter is in its extended position for preventing extension of said unit beyond a given holding length, and means on said other link member and engageable with said control finger when the latter is in its second extended position for causing movement of said stop finger to its retracted position.

4. In a check device for use between relatively swingably connected structures, an extensible linkage unit comprising a pair of relatively longitudinally movable link members, attaching means adjacent the ends of said unit and adapted for pivotally connecting said ends with said structures, stop means on said link members for cooperating engagement when said unit is substantially fully extended, a pawl having a stop finger and first and second control fingers, said pawl being supported by one of said link members for swinging relative thereto for moving said stop finger and said first control finger from extended positions to retracted positions and vice versa, said first control finger having a first extended position and a second extended position, said second control finger having an effective position and an ineffective position, means on the other link member and engageable with said first control finger when the latter is in its first extended position for causing movement of said stop finger to its extended position, stop means on said other link member and engageable with said stop finger when the latter is in its extended position for preventing extension of said unit beyond a given holding length, means on said other link member and engageable with said first control finger when the latter is in its second extended position for causing movement of said stop finger to its retracted position and movement of said second control finger to

its effective position, and means on said other link member and engageable with said second control finger when the latter is in its effective position for causing movement of said first control finger to its first extended position.

5. A check device as defined in claim 1 in which said link members are telescopingly slidable channel members having longitudinal side flanges in adjacent relation, and in which said flanges have openings therein to accommodate the fingers of said pawl when said fingers are moved to extended positions.

6. A check device as defined in claim 2 in which said link members are telescopingly slidable channel members having longitudinal side flanges in adjacent relation and provided with openings to accommodate the fingers of said pawl when said fingers are moved to extended positions, and in which said flanges are engageable by said control fingers for normally preventing full rotation of said pawl.

7. A check device as defined in claim 4 in which said linkage unit is hollow and said pawl is located within said unit and said fingers are of a length to extend to the exterior of said unit, and in which the engagement of said stop finger with said stop means is also effective to cause movement of said first control finger to its second extended position.

8. A check device as defined in claim 4 in which the means on said other link member and engageable with said first control finger comprises first and second shoulders, said first shoulder being engageable with one side of said first control finger in response to an extensible relative longitudinal movement between said link members and said second shoulder being engageable with the opposite side of said first control finger in response to a contracting relative longitudinal movement between said link members.

9. A holding device of the character described comprising, a pair of relatively longitudinally slidable link members having their adjacent ends in overlapping relation, said link member being channel shaped members each having a web portion and a pair of side flanges, anchorage pivots on said link members adjacent the outer ends thereof, stop means on said link members for cooperating engagement when the link members are substantially fully extended, a pawl having a stop finger and a control finger and being swingably mounted on the web portion of one of said link members for movement of said fingers from extended positions to retracted positions and vice versa, the side flanges of said link members having openings therein to accommodate said fingers when they are in their extended positions, first and second control shoulders on one side flange of the other of said link members and engageable with said control finger for causing movement of said stop finger to and from its extended position, and a stop shoulder on the other side flange of said other link member and engageable with said stop finger when the latter is in its extended position for preventing extension of said link members beyond a given holding length.

10. In a door check for mounting between a support structure and a door structure connected with said support structure for swinging to closed and open positions, a linkage unit comprising a pair of relatively longitudinally movable link members, a pawl pivoted on one of said link members and having control finger means and a stop finger, said pawl being swingable for extending and retracting said stop finger, and control means on the other of said link members and engageable with said pawl in response to such relative longitudinal movement, said linkage unit being movable to a substantially dead-center collapsed position during swinging of said door toward its closed position, said linkage unit being also movable beyond said dead-center position and subjected to a partial lengthening thereof as said door approaches its fully closed position, said control means comprising a first control element engageable with said control finger means to cause a partial swinging of said pawl upon movement of said linkage unit to said dead-center position and a second control element engageable with said control finger means during said partial lengthening to cause a further swinging of said pawl for extending said stop finger, said linkage unit being subjected to a further lengthening during swinging of said door in an opening direction from said closed position, said control means also comprising stop means engageable with said stop finger during the opening swinging movement of said door.

11. In a check device for use between a support structure and a door structure connected to said support structure by vertical-axis hinge means for swinging through an intermediate position to either of two extreme positions comprising a closed position and a full-open position; a collapsible and extensible linkage unit comprising a pair of relatively longitudinally movable link members extending in a longitudinally aligned relation and having their adjacent ends in an overlapped relation; one of said link members having side wall means and a longitudinal guideway and the other of said link members being slidably movable in opposite directions in said guideway; attaching members adjacent the ends of said unit for pivotally connecting the outer ends of said link members with said door and door-support structures; a pawl located in said guideway and pivotally mounted on said other link member adjacent the inner end of the latter; a first stop on said one link member adjacent the inner end thereof and projecting into said guideway; said pawl and first stop having a mutual engagement therebetween when said unit is in a substantially fully extended condition for checking opening movement of said door structure when the latter reaches said full-open position; a second stop on said wall means and located at an intermediate point of the length of said one link member; said pawl having finger means thereon and said pawl being positionable and repositionable by swinging thereof between retracted position in which said finger means lies within said guideway and extended position in which said finger means projects from said guideway; said finger means and second stop having a mutual engagement therebetween when said pawl is in extended position to establish an intermediate holding length of said unit for checking opening movement of said door structure at said intermediate position thereof; a first control element on said one link member adjacent the outer end thereof and projecting into said guideway; and second control elements on said wall means at spaced points along said one link member; said first control element and pawl having a mutual engagement therebetween when said unit assumes a substantially collapsed condition, and said second control elements and finger means having mutual engagement therebetween during the relative longitudinal movement between said link members; the mutual engagement between said control elements and pawl being effective to cause the positioning and repositioning swinging movement of said pawl.

12. A check device as defined in claim 11 and wherein said link members are telescopingly slidable channel-shaped members and the side wall means of said one link member comprises longitudinal edge flanges having said second stop and said second control elements thereon; said edge flanges having openings therein adjacent said second stop and said second control elements to accommodate the finger means of said pawl when the pawl is in extended position.

13. A check device as defined in claim 11 and wherein said link members are telescopingly slidable channel-shaped members having longitudinal web portions in a parallel relation; and wherein the side wall means of said one link member comprises longitudinal edge flanges having said second stop and said second control elements thereon; said first stop and said first control element being located on the web portion of said one link member and said pawl being pivotally mounted on the web por-

tion of said other link member; said edge flanges having openings therein adjacent said second stop and said second control elements to accommodate the finger means of said pawl when the pawl is in extended position.

14. A check device as defined in claim 11 and wherein said pawl has a body portion swingable about a pivot axis; and wherein said finger means comprises a control finger co-operable with said second control elements and projecting from said body portion on one side of said pivot axis, and a stop finger cooperable with said second stop and projecting from said body portion on the other side of said pivot axis.

15. A check device as defined in claim 11 and wherein said pawl has a body portion swingable about a pivot axis; and wherein said finger means comprises control fingers projecting from said body portion on opposite sides of said pivot axis and at least one of which control fingers is cooperable with said second control elements, and a stop finger co-operable with said second stop and projecting from said body portion at a point between said control fingers.

16. A check device as defined in claim 11 and wherein one of said attaching members comprises a bracket secured to said door structure and having a rigid projection forming a third stop located in an offset relation on the door-hinge side of the pivotal connection of said linkage unit with said bracket; said third stop being engageable by said linkage unit when the latter is in its fully extended condition for reducing lateral thrust on said hinge means transversely of the hinge axis.

17. In a check device for use between a support structure and a door structure connected to said support structure for swinging through an intermediate position to either of two extreme positions comprising a closed position and a full-open position; a first link member having spaced longitudinal side walls and a guideway between said walls; a second link member slidably movable in said guideway; means pivotally connecting said first link member with one of said structures; means pivotally connecting said second link member with the other of said structures; a pawl pivotally mounted on said second link member so as to lie in said guideway and having control finger means and a stop finger; said pawl having a relative translatory movement in opposite directions along a path provided by said guideway, and a pivotal movement between extended position in which said stop finger projects from said guideway and retracted position in which said stop finger lies within said guideway; a stop element on one of said side walls; said stop finger and stop element being mutually engageable for checking opening swinging movement of said door structure at said intermediate position when said pawl is in extended position; and control elements on the other of said side walls; said control finger means and said control elements being mutually engageable in response to the relative translatory movement of said pawl for causing the pivotal movement of the pawl for moving said stop finger between its extended and retracted positions.

18. In a check device for use between a support structure and a door structure connected to said support structure for swinging through an intermediate position to either of two extreme positions comprising a closed position and a full-open position; a first link member having spaced longitudinal side walls and a guideway between said walls; a second link member slidably movable in said guideway; means pivotally connecting said first link member with one of said structures; means pivotally connecting said second link member with the other of said structures; a pawl pivotally mounted on said second link member so as to lie in said guideway and having control finger means and a stop finger; said pawl having a relative translatory movement in opposite directions along a path provided by said guideway, and a pivotal movement between extended position in which said stop finger projects from said guideway and retracted position in which said stop finger lies within said guideway; a first stop element on said first link member and projecting into said guideway at one end of said path; said first stop element and pawl being mutually engageable for checking opening movement of said door structure when the latter reaches said full-open position; a second stop element on one of said side walls; said second stop element and said stop finger being mutually engageable for checking opening movement of said door structure at said intermediate position when said stop finger is in extended position; a first control element on said first link member and projecting into said guideway at the opposite end of said path; and other control elements on the other of said side walls; said first control element and finger means being mutually engageable and said other control elements and finger means being mutually engageable, in response to the relative translatory movement of said pawl for causing the pivotal movement of the pawl for moving said stop finger between its extended and retracted positions.

19. A check device as defined in claim 11 and intended for use on a vehicle body containing a compartment and in association with door and door support structures having upper edeg wall portions lying in an opposed relation when the door structure is in its closed position, wherein said attaching members are adapted for connection with said edge wall portions; and wherein said check device is housed between said edge wall portions with no portion of the device projecting into said compartment, when said door structure is in its closed position.

References Cited in the file of this patent

UNITED STATES PATENTS

2,001,507	Stribling	May 14, 1935
2,196,779	Persson	Apr. 9, 1940
2,229,512	Lustig	Jan. 21, 1941
2,264,382	Keller	Dec. 2, 1941
2,614,285	Snell	Oct. 21, 1952
2,797,119	Hollansworth	June 25, 1957