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TRAVEL LIMITING DEVICE

Filed May 29, 1943

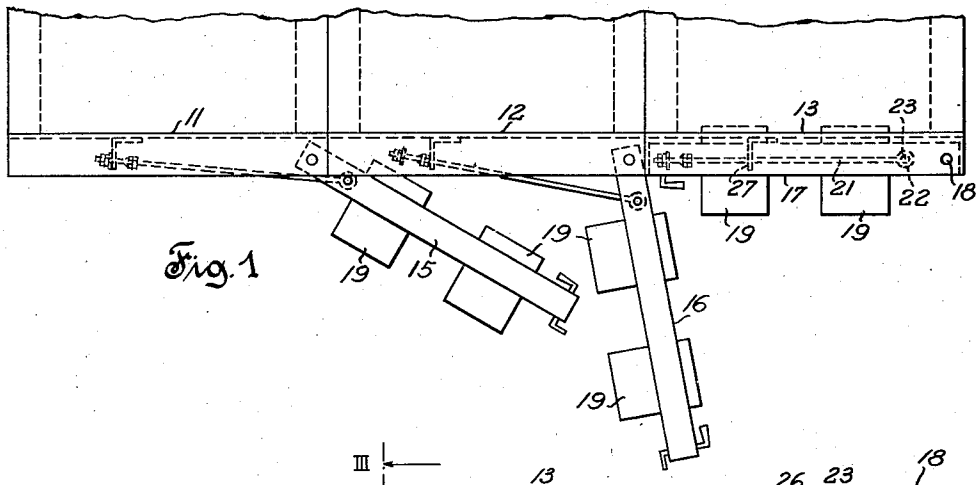


Fig. 1

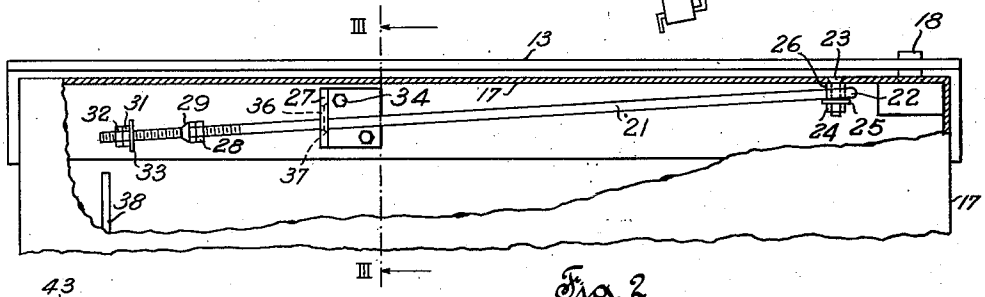


Fig. 2

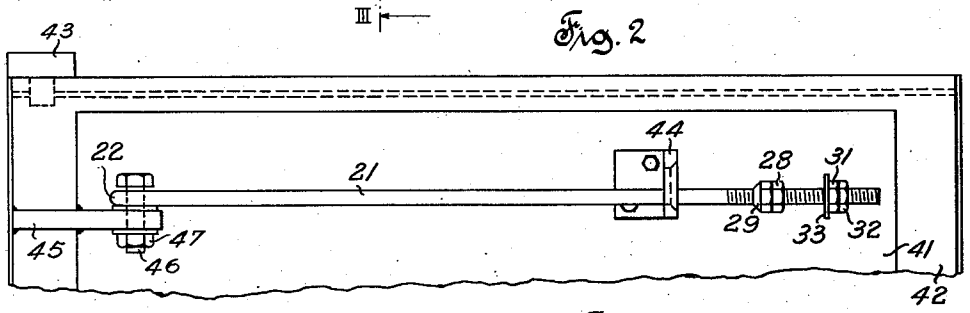


Fig. 4

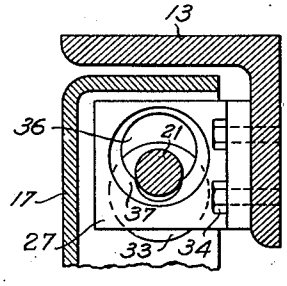


Fig. 3

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TRAVEL LIMITING DEVICE

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10 Claims. (Cl. 16—82)

This invention relates in general to improvements in travel limiting devices and more particularly to a device for stopping the movement of a door at selectable positions while leaving the door free to swing back and forth between certain of such positions.

The invention is especially applicable to structures employing a plurality of vertically mounted and alined panel doors, such as cubicles of metal enclosed switchgear. In such structures it is the usual practice to mount on the doors equipment which must be accessible at all times, such as electric meters and control switches, which may protrude materially from the front of the doors. Opening movement of a door to permit access to the rear thereof for inspection of the equipment fastened on the back of the door or disposed in the cubicle must be so limited in extent as to prevent collision of equipment mounted on the front of the door with that mounted on the front of an adjacent closed door.

The travel limiting means used for that purpose should be so arranged as to require readjustment by the operator when it becomes necessary to open the door to a greater extent for the removal of equipment installed in the rear thereof. The operator is thus reminded that the door may collide with an adjacent door, which should be opened first to a sufficient extent to prevent interference between the two doors. In some instances, as in outdoor installations, it may be desired to utilize the travel limiting device to limit opening movement of the door at only one position and to prevent premature reclosure of the door by the wind.

The desired control of the door movement is preferably effected by providing the door with a travel limiting device comprising a rod pivoted on the door or on the door frame and a stop mounted on the door frame or on the door and through which the rod slides during movement of the door. The rod is provided with the desired number of nuts or equivalent members for engaging the stop when the door is moved into predetermined positions, but the members may also be disengaged from the stop when the door is to be moved through the predetermined positions.

It is therefore an object of the present invention to provide an improved travel limiting device for a door for permitting the door to swing freely back and forth between two predetermined positions and to stop the door at least at one of such positions, the device being capable of adjustment to enable the door to pass through at least one of such positions.

Another object of the present invention is to provide an improved travel limiting device for a door whereby the door may be selectively stopped at or swung through an intermediate position and stopped at an extreme position.

Another object of the present invention is to provide an improved travel limiting device for a door whereby the door may be stopped at a predetermined position when swung in one direction of rotation and is allowed to pass freely through such position when swung in the other direction of rotation without change of adjustment of the device.

Objects and advantages other than those above set forth will be apparent from the following description when read in connection with the accompanying drawing, in which:

Fig. 1 is a plan view of portions of three adjacent alined frame structures and three associated panel doors shown in their closed, normal open or intermediate, and extreme open positions respectively, and utilizing a door stop mechanism constituting an embodiment of the present invention;

Fig. 2 is an enlarged view in elevation of a portion of the door shown in Fig. 1 in closed position, a portion of the door panel being assumed removed to expose the door stop mechanism for selectively stopping the door at one or at another open position;

Fig. 3 is a cross-sectional view taken along line III—III in Fig. 2; and

Fig. 4 is a view in rear elevation of a door for outdoor structure showing the door stop device rearranged to stop the door at one position and to permit its reclosure only upon intervention of the operator.

Referring more particularly to the drawing by characters of reference, Fig. 1 diagrammatically illustrates portions of three alined frame structures 11, 12, 13 constituting metal cubicles for electrical apparatus such as metalclad drawout type switchgear. The frame portions 11, 12, 13 are preferably arranged in abutting position as by being bolted together and are severally provided with closure panel doors 15, 16, 17. The doors are preferably made of sheet metal and are supported on the frame structure by suitably positioned hinge pins as at 18 for swinging movement relatively thereto.

As shown in Fig. 1, there may be mounted on the different door panels control devices such as relays, meters, etc. generally designated at

19. In general at least some of devices 19 will extend an appreciable distance outward from the front face of the doors. The devices mounted on adjacent doors may therefore collide and thereby be injured when one of the doors is opened to an angle which varies with the disposition of the doors and of the devices, but which usually greatly exceeds 90 degrees from the closed position. When a door is opened to provide access to one of the cubicles, it is therefore necessary to limit the opening movement of the door to a predetermined intermediate position, such as the position of door 16 in Fig. 1, which will be referred to herein as normal open position.

At least some of the devices 19 will also extend an appreciable distance from the rear surface of the doors, thereby interfering with the removal of equipment contained within the cubicle when the door is opened only to its normal open position. To effect such removal it is therefore necessary to open the door to another predetermined position, such as the position of door 15 in Fig. 1, which will be referred to herein as extreme open position. The adjacent door 16 must therefore first be opened to a position such as the normal open position thereof as illustrated in Fig. 1. Devices 19 mounted on doors 15 and 16 are thereby saved from damage by collision and the doors may be mounted in such close proximity that door 15 may swing into part of the space normally occupied by door 16 when it was closed.

To prevent the operator from inadvertently opening any door to its extreme open position, each door is provided with a travel limiting device illustrated in greater detail in Figs. 2 and 3. The device comprises a round rod 21 having one end thereof forged into an eyelet 22. Rod 21 is pivotally mounted on door 17 through eyelet 22 and a screw 23 mounted on the top flange of the door at a point remote from the axis of hinge pin 18. Screw 23 is fastened to the door by means of a nut 24, a washer 25, and a bushing 26 encompassed by eyelet 22. Rod 21 may swing in a horizontal plane in all directions about screw 23 and eyelet 22 is given sufficient vertical clearance by bushing 26 as to also permit rod 21 to swing to a limited extent in a vertical plane about screw 23. Rod 21 is thus capable of limited universal movement with respect to door 17.

The free extremity of rod 21 is threaded and is provided with a plurality of members adapted to engage a stop 27 mounted on frame 13 at a point remote from the axis of hinge pin 18. Such members may comprise a nut 28 adjustably secured in position by a tapered jam nut 29 and another nut 31 adjustably secured in position by a jam nut 32. When nuts 28, 29, 31, 32 have the same overall dimensions, a washer 33 of larger diameter may be disposed adjacent nut 31.

Stop 27 may consist of a short length of angle iron of which one web is secured to frame 13 by screws 34 and the other web forms a lug extending adjacent door 17. This lug portion is provided with an aperture 36 comprising a lower portion of width substantially equal to the diameter of rod 21. The upper portion of aperture 36 is sufficiently large for the passage of nuts 28, 29 therethrough but not for the passage of washer 33.

The edge of aperture 36 is provided with a bevel 37 on the side of stop 27 facing hinge pin 18. Rod 21 penetrates the lower portion of aperture 36 and is partially supported by stop 27 as a result of the universal pivotal attachment of the rod on screw 23. When door 17 is closed, rod 21 is in the position shown in Fig. 2. It will be apparent that screw 23 could also be attached to frame 13, stop 27 then being attached to door 17, without altering the functioning and efficacy of the device.

When the door is moved from closed position toward normal open position, rod 21 is guided by stop 27 in sliding engagement therewith and the door is left free to swing back and forth between closed position and normal open position. Upon opening movement of door 17 into normal open position, nut 28 abuts against the portion of stop 27 adjacent the lower portion of aperture 36 to stop the door. The door is thereby still left free to swing back toward closed position from the normal open position. The normal open position may be adjusted by screwing nuts 28, 29 in the one or in the other direction of rotation on rod 21.

If the door is to be opened to its extreme open position, the adjacent door must first be opened to substantially its normal open position. Nut 28 may then be disengaged at will from stop 27 by the operator to enable the door to be swung through normal open position. For this purpose the operator raises rod 21 by hand or, if he cannot reach the rod, by means of a stick 38. The rod is raised into the upper portion of aperture 36 in substantial axial alinement therewith so as to enable nuts 28, 29 to pass through the aperture while door 17 is being swung through normal open position. The operator thereupon allows rod 21 to drop back into the lower portion of aperture 36. The threaded portion of rod 21 slides over the wall of aperture 36 without interfering with the movement of the door. The necessity of raising rod 21 manually precludes inadvertent opening of door 17 to its extreme open position and serves to remind the operator that the adjacent door must first be opened. When the door is open to its extreme open position washer 33 abuts against stop 27 to stop the door.

When the door is swung back from its extreme open position to a position approaching normal open position, nut 29 slides over the beveled edge of aperture 36 in response to movement of the door for guiding nut 28 into sliding engagement with this beveled edge until the door is returned into its normal open position. Nut 28 is thus kept momentarily disengaged from stop 27 and moves past the edge of aperture 36, allowing rod 21 to drop back into the lower portion of the aperture and leaving door 17 again free to swing back and forth between closed position and normal open position.

In the embodiment illustrated in Fig. 4 a door 41 similar to door 17 is associated with a frame 42 cooperating therewith in a known manner to form a substantially weather tight structure. In doors of this character the hinge pin 43 is preferably mounted on the frame. In the present embodiment door 41 carries a stop 44 similar to stop 27 except that the beveled face of the stop is turned away from the hinge pin. Eyelet 22 is mounted on a bracket 45 welded to frame 42 through a bolt 46 screwed into the bracket and secured by a jam nut 47. Bolt 46 is screwed into bracket 45 to an extent permitting limited movement of rod 21 in a vertical plane. In the present embodiment the position of nuts 28, 29 is reversed from that shown in Fig. 2 to result in the operation hereinafter described.

When door 41 is swung from the closed position shown toward open position, rod 21 is forced to

swing with the door by stop 44 and also slides with respect to the stop. When door 41 reaches a predetermined position nut 29 slides over the beveled edge of stop 44 in response to movement of the door to raise rod 21 and guide nut 28 out of abutting engagement with stop 44 while passing therethrough. When nuts 28, 29 have passed through stop 44, rod 21 drops back to its original level. Further opening movement of door 41 finally causes washer 33 to abut against stop 44 to stop the door. The door remains free to swing back and forth between the positions defined by engagement of stop 44 with washer 33 and with nut 28 but cannot be closed without intervention of the operator. When the door is to be closed the operator lifts rods 21 to disengage nut 28 from stop 44. Closing movement of the door causes nut 28 to penetrate through the aperture of stop 44 and the door may then be closed completely without further attention to rod 21.

Although but two embodiments of the present invention have been illustrated and described it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

It is claimed and desired to secure by Letters Patent:

1. The combination of a frame structure, a door swingable relatively to said frame structure, and travel limiting means for said door comprising elements so mounted on said frame structure and on said door as to leave said door free to swing back and forth between two positions including an intermediate position and to prevent said door from being swung through said intermediate position by engagement of a first one of said elements with a second one of said elements, means for disengaging at will said first and second elements while said door is between said positions to enable said door to swing through said intermediate position to an extreme position, and means including said first one of said elements and a third one of said elements for stopping said door at said extreme position.

2. The combination of a frame structure, a door swingable relatively to said frame structure, and travel limiting means for said door comprising elements so mounted on said frame structure and on said door as to leave said door free to swing back and forth between two positions including an intermediate position and to prevent said door from being swung through said intermediate position by engagement of a first one of said elements with a second one of said elements, means for disengaging at will said first and second elements while said door is between said positions to enable said door to swing through said intermediate position to an extreme position, means including said first one of said elements and a third one of said elements for stopping said door at said extreme position, and means responsive to return movement of said door through said intermediate position for momentarily disengaging said first and second elements to leave said door again free to swing back and forth between the first said two positions.

3. The combination of a frame structure, a door structure swingable relatively to said frame structure, and travel limiting means for said door structure comprising a rod pivotally mounted on one of said structures and having two operating positions, a stop so mounted on the other of said structures as to guide said rod during movement of said door structure, and a member mounted on said rod operable when said rod is in one of said operating positions for engaging said stop upon movement of said door structure in one direction of rotation into a predetermined position and leaving said door structure free to swing in the other direction of rotation from said predetermined position and operable when said rod is in the other of said operating positions for clearing said stop.

4. The combination of a frame structure, a door structure swingable relatively to said frame structure, and travel limiting means for said door structure comprising a threaded rod pivotally mounted on one of said structures and operable into a raised position and a lowered position, a stop so mounted on the other of said structures as to guide said rod during movement of said door structure, and a nut adjustably screwed on said rod operable when said rod is in said lowered position for abutting against said stop upon movement of said door structure in one direction of rotation into an adjustable predetermined position and operable when said rod is in said raised position for clearing said stop.

5. The combination of a frame structure, a door structure swingable relatively to said frame structure, and travel limiting means for said door structure comprising a threaded rod pivotally mounted on one of said structures, a stop so mounted on the other of said structures as to guide said rod during movement of said door structure, a nut adjustably screwed on said rod for abutting against said stop upon movement of said door structure in one direction of rotation into an adjustable intermediate position, means for disengaging said nut from said stop when said door structure is in said intermediate position to enable said door structure to be moved through said intermediate position, and a second nut adjustably screwed on said rod for abutting against said stop upon movement of said door structure in said direction of rotation into an adjustable extreme position.

6. The combination of a frame structure, a door structure swingable relatively to said frame structure, and travel limiting means for said door structure comprising a threaded rod pivotally mounted on one of said structures, a stop so mounted on the other of said structures as to guide said rod during movement of said door structure, a nut adjustably screwed on said rod for abutting against said stop upon movement of said door structure in one direction of rotation into an adjustable intermediate position, means for disengaging said nut from said stop when said door structure is in said intermediate position to enable said door structure to be moved through said intermediate position, a second nut adjustably screwed on said rod for abutting against said stop upon movement of said door structure in said direction of rotation into an adjustable extreme position, and means responsive to movement of said door structure in the other direction of rotation through said intermediate position for moving said first nut out of abutting engagement with said stop only during said movement in said other direction of rotation through said intermediate positon.

7. The combination of a frame structure, a door structure swingable relatively to said frame structure, and travel limiting means for said door structure comprising a threaded rod pivotally mounted on one of said structures, a stop so

mounted on the other of said structures as to guide said rod during movement of said door structure, a nut adjustably screwed on said rod for abutting against said stop upon movement of said door structure in one direction of rotation into an adjustable intermediate position, means for disengaging said nut from said stop when said door structure is in said intermediate position to enable said door structure to be moved through said intermediate position, a second nut adjustably screwed on said rod for abutting against said stop upon movement of said door structure in said direction of rotation into an adjustable extreme position, and a tapered nut screwed on said rod adjacent said first nut for guiding said first nut into sliding engagement with said stop only during movement of said door structure in the other direction of rotation through said intermediate position.

8. The combination of a frame structure, a door structure swingable relatively to said frame structure, and travel limiting means for said door structure comprising a threaded rod pivotally mounted on one of said structures, a stop so mounted on the other of said structures as to guide said rod during movement of said door structure, and a nut adjustably screwed on said rod for abutting against said stop upon movement of said door structure in one direction of rotation into an adjustable intermediate position, means for disengaging said nut from said stop when said door structure is in said intermediate position to enable said door structure to be moved in said direction of rotation through said intermediate position, a tapered nut screwed on said rod adjacent the first said nut for guiding the first said nut into sliding engagement with said stop only during movement of said door structure in the other direction of rotation through said intermediate position, and a third nut adjustably screwed on said rod for abutting against said stop upon movement of said door structure in said other direction of rotation into an adjustable extreme position.

9. The combination of a frame structure, a door structure swingable relatively to said frame structure, and travel limiting means for said door structure comprising a threaded rod mounted for limited universal movement on one of said structures, a stop mounted on the other of said structures and comprising a lug portion provided with an aperture, said aperture comprising an upper portion and a lower portion which is of a width substantially equal to the diameter of said rod, said rod being partially supported by said lug and penetrating said aperture bottom portion whereby said lug guides said rod in sliding engagement therewith during swinging movement of said door structure, a nut adjustably screwed on said rod for abutting against the portion of said lug adjacent said aperture lower portion upon swinging movement of said door structure into a predetermined position, and means for raising said rod into said upper portion of said aperture, said upper portion being of such size as to enable said nut to pass therethrough to enable said door structure to swing through said position.

10. The combination of a frame structure, a door swingable relatively to said frame structure, and travel limiting means for said door comprising elements so mounted on said frame structure and on said door as to leave said door free to swing back and forth between an extreme position and an intermediate position and to prevent said door from being swung through said intermediate position by engagement of a first one of said elements with a second one of said elements, means for rendering said first and second elements inoperative to stop said door at said intermediate position to enable said door to be swung past said intermediate position, and means responsive to movement of said door into said intermediate position toward said extreme position for disengaging said first and second elements to enable said door to swing through said intermediate position.

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