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TORSIONALLY BALANCED HATCHWAY DOOR CONSTRUCTIONS

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2 Sheets-Sheet 1

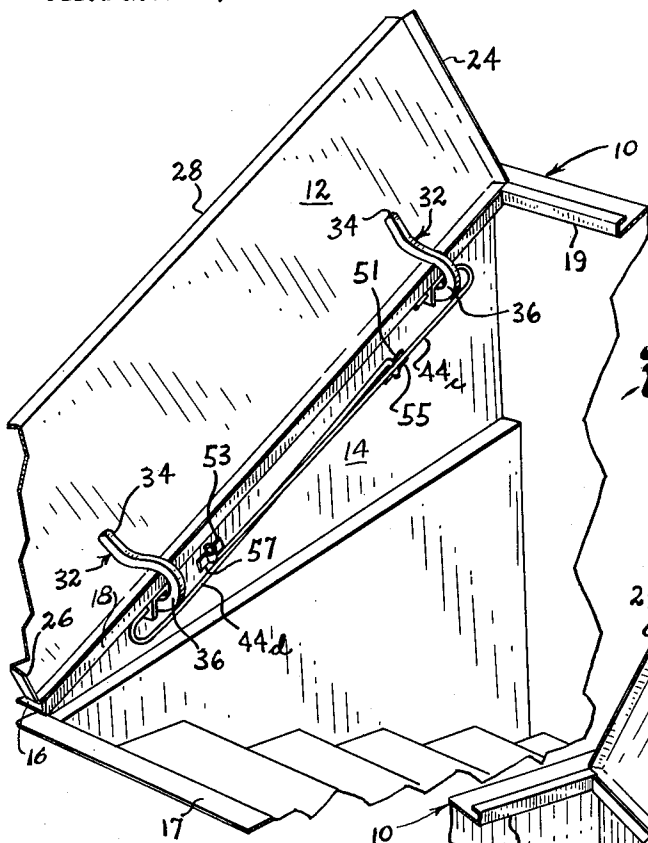


Fig. 1

Fig. 2

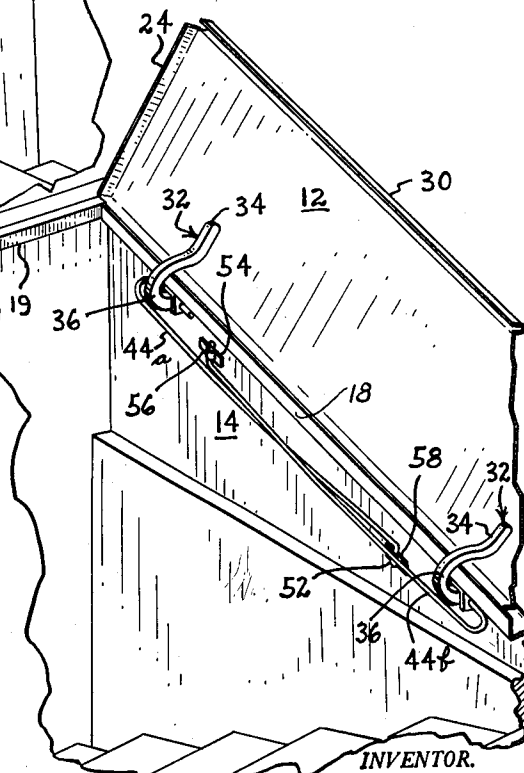
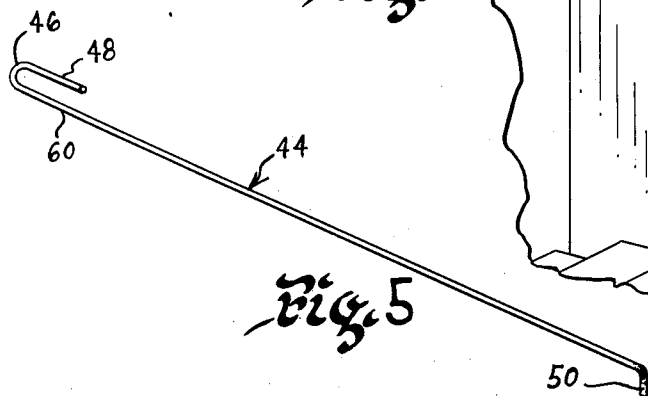


Fig. 5

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3,067,453 TORSIONALLY BALANCED HATCHWAY DOOR CONSTRUCTIONS

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This invention relates to a torsional suspension system for hatchway closures, and more particularly to torsional counterbalanced hatchway cover constructions characterized by simplicity of manufacture, assembly and operation.

In a common type of hatchway closure assembly, the door or cover is usually inclined to the vertical, with the result that substantially the full weight of the door has to be lifted or borne by the user in the course of opening and closing the same. In order to facilitate control of such doors, various types of lifting and counterbalancing mechanisms have previously been employed, but the more practical and effective of these have heretofore been relatively expensive and require mechanical skill to install, adjust and maintain.

It is the principal object of this invention to provide a counterbalancing suspension system for such doors which, due to its simplicity of construction and operation, is both rugged and inexpensive, yet requires no skill or special tools to assemble and install, and no maintenance to keep it in operating condition.

In brief, the invention disclosed and claimed herein provides hatchway cover assemblies in which door-counterbalancing torsion bar means is provided, which means is adapted and arranged to serve the dual function of both pivotally hinging a door to the hatchway frame, as well as exerting the counterbalancing force on the door to facilitate an almost effortless control thereof.

To this end, the torsion bar means is provided with an end portion adapted to fit into hinge pin bores in separable hinge members to removably secure such members together, while a second portion of the bar, spaced from the first mentioned end portion, is adapted to be removably secured against rotation to a frame member of the hatchway. Intermediate the aforesaid spaced portions of the bar, there is formed an offset or crank section which is engaged by other means on the door as the latter is swung towards closed position, whereby the bar is twisted to develop a torsional stress opposing the closing movement of the door.

The dual or combined function of the torsion bar means just described results in substantial economy of manufacture and a minimum number of parts. More importantly perhaps, it provides a construction, the assemblage of which in an improper manner is rendered completely impossible, yet is such that it is easily understood and accomplished by unskilled persons.

Other advantages and features of the invention will become apparent from the following description of a preferred form of construction illustrated in the accompanying drawings, in which

FIGS. 1 and 2 are fragmentary perspective views of the left and right hand sides respectively of a cellar hatchway having torsionally counterbalanced doors mounted in accordance with this invention.

FIG. 3 is a vertical cross-section through the lower portion of the hatchway construction shown in FIGS. 1 and 2, showing the camming or cranking action of the doors upon the torsion bars as the doors are moved from open to closed position.

FIG. 4 is a side elevation, in cross-section on line 4—4 of FIG. 3, of the interior of a two-door hatchway in which the door shown is in its raised or open position, and paired torsion bars for hinging and counterbalancing the door are employed; and

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FIG. 5 is a perspective view of a torsion bar for use in a hatchway cover assembly.

Referring first to the illustrations shown in FIGS. 1 and 2 of the drawings, the hatchway cover construction generally comprises a hatchway frame 10 having a pair of doors 12 hinged to opposite longitudinal edges of the frame and adapted to be swung into abutting relationship to close the access opening in the hatchway frame.

In the specific embodiment of the invention here illustrated, the hatchway closure assembly is formed of metal and is adapted for use as a cellar-way access. To that end, the side panels 14 of frame 10 are triangular in shape so as to dispose the hinge line of doors 12 at an incline to the horizontal. Panels 14 are heavy gauge sheet metal and are formed along their respective upper edges to provide an inwardly directed flange portion 16. The inner edge of each flange 16, in turn, is bent to provide an upstanding lip 18. The upper cross-member 19 (FIGS. 1 and 2) of frame 10, extending between and secured to panels 14, is similarly flanged along its upper edge to form a lip. The cross-member 17 at the lower end of the frame is preferably a flat sill plate connected at its ends to the side panels 14. The purpose of the lip is primarily to insure a weather-tight cover construction but the flanging also serves to strengthen the frame members whereby they may be formed of lighter gauge metal than otherwise would be satisfactory.

The cover members or doors 12 are also formed of heavy gauge metal which has been subjected to a bending operation to provide a peripheral lip 20 extending along the hinged edge 22 of each door and each adjacent end edges 24, 26 thereof. The abutting or unhinged longitudinal edges of the doors are likewise formed to provide lips, but in this case one lip 28 is directed upwardly while the cooperating lip 30 is cupped downwardly to overlie the former in the closed position of the doors. In this manner a weather-tight cover for the access opening is insured.

Each door 12 is mounted to the frame by a pair of spaced hinge straps 32, each of which has a base portion 34 by which it is suitably secured to its respective door 12, and an upstanding gooseneck portion 36. A hinge pin bore 38 is provided in the terminal or free end of gooseneck portion 36 of each strap. The gooseneck portion of these hinge straps provides cam surfaces arcuately spaced with respect to the hinge pin bores 38, as and for the purpose hereinafter described.

Suitable hinge brackets 40 are mounted on side panels 14 of frame 10 in respectively cooperating alignment with the hinge straps 32 on the doors. As best shown in FIGS. 3 and 4, U-shaped brackets 40 are secured to the underside of flange 16 so that the side flanges 41 of the bracket extend downwardly therefrom. As shown more particularly in FIG. 4, the side flanges 41 of each bracket 40 are spaced sufficiently to freely accept the corresponding hinge strap-between them. Flanges 41 are also provided with aligned bores 42 which cooperate with bores 38 of the hinge straps upon insertion of suitable hinge pins in the assemblies.

In the present invention, the hinge pins for the doors are formed as an integral part of torsion rods or bars 44 which have a crook 46 at one end providing a short terminal leg 48 directed backwardly, substantially parallel to the major portion of the bar. Preferably two bars 44 are employed for each door. The short legs 48 of the respective bars 44 pass through the bores 38 and 42 of the aligned hinge straps and brackets, respectively, whereby to pivotally support the doors 12 on the frame 10.

At their distal ends, bars 44 are each bent to form an offset 50 extending substantially perpendicular to the

plane defined by the crooked end of the bar. These offset ends 50 are adapted to be received in sockets formed by short metal straps 52, 53, 54 and 55, suitably secured to side panels 14 on the frame, as best seen in FIGS. 1 and 2.

As already mentioned, two bars 44 are employed for each door 12, each having the short legs 48 of crook 46 received in hinge pin bores 38, 42, with the crook end outermost, whereby the main body portions of the bars extend inwardly toward the center of the door. In order that the bars 44 may be identical in shape, and thus avoid the necessity of having left-hand and right-hand sets, arrangement is made for offset portions 50 of bars 44a and 44d to be inserted downwardly into the sockets formed by straps 52 and 55 respectively, while the corresponding offset portions 50 of bars 44b and 44c are received upwardly in the sockets formed by straps 54 and 53 respectively. Retention of the bars which have been inserted upwardly into their sockets is effected by crossing bar 44a beneath bar 44b and bar 44d beneath bar 44c to prevent the offset portions of bars 44b and 44c from dropping out of their sockets. Moreover, bars 44a and 44d are made to contact bars 44b and 44c respectively in crossing under the latter bars and to exert an upward force thereon. This is accomplished by so placing the straps 52, 54 and 53, 55 on the opposite inner walls of panels 14 respectively in such a manner that the lower edge 56 of strap 54 is in substantial longitudinal alignment with the upper edge 58 of strap 52 and the lower edge 57 of strap 53 is in substantial longitudinal alignment with the upper edge 51 of strap 55 whereby the aforesaid upper and lower edges are on a line substantially parallel to flange 16 at the upper edge of panels 14.

Assembly of doors 12 to the frame is readily accomplished by initially placing each door with its hinged longitudinally extending edge 22 resting on the shoulder formed by flange 16 of a side panel 14, as best shown in FIG. 3. In this position the door 12 need only be tilted slightly toward the center to slide the bored portions of the hinge straps between their respective bracket flanges 41 thereby placing the flange bores and hinge strap bores in substantial alignment so that the short leg 48 of a torsion bar 44 can be inserted through the said bores thereby hingedly securing the hinge strap 32 between flanges 41 of bracket 40. The same operation is repeated for the other hinge of the door and, where a two door enclosure is used as in the illustrated embodiment in FIGS. 1 and 2, the mounting procedure just outlined is repeated with the other door.

With both doors opened and resting in this supported position afforded by the hinge pin connections, the next step is to anchor the offset end portions 50 of each torsion bar to the frame 14 in the sockets, 52, 53, 54 and 55, provided therefor. More particularly, referring to FIG. 2, the offset portion 50 of torsion bar 44b is inserted upwardly into its socket formed by strap 54. Then, while temporarily holding that end of the bar to prevent its dropping out of the socket, the companion bar 44a is crossed beneath bar 44b and its free end is forced or bowed upwardly against the restraining contact with bar 44b where the bars cross, until the offset portion 50 of bar 44a may be inserted into the socket formed by lower strap 52. By virtue of the positioning of straps 52, 54, as aforesaid, upward pressure of bar 44a is thus maintained on the under side of bar 44b at all times, thereby retaining the distal end of the latter in its socket. Referring now to the anchoring arrangement of the torsion bars on the left hand side of a 2-door hatchway as shown in FIG. 1, the offset portion of torsion bar 44c is inserted upwardly into the socket formed by strap 53 and while temporarily holding that end of the bar to prevent its dropping out of the socket, the companion bar 44d is crossed beneath bar 44c and its free end is forced or bowed upwardly against the restraining contact with bar 44c where the bars cross, until the offset portion 50

of bar 44d may be inserted into the socket formed by the lower strap 55. By virtue of the positioning of straps 53, 55, as aforesaid, upward pressure of bar 44d is thus maintained on the underside of bar 44c at all times, thereby retaining the distal end of the latter in its socket.

As has been explained hereinabove, bars 44 serve not only as the hinge pins for the doors but also as torsion springs for counterbalancing the weight of the doors as they are moved to closed position. To this end, the crook portion 46 of each bar 44 forms a crank arm in which the longer leg 60 of the crook is engaged by the back of the gooseneck portion 36 of hinge straps 32. In the open position of a door 12, as shown in FIG. 4 and in phantom at the left in FIG. 3, leg 60 of each torsion bar 44 just contacts the under surface of the gooseneck 36. However, as the door is swung to its close position, as seen in solid lines to the left in FIG. 3, leg 60 is cranked or swung around its adjacent short leg 48 by gooseneck 36. Since the distal end of bar 44 is restrained against turning movement, the bar is twisted longitudinally of its axis, setting up a torsional strain or stress counteracting the movement of door 12 to the closed position. Thus, when it is desired to open the door, it may be easily accomplished since a large part of the weight of the door is counterbalanced by the torsional stress set up in the torsion bars.

The amount of counterbalancing force or torsional stress developed by bars 44 can be controlled by proper selection of the diameter and length of the bars. Generally it is desired that when the bars are fully stressed in the closed position of the door, the counterbalancing force is sufficiently less than the closing force of the doors, due to their weight, such that the doors will remain closed; but it is not so much less that an operator must exert more than a relatively light opening pressure on the edge of the door in order to open it.

In some constructions the hatchway is raised up on the side of the house more so than in others thereby resulting in the doors or covers being inclined more to the vertical than the horizontal. As the doors approach the vertical plane the lifting force required to overcome the closing force of the door becomes correspondingly less. Eventually a point is reached where the counterbalancing force exerted by the torsion bars on the door is greater than the closing force of the door. Thus the doors will tend to remain open. This can be overcome by utilizing the torsional force of only one of the bars on each door without destroying the unique hinge pin feature of the two bar construction illustrated in the drawings. This is accomplished by leaving the offset ends 50 of bars 44b and 44c out of their respective sockets 54 and 53, thereby rendering these bars incapable of exerting a counterbalancing force. The unsecured portions of bars 44b and 44c can be restrained from flapping loosely about by tying them to secured bars 44a and 44d respectively. In order to overcome any tendency of the unsocketed bar 44b to slide out of the hinge bores of bracket 40 and strap 32, a lock ring may be inserted over the free end of the short terminal leg 48 after it has been inserted through the hinge bores.

As hereinabove described, the specific construction and arrangement shown provides for the use of two torsion rods, each serving as a hinge pin and counterbalancing spring for its respective door. This is the preferred construction for various reasons, but it is within the purview of the invention to include constructions in which only one torsion bar is employed in cooperation with one of the hinge straps and brackets, while the other hinge strap and bracket on that door are secured together by a conventional, simple hinge pin. Obviously such a construction will require a heavier torsion bar in order to support the weight of a given door. As a further extension of this modification, one bar may be so formed that its opposite ends serve as hinge pins for both hinges of a door, the bar being provided intermediate its ends with means for preventing rotation and with a crank portion or portions

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spaced therefrom which are engaged by the door as the latter is closed, thereby setting up the counterbalancing torsional stress in the bar.

Other modifications will be apparent, such as a different hinge strap formation from that shown in FIGS. 1 to 4, whereby the rotation of the offset or crank portion of the torsion bar is twisted about its short leg 48. For example, if the use of the lipped edge on the frame of the hatchway is not desired, a straight hinge strap may then be employed, provided the hinge strap and crank portion of the bar are mutually engaged as the door is closed to twist the bar about its axis.

From the foregoing it is apparent that various modifications of the specifically illustrated construction shown in the accompanying drawings will occur to those skilled in the art, and the foregoing specific description is therefore intended to be illustrative and not limiting of the scope of the invention.

What is claimed is:

1. In a hatchway cover construction,
 - (a) a hatchway frame member positioned along one edge of the hatchway,
 - (b) a door hinged thereto for swinging movement between open and closed positions relative to said hatchway,
 - (c) at least one hinge member on the door and one hinge member on the hatchway frame, said hinge members having cooperating bores adapted to receive a hinge pin,
 - (d) said hinge member on the door having a gooseneck portion adjacent the hinge member on the frame, and
 - (e) torsion means yieldably resisting swinging movement of the door to a closed position,
 - (f) said torsion means comprising at least one long, resilient bar having a straight intermediate portion
 - (g) with a first terminal portion bent backwardly upon itself to form a crook, said crook being inserted into the cooperating bores in the hinge members to serve as the hinge pin therefor,
 - (h) and an opposite terminal portion projecting trans-

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versely to the longitudinal axis of the straight portion of the bar and a plane passing through the bar and the crook,

(i) said opposite terminal portion being confined on the frame against turning movement relative to said bar,

(j) said straight portion of the bar adjacent the crook abutting against the gooseneck portion of the hinge on the door so that upon pivotal movement of the hinge member, the straight portion of the bar is pivoted about the axis of the crook.

2. A hatchway cover construction as set forth in claim 1, wherein said frame and door are each provided with a pair of hinge members and a pair of torsion bars, and wherein said opposite terminal ends of said torsion bars are confined to the frame so as to extend in opposite directions whereby said torsion bars may be used as the hinge pin for either hinge.

3. A hatchway cover construction as set forth in claim 2, wherein said bent terminal ends are fixed to the frame by means of open-ended socket members, and one of said bent terminal ends extends downwardly in one socket member while the other of said bent terminal ends extends upwardly in the other of said socket members.

4. A hatchway cover construction as set forth in claim 3, wherein the sockets are so positioned on the frame that the torsion bar with the downwardly extending bent terminal end passes underneath the torsion bar with the upwardly extending bent terminal end and prevents the latter from being accidentally withdrawn from its socket.

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