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SELF-BALANCING DOOR

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Fig. 2

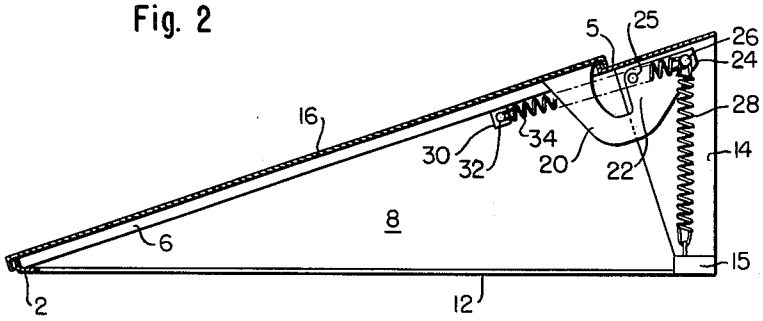


Fig. 1

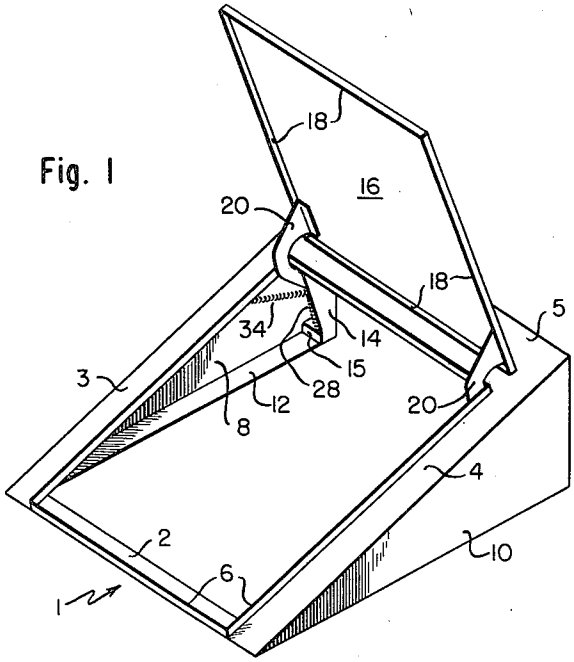


Fig. 3

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SELF-BALANCING DOOR

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4 Claims. (Cl. 20—16)

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This invention relates to a self-balancing door or closure such as a bulkhead, hatch cover or the like which is usually pivotally supported at such an angle that gravity acts either to open or close it, and hence in opening or closing such a door one must lift virtually its entire weight. This is a rather difficult task where the door closure is of steel construction and is accompanied by the danger of personal injury if one loses his grip.

The principal object of the present invention is to provide a self-balancing door or closure which is so constructed that it may be either balanced in any position, or self-opening upon the release of a latch, with a minimum effort required to close it, or self-closing, with a minimum effort required to open it.

Other objects are to provide a construction which may be applied to any side of the associated frame, to provide a construction wherein the closure has a tight, substantialy leak-proof fit about the frame and to provide a construction which eliminates unsightly exterior projections, fittings, etc.

Further objects relate to various features of construction and will be apparent from a consideration of the following description and accompanying drawings, wherein:

Fig. 1 is a perspective view of a bulkhead constructed in accordance with the present invention;

Fig. 2 is a vertical section through the bulkhead adjacent to one of the hinges, showing the door or lid closed; and

Fig. 3 is a view similar to Fig. 2, but showing the door open.

The particular embodiment herein shown for the purpose of illustration comprises a rectangular frame 1 of heavy gauge sheet metal having a bottom member 2, side members 3 and 4 and a top member 5, the inner edges of these members being formed with upstanding flanges collectively defining a continuous rim 6 about the doorway. The side members 3 and 4 are integral with side walls 8 and 10, the lower edges of which are formed with inwardly directed flanges 12 which permit the structure to be squarely seated on a foundation wall, stair well or other suitable supporting structure. Adjacent to each end the top member 5 carries a depending bracket 14, the lower end 15 of which is bent outwardly and secured to the adjacent inturned flange 12, each bracket 14 defining with the adjacent side wall a chamber for receiving a part of the self-balancing mechanism.

A door 16 of heavy gauge sheet metal fits about

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the opening in the frame 1 and its periphery is formed with a continuous depending flange surrounding the rim 6 when the door is closed, thus providing a substantially leak-proof structure. The door 16 is pivotally supported on the frame 1 by a pair of generally U-shaped hinges 20, one leg of each of which is welded or otherwise suitably secured to the under-surface of the door adjacent to its upper end. The other leg of each hinge is formed with an inwardly offset portion 22 and an outward projection 24. The offset portion 22 of each hinge is pivotally connected to the upper part of the adjacent depending bracket 14 by a pintle 25 and these pintles pivotally support the door for swinging movment to and from closed position.

The end of each projection 24 carries a stud 26 and one end of a tension spring 28 is secured to the stud, the other end being anchored to the end 15 of the bracket. A lug 30 is welded or otherwise secured to the under-surface of each of the side frame members and each lug 30 carries a stud 32 which is preferably slightly above a straight line running through a pintle 25 and stud 26, when the door is closed, as shown in Fig. 2. One end of a second tension spring 34 is secured to stud 26 and its opposite end is secured to the stud 32, the arrangement of the two springs being such that when the door is closed the spring 34 is slightly beyond the "dead center" line of pintle 25 and stud 26, and the axis of spring 28 is at an angle of the order of 90°, more or less, relative to the axis of spring 34.

With this construction and arrangement of parts the spring 28 exerts a force on the hinge 20, when the door is closed, tending to swing it open; but since the hinge 34 is slightly beyond "dead center" it exerts little or no force on the hinge tending to open the door, but rather a force tending to close the door. As the door opens the hinge 28 at first takes the entire load and continues to do so until the spring 34 is carried downwardly beyond "dead center" whereupon it comes into action, cooperating with the spring 28. As the opening movement of the door continues, the spring 28 becomes less effective, while the spring 34 becomes progressively more effective due to the angle at which it is acting on the hinge. After the door has swung past the halfway position, it exerts appreciably less force against the springs since the vertical distance between its center of gravity and the axis of the pintles decreases considerably, and although the springs have lost much of their original force, such loss is automatically compensated by the de-

creasing force necessary to swing the door to fully open position.

By selecting springs of proper tension and strength the conjoint efforts may be such as either (1) to balance the door in any position, or (2) to effect closing of the door when open, but with a minimum effort to open it, or (3) to effect opening of the door when closed, but with a minimum effort to close it, in which case any conventional latch device will be employed to hold the door closed.

While we have shown and described one embodiment of the invention, it is to be understood that this disclosure is for the purpose of illustration and that various changes and modifications may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

We claim:

1. A self-balancing door construction comprising a frame having oppositely disposed depending brackets adjacent to one end, a door fitting said frame, generally U-shaped hinge members, each having one leg secured to said door and the other leg having an inwardly offset portion and an outward projection, pintles connecting the offset portions and said brackets so as pivotally to support said door to swing to and from closed position, a first stud projecting laterally from said outward projection, a second stud projecting laterally from an adjacent side member of said frame and inwardly of the pintle, a first tension spring secured at one end to the first stud and its other end being anchored to the lower end portion of the adjacent bracket so that it extends at an angle of the order of 90° with respect to a line passing through the two studs when said door is closed, and a second tension spring secured at one end to the first stud and at its opposite end to the second stud, the construction and arrangement of parts and the tension of the two springs being such that when said door is closed, the first spring exerts a major force on the hinge tending to open said door and as said door opens the second spring becomes effective to exert a cooperating force on said hinge tending to swing said door from partly open to fully open position.

2. A self-balancing door construction comprising a rectangular frame having oppositely disposed triangular shaped side walls extending from one end to the other and brackets spaced inwardly of said sides and depending from the top part of said frame, a rectangular door fitting said frame, generally U-shaped hinge members, each having one leg secured to said door and the other leg projecting into the space between said bracket and the adjacent side wall and having an inwardly offset portion and an outward projection, pintles connecting the offset portions and said brackets so as pivotally to support said door to swing to and from closed position, a first stud projecting laterally from said outward projection, a second stud projecting laterally from the adjacent side frame inwardly of the adjacent pintle, the second stud being above a straight line passing through the pintle and first stud when said door is closed, a first tension spring secured at one end to the first stud and its other end being anchored to the lower part of the adjacent bracket so that it extends at an angle of the order of 90° with respect to a line passing through the two studs when said door is closed, and a second tension spring secured at one end to the first stud and at its opposite end to the second stud, the construction and arrangement of parts and the tension of the two springs being such that when said door is closed, the first spring exerts a major force of the hinge tending to open said door while the second spring exerts a force tending to hold the door closed, and as said door opens the second spring becomes effective to exert a cooperating force on said hinge tending to swing said door from partly open to fully open position.

3. A door construction as set forth in claim 1, wherein the door opening of the frame is provided with a continuous upstanding rim and said door is formed with a continuous depending flange fitting about said rim when said door is closed.

4. A door construction as set forth in claim 2, wherein the supporting pintles and the inwardly offset portions and outward projections are beneath the top part of the frame member.

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