United States Patent [19]

Pastva, Jr.

[11] **3,784,243**

[45] **Jan. 8, 1974**

[54] **DOOR STABILIZER**

[75] Inventor: **John V. Pastva, Jr.**, Parma Heights, Ohio

[73] Assignee: **The Eastern Company**, Cleveland, Ohio

[22] Filed: **Mar. 28, 1972**

[21] Appl. No.: **238,849**

[52] **U.S. Cl.** **292/300**, 49/366, 49/381, 220/1.5, 292/1, 296/50

[51] **Int. Cl.** **E05c 19/00**, E06b 3/34

[58] **Field of Search** ..... 292/218, 342, 281, 292/282, 283, 284, 300, DIG. 39; 49/366, 368, 381; 296/50, 51; 105/377, 378; 16/147; 220/1.5

[56] **References Cited**

UNITED STATES PATENTS

2,643,150	6/1953	Giles	292/256
1,766,183	6/1930	Mealia	292/300

FOREIGN PATENTS OR APPLICATIONS

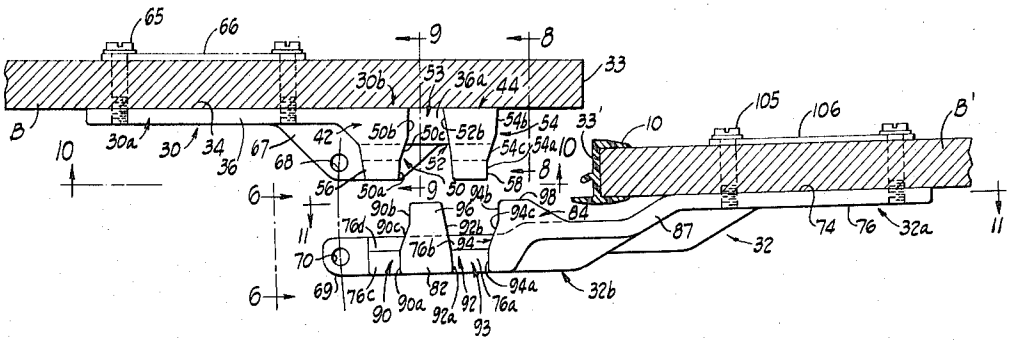
1,222,801	2/1971	Great Britain	49/366

Primary Examiner—Marvin A. Champion
Assistant Examiner—William F. Pate, III
Attorney—James T. Hoffmann

[57] **ABSTRACT**

A device for restraining movement of a pivoted or hinged closure member in closed position relative to a second member at the distal edge thereof, such as an adjacent second door and/or a door frame. The restraining device is especially useful on double doors of truck trailers and cargo containers and complements the usual door latches in preventing frame racking and opening of the door in response to an internally applied force due, for example, to a load shift. The device comprises two interengageable members, one fixedly connected to a hinged closure member adjacent to the distal edge thereof and the other on an adjacent second member. Opening of the closure member is prevented by the device when both the hinged closure member and the second member, such as the second door, are moved or when forces strain the hinged closure member to cause the interengaged members to bind. Movement in the plane of the door (so-called "racking") is inhibited through a rigidifying effect from the interengagement of the members of the restraining device.

13 Claims, 14 Drawing Figures



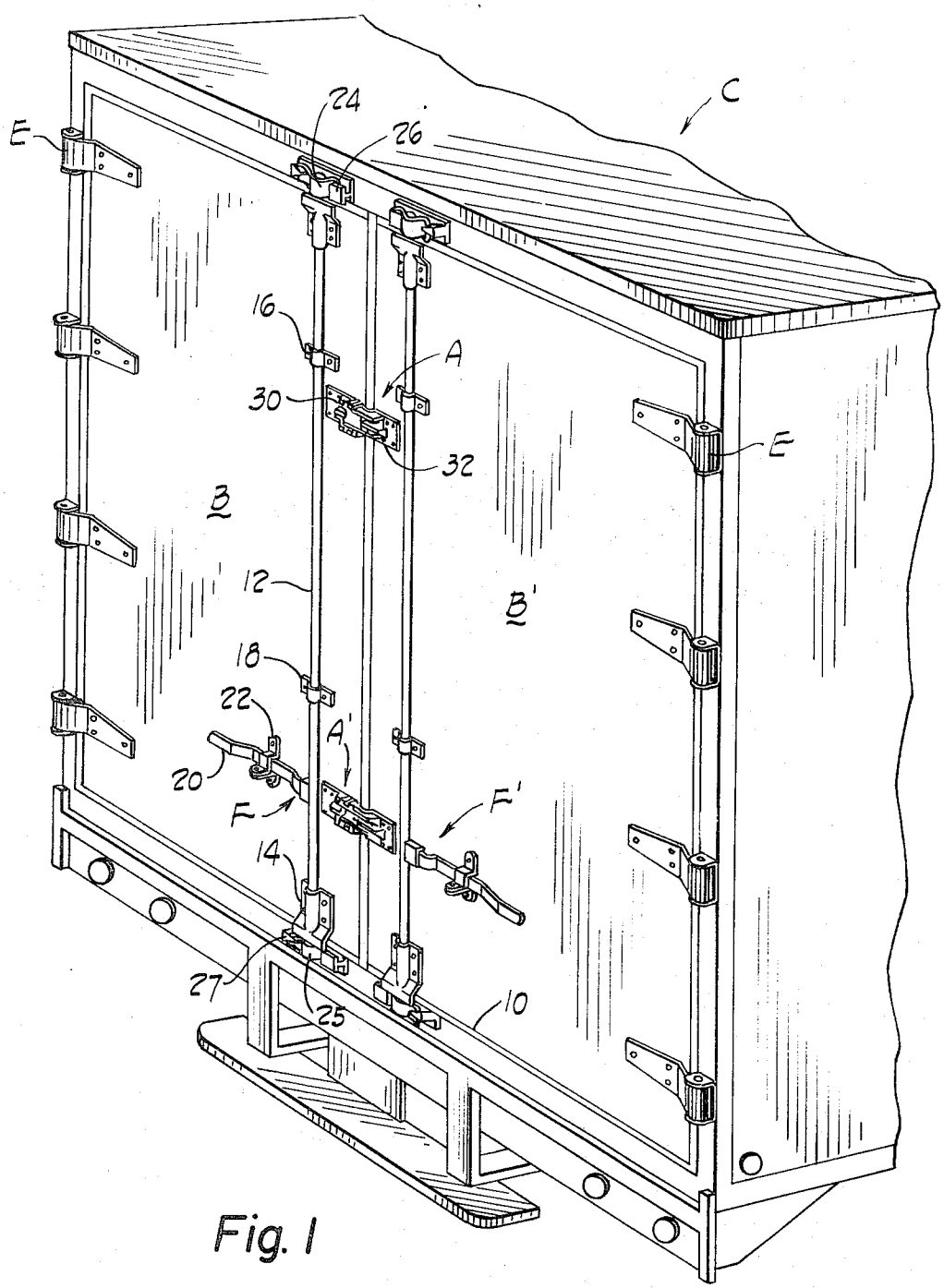


Fig. 1

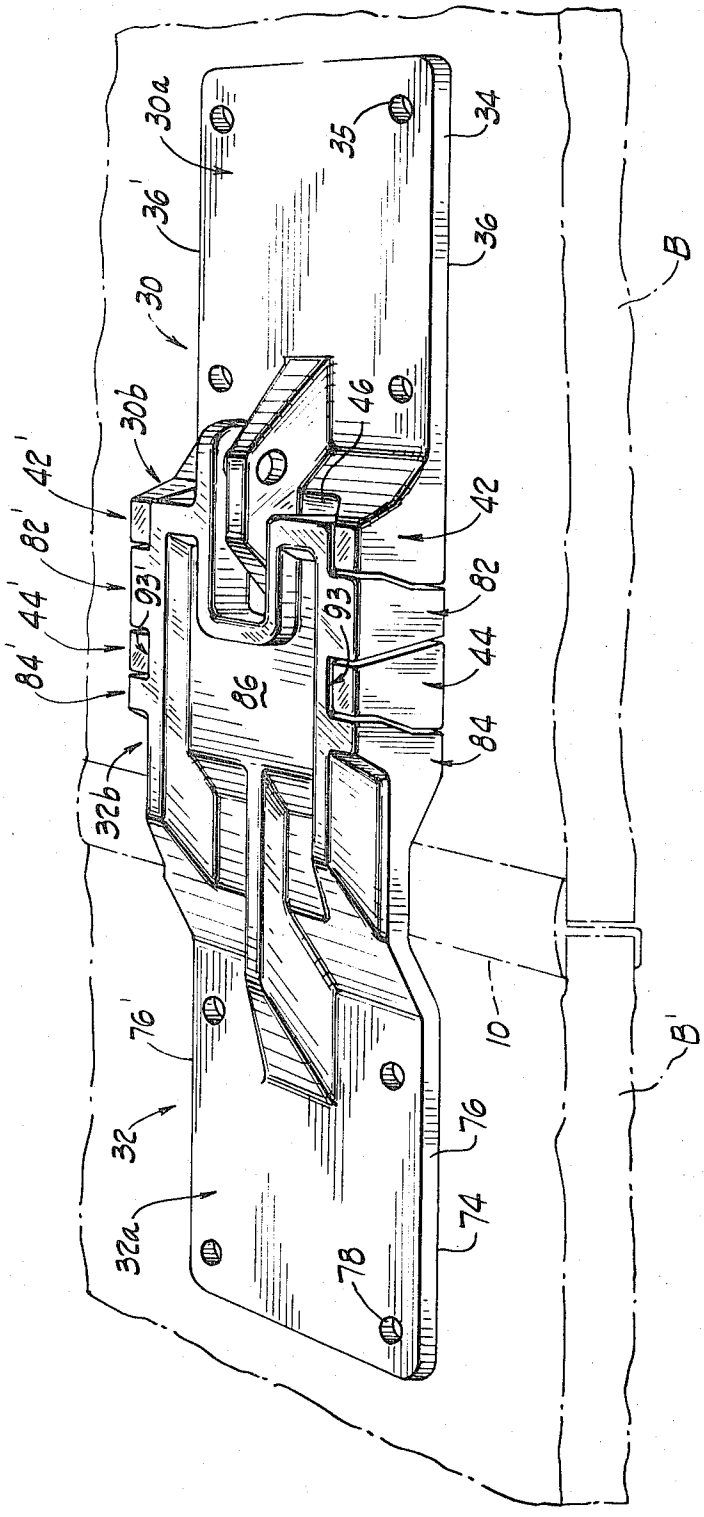

30a
35
34
36'
36
30
B
30b
46
42'
42
82'
82
93'
93
44'
44
84'
84
86
32b
76'
10
B'
32
76
32a
74
78

Fig. 2

Fig. 3

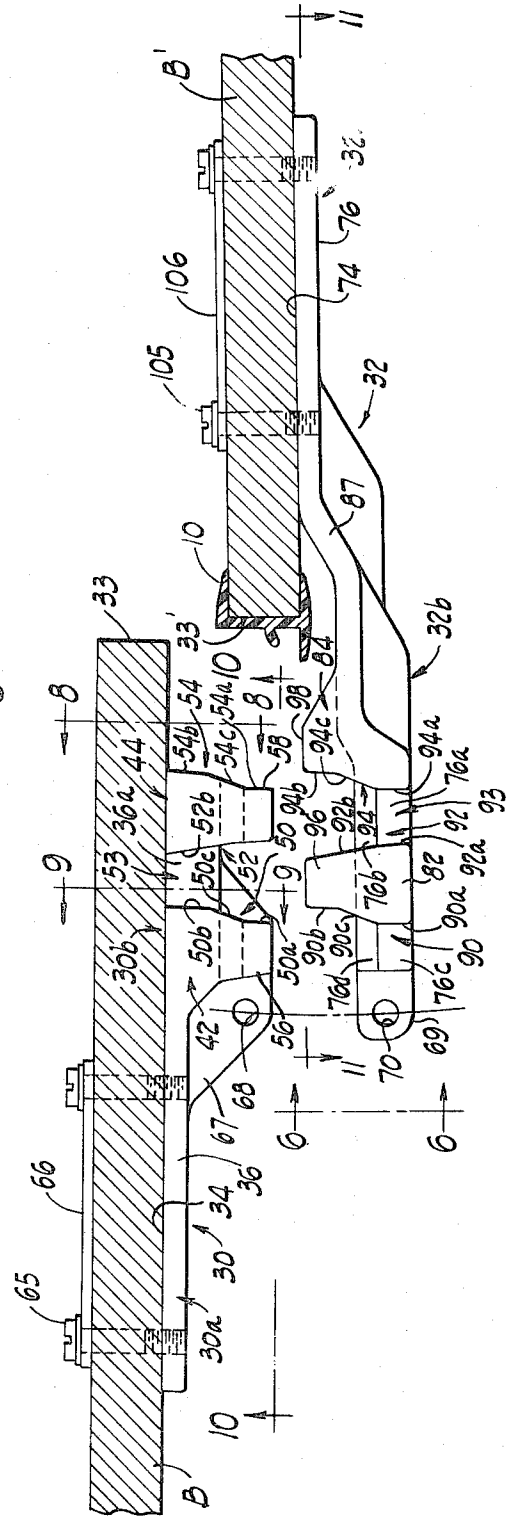
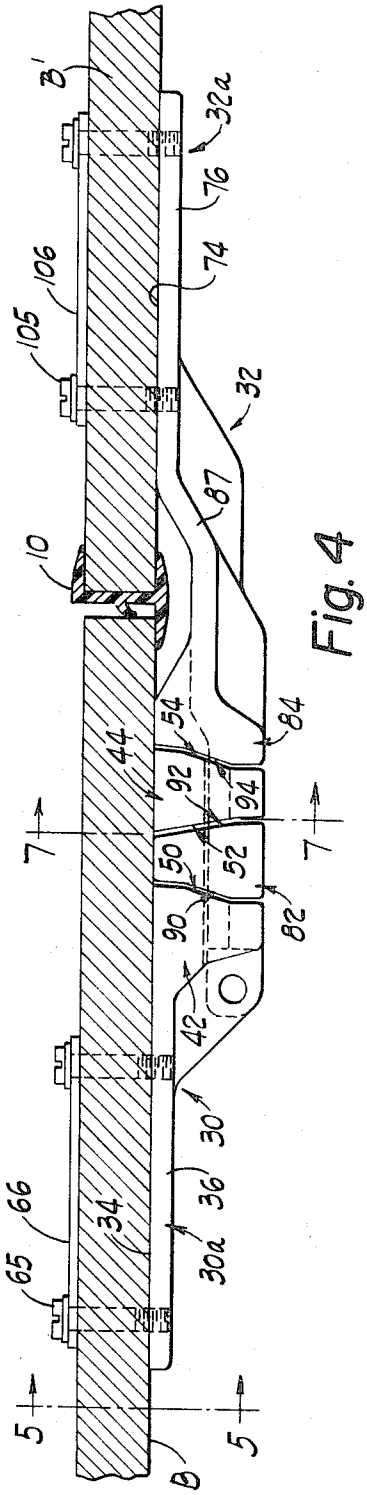


Fig. 4



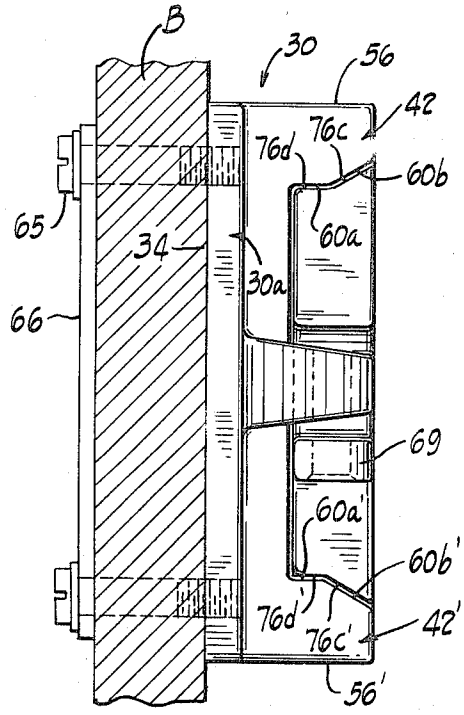


Fig. 5

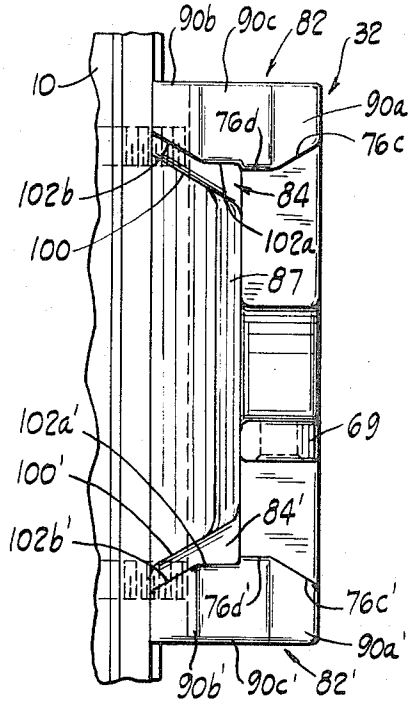


Fig. 6

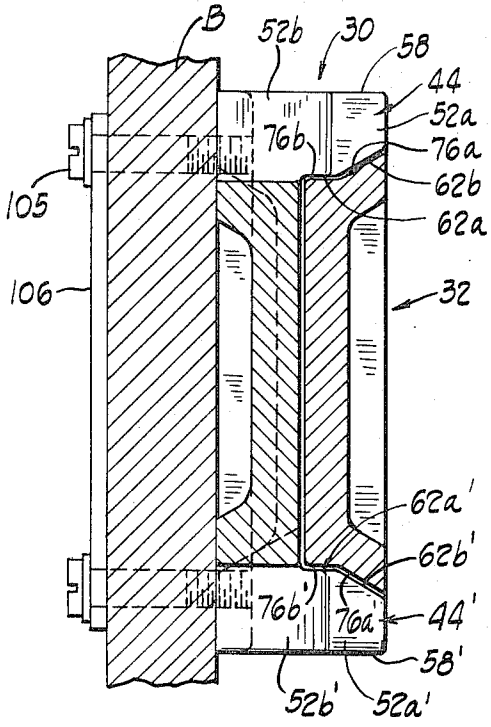


Fig. 7

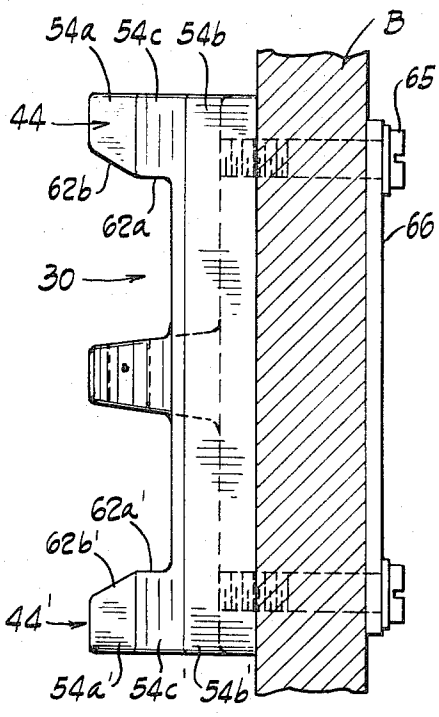


Fig. 8

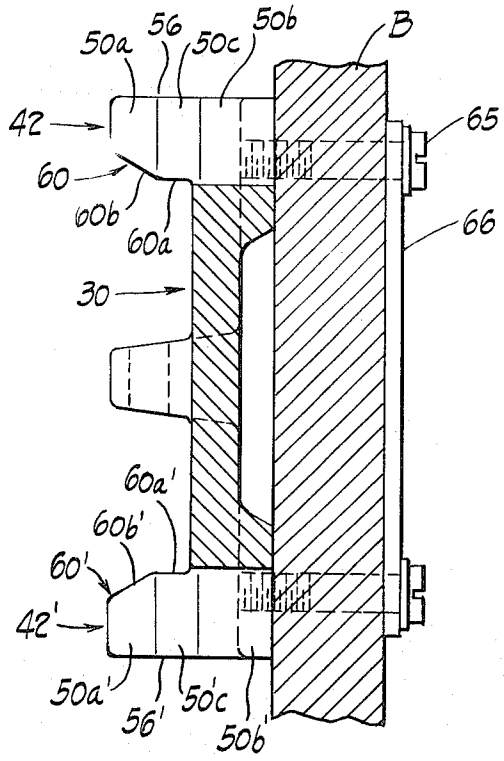

50a
56
50c
50b
B
42
65
60
60b
60a
66
30
60a'
60b'
60'
42'
50a'
56'
50c'
50b'

Fig. 9

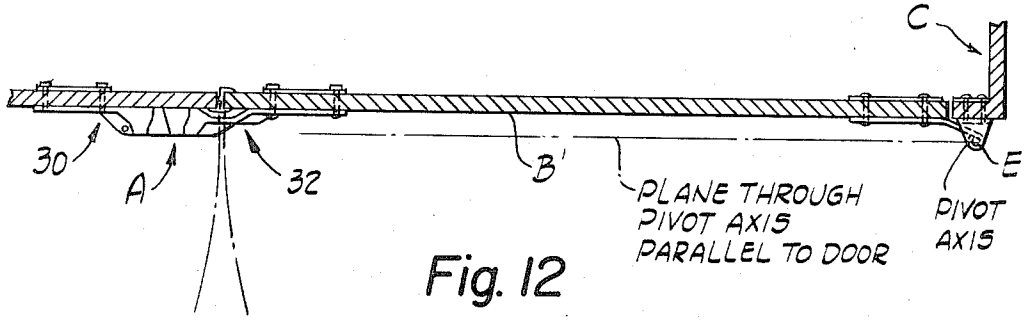

C
30
A
32
B'
PLANE THROUGH
PIVOT AXIS
PARALLEL TO DOOR
E
PIVOT
AXIS

Fig. 12

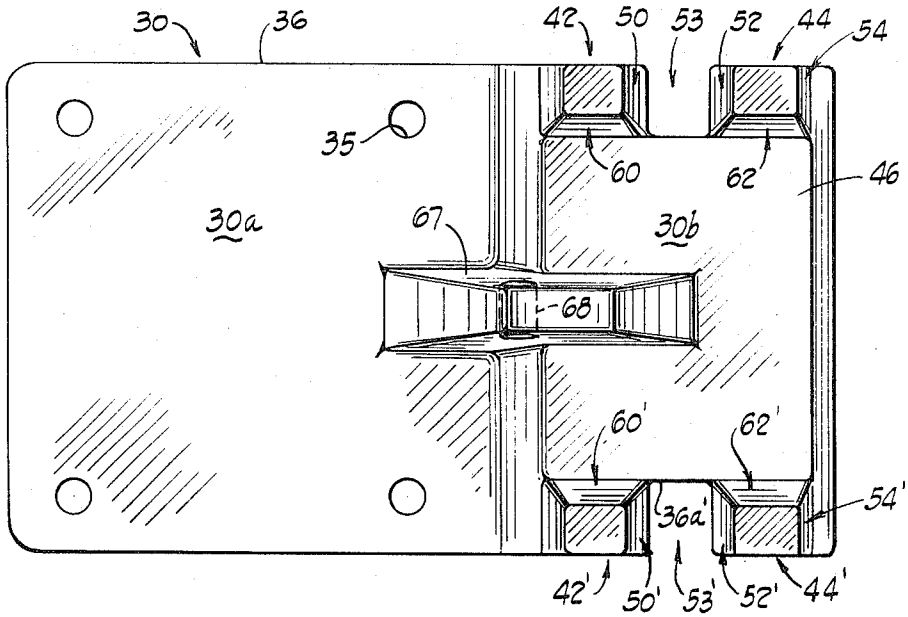

30
36
42
50
53
52
44
54
35
60
62
46
30a
67
30b
68
60'
62'
54'
36a'
42'
50'
53'
52'
44'

Fig. 10

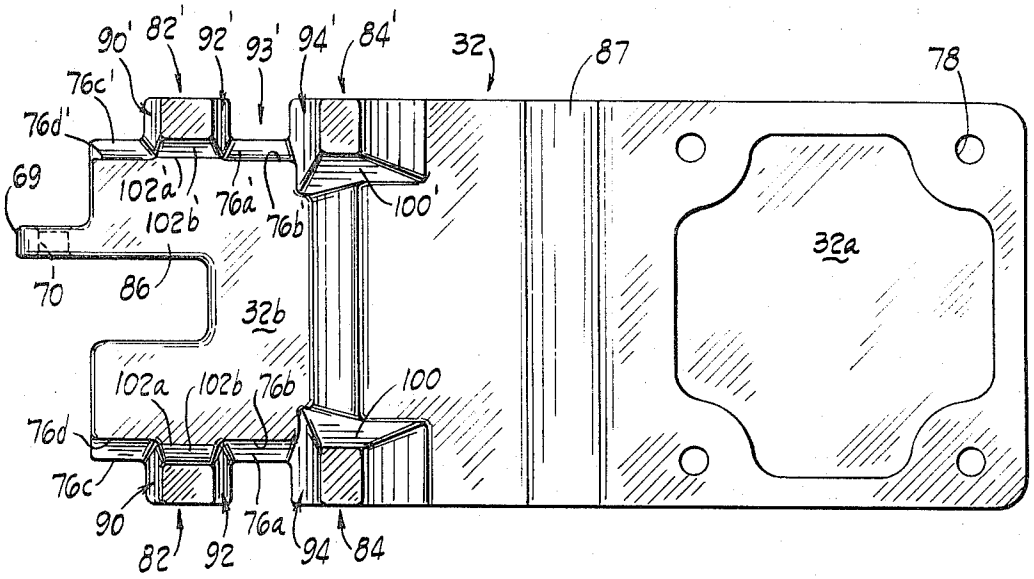

90'
82'
92'
93'
94'
84'
32
87
78
76c'
76d'
69
102a'
102b
76a'
76b'
100'
32a
70
86
32b
102a
102b
76b
100
76d
76c
90
82
92
76a
94
84

Fig. 11

Fig. 13

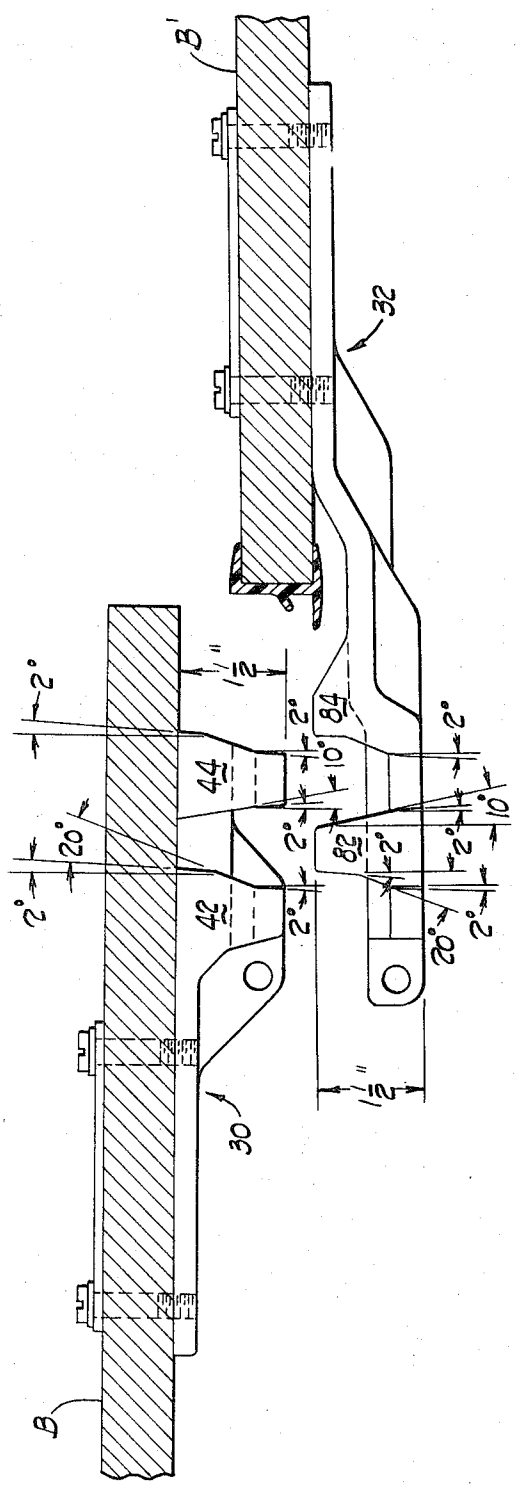
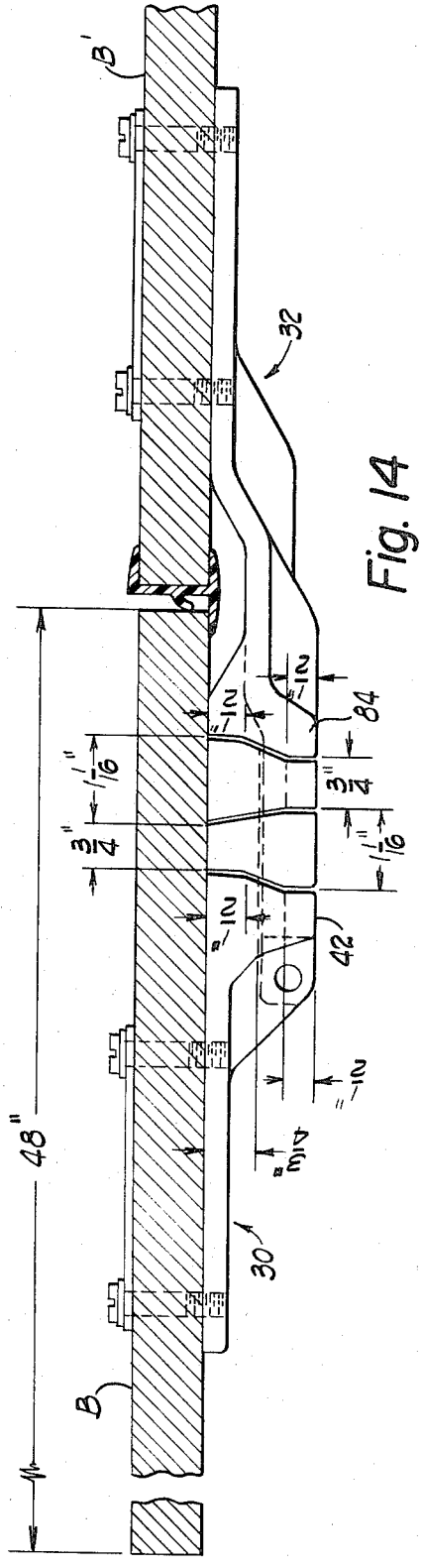

B'
32
2°
1/2"
2°
84
10°
44
20°
2°
82
2°
42
2°
30
B

Fig. 14


B'
32
1/16"
84
3/4"
1/16"
3/4"
1/16"
42
1/16"
48"
30
B

DOOR STABILIZER

BACKGROUND

This invention relates to a device for restraining movement of a hinged member or members, especially closed doors of truck trailers and cargo carriers.

Where pivoted members, such as hinged doors, are required to resist forces or loads that tend to pivot such members or doors from a latched or closed position, substantial forces may be applied to a latch mechanism that often results in distortion or failure of the latch mechanism. For example, typically pivoted doors at the end of a load carrying compartment, such as a truck trailer or cargo container, are held in a closed position by lock rods that extend the height of the doors and carry latching cams cooperable with keepers on the door frame. The rods or shafts are rotatable about their longitudinal axes to engage and disengage the cams with the keepers, and the rods, rod handles and latches act to resist opening of the associated door or doors. Under severe end loads, one or more elements of the latching assembly may distort or fail.

Typically, the latching assembly is also constructed to resist lateral shifting or distortion of the frame relative to the door or doors after latching and the accompanying movement of the doors in the plane of the door frame, a condition referred to as "racking," and such distortion applies further stresses and strains upon the latching mechanism.

Attempts to avoid failure or distortion of the latching mechanisms under end loads or from racking have resulted in a variety of specific latch designs and the use of door reinforcing beams, in some instances extending beyond the doors and engaging projecting pins or the like on the door frame to retard racking.

The present invention comprises a restraining device for a pivoted or hinged closure member or members, designed for use complementary to a latch mechanism, which requires no actuation but rather functions automatically as a result of the juxtaposition of parts to allow the pivotal member to freely pivot under prescribed conditions while preventing pivoting under other conditions. The present invention is especially useful for restraining the pivoting of a closed door relative to a second member, such as a door frame or second door, when the door is under stress, and for interlocking pivoted double doors having mutually adjacent edges when closed. For example, the present invention is advantageously used on double doors of truck trailers and cargo containers and complements the usual door latches in preventing door opening in response to excessive internally applied end loads due, for example, to a load shift and further inhibits frame racking from externally applied forces. The preferred construction also resists inward door movement from inwardly directed, externally applied, forces.

Basically, in its preferred embodiment, the invention is comprised of two relatively movable, interengageable parts, one adapted to be carried at the distal end of a hinged member and the other on a second member relative to which the first member is pivoted. In a typical use with double center-opening doors pivoted on opposite sides of a door frame, such as the end frame of a truck trailer or cargo container, concurrent opening of both doors from an applied force is prevented by a binding interaction between the engaged parts. The engaged parts further cooperate to produce a rigidifying effect between the two doors that inhibits relative movement between the two doors and between both doors and the frame in the plane of the doors (so-called "racking").

One important advantage of the present invention is that the cooperable parts or members include no moving or removable elements. As a result, a device embodying the invention is economical to fabricate, requires no assembly other than mounting, is rugged in construction and reliable in operation, and cannot be rendered useless through the loss of associated elements. Because of its construction and the manner in which the parts cooperate, a device embodying the present invention is ready to function automatically upon the closing of the doors and therefore is not subject to ineffectiveness because of human error.

Cooperable portions of the parts or members are constructed to interengage notwithstanding a lack of precise alignment therebetween at the time the doors are closed, and to guide the doors into accurate alignment. Also, one part extends beyond the distal edge of the associated door to overlie a portion of the other part, thus requiring a proper sequence of door closing. Where a gasket for sealing the central gap between double doors is carried by one door, which must be closed last, this enforced order of closing prevents damage to the gasket that otherwise occurs when the doors are closed in improper sequence.

The individual parts can be attached to doors in a manner that prevents external removal and the parts therefore are ideal for receiving the Federal seal used with truck loads, to show that the doors have been unopened.

To achieve the desired interaction between the parts, to resist concurrent pivotal movement of double doors, at least two integral surface portions extending in the thickness direction of the doors are provided on each part for interengagement with those of the other part. The surfaces are spaced across the doors and are oriented so that at least a component of each surface is resolvable into a plane parallel to the door edge that is opposed to the adjacent door, and preferably portions of the surfaces extend substantially perpendicular to the plane of the associated door and portions are inclined thereto in a direction that varies the distance of the surface portions from the respective pivot axis. The surface portions substantially perpendicular to the plane of each door are adjacent the forward and rear surfaces of the parts, which are secured at their rear surfaces to the faces of the doors, and can exert forces against each other without tending to cause relative sliding and separation of the parts. The inclined portions provide a wide opening and narrow end of a recess and projection bounded by the surface portions so that the parts are guided into alignment when they interengage and clearance is provided during disengagement through pivotal movement of one door relative to the other.

With the arrangement described, no restraint on pivotal movement is imposed by the parts when the second door closed is pivoted open without movement of the other. However, when the second door is pivoted concurrently and, hence, the second part of the restraining device is moved along with the first, the movement tends to separate the parts laterally in the plane of the doors, i.e., in directions toward the respective pivot axes while the parts are still interengaged. As a result,

the adjacent cooperable surfaces bind, especially the surface portions that are substantially perpendicular to the plane of the doors, and prevent pivoting movement. In this manner, the elements immediately limit the load that can be applied to the latch mechanisms of the door assembly and restrain a load in the event the latch mechanisms fail.

Duplicate interengageable surfaces of each part as above described are advantageously provided in regions spaced in a direction parallel to the pivot axes of the doors on which the parts are secured. In addition to doubling the strength of the device, this duplication acts as a couple to inhibit cocking of the doors, in the common plane of the doors, due to racking of the door frame that often results from forces generated by uneven support, especially in truck bodies or cargo containers, where a lack of cross bracing at the door opening permits distortion of the door frame and load compartment. Additional surface portions are advantageously formed on the parts to aid in preventing relative movement in the plane of the doors. These additional surfaces are provided in planes transverse to the door plane and to the pivot axes of the doors. For example, in the typical orientation of a truck trailer door, where the hinged axes are vertical, such additional surfaces would provide a surface component in the generally horizontal direction to resist any tendency of one door to shift vertically relative to the other as when the door frame is distorted from a rectangular shape to a rhomboidal shape from external stresses.

Most advantageously, the cooperable surfaces that resist pivoting of the doors are partially on projections extending from the parts transversely of the door planes, that overlap with projections of the other part in a direction transversely of the pivot axes, and with the base structure in a direction parallel to the pivot axes, thereby providing a firm interrelationship in mutually transverse directions, while permitting relative pivotal movement of one door in a predetermined path.

The above and other features and advantages of this invention will be better understood from the detailed description of the preferred embodiment described with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial perspective view of embodying the back end of a truck trailer showing a preferred embodiment of the present invention;

FIG. 2 is an enlarged perspective view of a portion of FIG. 1;

FIGS. 3 and 4 are plan views of the door restraining device shown in FIG. 2, with portions of the two doors of the truck trailer shown in section and with the parts of the restraining device separated in FIG. 3 and indicating in a dot-dash line the path of pivoted movement of the right-hand door of the truck trailer as viewed in FIGS. 1–4 in dot-dash line;

FIG. 5 is a fragmentary view appreciably on the line 5—5 of FIG. 4;

FIG. 6 is an end elevational view of one part of the restraining device as viewed from the plane of line 6—6 in FIG. 3;

FIG. 7 is a fragmentary view approximately on the line 7—7 of FIG. 4;

FIG. 8 is a fragmentary view approximately on the line 8—8 in FIG. 3;

FIG. 9 is a fragmentary view taken approximately on the line 9—9 of FIG. 3;

FIG. 10 is a front elevational view of one part of the restraining device as viewed from the plane 10—10 of FIG. 3;

FIG. 11 is an elevational view of one part of the restraining device as viewed from the plane 11—11 of FIG. 3;

FIG. 12 is a fragmentary sectional view illustrating the path of pivotal movement of the right-hand door as viewed in FIG. 1 and the relative location of the door hinge and door restraining device; and

FIGS. 13 and 14 are views similar to FIGS. 3 and 4 indicating by way of example certain suitable dimensions of a typical door restraining device similar to that shown in the drawings.

DESCRIPTION OF PREFERRED EMBODIMENT

The present invention, as embodied in a truck trailer, is illustrated in FIG. 1. As shown, two restraining devices A and A′ are secured to pivoted rear doors B and B′ of a truck trailer C at inner adjacent vertical edges. The doors are secured to a door frame D of the trailer by hinges E along the outer vertical edges. Door control mechanisms F and F′ in part secured to a respective door B, B′ and in part secured to the door frame D serve to latch the doors in closed position and in part constrain the doors and frame against racking. The restraining devices A and A′ complement the door control mechanisms by constraining the doors against opening as soon as forces become large enough to strain, i.e., distort, the doors or door control mechanisms so the doors start to move from the normally closed position. While two restraining devices are shown, each functions independently and the number used is a matter of choice.

The door, door frame, and hinge construction are conventional to truck trailers as well as cargo carriers of the type adapted to be carried on a truck trailer bed, railroad flatcar or in a ship. The door hinges E establish vertical pivot axes spaced outwardly from the frame D and plane of the doors, the outside of the doors typically being flush with the door frame. A gasket-like seal 10 extends about the door edges, with the seal for the central juncture between the doors being carried by the right-hand door B′.

The door control or latching mechanisms F and F′ are disclosed in more detail in the copending application of John V. Pastva, Jr., Ser. No. 19,867, filed Mar. 16, 1970 and entitled "Door Control Mecbanism."

For present purposes it will suffice to describe that each mechanism includes a pivotable shaft or lock rod 12 that extends vertically along the outside surface of the door from below a lower edge to above an upper edge of the door; upper and lower bearing members 13, 14 and intermediate bearing brackets 16, 18 that secure the lock rod 10 to the door for pivotable movement about the longitudinal axis of the rod; a handle 20 secured to and extending laterally from the rod; a handle retainer 22 for securing the handle in a fixed position relative to the respective door; upper and lower latching cams or cam members 24, 25 on opposite ends of the shaft or rod 12, located beyond the upper and lower edges of the door; and upper and lower keepers 26, 27 which are secured to the door frame D and cooperate respectively with the upper and lower latching cams to retain the doors B, B′ in a closed condition and

to align and maintain alignment of the door with the frame D. The lock rod 12 can be pivoted by the handle 20 to pivot the latching cams 24, 25 into and out of engagement with the keepers 26, 27.

Restraining device A, best shown in FIGS. 2 to 11, is comprised of two parts or members 30, 32 each carried by a different door B, B' and interengageable when the doors are closed. A cooperable interrelationship between the two parts allows the doors to freely close and open in a prescribed sequence and pivotal path, but otherwise prevents their opening. The part 30 is secured to the outside surface of the door B close to but behind the distal edge 33. The part 32 is secured to the outside surface of the door B' so that it extends beyond the distal edge 33' and overlies and engages the part 30 when the doors are closed and in a common plane.

The part 30 has a flat base surface 34 that extends beneath both an attachment portion 30*a* and a portion 30*b* interengageable with the other part, the base being adapted to lie against the outside surface of the supporting door. Four apertures 35 are provided in the attachment portion 30*a* for securing the element to the door. As shown, the element is oriented so that longitudinal side edges 36, 36' extend perpendicularly to the pivot axis of the door B.

Projections 42, 44 and 42', 44' along edges 36, 36', respectively, of the portion 30*b* extend outward from a generally flat central outer surface 46. The construction is symmetrical about a longitudinal centerline and like elements of the part on each side are identified with the same reference numeral plus a prime designation so that duplicate or mirror-image portions need not be described in detail.

A surface 50 of the projection 42 and a surface 52 of the projection 44 are spaced along the edge 36 (see FIG. 3) and face each other across a recess 53 formed by a portion 36*a* of the side edge perpendicular to the base. The surface 50 is comprised of angularly related portions 50*a*, *b*, *c*, and surface 52 is comprised of angularly related portions 52*a*, *b*, all transverse to the thickness of the door B and to a line perpendicular to the pivot axis of the door. Portions 50*a*, *b*, and 52*a* are approximately parallel and substantially perpendicular to the plane of the base 34 and the door B. Preferably a very slight angle of about 2° is provided from the perpendicular so that the surfaces 50 and 52 converge toward the base surface 34, permitting the surfaces to interengage with little or no clearance. Surface portions 50*c* and 52*b* are substantially inclined relative to the base 34, converging toward the base of the element 30. A second surface 54 forms a side of the projection 44 opposite from the side 52 and is essentially identical to the surface 50, having surface portions 54*a*, 54*b* generally perpendicular to the plane of the base 34 and a portion 54*c* inclined relative to the base, diverging toward the base with respect to the surface portion 52*b*.

Outer side surfaces 56, 58 of the projections 42, 44, respectively, are perpendicular to the base. Respective inner surfaces 60, 62 (see FIGS. 8 and 9) each have a flat portion 60*a*, 62*a* adjacent the flat surface 46 of the body of the element, perpendicular to the base 34 and an outer portion 60*b*, 62*b* inclined toward the outside surfaces 56, 58.

The apertures 35 of the attachment portion 30*a* of the part 30 are threaded to receive screws 65 that extend through the door B from the inside. A bolster plate 66 is located on the inside surface of the door, opposite the attachment portion 30*a* to prevent distortion of the door panel from the screws. Other means of attachment may be used, but this arrangement inhibits external removal of the element, making the two parts suitable for receiving a Federal seal. For that purpose an ear 67 projects from the part with an aperture 68, that cooperates with a finger 69 and aperture 70 of the part 32. When both doors B, B' are closed the apertures 68, 70 are aligned and can receive a seal.

The part 32 has a flat base surface 74 that extends beneath an attachment portion 32*a* from which a portion 32*b* is outwardly offset and cantilevered beyond the distal edge 33' of the door B' to engage the part 30. The base 74 is adapted to lie against the outside surface of the supporting door B' and the part is intended to be oriented with longitudinal side edges 76, 76' extending parallel to the side edges 36, 36' of part 30 and perpendicular to the pivot axis of the door B'. Four apertures 78 are provided in the attachment portion 32*a* for securing the part of the door.

Projections 82, 84 and projections 82', 84' along opposite edges 76, 76', respectively, of the portion 32*b*, extend inward, i.e., in a direction toward the door B' from a generally flat central body portion 86 of portion 32*b*, offset away from the plane of the portion 32*a* and the outer door surface by an inclined intermediate section 87. The construction of the part is symmetrical about a longitudinal centerline, except for the finger 69, and like parts of the projections on each side are identified with the same reference numeral plus a prime designation so that duplicate or mirror-image elements or portions need not be described in detail.

Spaced surfaces 90, 92 are formed on opposite longitudinally spaced sides of the projection 82 (see FIG. 3). The surface 90 is comprised of angularly related portions 90*a*, *b*, *c*, and the surface 92 is comprised of angularly related portions 92*a*, *b*, all transverse to the thickness of the door B' and to a line perpendicular to the pivot axis of the door. Portions 90*a*, *b*, and 92*a* are approximately parallel and substantially perpendicular to the plane of the base 74 and the door B'. Preferably a very slight angle of about 2° is provided from the perpendicular so that the surfaces 90*a*, 90*b* on one side and 92*a* on the other side converge slightly in a direction away from the body portion 86 and can lie directly against the surfaces 50*a*, *b*, and 52*a*. Surface portions 90*c* and 92*b* are inclined relative to the base, converging in the direction toward the door plane.

A surface 94 forms a side of the projection 84 that faces the surface 92 across a recess 93 formed by a portion of the side edge. The surface 94 is comprised of angularly related portions 94*a*, *b*, *c*, transverse to the thickness of the door B' and to a line perpendicular to the pivot axis of the door. The portions 94*a*, *b*, are generally parallel to portions 90*a*, *b* and 92*a*. Portion 94*c* is inclined relative to the plane of the door and is parallel to the surface 90*c* and diverges with respect to the opposed surface 92*b* in the direction toward the plane of the door.

Outer surfaces 96, 98 of the projections 82, 84, respectively, are perpendicular to the base surface 74. The inner surface 100 of the projection 84 is inclined but does not cooperate with the element 30. The inner surface 102 of the projection 82 has a flat portion 102*a* adjacent the flat central body portion 86 perpendicular to the plane of the base surface 74 and an outer inclined portion 102*b* that converges toward the outer

surface 96 in a direction toward the plane of the door B'.

Longitudinal side edge 76 of the body portion 86 includes two angularly related, longitudinal surface portions 76*a*, 76*b* in the recess 93, and two angularly related longitudinal surface portions 76*c*, 76*d* extending forwardly from the projection 82. The portions 76*a*, 76*c* are adjacent the outer surface of the body portion 86 and converge in a direction toward the door B'. The portions 76*b*, 76*d* are adjacent the inner surface of the body portion 86 and are perpendicular to the plane of the base surface 74.

The apertures 78 of the attachment portion 32*a* of the part 32 are threaded to receive screws 105 that extend through the door B' from the inside. A bolster plate 106 is located on the inside of the door for the same purpose as the plate 66.

As clearly illustrated in the drawings, the parts 30, 32 are constructed to closely interengage when the doors B, B' are in a common plane. In general, the body portion 86 of the part 32 fits between the projections 42, 42' and 44, 44' of the part 30, with the projections 82, 82' of part 32 being received in the recesses 53, 53'. The surfaces of each element that are directly adjacent surfaces of the other and extend generally perpendicular to the plane of the doors and transversely of a line perpendicular to the pivot axes, inhibit opening when the doors are pivoted concurrently. The adjacent surfaces that extend generally perpendicular to the plane of the doors and to the pivot axes inhibit racking, i.e., movement of the doors relative to each other and to the door frame in the plane of the doors. This is explained more specifically below.

When the parts 30, 32 are interengaged, and considering one side of the parts along the edges 36 and 76, the surface 50 of projection 42 and the surface 52 of projection 44 are directly adjacent the surfaces 90 and 92, respectively, of the projection 82 and the surface 54 of projection 44 is directly adjacent the surface 94 of the projection 84. As most apparent from FIGS. 3, 4 and 12, when both doors begin to pivot outward from a closed position the parts 30, 32 begin to cock relative to one another as they try to become angularly related to the original common plane of the doors. They also try to separate laterally, i.e., each moves in an arcuate path that has a directional component in the common plane that extends toward the respective pivot axis. This lateral separation does not occur immediately, becaUse the pivot axis is outward of the common plane, but does occur after only the slightest pivoting.

In response to the cocking or slight angular relationship established between the parts 30, 32, the opposed surface portions 50*b*, 90*b*; 54*b*, 94*b*; and 52*a*, 92*a* jam against each other and prevent further pivoting. The resistance to pivoting is particularly effective because of the substantially perpendicular orientation of the opposed surfaces, which avoids resolving the opposing forces into any components that might act to separate the parts, and because of the location of surface 52*a* spaced outwardly of the door as far as possible from the surfaces 50*b*, 54*b*. Thus surfaces 52*a* and 92*a* therefore act effectively as a couple with surfaces 50*b*, 90*b* and 54*b*, 94*b* to resist the cocking movement or relative pivoting between the parts.

In response to the lateral separation between the parts 30, 32, the surfaces 52 and 92 abut in a transverse direction to the direction of separation and thereby prevent further pivoting. The surface portions 52*a* and 92*a* are especially effective because they extend essentially at right angles to the direction of separation.

The surfaces along both longitudinal edges of the parts cooperate in the same manner. It will also be apparent that the surfaces will cooperate to prevent inward pivoting of the doors. In that respect, portions 50*a*, 90*a*, 52*b*, 92*b* and 54*a*, 94*a* are especially effective to resist the relative cocking due to inward pivoting, and the surfaces 52 and 92 resist the lateral separation that would occur.

The inclined diverging and converging surfaces, 50*c*, 52*b*, 54*c*, 90*c*, 92*b* and 94*c* of the projections essentially limit the length of the substantially perpendicular surface portions 50*a*, 50*b*, 52*a*, 54*a*, 54*b*, 90*a*, 90*b*, 92*a*, 94*a* and 94*b* and space those that form a common surface laterally to provide a wide space between projections at the approaching ends for "lead-in" in the event of misalignment and to provide pivoting clearance between the projections of the elements once the door B' has pivoted a slight distance along a prescribed path while the door B remains stationary. Because of the limited length of the substantially perpendicular surface portions, a slight inclination of about 2° that provides a very slight taper to the perpendicular surface portions (as shown in FIG. 13) or alternatively a small clearance therebetween, and the location of the pivot axis of the door B' outward of the plane of the door, there is no binding interference between the parts 30, 32 when only the door B' is pivoted under little force, as when it is opened after release of the latching mechanism. However, due to the close spacing and direct contact or very small clearance between the opposed surfaces of the substantially perpendicular surface portions, which does not substantially increase until significant pivoting has occurred, the parts 30, 32 will resist an opening force even if it is applied only to the door B, if the latch mechanism is fastened so that the force reaches a magnitude sufficient to distort the orientation of the door relative to the other door or to the door frame, which then causes the interengaged surfaces of the parts to bind before significant pivoting occurs. Accordingly, the present invention is useful on single doors as well as double doors, in combination with a latching mechanism, to restrain opening of the door, racking, or separation between the distal edge of the door and the door frame.

Longitudinal surfaces 76*a*, *b* and 76*c*, *d* of part 32 are located directly adjacent the surfaces 62*b*, *a* and 60*b*, a of the projections 44, 42 when the parts are together. Longitudinal surface 36*a* is located directly adjacent surface portion 102*a* and the projection 82. The inclined portion 60*b* of the projection 42, and 62*b* of the projection 44 serve to lead the interengaging portion 32*b* of the part 32 into the space between the projections and to aid in aligning the doors B, B'. The inclined portion 102*b* on projection 82 also guides the parts into alignment. The cooperable surface portions 76*b*, 62*a*; 76*b*', 62*a*'; 76*d*, 60*a*; 76*d*', 60*a*' extend perpendicular to the plane of the base surfaces of the parts, are spaced in a direction parallel to the pivot axes of the doors, and serve to effectively resist movement of parts and doors in directions having components parallel to the pivot axes in the plane of the doors (due to so-called racking) and without resolving any forces into components that tend to separate the surfaces through relative pivoting of the doors. It will be appreciated that the surfaces 50,

90; **92, 52**; **54** and **94** on the projections and the corresponding surfaces along the opposite longitudinal edge will also resist any tendency of the doors to separate in the plane of the doors or to move about pivot axes perpendicular to the plane of the doors due, for example, to door frame distortion or racking. The use of two or more devices, i.e., pairs of parts **30, 32,** spaCed along the height of the doors also enhances the resistance to racking by virtue of the spaced locations as well as by merely the increase in active surfaces.

By way of example, dimensions and angles of certain portions and surfaces of the parts that have been found suitable in constructing a device from a steel forging shaped as described above, for use with double truck trailer doors that are each approximately 4 feet wide by 8 feet high, are shown in FIGS. **13** and **14.** It should be appreciated that notwithstanding the many cooperable surfaces utilized in the preferred embodiment for strength and reliability, the basic action in preventing opening of the doors under internally applied loads is obtained through cooperation between at least two pairs of surface portions on each part, such as portion **50***b*, **90***b* and **52***a*, **92***a*, spaced laterally across the doors and extending transversely of the door planes.

While the manner in which the parts cooperate has been explained in detail along with the description of the parts, the operation is summarized as follows: Door B must be closed prior to door B′ because part **32** extends beyond the distal edge of door B′. In closing, the wide opening between projections **42** and **44** leads the narrower end of the projection **82** into seated engagement with the transverse surfaces **50, 52.** At the same time, the opening between projections **82** and **84** does the same for the projection **44** with respect to the surfaces **92, 94.** Concurrently, the inclined portions **60***b*, **62***b* of the projections **42, 44** and **102***b* of the projection **82** guide the parts into proper vertical alignment for interengagement. Once interengaged, the parts resist relative pivoting of both doors about the hinge axes and inhibit relative movement in the plane of the doors. They also prevent lateral separation of a door and door frame and racking if used on a single door and, in conjunction with a latching mechanism, will stop a single door from pivoting open under load if the door or door hinges distort before the latch mechanism fails. The doors can be purposefully opened when not under load by merely pivoting the door B′ while maintaining the door B in the plane of the closed doors.

While a preferred form of the invention has been described in considerable detail, it will be apparent that the invention is not limited to the construction shown or the uses referred to and it is my intention to cover all adaptations, modifications, and changes which come within the practice of those skilled in the art to which the invention relates and the scope of the appended claims. For example the specific shape of cooperating surface portions on the projections of the parts can be varied while maintaining the general relationship required, as by providing a continuous but slight incline to the opposed transverse surfaces rather than providing portions that are substantially perpendicular to the plane of the doors; or the projections can be received in apertures in the face of cooperating parts rather than in recesses in an edge.

What is claimed is:

1. A movement restraining device comprising: first and second cooperable parts, the first part being securable to and adjacent the distal edge of a first member that is hinged about a pivot axis and the second part being securable to a second member relative to which said first member is pivotable, the parts being interengageable, each said part having at least two integral surface portions that, when the parts are secured to said members and interengaged, (a) are spaced differently from said pivot axis, (b) are closely adjacent, opposed to, and cooperable with said surface portions of the other part, and (c) are transversely of and spaced differently with respect to a line that lies along said first member and that is perpendicular to said pivot axis, said interengaged surface portions of the parts being readily separable when the second part is stationary relative to said pivot axis and the first part is moved in a predetermined path about said pivot axis and being otherwise inseparable through mutual interference between said cooperable surface portions.

2. A movement restraining device comprising first and second cooperable parts, the first part being securable to and adjacent the distal edge of a first member that is hinged about a pivot axis and the second part being securable to a second member relative to which said first member is pivotable, the parts being interengageable, each said part having at least two integral surface portions that, when the parts are secured to said members and interengaged, (a) are spaced differently from said pivot axis, (b) are closely adjacent, opposed to, and cooperable with said surface portions of the other part, and (c) are on one part at opposite sides of a projection and on the other part at opposite sides of a recess into which the projection is received, and (d) are transversely of and spaced differently with respect to a line that lies along said first member and that is perpendicular to said pivot axis, said interengaged surface portions of the parts being readily separable when the second part is stationary relative to said pivot axis and the first part is moved in a predetermined path about said pivot axis and being otherwise inseparable through mutual interference between said cooperable surface portions.

3. A movement restraining device comprising first and second cooperable parts, the first part being securable to and adjacent the distal edge of a first closure member that is hinged about a pivot axis and the second part being securable to a second member relative to which said first member is pivotable, the parts being interengageable, each said part having at least two integral surface portions (a) that are spaced apart so that, when the parts are secured to said members, one of said surface portions of each part is farther from said pivot axis than the other, (b) that are closely adjacent, opposed to, and cooperable with said two integral surface portions of the other part when the parts are interengaged and (c) that are in part substantially perpendicular to the closure member and in part inclined thereto, said surface portions on one part forming opposite sides of a projection in which the inclined surface portions narrow the projection at its extending end and on the other part forming opposite sides of a recess into which the projection is received and in which the inclined surface portions cause the recess to be wider at its opening, said integral surface portions extending, when the parts are secured to members, in all respects transversely of a line that lies along said first member and that is perpendicular to the axis of pivotal movement, said interengaged surface portions on the parts

being readily separable when the second part is stationary relative to said pivot axis and the first part is moved in a predetermined path about said pivot axis, and being inseparable through mutual interference between said cooperable surface portions when the two parts are moved concurrently about separate pivot axes or when forces act to cock one part relative to the other.

4. A movement restraining device comprising first and second cooperable parts, each with a back face and a front face, the first part being securable against its back face to and adjacent the distal edge of a first closure member that is hinged about a pivot axis and the second part being securable against its back face to a second member relative to which said first member is pivotable, the parts being interengageable, with portions of the first part overlying portions of the second part, both parts having at least two integral surface portions (a) that are in part formed on projections that extend from opposed face portions, (b) that are spaced apart so that when the parts are secured to said members one said surface portion of each part is farther from said pivot axis than the other, and (c) that are closely adjacent, opposed to, and cooperable with said surface portions of the other part to form opposed pairs of surfaces when the parts are interengaged, said surface portions extending in all respects transversely of a line that lies along said first member and that is perpendicular to the axis of pivotal movement, at least one segment of each pair of opposed surfaces that is adjacent one face of said parts being substantially perpendicular to said line and another segment being significantly inclined thereto, said substantially perpendicular segment of one pair being located adjacent an opposite face from that to which the other pair is adjacent, and said inclined segment of each pair converging toward the other in a direction that increases the clearance between said pairs of surfaces when one part moves away from the other about said pivot axis, whereby said surface portions on the parts are readily separable when the second part is stationary relative to said pivot axis and the first part is moved in a predetermined path about said pivot axis, and are not separable due to mutual interference between said cooperable surface portions when the two parts are moved concurrently about separate pivot axes or when forces act to cock one part relative to the other.

5. A movement restraining device comprising first and second cooperable parts, each with a back face and a front face, the first part being securable against its back face to and adjacent the distal edge of a first closure member that is hinged about a pivot axis and the second part being securable against its back face to a second member relative to which said first member is pivotable, the parts being interengageable, with portions of the first part overlying portions of the second part, both parts having at least two integral surface portions (a) that are in part formed on projections that extend from opposed face portions, (b) that are spaced apart so that when the parts are secured to said members one said surface portion of each part is farther from said pivot axis than the other, and (c) that are closely adjacent, opposed to, and cooperable with said surface portions of the other part to form opposed pairs of surfaces when the parts are interengaged, said surface portions extending in all respects transversely of a line that lies along said first member and that is perpendicular to the axis of pivotal movement, at least one segment of each pair of opposed surfaces that is adjacent one face of said parts being substantially perpendicular to said line and another segment being significantly inclined thereto, said substantially perpendicular segment of one pair being located adjacent an opposite face from that to which the other pair is adjacent, and said inclined segment of each pair converging toward the other in a direction that increases the clearance between said pairs of surfaces when one part moves away from the other about said pivot axis, whereby said surface portions on the parts are readily separable when the second part is stationary relative to said pivot axis and the first part is moved in a predetermined path about said pivot axis, and are not separable due to mutual interference between said cooperable surface portions when the two parts are moved concurrently about separate pivot axes or when forces act to cock one part relative to the other, and additional surface portions on said projections of each part, transverse to said first-mentioned surface portions, which cooperate with the other part to restrain relative movement of the parts in the plane of said faces and which are in part perpendicular to the respective front face adjacent the juncture therewith and in part inclined adjacent the projecting end to reduce the cross-sectional area and provide a tapered lead-in surface.

6. A movement restraining device comprising first and second cooperable parts, each with a back face and a front face, the first part being securable against its back face to and adjacent the distal edge of a first closure member that is hinged about a pivot axis and the second part being securable against its back face to a second member relative to which said first member is pivotable, the parts being interengageable, with portions of the first part overlying portions of the second part, both parts having two regions of interengagement with the other that are spaced in a direction parallel to said pivot axis when the parts are secured to said members, each said region having at least two integral surface portions (a) that are in part formed on projections that extend from opposed face portions, (b) that are spaced apart so that when the parts are secured to said members one said surface portion of each part is farther from said pivot axis than the other, and (c) that are closely adjacent, opposed to, and cooperable with said surface portions of the other part to form opposed pairs of surfaces when the parts are interengaged, said surface portions extending in all respects transversely of a line that lies along said first member and that is perpendicular to the axis of pivotal movement, at least one segment of each pair of opposed surfaces that is adjacent one face of said parts being substantially perpendicular to said line and another segment being significantly inclined thereto, said substantially perpendicular segment of one pair being located adjacent an opposite face from that to which the other pair is adjacent, and said inclined segment of each pair converging toward the other in a direction that increases the clearance between said pairs of surfaces when one part moves away from the other about said pivot axis, whereby said surface portions on the parts are readily separable when the second part is stationary relative to said pivot axis and the first part is moved in a predetermined path about said pivot axis, and are not separable due to mutual interference between said cooperable surface portions when the two parts are moved concurrently about separate pivot axes or when forces act to cock one part

relative to the other, and additional surface portions on said projections of each part, transverse to said first-mentioned surface portions, which cooperate with the other part to restrain relative movement of the parts in the plane of said faces and which are in part perpendicular to the respective front face adjacent the juncture therewith and in part inclined adjacent the projecting end to reduce the cross-sectional area and provide a tapered lead-in surface.

7. A movement restraining device comprising first and second cooperable parts, the first part being securable to and adjacent the distal edge of a first member that is hinged about a pivot axis and the second part being securable to a second member relative to which said first member is pivotable, the parts being interengageable, each said part having two regions of interengagement with the other that are spaced in a direction parallel to said pivot axis when the parts are secured to said members, each said region having at least two integral surface portions (a) that are spaced apart in a direction so that one said surface portion of each region is farther from said pivot axis than the other, and (b) that are closely adjacent, opposed to, and cooperable with those surface portions of the other part when the elements are interengaged, said surface portions extending in all respects transversely of a line that lies along said first member and that is perpendicular to the axis of pivotal movement said interengaged surface portions on the parts being readily separable when the second part is stationary relative to said pivot axis and the first part is moved in a predetermined path about said pivot axis, and being inseparable through mutual interference between said cooperable surface portions when the two parts are moved concurrently about separate pivot axes or when forces act to cock one part relative to the other.

8. A movement restraining device comprising first and second cooperable parts, each with a back face and a front face, the first part being securable against its back face to and adjacent the distal edge of a first closure member that is hinged about a pivot axis and the second part being securable against its back face to a second closure member relative to which said first member is pivotable, the parts being interengageable, each said part having two regions of interengagement with the other that are spaced in a direction parallel to said pivot axis when the parts are secured to said members, each said region having at least two integral surface portions that (a) are spaced apart in a direction so that one said surface portion of each region is farther from said pivot axis than the other, and (b) that are closely adjacent and cooperable with those surface portions of the other part to form opposed pairs of surfaces when the parts are interengaged, said surface portions extending in all respects transversely of a line that lies along said members and is perpendicular to the axes of pivotal movement and one segment of each pair of opposed surfaces that is adjacent one face of said parts being substantially perpendicular to said line and another segment being significantly inclined thereto, said substantially perpendicular segment of one pair being located adjacent an opposite face from that to which the other pair is adjacent, and said inclined segment of each pair converging toward the other in a direction that increases the clearance between said pairs of surfaces when one part moves away from the other about its respective pivot axis, whereby said surface portions on the parts are readily separable when the second part is stationary relative to its pivot axis and the first part is moved in a predetermined path about its pivot axis, and are not separable due to mutual interference between said cooperable surface portions when the two parts are moved concurrently about separate pivot axes or when forces act to cock one part relative to the other.

9. In a restraining device for a pivoted closure member: a first member having parallel oppositely facing surfaces and being adapted to be fixedly connected to and adjacent the distal edge of a closure member hinged for movement in a predetermined path with said surfaces offset with respect to one another and from and parallel with the pivotal axis of the closure member and said surfaces being at one side of and normal to a plane in which said axis lies and offset with respect to one another transversely of said plane; and a second member having parallel oppositely facing surfaces adjacent to said parallel surfaces of said first member with a small clearance therebetween when said second member is fixedly secured to a third member at the distal edge of the closure member with the closure member in closed position; at least two of said parallel surfaces being adapted to engage one another and prevent opening of the closure member when distorted from its predetermined path.

10. In combination, a generally planar closure member supported for pivotable movement about an axis, a second member relative to which said closure member pivots and directly adjacent to which a distal end of said closure member is located in one pivoted position, and first and second cooperable parts, the first rigidly secured to said closure member adjacent the distal end thereof and the second to said second member at a position directly adjacent to the first member when the closure member is in said one pivoted position, each part having two fixed surface portions (a) that are transverse to the plane of the closure member and to a line perpendicular to said pivot axis, (b) that are spaced from each other in a direction transversely of said pivot axis so one is farther from the pivot axis than the other, and (c) that are located to be directly adjacent and opposed to said two surface portions of the other part and to cooperate therewith when the closure member is in said one position, said fixed surface portions being readily separable when the second member is stationary relative to said pivot axis and the closure member is moved in a predetermined path about said pivot axis, and being inseparable due to mutual interference between said cooperable surface portions when the two members are moved concurrently about separate pivot axes or when forces act to distort one or both of said members and cock one part relative to the other.

11. In combination, first and second doors supported for pivotable movement about parallel axes and arranged so their distal ends are directly adjacent when the doors lie in a common plane, and first and second cooperable members, the first secured to said first door adjacent and extending beyond the distal end thereof and the second secured to said second door adjacent the distal end and at a position directly opposite the first member when the doors are in a common plane, whereby the first member overlies the second, each member having two fixed surface portions, transverse to the plane of the respective door and to a line perpen-

dicular to said door pivot axis, said surface portions of each member being in a direction transversely of the pivot axis of the respective door so one surface is farther from the pivot axis than the other, the two surface portions of each member being located to be directly adjacent and opposed to the two surface portions of the other member and to cooperate therewith when the doors are in a common plane, said fixed surface portions being readily separable when the two doors are initially in a common plane, the second door is maintained stationary relative to the first, and the first door is moved in a predetermined path about its pivot axis, and being inseparable due to mutual interference between said cooperable surface portions when the two doors are concurrently moved from their common plane about their pivot axes or when forces act to distort one or both doors and cock one member relative to the other.

12. In combination, first and second doors supported for pivotable movement about parallel axes and arranged so their distal ends are directly adjacent when the doors lie in a common plane, and first and second cooperable members, the first secured to said first door adjacent and extending beyond the distal end thereof and the second secured to said second door adjacent the distal end and at a position directly opposite the first member when the doors are in a common plane, whereby the first member overlies the second, each member having two fixed surface portions, transverse to the plane of the respective door and to a line perpendicular to said door pivot axis, said surface portions of each member being in a direction transversely of the pivot axis of the respective door so one surface is farther from the pivot axis than the other, the two surface portions of each member being located to be directly adjacent and opposed to the two surface portions of the other member and to cooperate therewith when the doors are in a common plane, said fixed surface portions on each member extending in part substantially perpendicularly to the plane of the associated door and in part converging in a direction that will increase the clearance between said surfaces of one member relative to those of the other when the members are separated through pivoting of the first door relative to the second, said surface portions being readily separable when the two doors are initially in a common plane, the second door is maintained stationary relative to the first, and the first door is moved in a predetermined path about its pivot axis, and being inseparable due to mutual interference between said cooperable surface portions when the two doors are concurrently moved from their common plane about their pivot axes or when forces act to distort one or both doors and cock one member relative to the other.

13. In combination, a door supported for pivotable movement about an axis between open and closed positions, a member relative to which said door pivots and directly adjacent to which a distal end of said door is located when the door is in a closed position, and first and second cooperable parts, the first secured adjacent the distal end of the door to a surface of the door that faces in the direction in which the door pivots to an open position and the second secured to said member at a position directly adjacent to the first part when the door is in the closed position, the pivot axis being spaced from said surface of the door in the direction in which the door opens a distance approximately as great as that to which said parts extend from the plane of said surface of the door, whereby said parts are essentially between said door surface and a plane parallel thereto through the pivot axis, each part having two fixed surface portions transverse to the plane of the door and to a line perpendicular to said pivot axis, spaced from each other in a direction transversely of said pivot axis, and located to be directly adjacent those surface portions of the other part and cooperable therewith, said fixed surface portions being readily separable when said member is stationary relative to the pivot axis of the door and the door is moved from a closed position in a predetermined path about said axis, and being inseparable due to mutual interference between said cooperable surface portions when the door and member are moved about separate pivot axes or when forces act to distort the door or member and cock one part relative to the other.

* * * * *