ABSTRACT OF THE DISCLOSURE

A positioning mechanism for supporting a pivotable door or panel in a stable manner in a plurality of radial attitudes. A cam sleeve is carried concentric on a vertically disposed support shaft. The axis of the support shaft is the rotational axis of the door or panel. The cam edge on the cam sleeve is provided with high and low dwell regions. Disposed adjacent the shaft in parallel relationship to the shaft is a piston which is reciprocably supported in a frame secured to the door or panel. A cam follower is secured to the piston, which is guided by the cam follower moving in a vertical slot for reciprocal motion. The piston is biased so as to urge the cam follower into engagement with the cam edge.

This invention relates to a positioning mechanism and, more particularly, to a positioning hinge means for stably positioning a pivotably and rotatably mounted door at a plurality of accurately spaced positions.

In my Patent No. 3,089,184 granted May 14, 1963, there is disclosed a pivotably or rotatably mounted door in combination with a positioning mechanism for stably maintaining the door at a plurality of radial attitudes that are accurately spaced from each other. This invention is concerned with improved positioning mechanism which is more compact and has less axial height than the previous mechanism. Further, the present invention provides greater loading ability, for the coil spring is offset from the axis of the upright door-supporting shaft. A modified arrangement is provided herein which is adapted to support a substantially greater load than could be supported by the positioning mechanism disclosed heretofore in said Patent No. 3,089,184.

An object of this invention is to provide a door with improved, compact positioning mechanism for maintaining the door at a plurality of radial attitudes that are accurately spaced from each other, the positioning mechanism being housed within the door and such positioning mechanism including a spring offset from the axis of the door-supporting shaft for reducing the axial height of the positioning mechanism and for increasing the loading ability of the positioning mechanism.

Another object of this invention is to provide an improved positioning mechanism capable of use with relatively heavy doors, such positioning mechanism including a plurality of springs offset from the axis of the door-supporting shaft and uniformly spaced about the door-supporting shaft for equalizing the loading and for accommodating greater loads.

Further objects of this invention will become more apparent hereinafter.

Preferred embodiments of the invention are shown in the accompanying drawings, in which:

FIGURE 1 is an elevation view of a pivotably mounted door construction mounted in a door frame and wherein the door embodies the principles of the present invention;

FIGURE 2 is an enlarged, fragmentary view, partly in section, illustrating one form of the invention;

FIGURE 3 is a cross-sectional view taken on line 3—3 of FIGURE 2;

FIGURE 4 is an enlarged fragmentary view of a modified form of the invention capable of accommodating relatively large loads;

FIGURE 5 is a plan view of the sleeve member of FIGURE 4;

FIGURE 6 is a fragmentary elevation view of the sleeve member shown in FIGURE 4;

FIGURE 7 is a side view of another modified form of positioning hinge mechanism;

FIGURE 8 is a top view of the modified positioning hinge mechanism taken on line 8—8 of FIGURE 7;

FIGURE 9 is a side view of the positioning hinge mechanism of FIGURE 7;

FIGURE 10 shows a plurality of pivotally mounted doors aligned so as to form a room divider.

Referring now to the drawings, there is shown in FIGURE 1 a portion of a door frame including opposite upright sides 10 and 12, a top 14, and a bottom or floor 16. An elongated pivotable barrier door or panel 18 is illustrated positioned within the door frame. The vertical dimension of the door 18 is smaller than the door frame for reasons that will appear hereinafter. The mounting means for the door or barrier 18 includes an elongated mounting rod or support shaft 20. The door 18, as best seen in FIGURE 5, is hollow and includes opposed upright sides 22 and 24. From FIGURES 1 and 3, it can be seen that the support shaft 20 extends vertically longitudinally through the hollow door 18, spaced between the sides 22 and 24.

The support shaft 20 may be of any appropriate design which permits of ready positioning of the support shaft 20 within the door frame. As illustrated, the shaft 20 may be an extensible telescopic shaft of conventional construction known to the trade. If desired, the support shaft may have upper and lower journal members in the form of cups or annular flanges 26 and 28. The journal members, which embrace and position the end portions of the shaft 20, are secured to the upper and lower portions of the door frame, as by means of screws or the like to securely attach the shaft 20 to the door frame. The preferred construction is one where the support shaft 20 is equipped with hardware which permits of ready assembly or disassembly of the shaft 20 and the door 18 connected thereto in a door frame so as not to require extensive structural modifications of the door frame for the positioning of the door therein.

Turning now to a consideration of the specific positioning mechanism of the present invention, reference may be made to FIGURE 1 wherein is illustrated a frame means generally indicated at 30. The frame means 30 is located within the panel 18 and is rigidly affixed thereto, as for example, by suitable screw means extending through opening connections 33 in base 34. More specifically, as seen in FIGURES 2 and 3, the frame means 30 includes upper and lower horizontal frame members 32 and 34 and side supports 36 and 38. The upper and lower frame members 32 and 34 are apertured so that the support shaft 20 may extend through the frame members, whereby the frame means is pivotable together with the door 18 about the axis of shaft 20. The upright side frame members 36 and 38 are operatively connected to the horizontal frame members 32 and 34 by suitable fastening means, as, for example, machine screws 39.

Concentrically disposed about the shaft or pole 20 is an annular tube-like sleeve member 42 that is provided with an enlarged upper end 43 having a cam edge generally indicated at 44. The cam edge 44 defines an arcurately extending high-dwell edge portion or region 46, the ends of which merge into a pair of sloping straight-inclined or rounded cam-edge portions 48 which converge at a low-dwell cam-edge region 50. The high-dwell region 46 is preferably of substantial arcuate length in the range of
between 90 degrees to 180 degrees when the door 18 is intended to be used as a double-swinging door.

Positioned between the horizontal frame members 32 and 34 of frame means 30 and connected to the frame member 32 is a plurality of locating pins 52 and 54 which is a tubular member 56. Sidably and reciprocably supported within the tube 56 is a piston 58 which comprises a piston head 59 slidably in tube 56 and having an exterior surface generally complementary to the interior surface of the tubular member and a piston stem 60 which is attached to and adapted to extend through an opening 61 defined in the frame member 32. Coil spring 62, which is concentrically disposed about the piston stem 60, is adapted to abut at one end against a shoulder 64 defined within the frame member 32 and is adapted to abut at the other end against a shoulder 66 defined at the intersection of the reduced diameter piston stem 60 and the enlarged diameter piston head 59.

Affixed to the piston head 59 for movement therewith is a cam follower 68 which includes an axle 70 press-fit in a transverse opening formed in the piston head 59 and a roller 72 journalled on the bearing surface defined at one end of the axle 70, the roller 72 being adapted to engage with the cam edge 44 on the sleeve 42.

Provided in the sides of the tube 56 diametrically opposed to one another are a pair of upright slots 74 and 75. The axle 70 of the cam follower 68 is engaged within the slot and guided for movement vertically or along a plane passing through the axis of shaft 20 by means of the slots 74 and 75.

The lower reduced portion of the sleeve 42 extends through bearing 81 disposed in opening 76 in the lower frame member 34. A collar 78 slips over the lower end of the sleeve 42. The collar 78 is affixed to the annular sleeve 42 and through to the supporting shaft or pole 20 by set screw 80. Thrust bearing 82 is provided between the shoulder defined on the sleeve 42 at the intersection of the enlarged upper portion and the reduced lower portion and the top of the frame member 34. A second thrust bearing 84 is provided between the lower surface of the frame member 34 and the top of the collar 78.

Radial bearing 81 is disposed between bearings 82 and 84. Roll pin 83 operatively connects collar 78 and sleeve member 42 to prevent undesirable separation of collar 78 and sleeve member 42. By virtue of such construction, frame means 30 is rotatable about the axis of shaft 20 and cam follower 68 rises and falls during rotation of the door on cam member 42 that is affixed to shaft 20.

The weight of door 18 is borne by set screw 80. Frame means 30 is held captive between portion 43 of sleeve 42 and collar 78. The user may radially or axially adjust the panel 18 by releasing the collar, moving the door radially or axially to desired position, and then affixing the collar to the shaft.

The spring 62 functions to bias and retain the cam follower 68 in engagement with the cam edge 44 defined on the sleeve 42.

From the foregoing, it will be understood that the arrangement of the high-dwell cam region 46 and the low-dwell region 50 on the sleeve member 42 provides a plurality of arctanally spaced positions wherein the frame means 30 and the panel 18 in which the frame means connect may be stably positioned relative to the support shaft 20. When the door is moved to and is restrained at a position intermediate the high-dwell region 46 and the low-dwell region 50, the cam follower or cam roller 72 engages the intermediate sloping cam edge portions 45 so that the door 18 will automatically move to the low-dwell position where the panel or door 18 is stably maintained.

The present construction is compact inasmuch as the piston and the coil spring concentrically disposed thereabout are offset laterally from the axis of the support means 20. The frame means, as set forth above in the embodiments illustrated in my Patent No. 3,089,184, in use, potentially greater loading ability may be obtained because the spring is offset from the axis of the support shaft 20.

Referring to FIGURE 4, there is illustrated a modification of the present invention wherein duplicate spring mountings are provided for equalizing loading upon the shaft, and for increasing materially the loading capacity of the positioning mechanism. In essence, there is duplication of the piston stem and spring member therein 180 degrees apart within the frame means 30. The frame means are enlarged laterally in order to accommodate the additional components. Accordingly, common parts have been indicated by applying a prime to the common element.

The essential difference, as far as the invented arrangement and that illustrated in FIGURES 1, 2 and 3, other than the duplication of the spring mounting, is the modification of the cam-edge construction. The cam edge 100 on the enlarged portion 43 of sleeve 42 is provided with two high-dwell portions 102 and 104 spaced 180 degrees apart and two low-dwell portions 106 and 108 spaced 180 degrees apart (FIGURES 5 and 6). The high-dwell and low-dwell areas are alternate one with respect to the other and adjacent high-dwell and low-dwell areas are joined by intermediate sloping straight-inclined or rounded cam-edge regions.

Turning to FIGURES 7-9, there is illustrated a modified form of this invention wherein a non-rotating guide member separate from the cam follower is provided to guide up and down motion of the piston stem, with less friction in the direction of rotation than that of the embodiment shown in FIGURE 2.

The frame means 130 is adapted to be affixed within a panel by fastening means extending through openings 133 in base 134. The base 134 of frame means 130 has upstanding side supports 136 and 138 secured thereto. Frame member 132 is connected to the side supports by suitable fastening means, as, for example, machine screws 139. Location pins 131 may be used to align frame member 132 with the side supports 136 and 138 to accurately align the openings in the frame means that receive shaft 120, and piston 158.

Shaft 120, which may be either solid or tubular, extends through frame 130. Concentrically disposed about and affixed to shaft 120 is a tubular sleeve member 142 that is provided with an upper portion 143 having a cam edge 144. The cam edge 144 is similar in configuration to cam edge 44 (FIGURE 1) and includes a high-dwell portion 146 and a low-dwell portion 148 joined by a pair of sloping straight-inclined portions 147. The snap ring 149 acts as an axial stop on shaft 120 to prevent downward movement of the frame 130, as for example, if a person were to lean on the door or panel.

The lower end of sleeve member 142 is threaded as indicated at 150. Externally knurled nut or compression collar 152 has internal threads that cooperate with the threads on sleeve member 142. Compression ring 154 made from a rubber-like material such as neoprene or Buna "N" is compressed by the cooperation between collar 158 and member 142 to bear against compression washer 156 and shaft 120 to connect and restrain sleeve member 142 from any axial or radial motion with respect to shaft 120, thereby allowing the user to radially and/or axially adjust the panel 18 on shaft 120. It is noted that shoulder 142a of member 142 thrusts or bears against washer 156.

Sidably and reciprocably supported in frame 130 is a piston 158 which comprises a piston head 159 and stems 154 and 160 which are sidable in openings in base 134 and top frame member 152 respectively.

Carried with piston head 159 is a unitary cam follower 169 which includes an axle 170 journalled in piston head 159 and a roller portion 172 that rides on cam edge 144. Snap ring 173 retains the axle 170 in place on piston head 159.
Spring 162 disposed about the stem 160 maintains the roller portion 172 of cam follower 168 in engagement with cam edge 144.

Means separate from the cam follower are provided for guiding piston 158 along an axial path and preventing rotation thereof. This arrangement effects a desirable reduction of friction between the moving parts. Such guides means comprise a guide or dowel pin 188 affixed to piston head 159 and movable in an elongated slot 175 in side support 138 of the frame 130.

An annular recess 190 is provided in axle 170 for grease retention and for reducing friction. An annular recess 191 may also be provided in tubular sleeve member 142 for receiving lubricant to minimize rotational friction between the frame 130 and sleeve member 142.

The invention of FIGURES 7–9 has all the advantages of the form of invention shown in FIGURES 2 and 3. Further, the modification of FIGURES 7–9 has the added advantage of reducing friction by separating the functions of the guide pin 188 and the axle 172.

The positioning mechanism disclosed in FIGURES 2, 4 and 7 respectively, can be incorporated into a prefabricated panel and held in stock and delivered for installation where it is desired to have pivotable panels or doors of this type. The present constructions embody the advantages of my previous design, in addition to those further advantages noted herein. A construction is provided wherein the dwell positions of the cam permit the panel or door to be positioned at a plurality of alternate positions and when the panel is moved to an intermediate position, the panel is automatically moved to one of the dwell positions by the cooperation between the sloping intermediate cam edge portion and the cam follower. The offset arrangement of the spring from the support shaft provides for a compact construction having a lesser axial height and also provides for a construction capable of supporting substantial weight.

This invention may also be used to support a plurality of panels arranged to function as space dividers. Such arrangement is shown in FIGURE 10 wherein a plurality of decorative panels 218 are rotatably supported on shafts 220 by my improved positioning hinges as shown in FIGURE 2 or FIGURE 7. The panels are aligned so as to define a wall for dividing a room or like space. The panels may be suitably decorated to match the desired decor.

While there has been shown and described a particular embodiment of this invention, it will be obvious to those skilled in the art that further changes and modifications may be made therein without departing from the invention, and therefore, it is intended in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An improved compact positioning mechanism for a pivotable body which is adapted to be located in a stable manner in a plurality of radial attitudes that are accurately spaced from each other and which body will automatically tend to move to one of said stable attitudes when the body is unrestrained at an acute angle position intermediate said plurality of stable attitudes; said positioning mechanism comprising, in combination: an elongated shaft means; frame means pivotally mounted relative to said shaft means for movement along an axis parallel to the axis of said shaft means; a cam follower carried on said piston and engaging said cam edge as said frame member is pivoted; a partially compressed coil spring carried concentrically on said piston for insuring engagement between said cam follower and said cam edge; means for effecting selective locating of said frame means at a plurality of radial attitudes that are accurately spaced from each other, said means comprising said cam edge providing a high-dwell region having substantial arcuate length, and an inclined cam edge leading from said high-dwell region to a low-dwell region, said cam edge thereby providing for a plurality of arcutely spaced positions wherein the frame means are stably positioned radially relative to the shaft means; and guide means for guiding movement of said piston reciprocally along its axis as said frame means are pivoted relative to said support shaft while preventing rotation of said piston about its axis, said guide means including a tubular member supported upright in said frame means and having an upright slot in the wall thereof, said piston being reciprocably slidable in said tubular member with said cam follower being guided in said upright slot.

2. An improved compact positioning mechanism for a pivotable body which is adapted to be located in a stable manner in a plurality of radial attitudes that are accurately spaced from each other and which body will automatically tend to move to one of said stable attitudes when the body is unrestrained at an acute angle position intermediate said plurality of stable attitudes; said positioning mechanism comprising, in combination: an elongated shaft means; frame means pivotally mounted relative to said shaft means; a sleeve member concentric with said shaft means and providing an arcuate cam edge thereon; a piston carried by said frame means adjacent said shaft means for movement along an axis parallel to the axis of said shaft means; a cam follower carried on said piston and engaging said cam edge as said frame member is pivoted; a partially compressed coil spring carried concentrically on said piston for insuring engagement between said cam follower and said cam edge; means for effecting selective locating of said frame means at a plurality of radial attitudes that are accurately spaced from each other, said means comprising said cam edge providing a high-dwell region having substantial arcuate length, and an inclined cam edge leading from said high-dwell region to a low-dwell region, said cam edge thereby providing for a plurality of arcutely spaced positions wherein the frame means are stably positioned radially relative to the shaft means; and guide means for guiding movement of said piston reciprocably along its axis as said frame means are pivoted relative to said support shaft while preventing rotation of said piston about its axis, wherein said cam edge comprises a pair of high-dwell regions and a pair of low-dwell regions alternately defined on said cam edge, there being a pair of piston stems on said frame means mounted 180° apart, each piston stem supporting a cam follower, and a partially compressed coil spring carried concentrically on each piston stem for insuring engagement of said cam followers with said cam edge, said dual coil spring construction equalizing the loading about said shaft means and materially increasing the loading capacity.

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