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GRAVITY ACTUATED DOOR MOUNTING

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The present invention relates to mountings for closures such as doors, windows or shutters for openings in walls of buildings, cabinets, wardrobes, closets or similar enclosures, which mountings are so designed that a closure supported thereby will be firmly held in upright or closed position actuated by gravity and similarly held firmly in open position also actuated by gravity. In other words, with the door in closed position, no amount of shaking or vibration can swing the door to partly or wholly opened position; nor can the door when standing open be shaken loose to close the opening.

In the accompanying drawing one embodiment of the invention is illustrated and like numerals in the different views represent the same details.

Figure 1 is a vertical section of a cabinet or box with the door removed;

Figure 2 is a view in vertical section of the door with a bracket for the trunnion bearings attached;

Figure 3 is a view similar to Figure 1 showing the door in open position in the cabinet;

Figure 4 is a vertical section on an enlarged scale, taken on a plane along line 4—4 of Figure 3; and

Figure 5 is a transverse section on a plane along line 5—5 of Figure 4.

In the drawing the numeral 10 designates a cabinet of any suitable size and having one or more compartments 11 enclosed by side walls 12, rear wall 13, top and bottom walls 14, 15 and a front wall doorway 16 reaching from the front trim 17 to the bottom or floor 15.

Any suitable material may be used for the cabinet, whether wood, metal, fiber or plastic.

The door 18 fills the door opening completely and its bottom edge is slightly beveled as at 19 to permit easy entry. The door is not hung on hinges of the usual kind, but is instead provided with trunnions or lugs at each side edge. Thus a pair of top trunnions 20 is provided at the upper ends of two brackets 22, one at each side of the door, which brackets reach downwardly to the lower portion of the door, where another pair of trunnions 23 is located further in from the inner face thereof.

A side plate 25 of metal, preferably aluminum, if the cabinet is made of wood or the like, is secured as by screws 26, one on each side wall 14 of the cabinet. These plates have preferably the contour of a right angle triangle placed with the edges, forming the right angle, positioned along the bottom surface of the top wall 14 and the trim 17 respectively, which coincides with inner surface of the door.

In Figure 2 is shown the door 18 of a size to completely fill the opening 16 in the front wall of the cabinet from the trim 17 down to the floor or bottom 15. A slight bevel 19 at the bottom is, however, desirable to facilitate the closing of the door. Depending on what kind of material is used the thickness of the door varies considerably.

On the inner surface 27 of the door 18 and close to each side edge thereof, one of the brackets 22 is rigidly secured as by screws or rivets, the top edge of the bracket being flush with the top edge of the door. These brackets are preferably made of aluminum angle bars and the side flanges thereof are secured against the door.

About one half inch in from the door surface 27 and an equal distance down from its top each bracket 22 carries a trunnion 20. The lower trunnion 23 is carried on the bracket about one inch further in from said door surface 27 and at a radial distance L from trunnion 20.

The trunnions 20, 23 are permanently fixed, as by threads 26, and the projecting portion thereof may carry an anti-friction roller 29, see Figures 4 and 5.

The side plates 25 are each provided with guide grooves or tracks, one, designated 36, for the top trunnion 20 and another, designated 40, for the bottom trunnion 23.

In laying out these grooves or tracks standard measurements are used, namely L for the radial distance between the trunnions 20 and 23 and H for the vertical drop of the trunnion between locked and open positions of the door 18. These measurements are fixed for each cabinet but may vary proportionally in different sizes of cabinets. As an example in one case if L is 5 inches, H is ¾ inch.

For the top groove 36 a basic line 30 is drawn parallel to the top edge 31 of the plate 25 and about 1¾ inch therefrom, corresponding to ¾ inch below the top edge of the door 18, a second line, designated 32, is drawn parallel to line 30 at a distance H below the same. A third line, designated 33, is drawn vertically parallel to the inner surface line 27 about ½ inch inwardly therefrom and a fourth line, designated 34, is drawn parallel to line 33 one inch still further in. The intersection between lines 30 and 33 will be called A and indicates the topmost position of trunnion 20; the intersection between lines 32 and 33 will be called A and indicates the lowermost position of trunnion 20. A point called B is marked off on line 34, at a radial distance L from point A, indicating the position of trunnion 23, when the door is closed; and a point called B at a radial distance
L from point A, is marked off on line 33 and indicates the lowermost position of trunnion 23.

On the line 32 a point C is marked off about 64% from the inner surface plane 27 of the door, or sufficiently far back to permit the placing of the door almost horizontally entirely within the cabinet when open. On line 30 a point D is laid off about 6 inches from the surface plane 27.

By now describing circles of a diameter to accommodate the trunnion or its roller and drawing tangent lines between the circles an upper guide groove or track 36 is outlined. The main portion of the groove 35 runs from point A slightly upward to point D while a box pocket is formed at 37 including point A. From D, a cam surface 38 leads down to point C where an inner pocket is thus provided.

By similarly drawing circles at points B, C; and D and connecting them by tangent lines the other guide groove or track for trunnion 23 is outlined on plate 25. Since point B lies higher than point B, an upwardly slanting cam pocket 39 is thus obtained, while the middle portion 40 runs straight upward terminating with an arcuate portion 41 and runs up with circle C. It should be noted that both ends of grooves or tracks 36 and 40 are closed so that the trunnions 20 and 23 never run out of them.

The tracks proper for the trunnions will now be cut out along the tangent lines 35 and 40 in both plates 25. Completing the door opening between the trunnions 17 and the floor 15, the door 18 is then suspended and held firmly on trunnion 20 at A and trunnion 23 at B and since the center of gravity of the whole system 15 and 22 lies about halfway up the door, probably on or near line 35, the components of the weight tend to swing the door 18 inwardly at point B and outwardly at point A where the trunnions 23, 20 meet with dead walls at the ends of the tracks, thereby firmly securing the door in closed position.

Similarly, when the door is raised into open position with trunnion 20 in the pocket at point C and trunnion 23 lifted up to point C; the door is for the same reason held firmly open. It should be noted also that the constant distance L between the trunnions 20 and 23 must be adhered to between points A and B, and between points A and B, and as between points C and C.

In order to facilitate the opening and closing of the door 18 a handle 43 is provided at the lower end of the same.

Depending on its particular size and use different kinds of material may be selected for the door, so that any metal, plastic or wood may be found suitable and this will not in any way change the general construction or design.

To open the door the operator takes hold of the handle 43 and pulls it towards himself until trunnions 20 drop down from position 13 to position B, and trunnions 25 drop from A to A. He now pulls upwards on the handle 43, whereupon trunnions 23 will run up in tracks 40 and trunnions 20 will move along track 38 and finally land in pocket C where the dip will hold it and trunnions 23.

Thus the door whether closed or open will be held firmly. The term "door" as used in the claims is intended to cover any commonly known closure for wall openings for buildings, wardrobes, closets, cabinets, boxes and the like.

At times, doors similarly guided by trunnions in grooves, instead of swinging on vertical hinge axes, may be constructed in which it would be advisable to support the weight on casters or rollers. Since in that event the door weight would not aid in securely holding the door either in closed or open position other aids must be resorted to. For instance, flat springs may be used contacting with the trunnions or rollers to prevent accidental closing or opening, or, if double doors were used, they may be slightly sprung in closing to gain the same feature.

It is to be understood that the invention as herein disclosed may be varied from the details described and shown without departure from the spirit of the subjoined claims.

I claim:

1. In an enclosure having an entrance opening, a door completely filling said opening and means for firmly retaining the door in closed as well as in open position, said means comprising upper and lower trunnions on each side of the door and separate upper and lower bearing tracks for the upper and lower trunnions at each side of said opening, the trunnions being one inset relative to the other, the upper bearing tracks extending inwardly from the opening with short angularly directed ends forming pockets in which the upper trunnions are seated and maintained by the aid of the action of gravity and friction in the opened and closed positions of the door, the pocket of the upper track to hold the door in closed position being directed straight upwardly and the pocket for holding the door open being directed downwardly and inwardly from the general direction of the upper track, the lower bearing tracks being in angular relation to the upper tracks and having upwardly and inwardly directed lower end pockets receiving the lower trunnions for holding the door in closed position.

2. In an enclosure having an entrance opening, a door completely filling said opening and means for firmly retaining the door in closed as well as in open position, said means comprising upper and lower trunnions on each side of the door and separate upper and lower bearing tracks for the upper and lower trunnions at each side of said opening, the trunnions being one inset relative to the other, the upper bearing tracks extending inwardly from the opening with short angularly directed ends forming pockets in which the upper trunnions are seated and maintained by the aid of the action of gravity and friction in the opened and closed positions of the door, the pocket of the upper track to hold the door in closed position being directed straight upwardly and the pocket for holding the door open being directed downwardly and inwardly from the general direction of the upper track, the lower bearing tracks being in angular relation to the upper tracks and having upwardly and inwardly directed lower end pockets receiving the lower trunnions for holding the door in closed position, and rollers carried by said trunnions and engaging the bearing tracks.

3. Means for mounting a closure in an opening, comprising a pair of trunnions for each side of the closure, means supporting each pair of trunnions in vertically spaced relation on and spaced from one face of the door and an outer trunnion of each pair being positioned a greater distance from said closure face than the upper one, and a pair of guide tracks for the trunnions at each side of said opening, one track of each pair extending inwardly at a slight upward inclination from the opening and having the top one of the adjacent pair of trunnions slidable.
disposed therein, the other track of each pair being substantially vertical through the major part of its length and disposed beneath the end of the said one track which is nearest to the opening and having the lower one of the adjacent pair of trunnions slidably disposed therein, the said end nearest to the opening of the said one track of each pair being a short upwardly extending portion, and the said other track of each pair having at its lower end an upwardly and inwardly directed portion.

4. Means for mounting a closure in an opening, comprising a pair of trunnions for each side of the closure, means supporting each pair of trunnions in vertically spaced relation on and spaced from one face of the closure, the lower trunnion of each pair being positioned a greater distance from said closure face than the upper one, and a pair of guide tracks for the trunnions at each side of said opening, one track of each pair extending inwardly at a slight upward inclination from the opening and having the top one of the adjacent pair of trunnions slidably disposed therein, the other track of each pair being substantially vertical through the major part of its length and disposed beneath the end of the said one track which is nearest to the opening and having the lower one of the adjacent pair of trunnions slidably disposed there-in, the end nearest to the opening of the said one track of each pair terminating in a short upwardly directed portion and the opposite end thereof terminating in a short curving terminal portion, and the upper end of the other track of each pair terminating in an arcuate inwardly directed portion and the lower end thereof terminating in a short upwardly and inwardly directed straight portion.

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